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Labour Market Effects of Large-Scale Agricultural Investment: Conceptual Considerations and Estimated Employment Effects

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Summary. — Large-scale agricultural investments (LSAIs) in general and their socio-economic implications in particular have been heavily debated in recent years. While some claim that LSAIs are an important catalyst for development in neglected rural areas, others caution that they pose a risk to rural communities' livelihoods. The extent to which LSAIs provide benefits for local communities is hence still contested. This paper sets out to conceptually understand what effects the establishment of a large-scale farm has on the rural labor market in low- and middle-income countries. In addition, we empirically address the question of whether large-scale farming as recorded in the Land Matrix creates or destroys employment. We develop a transition matrix to identify several scenarios based on key determinants of the *direct* employment creation potential of LSAIs, namely the former land use, the crop type and the production model. We empirically assess the actual importance of these scenarios and the employment creation to be expected from this sample of LSAIs based on labor intensities. We further look into the *net* employment effects for land formerly used by smallholder farmers. Our analysis shows that LSAIs massively crowd out smallholder farmers, which is only partially mitigated through the cultivation of labor intensive crops and the application of contract farming schemes. This holds true for all regions targeted by LSAIs, although regional differences are found in terms of magnitude. The paper concludes that these effects tend to be large on the local scale (i.e., in the immediate surroundings of the investment site) but small in relation to total national employment in agriculture. However, *indirect* employment creation related to LSAIs, which is discussed but not empirically addressed in this paper, needs to be taken into account to have the full picture.

Key words — large-scale agricultural investments, Land Matrix, rural labor market, labor intensity, employment

1. INTRODUCTION

The demand for land suitable for agricultural production is growing globally (Lambin & Meyfroidt, 2011). A major driver is the increased demand for food and energy of growing populations worldwide (Scheidel & Sorman, 2012). In this context the expansion of large-scale commercial farming is seen as a potential solution [1] to satisfy this demand (Deininger, 2013). In the last decade investors have been increasingly acquiring land in developing countries for huge farming operations (Nolte, Chamberlain, & Giger, 2016). The media have coined this phenomenon "land grabbing"; a more neutral term is "large-scale agricultural investments" (LSAIs). The term "LSAI" [2] is also more precise since it excludes cases of speculation and only considers land acquisitions that result in an operational farm.

Such investments, in general, and the socio-economic implications of these investments, in particular, have been heavily debated in recent years (Ali, Deininger, & Harris, 2017; Baumgartner, von Braun, Abebaw, & Müller, 2015; Collier & Venables, 2012; Cotula, 2013; German, Schoneveld, & Mwangi, 2013; Herrmann, 2017; Kleemann & Thiele, 2015; Messerli, Giger, Dwyer, Breu, & Eckert, 2014). The implications such investments have for target countries' agricultural sectors and, more specifically, for rural employment are still contested. The creation of jobs is one of the most important and common pledges investors make to local communities and governments when acquiring land; although, the actual realization of this commitment is often debated: while some see potential for employment creation (Baumgartner *et al.*, 2015; Kleemann & Thiele, 2015), others fear that the most vulnerable parts of society will lose their means of existence (Li, 2011). Obviously, whether and to what extent these investments turn out to benefit host countries critically hinges on the potential for employment creation, particularly for those who lose their land without compensation. Although past experiences with large farms have been largely negative, recent changes in the context conditions have given reason to believe that large farms may have a future (Deininger & Byerlee, 2012) and may actually contribute to increased welfare and poverty reduction due to employment creation (Deininger & Xia, 2016; Herrmann, 2017; Van den Broeck, Swinnen, & Maertens, 2017).

Moreover, generating employment is a key component of economic and social development and, thus, of poverty alleviation (World Bank, 2012) — an issue ranked high on most

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national development agendas. However, development processes typically go hand in hand with declining shares of agricultural sectors' gross domestic product (GDP) contributions and decreasing employment in agricultural sectors (Chenery & Syrquin, 1975; Foster & Rosenzweig, 2007; Kuznets, 1957; Üngör, 2013). In other words, the shift from agriculture-based economies toward industrialized or service-oriented economies seems to be a necessary precondition for development. In many poor countries, the agricultural sector continues to be the backbone of the economy and employs a large share of the population. Development processes often focus on urban areas and leave rural populations behind (Headey, Bezemer, & Hazell, 2010). Against this logic, large-scale farms in rural areas could hence shoulder the burden of creating agricultural wage employment, for instance, by (i) satisfying labor demand by directly employing former land users and (ii) stimulating the local economy and creating employment opportunities outside the agricultural sector through sectoral linkages. Moreover, establishing a large-scale farm might have further implications for the local economy, such as lower food prices and greater access to new technologies, to name but a few. Depending on the extent to which these effects materialize, they could alleviate poverty (Irz, Lin, Thirtle, & Wiggins, 2001; Maertens & Swinnen, 2009).

This paper seeks to conceptually understand the effects the establishment of a large-scale farm has on the rural labor market in low- and middle-income countries. Moreover, it addresses the question of whether large-scale farming creates or destroys employment when compared with the previous activity carried out on the land in question (e.g., smallholder farming). To do this, we provide relevant background information on rural labor markets in general and the labor productivities and intensities in the agricultural sector in particular in Section 2. In Section 3 we elaborate on the direct labor market effects that occur once a large-scale farm is set up. For these direct effects, we identify and discuss three key determinants which are decisive for the employment creation potential of LSAIs: (i) the former land-use type, (ii) the crop cultivated, and (iii) the production model applied. Based on these determinants, we develop different scenarios and illustrate them in a transition matrix. In Section 4 we present the data for our empirical application. In Section 5 we empirically assess the employment creation in three steps: First, we assess small-scale and large-scale labor intensities based on data from the Land Matrix Global Observatory [3] and the FAO smallholder data portrait. Second, we assess which scenarios are actually occurring in reality and derive implications for the labor market. Third, we estimate the net employment effect for LSAIs on former smallholder land in selected countries. In Section 6 we elaborate on further indirect effects and discuss the validity and limitations of our findings, before concluding in Section 7.

2. RURAL LABOR MARKETS AND LABOR PRODUCTIVITY

(a) Rural labor markets

In rural areas of low- and middle-income countries, agriculture is the main source of employment and income (Rosenzweig, 1988). In 2010, 24% of the workforce in low- and middle-income countries was employed in agriculture, while agriculture's contribution to GDP was at 10% (World Bank, 2016). In those countries heavily targeted by foreign agricultural investments, the share of workers in the agricultural sector is even higher — for instance, 73% in Ethiopia and 72% in Uganda in 2013 (World Bank, 2016). [4]

Over two-thirds of farming activities are performed by self-employed individuals (Gindling & Newhouse, 2014); wage and salary employees are mainly found in the processing industry. Agricultural wage employment opportunities exist predominantly only for casual and seasonal workers, which can be explained by the seasonality of agricultural production. For most crops, there are clear seasonal peaks (e.g., toward harvest times) during which times labor demand is high (Nolte & Subakanya, 2016; Rosenzweig, 1988). In addition to being limited in terms of quantity, those temporary jobs are also limited with regard to quality. Major differences between regular and irregular wage employment can be found in the working conditions, social protection, and entitlements and benefits for workers (International Labour Organisation (ILO), 2003).

Labor supply in rural areas is considered to be infinite. Even in areas where new labor opportunities open up, the supply remains high due to people migrating into these areas (Taylor & Martin, 2001). A major constraint in rural areas is that the workforce typically lacks the training to perform high-skill tasks (Collier & Dercon, 2014).

Jobs created by LSAIs are often earmarked for wage workers. In some cases self-employment opportunities are provided through contract farming. A smallholder farmer's decision on whether to switch from self- to wage employment is mainly driven by the social opportunity costs of the self-employed (shadow wages). Smallholders will only decide to enter wage employment or release family members to work on a large-scale farm if the drop in profits is compensated by the wage earned on the large-scale farm. More precisely, wages paid on large-scale farms have to be equal to or exceed the marginal revenue product of smallholder farmers (Barrett, Sherlund, & Adesina, 2007).

Another aspect of wage employment created on large-scale farms is that it contributes to the formalization of the agricultural sector, from self-employed smallholder farming to wage employment. This in turn increases the fiscal revenue of an economy since larger holdings are more likely to be formally registered and hence taxable compared to smallholders (Irz *et al.*, 2001); this is despite the fact that investors in agriculture enjoy considerable tax benefits in many countries (Cotula, Vermeulen, Leonard, & Keeley, 2009).

(b) Agricultural labor productivity and labor intensity

As countries develop, their agricultural sectors lose importance. This can be illustrated by comparing the share of people employed in agriculture and the sector's contribution to GDP in low- and middle-income countries over time. During 2000–10, the share of the workforce engaged in agriculture almost halved from 45% to 24%. Within the same period the agricultural sector's contribution to GDP only decreased by 23% (from 13% to 10%) (World Bank, 2016). The sharp drop in agricultural employment compared with the more modest decrease in agriculture's GDP contribution clearly points to increased labor productivity. In other words, less labor input is required to produce the same level of output. Labor productivity measures employment efficiency and is defined as output per unit of labor input during a period of time.

Generally speaking, (agricultural) labor productivity varies largely across countries. In 2015 the agriculture value added per worker (in constant 2010 USD) in Norway was more than four hundred times higher (USD 98,950) than that in Burundi (USD 231) (World Bank, 2016). These differences in agricultural productivity can be explained by a variety of factors: First, policies that distort farm size may lead to a misallocation of farmland and impair productivity (Adamopoulos & Restuccia, 2014). Second, the self-selection of low-skilled workers into the agricultural sector in developing countries is considered to decrease agricultural productivity (Gollin, Lagakos, & Waugh, 2014; Lagakos & Waugh, 2013). Third different agro-ecological conditions (e.g., rainfall and soil quality) determine agricultural productivity and explain differences (Gallup and Sachs, 2000). And fourth, differences in agricultural productivity are particularly stark between countries in diverse states of development. The last point is often rooted in contrasting models of agricultural production. For instance, large-scale agriculture accounts for the majority of agricultural production in industrialized countries, whereas smallholder and family farming [5] play an important role in developing countries. Large-scale farms and smallholder farms also differ in terms of their capital and labor endowments. While smallholders largely depend on labor, large-scale farmers often substitute labor with capital. The extent to which such a substitution can take place depends on, inter alia, the crop itself. The crop determines the labor intensity, i.e., the amount of labor needed in a production process (Deininger & Byerlee, 2011). The cropping practice related to these different labor and capital intensities of production further affects agricultural productivity (Bustos, Caprettini, & Ponticelli, 2016).

In agricultural science it is common to use a labor *input* measure (labor intensity) instead of an *output* measure (labor productivity). Labor intensity (*LI*) is defined as the amount of labor needed in a production process and is calculated as the number of workers required to cultivate one hectare of a specific crop:

$$LI = \frac{Number\ of\ workers\ on\ the\ farm}{Area\ in\ production\ (hectare)}$$

Two main crop classes are often distinguished based on their cultivation patterns: annual crops and perennial crops. Annual crops (e.g., wheat, corn, and soya beans) perform an entire life cycle in one season and have to be replanted every year. Since the process from planting to harvest can be largely performed with the aid of machinery, annual crops are considered *capital intensive*. Subsequently, there is a great deal of scope for capital to replace labor. On the contrary, perennial crops (e.g., tea, coffee, and bananas) persist for many growing seasons. Planting, caring for, and harvesting these (typically tree) crops require more labor input. They thus provide less scope to substitute labor for capital and are considered rather *labor intensive*. Therefore, in terms of labor input, there are significant differences between crops for which labor can easily be substituted by capital. For instance, Deininger and Byerlee (2011) find that oil palm and (manual) sugar cane generate 10–30 times as many jobs compared with mechanized grain farming. Hence, for perennials, key operations potentially vary little between large-scale and smallholder farms and, accordingly, labor intensities are similar. This is not the case for mechanized grain production, where large differences exist between smallholder and large-scale farms (Deininger & Byerlee, 2011). In these cases a hectare under smallholder production is typically thought to employ more people than a hectare under mechanized large-scale farming.

3. CONCEPTUAL FRAMEWORK

The establishment of a new large-scale farm implies the transition from a certain former land use to large-scale farming. This has far-reaching consequences on the rural labor market. We distinguish *direct* and *indirect* employment creation: Direct employment creation can be directly linked to the operation on the farm. These effects typically become visible immediately with the farm establishment. Indirect employment creation, in turn, concerns employment creation that is triggered by the farm operation but does not occur on the actual farm. These effects can occur immediately but typically occur in the medium- and long-term when sectoral changes become effective (forward- and backward linkages). In our conceptual framework and the empirical application we focus on changing labor requirements due to direct employment creation and discuss the indirect employment effects in 6(a) 6().

In order to conceptualize how the establishment of a large-scale farm in a rural context can directly affect the labor market, we illustrate different scenarios (1a–5d) in a transition matrix (Table 1). Accordingly, the direct employment effects depend on three factors: (i) the former land-use, as it determines whether and to what extent crowding out of labor takes place, (ii) the type of crop cultivated, as labor intensity differs between crops, and (iii) the production model, which could mitigate the crowding out of smallholder farmers. The labor demands of new farms vary over time. In the initial stages land preparation and infrastructure development contribute to employment creation. But once the farm is operational, the crops produced and the production model applied are the decisive factors behind further employment creation. We are interested in longer-term employment prospectives and thus only consider the employment creation of operational farms.

The former land use determines the loss of employment. A newly established farm leads to a change in land use and all former income-generating activities on the land cease to exist. We distinguish between investments on farmland already used for large-scale agriculture (1a–1d, brownfield) and the establishment of an entirely new farm (greenfield) on land formerly used for smallholder agriculture (2a–2d), pastoralism (3a–3d), forestry (4a–4d), or conservation (5a–5d).

Labor requirements for the new large-scale farm largely depend on the crops or, more precisely, on the labor and capital intensity of crop production (as discussed in 5(a) 5()). Accordingly, we differentiate between labor-intensive and capital-intensive crops in our transition matrix.

We further account for different production models in that we distinguish between investors who introduce contract farming schemes (CF) and those who do not (no CF). Contract farming schemes are thought of as a solution to preserve smallholder employment and achieve considerable social benefits for participating farmers (Deininger & Byerlee, 2012; Kleemann & Thiele, 2015). The term “contract farming” refers to agreements between a farmer and a firm. Under such an agreement, a farmer is required to provide a certain quantity and quality of commodity that is either produced on the farmer’s own land or on land acquired by the investor but worked by the farmer. In turn, the investor provides production support and processes the farmer’s produce or puts it on the market (Eaton & Shepherd, 2001). Regardless of whether leased or non-leased, in both cases jobs are largely maintained and — depending on the specific contract arrangements — production conditions might improve, for instance, through the provision of credit; agricultural inputs in the form of seeds, fertilizer, and pesticides; and training in production methods. Contract farming is a highly debated practice in the literature (Baumann, 2000; Simmons, 2002). On the one hand, such arrangements are criticized because of the unequal power relationship between the smallholder and the investor, which could lead to the latter exploiting the former. On the other hand, it is considered an opportunity to include local farmers

Table 1. *Transition matrix*

Former land use		Final land use Large-scale farm			
		Labor intensive crops		Capital intensive crops	
		no CF	*CF*	*no CF*	*CF*
Brownfield investments	Large-scale agriculture	1a	1b	1c	1d
Greenfield investments	Smallholder agriculture	2a	2b	2c	2d
	Pastoralists	3a	3b	3c	3d
	Forestry	4a	4b	4c	4d
	Conservation	5a	5b	5c	5d

Source: Author's compilation.
Note: CF = contract farming.

in development processes in the context of large-scale land investments (De Schutter, 2011; Robertson & Pinstrup-Andersen, 2010).

(a) Scenarios for brownfield investments

For scenarios 1a–1d, we would expect new investments to take over existing farms. In this case there would be no crowding out of smallholder agriculture or other income-generating activities of local communities; although employees of the previous farm might still be released. Therefore, the net employment effect is strongly driven by the labor intensity of the cultivated crops and the question of whether contract-farming schemes are applied or not. If the investor decides to plant more labor-intensive crops (1a+1b), we would expect a more positive employment effect than if the investor were to opt for capital-intensive crops (1c+1d) under high mechanization. This positive effect might be further stimulated if the investor implements contract-farming schemes, which would offer employment opportunities to smallholder farmers in the region.

(b) Scenarios for greenfield investments

If new farms are established on land that was not formerly used for large-scale agriculture, former land use plays a more pronounced role since jobs connected to the land's former use will be lost. This holds particularly true for investments in scenarios 2a–2d, which target land that was formerly used for smallholder agriculture. Accordingly, we expect displacements and massive crowding out of smallholder employment. In the scenarios 3a–3d we expect pastoralists to be crowded out, while in scenarios 4a–4d we expect labor engaged in forestry to be crowded out. Conservation areas often serve various purposes, such as hunting, fishing, and gathering of firewood. Therefore, these activities would be expected to cease in scenarios 5a–5d. Generally speaking, we expect low crowding out of former employment on land formerly used for forestry and conservation (scenarios 4a–5d) due to the relatively low labor demand for forestry, which ranges between 0.02 and 0.04 workers per hectare (Bustos *et al.*, 2016; Deininger & Byerlee, 2011).

Similar to brownfield investments, employment is created according to the crops that are cultivated and the business model: labor intensive crops (a+b of scenarios 2–5) are more likely to preserve existing jobs or even generate additional employment opportunities, which could lead to net employment creation. With capital-intensive crops (c+d of scenarios 2–5), the newly created employment might not compensate the employment that was crowded out in the first place. Some investment projects implement contract-farming schemes (b+d of scenarios 2–5), which could — similarly to labor-intensive crops — mitigate the crowding out of employment linked to different former land uses.

In sum, the net employment effect is driven by the combination of these three aspects in each acquisition, ranging from massive crowding out and very few new employment opportunities to hardly any crowding out mitigated by contract-farming schemes and many new jobs. The negative effects are prone to be strongest for former greenfields which experienced high crowding out of former employment — specifically, former smallholder farms. The cultivation of labor-intensive crops might mitigate the loss through substantive labor demand, while capital-intensive crops are expected to generate only limited employment. If contract-farming schemes are implemented, the crowding out of former employment can be reduced and smallholder farmers can partake in the development process of the region.

4. DATA

In our empirical analysis we mainly draw on two databases. For LSAIs, we use data from the most comprehensive database on large-scale land acquisitions, the Land Matrix (retrieved on 1 August 2016). We include all concluded agricultural deals (both oral agreement and signed contract) above two hundred hectares. [6] Our data sample contains 1,346 deals amounting to 35.2 million hectares. The Land Matrix contains comprehensive information on individual large-scale farming projects with exact figures for the acquired area. In particular, it feeds the transition matrix with information on the (i) former land use, (ii) the type of crop cultivated including its respective current size under production and current number of workers, and (iii) the production model by capturing contract-farming schemes (with information on the area used for contract farming and the respective number of contract farmers, either inside or outside of the land acquired by an investor).

The land acquired by investors often contains multiple entries for several of these categories. If the share of these different entries is not given, we assume equal shares for each entry. For those cases of contract farming, where the actual area for contract farming is not given, we assume that contract farmers cultivate the entire acquired area.

To assess the employment loss from the former land use smallholder farming we draw on the FAO's Smallholder Farmers' Dataportrait [7] — a standardized smallholder-specific database that consists of Living Standards Measurement Study (LSMS) survey data and FAO Rural Income Generating Activities (RIGA) data. We use this to estimate the labor intensity of smallholder farmers (see 5(i) 5()).

To allow for the assessment of the net employment creation potential (see 5(b) 5()), we use five African low- and middle-income countries covered by the Smallholder Farmers' Dataportrait: Ethiopia, Kenya, Nigeria, Tanzania, and Uganda. For these countries, Land Matrix and FAO data overlap and provide a solid basis for a cross-country comparison.

5. EMPIRICAL APPLICATION

(a) Labor intensities

In the first step of our empirical analysis, we derive and compare the labor intensities of large-scale and smallholder farmers. This allows us to distinguish labor and capital intensive crops which is an important precondition to study actual employment effects. Based on the labor intensities, we can estimate the loss of employment from land formerly used for smallholder farming as well as the employment creation on now commercially farmed land.

(i) Smallholder agriculture

For smallholder agriculture, labor intensity is derived from the number of workers (family and hired workers) on a smallholder farm and the size of the farm as reported in FAO's Smallholder Farmers' Dataportrait. Both measures are median-weighted averages aggregated on country level. Because of its level of aggregation, the smallholder data do not account for individual crops, former uses, or production models. However, since the data set is derived from national labor surveys and household surveys and only addresses smallholder farmers, it reflects country-specific cropping patterns — that is, the data capture the typical crops cultivated and the respective labor intensity level for each crop. Therefore, the derived estimate can be considered — in the country context — a good estimate of smallholder labor intensity.

Based on the FAO data, we consider smallholder labor intensities to range between 1.13 and 3.77 workers per hectare (see also Table 3 below in (c)), with a mean of 1.77 and a median of 1.26.

(ii) Large-scale agriculture

For our large-scale agriculture labor intensity estimate per crop [8], we use Land Matrix data. To cater for the differing labor demand under contract farming arrangements, we calculate intensities for such cases separately. [9]

In the following, we look at the labor intensities of some key crops, determined by their frequency in the Land Matrix. We assume that labor intensities are similar across world regions. This is a strong supposition given that agro-ecological conditions, such as rainfall and soil quality, vary largely across world regions. Our assumption, however, may be justified given (i) the highly mechanized mode of production in large-scale agriculture, which is comparable across the globe, and (ii) the fact that agro-ecological conditions predetermine cropping patterns — for example, certain crops are only cultivated if the operation is thought to be profitable. We consider the derived estimates to be a valid approximation of differences in the labor intensities of various crops but are fully aware that one overall value will not be able to precisely reflect labor demands across the world.

Figure 1 shows labor intensities for annual and perennial crops and confirms that indeed annual crops have lower intensities. Nevertheless, there is some variance and hence some exceptions to this rule. For instance, rice shows a rather high labor demand of over 0.6 workers per hectare despite being considered a capital-intensive annual crop. However, this is not due to the natural characteristic of the plant but rather due to the way it is commercially cultivated. Although a perennial crop by nature, rice is usually replanted every year in order to generate higher yields. Similarly, cotton is cut down every year to prevent disease and pest infestation even though it can survive several growing seasons. We also find heterogeneity in terms of labor intensities among perennial crops. Typically, such perennials are commercially produced on plantations. Due to their physical characteristics, some of these crops (e.g., tea, bananas, and coffee) are indeed quite labor intensive, while others (e.g., rubber, cocoa, and palm oil) are less labor intensive (International Labour Organisation (ILO), 1994). In the latter group of crops it is easier to substitute labor with capital.

We check the labor intensities derived from Land Matrix data against reports on labor intensity in the literature (see Table 4). Generally speaking, we find similar labor intensities.

These empirical findings show that the classification of annuals and perennials reflects potential labor intensity quite well, although not perfectly. In the following empirical applications we hence do not use strict annual versus perennial crops as categories but categorize crops as either labor intensive or capital intensive. In general, the labor-intensive category consists of perennial crops; however, we also include those annual crops which are more labor intensive and exclude those perennial crops which, relatively speaking, are less labor intensive. The capital-intensive category typically comprises annual crops, though some labor-intensive annuals are excluded, while some perennial crops with low labor intensities are included.

To now distinguish labor-intensive from capital-intensive crops, we feed labor intensities of annual and perennial crops

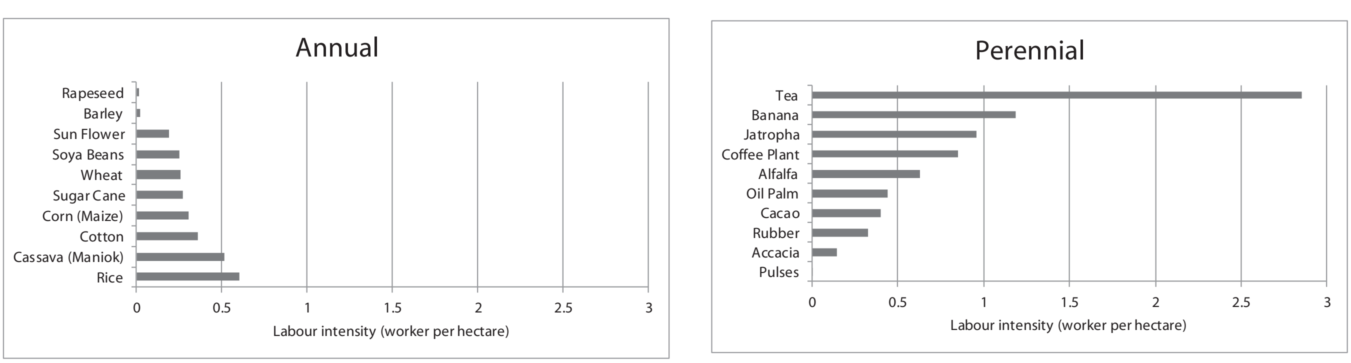

Figure 1. *Labor intensities for major annual and perennial crops.*
Source: Author's calculation based on The Land Matrix Global Observatory (2016).

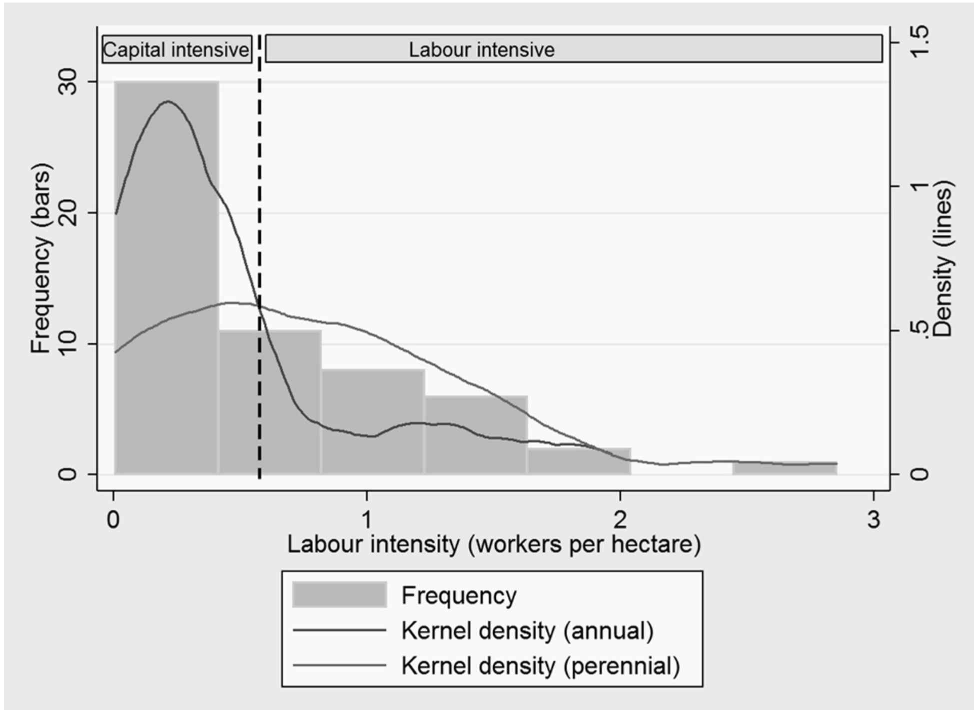

Figure 2. *Frequency and density of labor intensity by crop class.*
Source: Author's calculation based on The Land Matrix Global Observatory (2016).

derived from the Land Matrix into a non-parametric estimation (kernel density). The point of intersection is used to derive the threshold between labor and capital intensity. Figure 2 shows that this point is at a labor intensity of 0.576 workers per hectare. Consequently, we define all crops above 0.576 workers per hectare as labor intensive, and all crops below that threshold as capital intensive.

(b) Transition to large-scale farming

(i) Global overview on different scenarios

We now address the transition from the former land use to large-scale farming by using the transition matrix (introduced in Section 3) to illustrate how the total acquired area is distributed across each of the following three key factors: (i) the former land-use (large-scale agriculture, smallholder agriculture, pastoralists, forestry, and conservation); (ii) the labor intensity of the crop cultivated (labor intensive, capital intensive; see 5(a) 5()); and (iii) the production model applied (contract farming, no contract farming). As a result, we can estimate the area that is transformed from the respective former land use to large-scale farming, taking into account the crops planted and the production models applied. Table 2 shows the transition matrix with the former land-use and the respective final land-use based on Land Matrix data. We use the acquired area (expressed as percentage of the total acquired area) as a measure; the areas' sizes in hectares can be found in Table 5.

Relating the derived estimates to the potential employment effect of each key determinant reveals that over three-quarters of the land acquired has previously been used for agriculture — 44% for large-scale agriculture and another 34% for smallholder agriculture. Meanwhile, 13% of the land targeted was formerly used for forestry; 5%, by pastoralists; and 4%, for conservation. This global overview on former land use suggests that investors do not primarily target "idle" land. Instead, targeted land has usually been used for agriculture before suggesting that crowding out of former employment can be expected.[10]

Looking at the crop type, we find a clear majority of the area used to cultivate capital-intensive crops (75%). This suggests a rather low employment creation potential for most LSAIs as capital-intensive crops indicate a highly mechanized production with low labor inputs.

In total, LSAIs only implement contract-farming schemes on 2 out of every 10 hectares. This is more often the case for capital-intensive crops (17%) compared to labor intensive crops (3%).

We now look into the different scenarios of the transition matrix. For brownfield investments, i.e., land formerly used by large-scale farms (1a–1d, 44%), we do not expect a crowding out of former employment. The share of capital-intensive crops (40%, with and without contract farming) is eight times higher than the share of labor-intensive crops (5%). In contrast to other former uses, contract-farming schemes are relatively common and applied on almost one-third of the area formerly used for large-scale agriculture (adding up the percentages of labor intensive and capital intensive crops, see explanation on within group comparisons[11]), especially for capital-intensive crops. Given that crowding out of former employment is considered limited, positive employment effects might occur in this scenario even in the dominating case with capital-intensive crops, especially if contract farming schemes are applied.

Over one-third of the land area has previously been used by smallholder farmers (2a–2d), implying a potential crowding out of this former employment. This crowding out is only partially mitigated through the cultivation of labor-intensive crops (41%) or through contract-farming schemes (15%). We hence expect that potential employment losses are rather high

Table 2. *Transition matrix — Results as percent of the area acquired (n = 1,031)*

Former land use			Final land use Large-scale farm: Labor intensive 25%		Capital intensive 75%		Total
			no CF	CF	no CF	CF	
Brownfield investment	**Large-scale agriculture**		1a	1b	1c	1d	
		Acquired area (%)	3%	2%	28%	12%	**44%**
Greenfield investment	**Smallholder agriculture**		2a	2b	2c	2d	
		Acquired area (%)	12%	1%	16%	4%	**34%**
	Pastoralists		3a	3b	3c	3d	
		Acquired area (%)	2%	<1%	3%	<1%	**5%**
	Forestry		4a	4b	4c	4d	
		Acquired area (%)	6%	<1%	6%	1%	**13%**
	Conservation		5a	5b	5c	5d	
		Acquired area (%)	<1%	<1%	3%	<1%	**4%**
		Total (%)	**22%**	**3%**	**57%**	**17%**	**100%**
		Total (#)	**183**	**66**	**611**	**171**	**1,031**

Source: Author's calculation based on The Land Matrix Global Observatory (2016).
Notes: Total can vary due to rounding. CF = contract farming.

Table 3. *Employment creation through LSAIs for selected countries (scenarios 2a–2d)*

Country[(a)]		Labor intensive		Capital intensive		Total	As % of employment in agriculture[(b)]
		no CF	CF	no CF	CF		
Ethiopia	Gross employment creation through new large-scale farm	106,775	529	31,445	9,329	**148,078**	**0.48%**
(LI = 1.24; *n* = 43)	Crowding out of former smallholders on acquired area	137,000	458	149,034	29,760	**316,252**	**1.03%**
	Net employment effect	*−22%*	***16%***	*−79%*	*−69%*	*−53%*	***−0.55%***
Kenya	Gross employment creation through new large-scale farm	76,507	7,179	n/a	687	**84,373**	**0.39%**
(LI = 3.77; *n* = 6)	Crowding out of former smallholders on acquired area	301,600	16,965	n/a	10,682	**329,247**	**1.53%**
	Net employment effect	*−75%*	*−58%*	***n/a***	*−94%*	*−74%*	***−1.14%***
Nigeria	Gross employment creation through new large-scale farm	23,450	28,272	9,870	113,449	**175,042**	**1.18%**
(LI = 1.43; *n* = 32)	Crowding out of former smallholders on acquired area	47,428	50,306	39,087	278,188	**415,009**	**2.80%**
	Net employment effect	*−51%*	*−44%*	*−75%*	*−59%*	*−58%*	***−1.62%***
Tanzania	Gross employment creation through new large-scale farm	16,820	16,675	n/a	5,225	**38,721**	**0.29%**
(LI = 1.26; *n* = 10)	Crowding out of former smallholders on acquired area	21,672	13,469	n/a	14,616	**49,757**	**0.37%**
	Net employment effect	*−22%*	***24%***	***n/a***	*−64%*	*−22%*	***−0.08%***
Uganda	Gross employment creation through new large-scale farm	2,133	947	n/a	11,363	**14,443**	**0.15%**
(LI = 1.13; *n* = 8)	Crowding out of former smallholders on acquired area	2,837	1,363	n/a	29,821	**34,022**	**0.34%**
	Net employment effect	*−25%*	*−31%*	***n/a***	*−62%*	*−58%*	***−0.20%***

Source: Author's calculation based on The Land Matrix Global Observatory (2016) and International Labour Organisation (ILO) (2016).
Notes: [(a)] Labor intensities (LI) of smallholder farmers and number of LSAIs (n) per country in parenthesis.
[(b)] The figures on employment in agriculture correspond to the latest available year per country.
CF = contract farming.

in the majority of cases where land formerly used by smallholders is targeted. This specific scenario will be looked at in greater detail in 5(c) 5().

On former pastoralist land (3a–3d, 5%) it is likely that pastoralists will be crowded out once the land is transferred to a large-scale farmer. According to our findings, capital-intensive crops dominate (66%) — which impairs the (new) employment generation — and there is almost no evidence of contract farming (4%). Therefore, we expect the majority of deals on former pastoralist land to result in employment losses.

We find capital-intensive crops on more than half of the land (57%) formerly used for forestry (4a–4d, 13%). Moreover, only a small share (12%) of former forestry land is farmed under contract-farming schemes. However, considering the generally low labor requirements of the former forestry land, on those areas where labor-intensive crops are cultivated (43%) and where contract farming is applied, we expect rather positive employment creation potential.

The same holds for former conservation land (5a–5d, 4%), which is typically characterized by a rather low labor intensity and does hence not imply a large crowding out of former employment. The predominant cultivation of capital-intensive crops without contract farming indicates very limited employment creation, which might however be positive if there is indeed no crowding out of former employment.

(ii) Regional perspective

In order to provide a more realistic picture, regional differences have to be taken into account. Figure 3 shows that the three key determinants differ across regions.

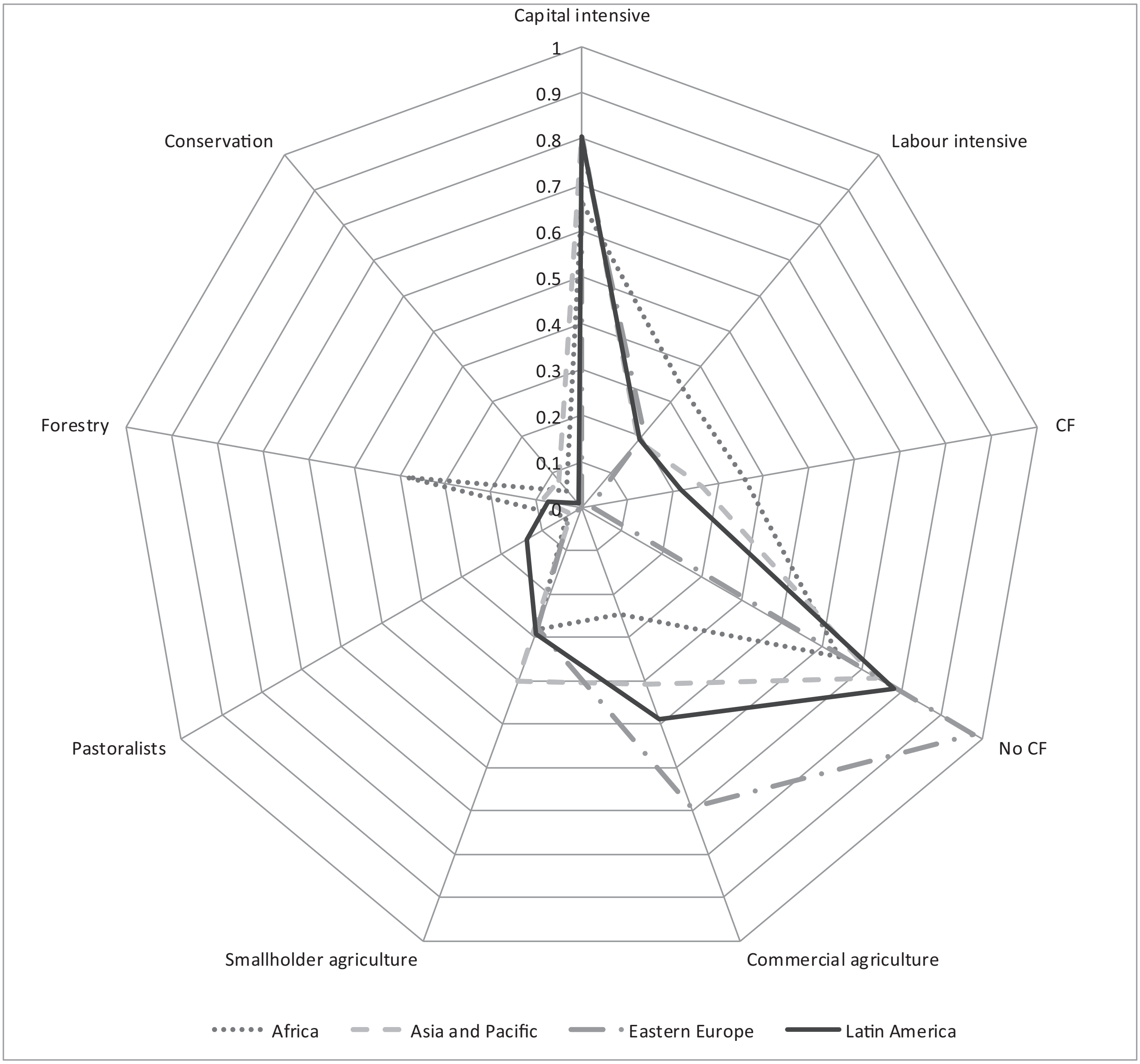

Figure 3. *Regional perspective according to the key determinants.*
Source: Author's calculation based on The Land Matrix Global Observatory (2016). Note: CF = Contract farming. This figure also includes deals which lack the information of the former use but do have information on the crop and/or the production mode.

On the African continent, half of the LSAIs are set up on agricultural land that had been primarily used by smallholders (28%) and we also find the largest share of former forestry land (39%) compared to other regions. Former pastoralist land and conservation areas only constitute 4% and 5%, respectively. LSAIs in Africa have a clear preference for capital-intensive crops (66%); however, contract-farming schemes (36%) are also often applied compared to other regions. The considerable share of labor-intensive crops (33%) in combination with the frequent occurrence of contract farming (36%) has the potential to — at least partly — mitigate the crowding out of smallholders and pastoralists in Africa.

The Asia and Pacific region has the highest share of investments on former smallholder land (40%) and hence entails the greatest risk of crowding out. A similar share of the acquired area was formerly used for large-scale agriculture. Less labor-intensive forestry and conservation activities were each carried out on less than 10% of the area. Pastoralists are less common in the region, accounting for only 3% of the land. Similar to Africa, though more pronounced, investors in the Asia and Pacific region concentrate on capital-intensive crops (81%). The high level of crowding out and the low level of labor-intensive crops point to negative net employment creation in the region; although the considerable share of contract farming (26%) might partly mitigate this.

Two thirds of LSAIs in Eastern Europe target former large-scale farms, followed by former smallholder land (28%). Similar to patterns in Africa and the Asia and Pacific region, capital-intensive crops (79%) are favored over labor-intensive crops (21%). Contract-farming schemes are irrelevant, accounting for only 2% of the acquired area. Although most of the investments target large-scale farms, the choice of crops and production mode make mitigation of the considerably high crowding out of smallholders unlikely.

As in Eastern Europe, albeit less pronounced, most investors in Latin America target existing large-scale farms (49%). Smallholder land accounts for 29% of LSAIs in the region; pastoralists, 14% (the largest share across all regions); forestry, 7%; and conservation areas, 1%. The crowding out of smallholders and pastoralists is further accelerated by the prevailing cultivation of capital-intensive crops (81%). Contract-farming schemes, which are in place on about one out of every five hectares, could cushion, without eliminating, the negative effects. Thus, overall net employment is expected to be negative.

This regional analysis shows that crowding out of former smallholder farmers is a serious problem across all regions, particularly in the Asia and Pacific region, whereas the crowding out of pastoralists is most marked in Latin America. The creation of new employment and therewith the mitigation of crowding out through cultivating labor-intensive crops are, generally speaking, rather low but slightly higher in Africa. Contract farming might be able to mitigate crowding out to some degree — especially in Africa and to a lesser extent in Latin America and the Asia and Pacific region but not in Eastern Europe.

Given the preceding empirics of the three determinants in the different world regions, we see very little scope for a positive direct employment effect across all regions; rather, we expect high crowding out of existing jobs and relatively few new jobs to emerge.

(c) Estimation of labor creation potential through LSAIs

Finally, we assess the net employment creation potential for those countries where Land Matrix and FAO data overlap. We provide estimates for both smallholder and large-scale farmers for each of the five African countries by multiplying the acquired area with the previously derived labor intensities (crop-specific in the case of large-scale agriculture and country-specific in the case of smallholder agriculture). This estimate is based on the size of the acquired area to show the number of jobs potentially created for each recorded LSAI if the entire area was cultivated. The difference between the number of jobs created by large-scale farmers and the number of jobs formerly required by smallholders is the potential net employment effect. We then relate this effect to the total number of people employed in agriculture in the respective country. These estimates are meant to give an idea about the dimensions of potential employment creation but entail important uncertainties, which we discuss in detail in 6(b) 6().

To derive the respective net employment effect, we contrast the gross employment of large-scale holdings with the former form of employment, only looking at land formerly used for smallholder agriculture (i.e., scenarios 2a–2d of the transition matrix; see Table 1).

The net employment effect EE_{net} is defined as the difference between the number of jobs created on a newly established large-scale farm and the number of jobs derived from the former land-use type (here, smallholder agriculture) expressed as a percentage of the former use:

$$EE_{net} = \frac{Jobs_{commercial} - Jobs_{former\ use}}{Jobs_{former\ use}}$$

Table 3 shows the estimated net employment effect with respect to the three key determinants in the transition matrix, focusing on land formerly used by smallholders. To put the total value in specific national contexts, we further report the employment effect as a percentage of overall employment in agriculture in the respective country.

Across all countries we encounter a strong negative net employment effect if a large-scale farm is established on land formerly used for smallholder agriculture, which is due to high crowding out. The effect ranges between −22% (Tanzania) and −74% (Kenya). As expected, farms cultivating capital-intensive crops suffer greater job losses than do farms cultivating labor-intensive crops. Looking into the net employment effects of labor-intensive crops, the mitigation potential of contract farming is clearly evident. In fact, we even identify net employment creation of 16% to 24% for Tanzania and Ethiopia, respectively. We also find lower employment losses for farms cultivating capital-intensive crops if contract farming is used.

The last column of Table 3 gives an indication on the magnitude of the net employment effect in the respective country. The employment losses expressed as a percentage of overall agricultural employment through LSAIs are relatively small and range between 0.1% (Tanzania) and 1.6% (Nigeria). This shows that on a global and national scale, the crowding out of smallholder farmers and the accompanying net employment losses are rather small. However, they can be substantial in the immediate proximity of the investment, especially if there are no other employment opportunities available in the respective local labor markets.

6. DISCUSSION

Large-scale agricultural investments cause a significant loss of employment on the local level considering the direct employment creation only. This is mainly due to the crowding out of former employment, which can only be partially mitigated. In this section we also elaborate on the indirect employment creation of LSAIs and discuss the validity and limitations of our estimates.

(a) Indirect employment creation

Establishing a large-scale farm does not only have direct employment effects, as empirically assessed in the preceding sections, it also has indirect effects that may result in employment creation not directly linked to farming. One such effect is related to the inflow of capital, which makes new technologies available (e.g., inputs such as seeds, fertilizer and pesticides, and machinery). Improved technologies typically increase labor productivity; this is particularly the case for agricultural workers on large-scale farms. Depending on the potential of the spillover effects, advanced technologies might also reach smallholder farmers, resulting in productivity gains for them, too. Such productivity gains do three things: First, they increase the availability of food if food is produced, which in turn reduces the market price. The reduction of food prices relative to farm workers' incomes frees up shares of households' budgets, which can then be used to purchase non-food goods and services. The resulting increase in demand for industrial goods and services fosters the growth of these respective sectors (Dorward, 2013). Second, they release labor from agriculture to other sectors (Dorward, 2013; Timmer, 1988). In short, capital inflow into agriculture is expected to change the sectoral composition from employment in agriculture toward employment in industry and services. Third, they result in higher total labor incomes (FAO, 2016; Satchi & Temple, 2009).

However, empirical studies show that technological changes are not labor saving *per se* and hence do not always trigger a sectoral shift. For example, Bustos *et al.* (2016) study two technological changes in Brazil: the introduction of genetically engineered soy and the introduction of a second harvesting season. The former is strongly labor-saving and fosters industrialization processes and a shift of employment toward the industry and service sectors (as expected). In contrast, a second harvesting season is land-augmenting and can hinder industrialization. In this case, technological change did not lead to a shift of employment from agriculture toward other sectors. Kouser, Abedullah, and Qaim (2015) examined the technological change of introducing insect-resistant *bacillus thuringiensis* (Bt) cotton in Pakistan. They found that rather than reducing agricultural labor demand due to less spraying of chemical pesticides, the introduction of Bt cotton resulted in a 55% increase in the demand for hired labor mainly due to the need to harvest larger yields.

Another effect is related to the potential of large-scale farms to build productive relationships with other industrial branches over time (Larson & Shaw, 2001). A common distinction of these relationships is backward and forward linkages. In the agricultural context backward linkages describe the interconnection of a large-scale farm with the industrial branch supplying it with inputs (e.g., seeds, fertilizer, and pesticides). The increased demand for such inputs — induced by large-scale farms — might trigger the expansion of the upstream industry and present new employment opportunities. Forward linkages, on the other hand, comprise all downstream industries processing the farms' output — for instance, the processing, packing, and shipping industries. In this case the increased output of large-scale farmers might lead to an expansion of the processing industry — if processing is done in the target country — and hence more jobs in the industrial sector. The fact that labor is released from the agricultural sector due to productivity gains is conducive to establishing these linkages.

For backward linkages, there is hardly any causal evidence available in the literature. In cases where a newly established farm procures inputs locally, we expect jobs to be created through backward linkages. However, with a highly competitive and increasingly concentrated supply side for the main agricultural inputs and technologies (for instance, seeds, fertilizer and machinery) dominated by a few global players, the establishment of domestic input supply industries for agriculture is unlikely. Jobs would hence mainly be created through the (usually locally rooted) service sector — for instance, trade intermediaries and logistic and shipping companies which facilitate access to agricultural inputs.

Forward linkages bear potential for the development of the local industry. The growing output triggered by higher productivity requires adequate processing facilities. In one out of three deals according to Land Matrix data, the produced commodities are exported unprocessed. For this one-third of deals hardly any employment creation is expected through forward linkages, whereas the opposite might be the case for the remaining two-thirds of deals. A key determinant for unlocking the potential of forward linkages lies in the capital intensity of the processing industry. This is nicely illustrated by the examples of Brazil and Thailand. In Brazil large-scale mechanized farming substituted capital for labor, resulting in low employment creation and growing inequalities. In Thailand agricultural commercialization took a different turn as off-farm enterprises did not have access to subsidized credit and, therefore, could not afford labor-displacing technologies. This consequently generated massive employment, especially in the processing industry (World Bank, 2009).

In sum, from a theoretical stance we would clearly expect a change from a smallholder-dominated labor market to a labor market dominated by industry and service. Empirically, the picture is less clear as the literature also reports cases in which technological changes have increased the demand for agricultural labor. Employment creation in the industrial sector through backward and forward linkages depends on the specific country and sector contexts.

(b) *Validity and limitations of the estimates*

The validity of our results heavily hinges on the quality of the Land Matrix data. While Land Matrix data were criticized when first published (see, for instance, Bräutigam & Zhang, 2013; Edelman, 2013; Oya, 2013), the data are now widely used by researchers (see, for instance, Arezki, Deininger, & Selod, 2015; Messerli *et al.*, 2014; Osabuohien, 2014). The Land Matrix Initiative is transparent about potential biases in the data and does not claim to provide a realistic representation of reality (The Land Matrix Global Observatory, 2016). In fact, due to the opaqueness surrounding many LSAIs, the Land Matrix data are likely to underestimate the phenomenon. Accordingly, the acquired areas as reported in the Land Matrix can be considered a conservative estimate of the overall phenomenon. Despite certain biases, we consider Land Matrix data to be the most accurate information available and well suited to highlighting overall global trends.

The conceptual framework incorporates three key determinants, which require some assumptions and simplifications in their empirical application. First, input for the labor intensities would ideally be calculated on an individual level or, more precisely, on the basis of man-hours per hectare and per crop. Because such disaggregated figures are not available, we use the total employment numbers of each holding as reported in the Land Matrix. Although the Land Matrix differentiates the type of employment, only one out of five cases explicitly state the number of seasonal workers. For the remaining cases, we assume that seasonal workers are included in the total employment figures. A conversion factor could be used to translate these seasonal-employment figures into full-time equivalents in order to account for the fact that seasonal laborers only work part of the year. However, we consider such a factor to be too arbitrary to account for the variation in working hours of seasonal workers and instead treat seasonal labor as full-time equivalents. In contrast, FAO's Smallholder Farmers' Dataportrait accounts for the heterogeneity to a certain extent by calculating labor input as the total number of person-days divided by the number of workdays in a year. However, also person-days per workdays can be only considered as a second best solution to address the labor input compared to man-hours. More precisely, it lacks the detail to distinguish between part-time and full-time during a workday and therefore fails to fully capture time-related underemployment; a reality often found on smallholder farms owned by families which would overstate the actual labor input. As a result of these different approaches, the labor input and therewith the estimated labor intensities derived from Land Matrix data could be overestimated. Although both overestimations are likely to cancel each other out, the gross employment generation estimated in Table 3 should be considered an upper bound estimate.

Second, we assume that the whole area acquired by an investor was to be cultivated. This is meant to give an idea of how many jobs could potentially be created on the land acquired. In reality, investors often lack the capacity to cultivate all the land acquired, and, usually, not all of the land acquired is suitable for production; hence, only a fraction of the land will be cultivated. This also adds to the overestimation of *gross* employment generation through large-scale farms in Table 3. However, we equally pretend the whole area was formerly under production and thus overestimate the crowding out of former employment. This is particularly important for land formerly used by smallholder farmers. Consequently, the estimate for employment losses of former smallholders is also an upper-bound estimate.

Third, we cannot account for the quality of newly created employment. Employment quality plays an important role as there might be a huge difference between a self-employed smallholder and a wage employee in terms of decency. One important aspect in this context is that self-employed smallholders usually operate in the informal economy and are hence excluded from social security systems and lack adequate representation. On the contrary, formal wage employees ideally have access to these systems and are also able to express their concerns through workers' organizations. However, the transformation from smallholder farming to wage employment can heavily impact the social relations in communities and within households. Ethnographic research on Vietnam (Dao, 2016) and Indonesia (Julia & White, 2012) shows that employment on plantations is often perceived as a downgrade. Households that have lost agricultural self-employment have the possibility to compensate for their lost income by switching into wage employment. Although fewer employment opportunities are expected to emerge, overall compensation is still feasible since many low-pay jobs are replaced by fewer better paid jobs.

Fourth, in terms of multicropping patterns and multiple former land uses, we assume that the total area of a holding — and hence the labor input — is equally distributed across each former land-use type and crop. As we do not know the real share of an area attributed to various former land uses or crops, this is a necessary assumption even though it can potentially introduce biases. For instance, cases reporting two different crops are difficult to determine. It could be different plots of land used for each crop or it could be multicropping — that is, both crops sharing one plot through intercropping or succession planting. In the first case, the area could be equally or unequally distributed across the crops, whereas in the case of multicropping the same plot of land is used for both crops, meaning that an equal distribution across the two crops is very likely. In both cases labor intensity is increased compared to single-cropping, either through higher yields or through an additional growing cycle in one season. However, when comparing the labor intensities of single-entry cases with multiple entry-cases in our data, there are no major differences.

Fifth, in terms of production models there is obviously more diversity than just contract farming and non-contract farming. Moreover, even contract-farming arrangements exist in different forms and context conditions. The effects of contract farming on participating farmers are diverse and a source of controversial debate in the literature (Bijman, 2008; Minot, 2007). Different contractual arrangements, diverse context conditions, and an unequal power balance between the firm and farmers may explain the variance in outcomes. We neglect these variances in our analysis and only consider the sheer prevalence of such agreements. However, we do use — whenever available — labor intensities for contract-farming arrangements and thereby attempt to capture the importance of different production models with data based on real contract-farming schemes.

Sixth, our analysis of net employment effects is limited to land formerly used by smallholders as we lack information on the crowding out of former employment for other types of land use. On the one hand, the acquisition of former smallholder land is highly relevant as it concerns more than a third of the acquired land, which is of major concern to opponents of LSAIs. Hence, there certainly is a rationale to focus on former smallholder land. On the other hand, we have to bear in mind that we expect the largest degree of crowding out to occur on these areas and smaller degrees to happen on land with other uses. Thus, our net employment estimates cannot be transferred to other former land-use types. The effects are expected to be more positive in the other scenarios due to less destruction of former employment.

Last, we deliberately choose to focus on employment effects and thus neglect other effects associated with establishing a large-scale farm. We do so to understand the very complex effects on the labor markets. At the same time, we are aware of the profound and diverse effects of large-scale farms on the economic and social spheres of local communities as well as on the environment (for instance, see Oberlack, Tejada, Messerli, Rist, and Giger (2016) for a meta-analysis of case studies on livelihood outcomes of large-scale land acquisitions).

With all of these caveats in mind, the above-described empirical exercise provides an empirical assessment of the potential employment effects of LSAIs. We provide a simple but powerful tool to assess the direct employment creation of investments by taking three decisive — albeit simplified — factors into account. Using Land Matrix data implies that we underestimate the overall phenomenon as the area acquired is probably much larger. However, we believe that Land Matrix data reveal accurate trends concerning these three factors. Certain assumptions (e.g., about land distribution or the complete use of the acquired land) and simplifications of complex issues (e.g., contract farming) are necessary, though they lead to an upward bias in labor intensities and demand of large-scale farmers. As a result, we tend to overestimate large-scale farms' gross employment creation that we consider to be upper bounds. Accordingly, the predicted values for net employment creation might — despite the negative values — even be too optimistic. We therefore consider these net employment effects for land formerly used by smallholders as a conservative estimate of employment losses. However, it is important to bear in mind that this is hugely driven by the crowding out of smallholder farmers (for which we also use an upper-bound estimate) and that net employment effects are more likely to be positive for other land-use types. Although our estimates should not be taken at face value, they indicate overall trends of the direct employment effects of the different scenarios in our transition matrix.

7. CONCLUSION

This paper debates the employment effects of large-scale agricultural investments (LSAIs). It contributes to the debate by providing and empirically testing a conceptual framework on direct employment effects. To this end, we identified and discussed key determinants of these direct employment effects: (i) the former land-use, (ii) the crop cultivated, and (iii) the production model applied. We summarize these key determinants in a transition matrix to illustrate scenarios that could potentially occur in the course of transitioning from the former land use to large-scale farming.

In our empirical application, we use Land Matrix data to assess which scenarios actually occur in reality and then derive implications for employment creation. The largest generation of direct net employment is expected for investments that do not entail massive crowding out of former income-generating activities and cultivate labor-intensive crops under contract-farming schemes. However, Land Matrix data show that this scenario only applies to a very small amount of the acquired area. Instead, we find that over a third of land targeted was formerly used by smallholder farmers and that contract-farming schemes are only used on 2 out of every 10 hectares. This implies that crowding out of former smallholder farmers is a serious issue. Moreover, capital-intensive crops are clearly dominating, which hints at investors focusing on highly mechanized farming with low labor demand. Accordingly, direct net employment creation for the great majority of LSAIs is limited, and high hopes for massive direct employment creation through LSAIs are clearly misplaced.

Crowding out of smallholder farmers is a severe problem in all regions, with some nuances. For instance, crowding out of smallholders is most pronounced in the Asia and Pacific region while pastoralists are particularly affected in Latin America. Only about 20% of land is used to cultivate labor-intensive crops, which is generally low; only in Africa is this share slightly higher. Africa also reveals the highest amount of mitigation potential through contract-farming schemes.

We then derived the net employment effects for land formerly used by smallholders for selected countries. We find a massive loss of employment (ranging between −28 and −75%), with the highest losses stemming from the cultivation of capital-intensive crops. However, in few cases, we identified a positive net employment effect associated with the cultivation of labor-intensive crops in combination with contract farming, suggesting that LSAIs may actually be capable of creating net employment if a specific combination of key determinants is in place. Although these results hint at large losses for individual farming operations, the overall impact on the population employed in agriculture at the national level is for our sample below 1.5% and hence relatively small.

To assess employment creation triggered by large-scale farms, it is essential to look into indirect effects, which typically occur in the medium- and long-term. Such effects are usually linkages to other sectors, but they also include price and wage effects on local markets. Price and wage effects foster growth of the non-agricultural sector, which can absorb the released labor force with a certain time lag. New employment opportunities might also emerge through backward and forward linkages. However, these indirect effects cannot be directly attributed to the setting-up of large-scale farms and are hence difficult to empirically assess. The indirect employment creation would need to be empirically addressed in order to reveal the full employment potential of LSAIs.

Another aspect that deserves further attention is the formalization of the labor market. While smallholder farming is, in most cases, informal employment, large-scale farms provide wage employment and usually pay taxes. This is linked to the quality of employment. Further research is required to assess the quality and decency of the employment opportunities created. In particular, to address the question of what extent the wage-employment opportunities created are able to compensate for the income lost by self-employed farmers.

The employment effects of LSAIs depend on the specific project. Looking at the overall picture, mechanized large-scale farming creates (gross) employment but is unable to absorb all the labor released from former income-generating activities, in particular smallholder farmers. This requires targeted policy responses in order to reach an inclusive and sustainable development process. We recommend three measures. First, it is essential to support alternative employment opportunities. Such measure might include creating employment in the service and processing industries as well as providing vocational training to released laborers in order to smooth their transition into alternative employment. Key to this is supporting local industries, for instance the processing industry. In this context, a social safety net is crucial to ensure a socially responsible transition. Second, our analysis showed that some LSAIs use more inclusive business models and hence increase the potential to include local communities in development processes. It is necessary to conduct further research on which business models are successful in including local communities and important that there is greater political support for such models. Third, in certain contexts, for instance in areas with high population densities and smallholder agriculture or pastoralism as key income generation strategies, LSAIs are likely to lead to massive employment destruction with little or no scope for mitigation. In these cases, governments are well advised not to lease or sell land without having well-elaborated active labor market policies and alternative employment opportunities for crowded out land users.

NOTES

1. Another view is that smallholder farming is still the backbone of global food security in the developing world. Tscharntke *et al.* (2012) therefore suggests that there is a need to link agricultural intensification with biodiversity conservation and hunger reduction instead of conventional intensification.

2. We use the terms LSAIs and large-scale farms interchangeably. We believe that the size of a farm best distinguishes the different production models; i.e., large-scale commercial and (often) mechanized farming, and less mechanized smallholder farming. We acknowledge that smallholder farmers not only produce for own consumption but may also produce commercially for the market (see also endnote 5).

3. The Land Matrix Global Observatory is a global and independent land monitoring initiative that promotes transparency and accountability in decisions regarding land and investment. It records land acquisitions of 200 hectares and more in low- and middle-income countries that have occurred since the year 2000. Further information can be found at http://www.landmatrix.org/.

4. These figures might even be underestimated since many surveys only focus on the primary occupation of the respondent. Agricultural activities, however, are often pursued as secondary or tertiary occupations and therefore not captured by survey. Especially on family farms it is common for household members to work on the farm in addition to their main job in the industrial or service sectors. Consequently, the importance of farm activities might be understated (Haggblade, Hazell, & Reardon, 2010).

5. There is no universal definition of "smallholder" or "family farmer" (HLPE, 2013). Smallholder farming refers to the size of the farms; however, the understanding of what is "small" depends very much on the context. Most commonly, an upper threshold of two hectares is used to identify smallholders. Family farming in turn refers to who owns and works the land. Thus, farms that principally rely on a family labor supply are considered family farms. While both concepts overlap, they are not the same (Lowder, Skoet, & Raney, 2016). We use the term smallholder farming in the following to distinguish smaller (often, but not necessarily, family-operated) farms from large-scale farming operations; the latter are identified by their size of two hundred hectares or more.

6. Land Matrix data also record "intended" and "failed" deals and include deals for other purposes, including mining and tourism. We hence use a subset of 1,346 deals included in the Land Matrix. We also include deals below two hundred hectares if the leased area combined with the area under contract farming amounts to more than two hundred hectares.

7. Available at: http://www.fao.org/economic/esa/esa-activities/esa-smallholders/dataportrait/farm-size/en/ (visited 26/09/2016).

8. Here we explicitly use the labor per area under production and not per acquired area. This takes into account that the acquired area (i.e., the area under contract) usually exceeds the area actually used for production since investors typically do not immediately enter into the production phase on the entire area acquired. Missing values in the size under production are imputed by a simple mean imputation based on the ratio of the size under contract and the respective size in production for all cases that have this information.

9. If the labor intensity of contract farmers was not available, we used large-scale farmers' intensity. The rationale here is that contract farmers' labor intensity falls somewhere between that of smallholder farmers and large-scale farmers, depending on their access to improved technologies. Accordingly, we consider the labor demand of a large-scale farmer to be a lower-bound estimate.

10. This also confirms the findings of Messerli *et al.* (2014): Based on detailed insights into the geographical contexts of land acquisitions, they question the often postulated idea that targeted land is "idle" or "marginal."

11. Sample calculation for within group comparison: $\frac{CF_{labor}+CF_{capital}}{Total_{former\ use}} = \frac{2\%+12\%}{44\%} = 31.8\%$

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APPENDIX A

Table 4. *Labor intensity for different crops*

Crop	Labor intensity (workers per hectare)	Region	Year	Source
Banana	0.16	Philippines	2007	Bathan and Lantican (2010), Arias, Dankers, Liu, and Pilkauskas (2003), Bagamba, Ruben, and Rufino (2007)
	0.67	Costa Rica	1999	
	1.00–5.00	Ecuador	1999	
	1.08–1.75	Uganda	2007	
	3.64	Côte d'Ivoire	1999	
Barley	0.04–0.11	Ethiopia	1996–2002	Simpson and Cheong (2014), García Bendezú (2011); Abreha (2007)
	0.04–0.69	Peru	2004–2008	
	0.06	Tanzania	2008	

Table 4 (*continued*)

Crop	Labor intensity (workers per hectare)	Region	Year	Source
Cassava	0.06–0.13	Colombia	2000	Pimentel (2009), FAO (1977), Gray (1982), Ospina Patiño, Cadavid López, García González, and Alcalde Torres (2007)
	0.12–0.21	Brazil	1982	
	0.41–0.43	Congo (DRC)	1977	
	0.85	Nigeria	1996	
	0.97–1.15	Uganda	1977	
Corn (Maize)	0.04–0.68	Ghana	2009	Pimentel (2009), García Bendezú (2011), Dutch Jatropha Consortium. (2009), Deininger and Byerlee (2011), Ngeleza, Owusua, Jimah, and Kolavalli (2011)
	0.17	Cameroon	Unknown	
	0.19	Mozambique	2005	
	0.33	Indonesia	1996	
	0.41–1.10	Peru	2004–08	
Cotton	0.03–0.17	Benin	1998	Minot and Daniels (2005), Tschirley, Poulton, and Labaste (2009)
	0.04–0.28	Uganda	Unknown	
	0.05–0.60	Mozambique	Unknown	
	0.11–0.45	Zambia	Unknown	
	0.16–0.46	Tanzania	Unknown	
	0.19–0.38	Zimbabwe	Unknown	
Cocoa	0.30	Unknown	2013	Tiffen and Mortimore (1990), ICCO (2013)
	3.25	Malaysia	1983	
Coconut	4.50	Sri Lanka	1984	Tiffen and Mortimore (1990)
Coffee	0.25	Colombia	Unknown	SCP (2014), Robinson, Brahmananda, and Deshpande (1983), Tiffen and Mortimore (1990)
	1.04-1-41	India	Unknown	
	1.83	Java	1983	
Grains (cereals)	0.01	Unknown	Unknown	World Bank (2011), Bustos et al. (2016)
	0.02	Brazil	2006	
Jatropha	0.04–0.49	Mozambique	2005	Deininger and Byerlee (2011), Mintz-Habib (2016), Scharschmidt (2010), Dutch Jatropha Consortium (2009), Arndt, Benfica, Tarp, Thurlow, and Uaiene (2008); Worldwatch (2007)
	0.1	Unknown	Unknown	
	0.13–0.27	Tanzania	2001	
	0.21–1.30	India	Unknown	
	0.42	Unknown	Unknown	
Oil palm	0.11	Indonesia	2012	World Bank (2011), Schwarze et al. (2015), Tiffen and Mortimore (1990)
	0.35	Unknown	Unknown	
	3.60–4.00	Malaysia	1976/1983	
	3.80	Nigeria	1987	
	5.00–7.50	Africa	1977	
Rice	0.20–0.71	China/India	1995	Hossain (1998), Ngeleza et al. (2011)
	0.39–1.17	Ghana	2009	
Rubber	0.33	Cambodia	2007	World Bank (2011), Schwarze et al. (2015), Tiffen and Mortimore (1990), Dararath, Top, and Lic (2011)
	0.42	Unknown	Unknown	
	0.48	Indonesia	2012	
	2.10–2.85	Malaysia	1978/1983	
Sorghum	0.05	Unknown	Unknown	World Bank (2011), Ainembabazi, Bashaasha, Mugisha, Pender, and Hyuha (2005)
	0.83–1.09	Uganda	2000–01	
Soya bean	0.02	Unknown	Unknown	World Bank (2011), Bustos et al. (2016), Pimentel (2009)
	0.02	Brazil	2006	
	0.39	Philippines	1996	
Sugar cane	0.14–0.66	Brazil	1982	Deininger and Byerlee (2011), Gray (1982), Arndt et al. (2008)
	0.15–0.34	Mozambique	Unknown	
	0.70	Tanzania	Unknown	
Sunflower	0.19	Mozambique	2005	Dutch Jatropha Consortium (2009)
Wheat	0.04–0.05	Ethiopia	1996–2002	García Bendezú (2011), Pimentel (2009), Abreha (2007), Simpson and Cheong (2014)
	0.06	Tanzania	2008	
	0.20–1.05	Peru	2004–08	
	0.36	Kenya	1996	
Tea	0.20–0.80	Sri Lanka	1984	Tiffen and Mortimore (1990), Campbell (2017), Grigg (1974)
	0.52	Kenya	1983	
	0.63	Java	1983	
	0.80	Malaysia	1983	
	3.5	India	1974	
	3.7–4.9	Unknown	Unknown	

Table 5. *Different scenarios and acquired areas in hectares*

Former land use			Final land use Large-scale farm				Total (n = 1,031)
			Labor intensive (3,188,127)		Capital intensive (9,390,727)		
			no CF	CF	no CF	CF	
Brownfield investment	**Large-scale agriculture**		2a	2b	2c	2d	
		Acquired area (in ha)	341,181	232,977	3,522,884	1,460,318	**5,557,360**
Greenfield investment	**Smallholder agriculture**		1a	1b	1c	1d	
		Acquired area (in ha)	1,511,032	154,730	2,075,338	485,182	**4,226,282**
	Pastoralists		3a	3b	3c	3d	
		Acquired area (in ha)	202,069	2,952	426,773	20,550	**652,344**
	Forestry		4a	4b	4c	4d	
		Acquired area (in ha)	693,060	10,711	743,480	181,905	**1,629,156**
	Conservation		5a	5b	5c	5d	
		Acquired area (in ha)	37,477	1,939	422,970	51,327	**513,713**
		Total	**2,784,818**	**403,309**	**7,191,445**	**2,199,282**	**12,578,854**

Source: Author's calculations based on The Land Matrix Global Observatory (2016).
Note: CF = contract farming.