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Decent Rural Employment

Decent rural employment, productivity effects and poverty reduction in sub-Saharan Africa

Decent Rural Employment, Productivity Effects and Poverty Reduction in sub-Saharan Africa

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Abstract

Promoting decent rural employment, by creating new jobs in rural areas and upgrading the existing ones, could be one of the most efficient pathways to reduce rural poverty.

This paper systematically investigates the impact of decent rural employment on agricultural production efficiency in sub-Saharan African countries, taking Ethiopia and Tanzania as case countries. The analysis applies an output-oriented distance function approach with an estimation procedure that accounts for different technological, demographic, socio-economic, institutional and decent rural employment indicators.

Data of the most recent round of Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) for the two countries are used, and a set of indicators are derived to proxy core dimensions of decent rural employment. The findings of our analysis show that decent rural employment contributes to agricultural production efficiency.

Keywords: decent work, rural employment, distance function, efficiency, poverty reduction

Introduction

Unfolding the complex relationship between employment, labour supply, factor markets and productivity is a crucial aspect in development research and policy design (Alic, 1997; Rao et al., 2004; Barrett et al., 2008; Satch and Temple, 2009; Todaro and Smith, 2012). Uncertainties regarding the interdependence of economic and population growth, sustainability, labour, poverty, as well as working and living conditions generated a great deal of discussions since the first economic development theories came to play (Harris and Todaro, 1970; Alic, 1997; Ortega and Marchante, 2010).

Classical development theories and empirical works in applied economics highlight that productivity gains can have an impact on wage rates and employment conditions, as well as on the overall functioning of the labour market (Harris and Todaro, 1970; Todaro and Smith, 2012). Much attention went to empirically explain low/high wage rates in small or large enterprises with their respective productivity levels (Harris and Todaro, 1970; Satch and Temple, 2009). Recent work around the employment-economic growth nexus emphasizes the importance of the quality of employment and working conditions, as coined by the very concept of decent work and its policy agenda. There is greater emphasis not only on generating more employment opportunities but also on improving the quality of new and existing jobs, for example, by ensuring that fundamental rights at work are respected. The implications of decent employment on productivity, living standards, social justice and sustainable development are increasingly acknowledged (Anker et al., 2002; Ghai, 2002; Vandenberg, 2004; Buchanan, 2006; Evans and Gibb, 2009; Dorward, 2013; Burchell et al., 2014).

At the empirical level, the concepts and theoretical formulations often encounter issues related to data availability (Anker et al., 2002; Ghai, 2002; Burchell et al., 2014). Despite that, there is some analytical evidence on the role of employment and decent work on economic performance in some sectors, especially in manufacturing and, more recently, services. Many of those studies focus on the impact of specific employment dimensions, such as length of the labour contract and tenure stability, or shared profit and management on productivity of manufacturing firms (see Yao, 1997; Conyon and Freeman, 2002; Auer et al., 2004; Ortega and Marchante, 2010). There exists also some empirical evidence on the role of “fair”, “efficient” and higher wages on the level of productivity and improvement of service provision (Katz, 1986; Akerlof and Yellen, 1990; Levine, 1992; Mas, 2006).

However, the decent work literature on the developing countries is rather thin and even more so when applied to agriculture and rural areas. And yet it is precisely in these contexts where the link between (quantity and quality of) employment and productivity has more relevance in regard to an effort towards reducing poverty. In sub-Saharan Africa and South Asia, where the majority of the poor and food insecure people live, rural poverty is mostly related to the lack of productive employment in agriculture and poor performance of the rural non-farm economy (Haggblade et al., 2010; FAO, 2012). Therefore, rural poverty reduction is no longer conceived as a matter of just being employed or generating some type of income, but as holding a productive and decent job both in rural farm and non-farm activities (Rao et al., 2004, ILO, 2006; Dorward, 2013).

As the majority of the rural poor depend on agriculture, improving agricultural production conditions will be pro-poor, and contribute to food security (World Bank, 2008). At the policy level, the

International Labour Organization (ILO) and FAO have increasingly paid attention to decent work in agriculture and rural areas. In particular, the FAO considers the promotion of decent rural employment as a key component of integrated strategies to reduce rural poverty and enhance food security (FAO, 2010, 2012, 2014). By providing access to income, employment is crucial for ensuring food access, and for the poor this is even more crucial, as their labour is often the main asset that they can rely upon for income generation. Furthermore, it is precisely the rural poor who are often most exposed to pervasive decent work deficits, in terms of insecure and low incomes, poor health and safety conditions, child labour, gender inequality, inadequate social protection and lack of social dialogue (FAO, 2012, 2014). In this context, various empirical studies have analysed the sources of agricultural productivity and efficiency in the developing world, including sub-Saharan Africa (e.g., Coelli and Fleming, 2004; Irz and Thirtle, 2004; Rahman, 2009). Nonetheless, to our knowledge, studies that explicitly analyse the implications of labour conditions on agricultural production efficiency are in an infant stage.

The aim of this paper is filling this existing shortfall in the literature, by shedding empirical light on the relationship between labour conditions (as defined by the decent work agenda) and the efficiency of agricultural production, taking Ethiopia and Tanzania as case studies. The key hypothesis is that better labour conditions improve technical efficiency in smallholder agriculture in sub-Saharan Africa. The remainder of this paper is structured as follows: the second section defines key concepts and the decent work related indicators used in the paper. The data and empirical approach used in the paper are illustrated in the third section. The subsequent section discusses the findings and, section five concludes and describes the main policy implications.

Conceptual overview

1

The concept of decent work, introduced by the ILO and endorsed by the UN system as a whole, goes a step beyond in the relationship between employment and growth, and thus towards poverty reduction. Decent work is not only about job creation and labour remuneration. The concept is rooted in human rights and acknowledges the importance of the quality of labour conditions. In particular, the ILO defines decent work as "a condition which promotes opportunities for work, freedom of choice, equal treatment, security of job, and dignity for both men and women" (ILO, 1999, p. 3). Hence, decent work comprises fair pay levels, safe working conditions, non-discrimination, job security and social protection, as well as satisfaction of the worker or employee (Anker et al., 2002; Ghai, 2002; Buchanan, 2006). With the aim of addressing all these dimensions, ILO developed the "Decent Work Agenda" with four core pillars: (i) employment creation and enterprise development, (ii) social protection, (iii) standards and rights at work, and (iv) social dialogue.

The term decent work is considered as one of the fundamental aspects of quality of life, though used with varying definitions and conceptualizations (Vandenberg, 2004; Burchell et al., 2014). The term has changed over time. It has changed from academic conceptualizations based on subjective judgments of workers (Slocum, 1981) to definitions based on more objective identification of the quality of employment (ILO, 1999; Anker et al., 2002; Burchell et al., 2014). Although decent work is universally recognized as a labour standard, the importance attached to each of its dimensions varies strongly across countries, regions, and sectors (Anker et al., 2002; Bell and Newitt, 2010).

Using the ILO definition as a reference point, there have been efforts to translate the concept and its multiple dimensions into empirical terms. For instance, Anker et al. (2002) developed six essential components of decent work (i.e., availability, acceptability, dignity, social relation and quality of employment), which they used to develop indicators derived from regional (macro) and household (micro) level data sets.

However, the multi-dimensional nature of decent work comes with many measurement challenges. Some studies opt for empirical definitions adapted to the specific research questions and many of the choices seem dictated by the nature of the dataset at hand. For example, Pollin et al. (2007, p. 3) in a work in Kenya translate decent work into empirical terms as "a work situation that enables the worker and his/her family to live above the defined poverty line". This definition is based on the premise that unless workers receive enough money to pay for the minimum living condition, there is less incentive and capability to invest their potential towards productivity. However, there arise questions related to the application of such measures in empirical work. For instance, one can argue that higher income does not necessarily reflect the quality of the job. The family might generate its income from more than one source, or the income earners in a family may do so with differences in quality of work. Ghai (2002) highlighted that it is rare and impractical to find a unique and best indicator for decent employment, and an index of combinations of some indicators could rather be robust. With the same token, prioritizing of indicators of decent work is much more complex than its theoretical inception, since those indicators are influenced by the social, economic and political conditions of the region on the one hand, and complications due to (uncertain) relationships of indicators on the other (ibid).

These measurement challenges become particularly pungent when applying decent work to the specific features of the agricultural sector and the rural settings in developing countries. In many developing countries, especially in sub-Saharan Africa, agriculture and rural non-farm activities have a significant potential to promote employment opportunities for the rural poor. Agriculture remains the main sector of employment for a large share of the workforce of developing countries, including both on-farm self-employment and wage employment (World Bank, 2008; Davis et al., 2014). Agricultural growth tends to be strongly pro-poor (World Bank, 2008). In particular, smallholder agriculture constitutes the largest proportion of output in sub-Saharan Africa (Davis et al., 2014). As rural economies diversify and transform, off-farm jobs in commercial farms are gaining relevance, as well as in modern agro-industries and the distribution and retail segments of food markets (World Bank, 2008; Haggblade et al., 2010; FAO, 2012). During such transitions, agricultural wage workers often remain exposed to informal or casual work arrangements, in part because labour demand in commercial farming remains seasonal (Haggblade et al., 2010; FAO, 2012; ILO – FAO – IUF, 2007). Rural workers also suffer from other challenges and exclusions in the form of: unemployment or underemployment, poor quality and unsafe working conditions, denial of rights, gender inequality, and inadequate protection at work, at times of disability and old age. These decent work deficits contribute to the vicious circle of rural poverty and food and nutrition insecurity (ILO, 2008; Fields, 2011; FAO, 2012, 2014). Conversely, decent rural employment conditions (for instance, improved access to productive jobs), can contribute to break this cycle (FAO, 2012; 2014).

Decent rural employment concept includes both agricultural and non-agricultural employment, as well as self-employment and wage employment[1]. And it is employment that complies with core labour standards[2], provides sufficient income, reasonable working conditions, respect occupational safety and health standards and guarantees some level of protection, thereby empowering rural workers and their families to lead productive, healthy and dignified lives.

Empirical analysis on decent rural employment needs to incorporate all these elements, while allowing adaptive conceptualization of decent rural employment to the heterogeneous circumstances of rural work across diverse agricultural systems and regions. Overall, when translating these complex concepts into empirical terms, it is important to note that the conceptual discussion, specifically with regard to measurement and indicators, is still open and quite vivid.

Hence, for this paper, we have identified a number of indicators to capture several of the core dimensions of decent rural employment. Our hypothesis is that the more decent rural employment opportunities are - both in quantity and quality terms - the more likely there be an improvement in the efficiency in the use of resources in agricultural production. The indicators selected for the estimation procedure are seen as the more relevant to the context (sub-Saharan Africa), though the choice of indicators has been conditioned as much by data availability. The analysis relies on Living Standards Measurement study-Integrated Surveys on Agriculture (LSMS-ISA) datasets, which include mainly household level data and a relatively limited set of questions on employment, for which indicators ought to be defined at the household level. Hence, exploiting the LSMS-ISA datasets in the two countries, we derive indicators for three out of four pillars of the decent work agenda[3].

Table (1) summarizes the decent rural employment indicators used in the paper, indicating the respective pillar of decent work, and the expected relationship with respect to the efficiency of agricultural production.

[1] Rural employment covers any activity, occupation, work, business or service performed by rural people, for remuneration, profit, social or family gain, in cash or in kind, including both agricultural and non-agricultural activities. It therefore applies to waged and salaried workers as well as self-employed workers (including contributing family workers).

[2] Core labours standards include: freedom of association and the effective recognition of the right to collective bargaining, the elimination of all forms of forced compulsory labour, the effective abolition of child labour, and the elimination of discrimination in respect of emplyment and occupation.

Table 1: Decent rural employment indicators and expected relationship with efficiency

Pillar of decent work	Indicators used	Measurement	Expected sign
Pillar 1: Employment creation	Employment to total workforce ratio*	Proportion of employed HH members to total HH workforce available	+ve
Pillar 2: Social protection	Share of government transfer to income*	Total transfer from government and NGOs or PSNP in Ethiopian Birr and Tanzanian Shilling from the total income	+ve(-ve)
	Informal transfers to total income‡	Total informal cash, food and in-kind transfers in Ethiopian Birr from the total income	+ve(-ve)
Pillar 3: Standards and rights at work	Child labour ratio†[4]	Proportion of child labour from the total labour used for agriculture activities by the HH	-ve
	Precarious employment ratio*	Proportion of HH seasonal and casual labour from the total HH agricultural workforce	-ve

Notes: HH = household; * Ethiopia & Tanzania; † Tanzania; ‡ Ethiopia

Under pillar one of decent work, on the availability of employment opportunities, we use the ratio of employed household members to total household workforce[5] . Although it does not explicitly address the work conditions and income generated, this ratio captures the proportion of household members involved in productive work, either in terms of self-employment or in some kind of wage employment, from the total workforce available in that given household. The more employment opportunities (either by self-emloyed on the farm, or hired in off-farm and non-farm activities) are associated with improvements in the agricultural production activities. For pillar two, on social protection, indicators capturing access to cash and food transfers are used in the model. We have accounted for differences in the social protection systems of the two countries, and also for the limited social protection coverage in rural areas that both systems have. We note as well the paucity of data in this

[3] Data at disposal do not allow for capturing indicators for the fourth pillar of decent work, on social dialogue, nor the other dimensions of decent rural employment (such as occupational health and safety). Future research could enrich the analysis as new waves of datasets are released with richer information on rural labour.

[4] Child labour ratio as an indicator is used only for Tanzania due to low response rates in Ethiopia.

[5] We have built this indicator adapting the "employment-to-population" ratio to our analytical setting and data at disposal. Hence, employment-to-population ratio was measured using the last 7 days as reference period, includes those who were employed over the last 7 days reference period as self-employed, part-time, casual or seasonal work on farm/off/ or non-farm, after controlling for those who are inactive (went for schooling, ill and physically incapable).

domain. Hence, for Tanzania, we have used receipt of cash and food transfers[6]; and for Ethiopia, transfers from the Productive Safety Net Programme (PSNP) and participation in food for work. In both countries, such programmes provide significant protection to small-scale producers and rural dwellers, especially given the limited outreach of insurance markets in rural areas of sub-Saharan Africa. In addition, for Ethiopia, we onsider cash and in-kind transfers, which capture more informal forms of social protection through which households get support from relatives, neighbors and friends[7].

The debate about the impacts of social protection on labour participation is on-going. While critics argue that cash transfers may result in labour disincentives and dependency on public support, there is also empirical evidence, such as the one from the From Protection to Production project, a joint effort of FAO and UNICEF, showing that cash transfer programmes in sub-Saharan Africa have positive impacts in terms of increases in productive activities among beneficiary households. Moreover, in Kenya, Ghana, Lesotho, Malawi and Zimbabwe, cash transfers programmes have given households more flexibility with their time, and there is evidence that some shift from precarious, agricultural wage labour of last resort to their own on-farm activities (Gilligan et al., 2008; Hoddinott et al., 2012; Asfaw et al., 2014; Boone et al., 2013). Pillar three on standards and rights to work is proxied through two indicators capturing forms of employment deemed non desirable or 'non-decent' in agriculture, namely child labour and precarious forms of work used for agriculture activities by a given household. Prevalence of child labour and that of precarious employment in agriculture are expected to influence the efficiency of production negatively.

[6] It is an aggregate measure of free food distribution, food, cash and input for work, scholarships or bursaries for primary or secondary school from the government or NGOs (in Tanzanian Shilling).

[7] It constitutes cash, food and in-kind transfers/gifts from friends, neighbors and relatives (in Ethiopian Birr).

Methodology

2

2.1 Theoretical Framework

A single step approach integrating the production function and decent rural employment indicators is used in our estimation. In a poor smallholder farm context, however, it is not easy to integrate the concepts of labour supply in the production analysis. This could arise, according to Barrett et al. (2008), from the fact that, in a smallholder farm context, the major share of family labour is self-employed. This makes it difficult to estimate or to attach an economic value to labour. In addition, this could be associated to the rigidity of the rural labour market (resulting for example from high search and transaction costs, location preferences, etc.). We assume that each household has an endowment of labour which can be used for household production activity either in the form of self-employment or as wage labour supplied to off and non-farm activities. Despite the possible differences in skill, experience and opportunity cost on the type of labour used, hired labour and family labour can be considered substitutes in agriculture (Sadoulet et al., 1998). In our analytical framework, labour is treated as an important input in the production process, and thus is used in the production frontier estimation. The distance function approach builds a framework on the demand of labour, without any implicit or explicit assumption to limit the source (either family labour or hired labour) used in the production process. Labour supply and labour demand might not necessarily be equal, excess labour can be offered for employment and the household can hire labour in times of shortage. The decent rural employment indicators will be included as covariates in the efficiency component.

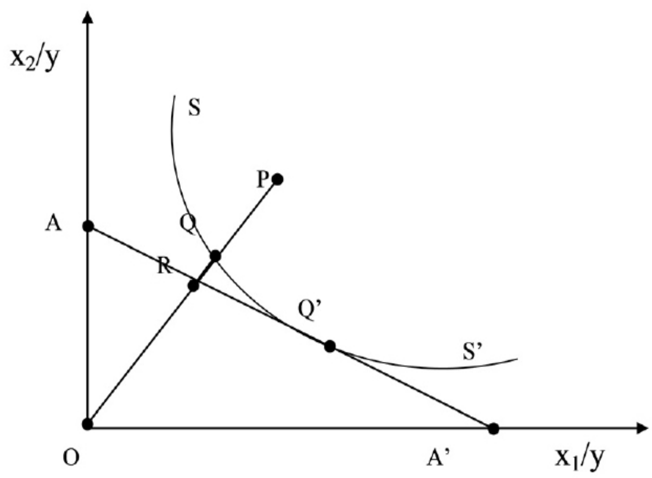
The construction of the production possibility frontier, either with parametric assumptions or piecewise constructions, is the fundamental step in efficiency estimation (Farell, 1957; Coelli et al., 2005). The role of decent rural employment in agricultural production efficiency is examined here in the context of smallholder farming, characterized by multiple crop and livestock production. Hence, a multi-output, multi-input production technology specification is required. Based on Farrell's (1957) work, the input-output transformation equation is adapted to the agricultural sector (e.g. Newman and Matthews, 2006; Rahman, 2009) as:

$$S = \{(x, y): x \textit{ produces } y\} \qquad (1)$$

Where S is a certain technology, using input vector x to produce output vector y.

Figure 1 further illustrates the standard model for a distance function using farms involved in the production of output (y) using two inputs (x1 and x2) and assuming constant returns to scale.

Figure 1: Production and efficiency



Source: Coelli et al., 2005, p. 52

SS' represents the isoquant of fully efficient farms. If a farm uses combination of inputs represented by point P, it is considered technically inefficient. The distance QP represents such technical inefficiency, which empirically proxies the amount of all inputs that the farm could (proportionally) reduce without a reduction in output. The technical efficiency (TE) of a farm can be measured by the ratio (TE = OQ/OP), which takes values between 1 and 0, and where value one implying the farm is fully technically efficient. In the figure, point Q is technically efficient. In a parametric setting with more than one output, a Stochastic Distance Function (SDF), either input or output oriented can be employed for efficiency analysis. The SDF approach has a number of advantages over the deterministic approach as it can better differentiate noise (e. g., weather variation, measurement error etc.) - which is relatively common in agriculture and in rural labour data - from technical inefficiency effects and thus enables single-step efficiency estimation. It also extends the classical Stochastic Frontier Analysis (SFA) with the accommodation of more than one output in the estimation procedure (Kumbhakar and Lovell, 2000; Coelli et al., 2005). The input oriented approach is based on the radial contraction of the input use of firms (farms, in this paper) that brings the farm to the isoquant. The output approach on the other hand tries to find the radial expansion of the outputs while keeping the level of input use. This parametric approach[8] has the necessary technical features to empirically evaluate the relationship between decent rural employment and technical efficiency of farms (Kumbhakar and Lovell, 2000; Coelli et al., 2005; Newman and Matthews, 2006; Rahman, 2009). Distance function can be represented in a mathematical model as:

$$d_i^I = d^I(x_{1i}, x_{2i} \dots x_{Ni}, y_{1i}, y_{2i} \dots y_{Mi}) \quad (2)$$

$$d_i^o = d^o(x_{1i}, x_{2i} \dots x_{Ni}, y_{1i}, y_{2i} \dots y_{Mi}) \quad (3)$$

Where equation (2) and (3) illustrate the respective representations of input and output oriented respective representations of input and output oriented distance function (d_i) in a technological set of producing M number of outputs (y) using N number of inputs (x). According to Kumbhakar et al. (2007), technology with distance function representation can be defined as:

$$1 = f(y, x, \beta) . \exp(v + u) \quad (4)$$

Or, in logarithmic expression:

$$0 = \ln f(y, x, \beta) + v + u \quad (5)$$

Where x and y are vectors of inputs and outputs respectively, β is a vector of technological coefficients, v is the classical noise component and u is the one sided random term representing inefficiency. Lovell et al. (1994), with an underlying homogeneity concept, specified an output oriented distance function approach as:

$$D_0(x, \mu y) = \mu D_0(x, y) \quad (6)$$

This implies that by choosing one of the outputs arbitrarily (Coelli and Perelman, 1996; Irz and Thirtle, 2004) to normalize the equation, for example M^{th} output of farms, and setting $\mu = 1/y_M$, we will reach to:

$$D_0(x, y/y_M) = D_0(x, y)/y_M \quad (7)$$

By integrating it with the functional relationships presented in equation (4) and (5), the right hand side of equation (7) can be concisely specified in a functional form as:

$$\ln(D_{0i}(x, y)/y_{Mi}) = \ln f(y_{mi}/y_{Mi}, x, \beta) \quad (8)$$

After simple mathematics and rearrangement of the terms in the equation, the specification can finally be reduced in to:

$$\ln(D_{0i}(x, y)) - \ln(y_{Mi}) = \ln f(y_{mi}/y_{Mi}, x, \beta) \quad (9)$$

By replacing the distance parameter with the error term (a composition of the noise component v_i and the inefficiency parameter u_i), it can be observed that this coincides with the classic stochastic specification

[8] Technical features such as factoring out the noise, allowing for a multi-output setting in mixed crop-livestock production, etc.

of the input-output relationship.

$$- \ln y_{Mi} = \ln f({}^{y}/y_{M} , x , \beta) + v_i + u_i \qquad (10)$$

One of the relevant questions regarding this estimation procedure could be the possibility of simultaneous equation bias, which results from the incorporation of output terms in the right-hand side of the equation. Such a case could lead to biased estimates of both coefficients and the inefficiency term (Kumbhakar and Lovell, 2000; Coelli et al., 2005). However, as equation (10) shows, only the ratios of the outputs are used as explanatory variables in the specification and are assumed exogenous (Coelli and Perelman, 1999, 2000; Brümmer et al. 2002). On the other hand, while there are questions raised on the validity of these assumptions (Kumbhakar and Lovell, 2000; Kumbhakar, 2011; Tsionas et al., 2015), Coelli and Perelman (1999; 2000) argue that as it is a measure of the output mix, it is more likely to be exogeneous. The estimation of inefficiency is based on the output ratios and not on the output measure itself, and these are uncorrelated with the residual. Hitemaki (1996) argued that the output ratio as a regressor in the distance function is less susceptible to endogeneity problem. The issue of endogeneity of the output (or the output ratio) seems unsettled and remains a point of active research (Brümmer et al. 2002, Kumbhakar, 2011; Tsionas et al., 2015). In the formulated specification, we are dealing with radial expansion or contraction of outputs and inputs respectively, and these ratios are constant for each term (Coelli and Perelman, 1996).

With the distributional assumption of Aigner et al. (1977) for the two error components, v and u, and a follow-up application of maximum likelihood technique, we can single out the efficiency estimates. Aigner et al. (1977) assume that the error term (v) is iid N(0, δ_v^2) - independently and identically distributed with mean zero and standard deviation δ^2.

According to Battese and Coelli (1995), with a more generalized assumption of truncated normal distribution, u are iid $N^+(\mu, \delta_u^2)$ – independently and identically distributed half normal random variables with a scale parameter δ_u^2.

Finally, technical efficiency of farm households in the production of mixed outputs will be calculated as:

$$TE_0 = \exp(-U_i^+) \qquad (11)$$

Battese and Coelli (1995) developed a single step maximum likelihood procedure to estimate both the parameters of distance function frontiers and factors that determine the technical efficiency of farms. Accordingly, this can be done by integrating the following equation to the estimation procedure.

$$\mu_i = \alpha_0 + \sum \alpha_n Z_{ni} + \varepsilon_i \qquad (12)$$

Where μ_i is the conditional mean of u_i from the first estimation procedure, Z_i´s are vectors of household parameters to explain the inefficiency parameter, ε_i is the statistical noise, and α´s are the unknowns that will be estimated in the procedure.

2.2 Data and Empirical Model

Ethiopia and Tanzania are the case studies used to test the hypothesis. While the two countries are diverse in many ways, their agriculture sectors are deemed representative of many sub-Saharan African countries. Namely, predominantly rural realities where agriculture is the mainstay of the economy, and is mainly composed of small-scale, subsistence-oriented farming activities as well as significantly dominated by crop-livestock mixed production systems. For the study, we have used cross-section data of the Living Standards Measurement study-Integrated Surveys on Agriculture (LSMS-ISA) made available by the Development Research Group of the World Bank in 2011. The dataset comprises of households living in small towns, who based their livelihood on non-farm activities and shows missing values with respect to key input and output components. Some farmers in the sample might not supply all of their produce (one or more products, or the entire harvest) to the market; or in cases where all is used for subsistence, farmers were unable to respond to the questions related to selling prices of the commodities they produce. In such cases, we have used the opportunity cost approach to estimate the value of production using regional averages of prices of commodities. After taking out those cases that cannot fit in the estimation procedure, the respective country samples used in this paper total, respectively, 1,151 observations, in Ethiopia; and 931 observations, in Tanzania.

Existing analytical work on the empirical efficiency of peasant (small-scale) agriculture provides various approaches to classify the output from the production process. For example, Chavas et al. (2005) in their work in Gambia used a very detailed classification of outputs (vegetables, fruits, rice, sorghum and millet, groundnut, maize and cassava, and off-farm income from wages or self-employment), while ignoring livestock production due to lack of data. Conversely, Coelli and Fleming (2004) used a more aggregated approach that included the value of subsistence crops, cash crops and coffee production. The empirical choice of outputs and aggregation levels is determined by the type of production technology, availability of data, sample size (to keep some level of degree of freedom) and the requirements of the estimation procedures (Coelli and Fleming, 2004; Chavas et al., 2005).

In our estimation procedure, we have aggregated the outputs as the annual value of crop harvest and livestock production per household, valued in the respective local currencies (Birr in Ethiopia and Shilling in Tanzania). The value of these outputs is calculated using an opportunity cost method, by using the price of the sold proportion to calculate the return of the unsold items. Cultivated land per household (in square meters), family labour (as adult equivalent), and the intermediate input expenditure (in Birr and Shilling in Ethiopia and Tanzania respectively) are the common inputs in the production process and are used as explanatory sets in the estimation procedure.

Translog function is more flexible in its form among the alternative production functions, and is widely used in empirical studies. The production function helps to represent the transformation relationship of inputs and outputs (Aigner et al., 1977; Coelli and Perelman, 1999; Sauer et al., 2006). In addition to this empirical importance, some of the functions, such as Cobb-Douglas violate important curvature properties (e.g., convexity) (Coelli and Perelman, 2000; Fare et al., 2005). Building upon equation (10), the empirical model of the multi-input and output production frontier with translog specification will look like:

$$
\begin{aligned}
- \mathit{lnCrop} = {} & \beta_0 + \beta_1 \ln(liv/crp) + \beta_2 lnlan + \beta_3 lnint + \beta_4 lnlab + \beta_5 lntlu + 0.5\,\alpha_1 lnlnd^2 \\
& + 0.5\,\alpha_2 lnint^2 + 0.5\,\alpha_3 lnlab^2 + 0.5\,\alpha_4 lntlu^2 + \alpha_5 lnlan * lnint + \alpha_6 lnlan \\
& * lnlab + \alpha_7 lnlan * lntlu + \alpha_8 lnint * lnlab + \alpha_9 lnint * lntlu + \alpha_{10} lnlab \\
& * lntlu + \alpha_{11} \ln(liv/crp) * lnlan + \alpha_{12} \ln(liv/crp) * lnint + \alpha_{13} \ln(liv/crp) \\
& * lnlab + \alpha_{14} \ln(liv/crp) + lntlu + v_i + u_i
\end{aligned}
\qquad (13)
$$

We integrate this translog production frontier estimation from equation (13), with the inefficiency model from equation (12) in a single step maximum likelihood procedure. Regional dummy (used as an explanatory variable to capture an unobservable characteristics), age and sex of the household head, age dependency ratio, livestock holding in tropical livestock unit (TLU), access to advisory services, concentration index, access to credit, distance to the nearest market, and the set of decent rural employment indicators (as defined in section 2, table 1) are used in the estimation to explain technical efficiency of the households in the use of inputs in the production process. We use these covariates in the estimation procedure for both countries, except for child labour ratio in Ethiopia and share of informal transfers in Tanzania, respectively. These variables are ignored from the model since they were reported for only few observations in the respective countries.

The indicator used to explore the effect of specialization in production activities on the overall technical efficiency of farms, referred to as concentration (diversification) index in the literature, is specified by the Ogive index. This index was developed by Ali et al. (1991) and measures the deviation from full diversifications (equal distribution of output shares) among production activities (Coelli and Fleming, 2004).

$$Ogive = \sum_{n=1}^{N} \frac{(X_n - (1/N))^2}{1/N} \qquad (14)$$

N is the total production activities and X_n is the share of the income from production activities (crop, livestock production and off and non-farm activities).

3 Results and Discussion

3.1 Descriptive statistics

Table 2 presents the descriptive statistics of the whole sample to give an overall picture of the households in the two countries included in the analysis. The average landholdings in Ethiopia and Tanzania are 1.2 and 3.34 hectares, respectively. The sample includes crop-livestock mixed production system, which has been practiced by most of the farm households. There is diversity in the production systems across regions of both countries. For instance, such diversity is clearly observed in differences in terms of livestock ownership: in mixed crop-livestock production systems few animals seem to be kept primarily for draft power requirements and risk coping strategy; whereas agro-pastoral households keep quite a relatively larger number of livestock (cattle) as their primary (and sometimes single) income source. Around 86% and 83% of the sample households are male headed; and about 40% and 26% of the household heads in the sample are illiterate (i.e., cannot read and write), in Ethiopia and Tanzania, respectively.

The availability of productive and gainful employment is captured through the ratio of employed members in the household to total household members available for work. The average value for this ratio is around 80% in both countries, which is a little lower than the average labour force participation rate of about 86% in Ethiopia and 90% in Tanzania (World Economic Forum Report, 2013). As described in table 1, the indicator for the prevalence of precarious employment includes casual (short term contracts) and seasonal work to total workforce engaged in the agricultural production activities of the household. Participation of women in agricultural activities rangesfrom 14% in Ethiopia to 48% in Tanzania. Based on the data at disposal, child labour in the sample for Tanzania is around about 6% of the total agricultural labour used by the household. The average proportion of employment in the precarious category to the total labour is 0.06 in Ethiopia and 0.09 in Tanzania. These low values may be explained by the limited use of hired labour among smallholders in the sample, who are mainly subsistence producers and may rely on family members, and thus only limited labour is outsourced.

In terms of social protection, share of transfers from the total income in Ethiopia and Tanzania are social protection schemes captured through this analysis. In addition, share of cash, food and in-kind transfers from the total income from relatives, friends and neighbours in Ethiopia are considered as informal social protection options.

In a smallholder agricultural production system, access to timely, reliable and affordable input and technical advisory services is crucial. Ethiopia and Tanzania have public agricultural extension systems that provide both input and advisory services. In the two countries, there is a significant variation on the access to agricultural advisory services. The importance of (micro) credit services in smallholder agriculture is widely acknowledged, given prevailing liquidity constraints that condition the overall production process. However, only less than a quarter of the households in Ethiopia and only a few households in Tanzania have access to those services[9].

Infrastructure development is another crucial element

[9] A household is considered to have access to credit if it received loans, either from informal or formal sources, in the year.

in enhancing production and productivity of smallholder farmers, but rural areas in Ethiopia and Tanzania have poor functional linkages with the input and output markets due to existing poor infrastructure condition. The average distance to the nearest main road in the sample is about 14 km and 18 km in Tanzania and Ethiopia, respectively.

Table 2: Descriptive statistics of the sample

Variables	Units	Ethiopia (N=1346)		Tanzania (N=931)	
		Mean	Std. dev.	Mean	Std. dev.
Age of the Household head	Years	44.19	14.20	47.58	14.32
Age dependency ratio	%	1.25	0.91	1.14	0.82
Land	Hectares	1.21	1.93	3.34	5.19
Cost of intermediate inputs	Monetary	463.21	812.03	1.41e+05	2.66e+05
Labour	Adult equivalent	122.54	150.95	164.36	156.72
Value of crop harvest	Monetary	7989.74	16169.94	4.58e+06	1.05e+08
Value of livestock	Monetary	3068.23	8909.06	1.45e+06	1.56e+07
Livestock	TLU	5.82	4.68	1.84	6.56
Concentration index	Index	1.58	0.55	1.06	0.56
Share of government transfer to income	%	0.98	12.56	0.34	1.11
Share of informal transfers to income	%	6.32	80.21	-	-
Employment to workforce ratio	%	0.80	0.25	0.81	0.26
Precarious employment ratio	%	0.07	0.17	0.09	0.17
Women labour ratio	%	0.14	0.27	0.48	0.22
Child labour ratio	%	-	-	0.06	0.12
Distance to major road	Kilometers	18.43	18.91	14.81	23.05
Annual precipitation	Millimeters	942.39	373.38	1061.16	221.02
Wettest quarter precipitation	Millimeters	613.93	240.51	570.45	128.08
Value of crop harvest	Monetary	7989.74	16169.94	4.58e+06	1.05e+08

Dummy variables

	Group	Ethiopia	Tanzania
		Percent	Percent
Sex of the household head	Male	86.26	82.71
	Female	13.74	17.29
Household head literacy	Illiterate	39.52	25.99
	Literate	60.48	74.01
Access to credit	With	26.15	3.11
	Without	73.85	96.89
Advisory services	With	64.64	19.23
	Without	35.36	79.05

We acknowledge the fact that differences in production systems may condition the diversity in gross margins generated from agricultural production per household across regions. In order to evaluate whether there exists a significant difference in the mean partial productivity estimates across regions, a multivariate test of means was applied, using a generalized form of mean comparison using chi-square statistics. For that purpose, partial productivity measures, such as production per hectare of land or production per labour use in adult equivalent are often used to get some picture of the production system. In particular, we have calculated and tested for differences across regions for measures of productivity per hectare of land for the agricultural production activity, and production per used labour in adult equivalent. These values show statistically significant differences in Ethiopia, while no significant heterogeneity across regions is found in Tanzania (see Appendix 1). The variability across regions in Ethiopia could be explained by many factors, including differences in the production system, production orientation, population and settlement conditions, agro-ecological and climatic conditions, market or other institutional arrangements.

Nonetheless, due care should be given when drawing a conclusion from partial productivity measures, since they do not completely reflect the whole picture of the production process. The overall production efficiency, which captures the combined input-output transformation effects of the production process, is discussed in the following sections.

3.2 The production function estimation

The maximum likelihood (ML) results of the Output Oriented Distance Frontier estimation are presented in Table 3. Prior to the estimation, all the respective output and input variables are standardized (corrected by the geometric mean) so that the first order coefficients can be interpreted as distance elasticity evaluated at the geometric mean (Kumbhakar et al., 2007; Solis et al., 2009). A likelihood ratio test has been applied comparing commonly used specifications. The more restrictive Cobb-Douglas specification was rejected.

The residuals of our estimation results are negatively skewed[10] and likelihood ratio test rejects the null hypothesis of absence of inefficiency component. Hence, the technical inefficiency component is a statistically significant addition to the model (Coelli and Fleming, 2004). One of the crucial steps after estimating the production function is to check whether the fitted model violates any major assumption of parametric approaches, which can otherwise lead to a misleading interpretation of the findings (Kumbhakar and Lovell, 2000; O'Donnell and Coelli, 2005; Sauer et al., 2006). According to O'Donnell and Coelli (2005), stochastic output distance function should behave in a certain way to meet the assumptions of monotonicity[11]. The variables for land, labour and cost of intermediate inputs used are significant and have the expected signs at the geometric mean, fulfilling the assumption of monotonicity. In other words, our estimated output oriented distance function is non-decreasing in output.

Table 3: Maximum likelihood estimate of translog specification

Variables	Ethiopia		Tanzania	
	Coeff. (std.err)	z	Coeff. (std.err)	z
***ln*Value of total crop harvest**				
***ln*land**	- 0.16 (0.03)	- 4.62***	- 0.30 (0.03)	- 9.50***
***ln*Cost of intermediate inputs**	- 0.11 (0.02)	- 4.65***	- 0.15 (0.02)	- 8.49***
***ln*Labor**	- 0.11 (0.02)	- 3.99***	- 0.34 (0.04)	- 8.77***
***ln*Livestock per crop**	0.11 (0.01)	8.99***	0.17 (0.02)	11.07***
(*ln*land)²	- 0.05 (0.02)	- 2.70***	0.01 (0.01)	0.29
(*ln*costintermediateinputs)²	- 0.01 (0.00)	- 1.83*	- 0.03 (0.00)	3.06***
(*ln*labor)²	0.00 (0.02)	0.11	0.01 (0.02)	0.39
***ln*landlncostinput**	- 0.03 (0.02)	- 1.23	- 0.03 (0.02)	- 1.97**
***ln*landlnlabor**	- 0.03 (0.03)	- 0.84	- 0.03 (0.03)	- 0.98
***ln*costsinputlnlabor**	0.01 (0.02)	0.65	0.02 (0.02)	0.95
***Ln*landlivestock ratio**	- 0.01 (0.01)	- 0.67	- 0.00 (0.01)	- 0.05
***Ln*costinputlivestock ratio**	- 0.01 (0.01)	- 0.65	- 0.01 (0.01)	- 0.69
***Ln*laborlivestock ratio**	0.03 (0.01)	2.80***	- 0.04 (0.02)	- 2.31**
_cons	0.39 (0.07)	5.82***	0.34 (0.10)	3.19***
sigma_v	0.44 (0.03)		0.69 (0.04)	
lambda	2.65 (0.09)		1.25 (0.12)	
Log likelihood	-1277.58		- 1114.38	
Wald chi2 (12)	265.76		611.89	
Prob > chi2	0.00		0.00	
N	1151		931	

Note: *, **, and *** represents 10, 5, and 1% level of significance

[10] However, since u_i is positive, the presence of negatively skewed residuals reveals the presence of inefficiency component in the estimation (Coelli, 1995).

[11] Monotonicity in this case is interpreted as the non-decreasing property of the function.

3.3 Decent rural employment and technical efficiency

We do find a wide variation in the technical efficiency level of smallholder farmers in Ethiopia and Tanzania, with mean efficiency estimate of about 55% and 68%, respectively. This finding is in line with technical efficiency scores estimated by many empirical researches in the developing world (69.4% for Bangladesh by Coelli et al., 2002; 78% in Central America by Solis et al., 2009; or 78% in Papua New Guinea by Coelli and Fleming, 2004) and also in sub-Saharan Africa (Thirtle et al., 2003; Alene and Zeller, 2005. For instance, Thirtle et al. (2003) found a technical efficiency rage from 48% for non-adopters of Bt Cotton with late rains to 88% for adopters in good rainfall pattern in South Africa. Our results indicate that there is potential to improve the farms' technical efficiency with the available resources and technology.

Overall, in the estimation, we do find common variables for the two countries in explaining the technical efficiency of farm households and some variables are relevant in explain the inefficiency level only a country. Farm technical efficiency is significantly different across regions in both Ethiopia and Tanzania, which differs from preliminary analysis based on partial productivity estimates. We expect that these differences across regions play a role in terms of diverging decent employment conditions across regions in both countries, which need to be accounted for in agricultural and rural development policy interventions aiming at poverty reduction.

We do find evidence that most of the decent rural employment indicators influence the production efficiency of smallholder farmers. In the case of Ethiopia, employment to family available for work ratio has positively contributed to the household production efficiency. Rao et al. (2004) have found similar results in their study of productivity and productive employment relationship from a macro perspective using data from 111 countries. In both countries, transfers received from social protection programs significantly contribute to improve agricultural

Table 4: Determinants of inefficiency

Variables	Ethiopia		Tanzania	
	Coeff. (std.err)	z	Coeff. (std.err)	z
Regions[12]		***		***
Annual precipitation	0.00 (0.01)	0.33	0.00 (0.00)	0.12
Precipitation of wettest quarter	- 0.00 (0.01)	- 0.01	0.00 (0.00)	0.26
Sex of the household head	- 0.34 (0.23)	- 1.44	- 0.77 (0.57)	- 1.33
Age of the household head	0.00 (0.01)	0.09	- 0.01 (0.01)	0.43
Household head literacy	- 0.42 (0.12)	- 3.34*	- 0.13 (0.07)	- 1.66*
Age dependency ratio	- 0.03 (0.07)	- 0.53	- 0.14 (0.14)	- 1.02
Livestock	0.06 (0.02)	3.21***	0.02 (0.02)	0.95
Concentration index	0.62 (0.13)	4.49***	- 0.25 (0.19)	- 1.31
Share of government transfer to income	- 5.00 (2.47)	- 2.02**	- 66.29 (25.83)	- 2.57***
Share of informal transfers to income	- 0.69 (0.50)	- 1.38		
Advisory service	- 0.01 (0.14)	- 0.10	- 0.07 (0.21)	- 0.34
Access to credit	- 0.36 (0.14)	- 2.47**	- 0.36 (0.73)	- 0.49
Distance to the major road	0.01 (0.00)	1.69*	0.01 (0.00)	2.04**
Employment to workforce ratio	- 0.78 (0.23)	- 3.30***	- 0.15 (0.42)	- 0.36
Precarious employment ratio	2.08 (0.49)	5.07***	2.74 (0.64)	4.29***
Women to total labour ratio	0.19 (0.30)	0.63	0.28 (0.59)	0.49
Child labour ratio			2.42 (0.98)	2.46**
_cons	0.20 (0.54)	0.37	1.47 (1.11)	1.32
N	1151		931	

Note: *, **, and *** represents 10, 5, and 1% level of significance

[12] The analysis was performed using regional dummies. They are not reported here for space reasons, as the dataset consists of 10 regions in Ethiopia and 22 regions in Tanzania.

efficiency. This is in line with existing evidence around the positive impacts of public in-kind and cash transfers to rural households in sub-Saharan Africa (Gilligan et al., 2008; Boone et al., 2013; Hoddinott et al., 2012). Such positive effects could be explained in two ways: either the cash transfer is used for agricultural investments or it contributes for consumption smoothing which in turn improves the production capacity of farm households (see also Asfaw et al., 2014; Boone et al., 2013). We verified the idea that precarious employment increases technical inefficiency in both countries. Given the inherent labour characteristics of smallholder agriculture in sub-Saharan Africa (e.g., labour intensive technologies, farms operated by household members), employment options in the agricultural sector are largely limited to peak seasons, and are often casual. Such employment opportunities are significantly limited to seasonal and casual forms of agricultural wage work, which is mainly undertaken by the landless and other resource poor workers. In an overall low productivity setting, these low paid and precarious forms of employment could be detrimental to the overall agricultural efficiency. This could be due to limited incentives for investing in more capital intensive technology or in acquiring skills specific to a given farm or farming practice. In addition, since the wage rate for these seasonal workers has little association with their contribution to the production process, there is little motivation for them to work. This at least requires serious control and monitoring mechanism which in turn increases the cost of production. Furthermore, considering limited opportunities available for off- and non-farm employment in rural areas of Ethiopia and Tanzania, we would argue that there are major issues in terms of availability of productive employment all year long, and when available, employment (especially wage employment) is of low quality. As Ethiopia and Tanzania share many characteristics with other sub-Saharan realities, this finding may also prove relevant in those contexts, and much of the developing world.

In Tanzania, as expected, child labour contributes to higher inefficiency in agricultural production. Hence, in using child labour for agricultural activities, the household gets comparatively low level of returns had it been from adult labour. This result is in line with Sherlund et al. (2002) that found that the output response from added child labour was one third relative to added adult labour. Furthermore, our finding is in line with overall recognition that child labour should be prevented from a human rights perspective and also because it perpetuates a cycle of poverty for the children involved, their families and the community as a whole (FAO, 2015)[13].

Literate household heads are more likely to be technically efficient in agricultural production than the illiterate counterparts. This relationship would refer to the role of human capital in the decision making process about resource use in agricultural production. Solis et al. (2009) in their empirical work in Central America have found a similar relationship between human capital measured with education levels and production efficiency. Coelli and Fleming (2004) however got contrasting results, where the education level of the household head was negatively associated with technical efficiency. They substantiated their findings with the premise that better educated household heads may have better access to non-farm employment, which limits their efficiency in agricultural production. In Ethiopia and Tanzania, prevailing low educational levels seem to condition the adoption of improved agricultural technologies and farm management strategies. They lack the ability to efficiently use resources and to translate skills and knowledge to improve production. In Ethiopia, we do find that higher household concentration or specialization is associated with higher inefficiency in agricultural production. In this paper, the specialization or or concentration index is mainly referring to on-farm specialization in crop and livestock production. This is due to the fact that, in our sample, few households participate in off- and non-farm income-generating activities, and the share of income out of those activities is quite low. Coelli and Fleming (2004) and Rahman (2009) found out that the concentration of output shares significantly explains inefficiency.

[13] Data at disposal do not allow for further analysis of child labour in terms of types of agricultural tasks assigned to children, their relative time intensity and potential occupational hazards, and thus we cannot conclude about any potential conflict with schooling (attendance and performance) or specific risks for the children's health and development.

Coelli and Fleming (2004) argued that the benefits that smallholder farmers could realize through diversification in production outweigh the benefits from specialization. Conversely, Mugera and Langemeier (2011) in a study on diversification in the USA found that crop farms were more technically efficient than diversified farms. Hence, the trade-off in efficiency gain between specialization in one type of production and on-farm diversification depends on the specific features of the farm context. From our findings, smallholder farms in Ethiopia can gain relatively more by diversifying their on-farm production activities than specializing in one type of production activity.

In Ethiopia, increased livestock ownership has a significant negative impact on the household production efficiency. For those farms with already some level of on-farm diversification, increasing the scale of operations could lead to lower efficiency levels. The larger the flock size of the household, the lesser the family can monitor the operation of the farm that in turn lead to lower efficiency levels. Chavas et al. (2005) in Gambia have also found out that herding negatively influences the technical efficiency of crop production activities, as there are trade-offs in terms of labour availability and other production inputs between livestock and crop production, which ultimately leads to lower farming efficiency. In a small farm context, crop and livestock activities could be a complementary joint production scheme. Farms in our sample practice mixed crop livestock agricultural activities to manage risk and wealth accumulation, given less developed financial markets and the natural complementarity of such practices. However, when the size of the farm increases (e.g., expansion in livestock ownership and/or production levels beyond subsistence), a competition over resources develops across on-farm activities, including labour costs (time intensity of family workers, and hiring costs for non-family wage work) and increased demand for managerial capacity and supervision; all of which can ultimately compromise farm efficiency. However, this is not the case for Tanzania where this variable remains insignificant. Only a small proportion of the sample for Tanzania engages in livestock production activity.

Access to credit in Ethiopia contributes to the production efficiency of farm households. There is varied empirical evidence on the role of credit market to agricultural efficiency. For instance, Binam et al. (2004) argue on the relevance of credit to improve the liquidity of farms in smallholder agriculture. Chavas et al. (2005), on the contrary, underscores that credit might not necessarily contribute to production efficiency. The amount of credit could be too low to invest, and it is possible that it can be used for household consumption. These variations in the role of credit on agricultural efficiency might be explained if the nature of the service and the characteristics of beneficiaries come in to consideration. Despite mixed findings, empirical literature seems to agree that more demand driven and better targeted credit can contribute to improved production (Binam et al., 2004; Chavas et al., 2005; Barrett et al., 2008; Anriquez and Daidone, 2010). Hence, based on our empirical finding, we argue that improved access to credit can improve agricultural production efficiency of farm households.

Technical efficiency of the farm household is significantly hampered with poor road infrastructure conditions in both countries. There is empirical evidence on the implication of infrastructure development for agricultural production efficiency (Coelli et. al, 2002; Binam et al., 2004, Rahman, 2009). Poor and underdeveloped infrastructure in sub-Saharan Africa impedes smallholders' access to production inputs, improved production and technologies, their engagement in off-farm income generating activities, participation in the output markets and access to market and technological information (Chavas et al., 2005; Barrett et al., 2008; Anriquez and Daidone, 2010).

3.4 Scale and Technical Efficiency in Ethiopia and Tanzania

The scale elasticity can be estimated from the coefficients in the SDF, using the estimation procedure introduced by Fare and Primont (1995) and commonly used in relevant empirical literature (Coelli and Perelman, 1996; Kumbhakar et al., 2007). The negative of the sum of the input elasticity (coefficients) in the model, 0.38 for Ethiopia and 0.79 for Tanzania respectively, reveals the presence of decreasing returns to scale (DRTS) in agricultural production. There are a number of empirical findings that support the presence of decreasing returns to scale in sub-Saharan Africa. The only question that might arise in our estimation is on the magnitude of the scale elasticity. Such a low level of scale efficiency might be the result of the overuse of some of the resources in the production process and/or presence of imperfect market conditions both in factor and product market (Chavas et al., 2005; Anriquez and Daidone, 2010). Chavas et al. (2005) on smallholder farms in Africa, Gonzalez and Lopez (2007) and Solis et al. (2009) in South America have found DRTS in multi-input and output estimation procedure. These authors have argued that this sub-optimality can arise from the use of some of the inputs in the production process (such as surplus labour) beyond the optimal level. Anriquez and Daidone (2010) on the other hand found increasing returns to scale (IRTS) in Ghana, and they interpreted the result as an indication of the existence of imperfect markets, where farmers lack flexibility of allocating resources to alternative production activities. In sub-Saharan Africa, factor markets are less developed and weakly functional and hence they pose limits to the flexibility that farm operators have for resource allocation (Chavas et al., 2005; Barett et al., 2008; Anriquez and Daidone, 2010). From our analytical perspective, the availability of productive employment (both in quantity and quality terms) for the working age population in Tanzania and Ethiopia is limited. This might imply an excess of labour supply that is employed in agricultural activities, mainly due to limited availability of options outside the farm. There may be also underemployment, where the available labour is underutilized within the production unit. Despite the low level of marginal contribution of such an extra labour, they might have limited options than to engage in precarious employment, as casual and seasonal workers.

Table 5: First order production elasticities

Variables	Ethiopia		Tanzania	
	Coeff.	Std. err	Coeff.	Std. err
Land	0.16	0.03	0.30	0.03
Cost of intermediate inputs	0.11	0.02	0.15	0.02
Labour	0.11	0.02	0.34	0.04
Returns to scale	0.38		0.79	

4 Concluding Remarks and Policy Implications

This paper has substantiated the importance of decent rural employment for more effective rural development policies and strategies. Our literature review confirms that, while there are conceptual and policy discussions around the topic, a major gap prevails at the empirical level. The paper contributes to fill this gap through an analysis of the implications of decent rural employment on agricultural production efficiency.

The paper has analysed whether there is an empirical relationship between decent rural employment and efficiency in agricultural production. The relationship has been verified, and the empirical findings show a significant relationship, as captured by a set of decent rural employment indicators (i.e., employment to workforce available ratio, share of public transfers to the total income of the farm household, proportion of precarious employment to the total employment available, and child labour ratio) and technical efficiency of farms.

The positive effect of the employment ratio on technical efficiency proves the importance of creating and expanding productive jobs for farmers and their working-age family members in rural areas. In particular, the findings emphasize that supporting more productive and decent on-farm employment (i.e., self-employment of farm household heads), and creating more productive and decent employment opportunities for the rural workforce by and large can lead to a win-win situation for sub-Saharan Africa smallholder agriculture in terms of efficiency gains in farm production and job creation.

Given high population growth in rural areas of sub-Saharan Africa, investing in the creation of employment opportunities is particularly pertinent. Availability of employment is indeed essential but not a sufficient condition to improve the overall agricultural efficiency and hence the economic transformation of the agricultural sector. The available options should on the one hand, be productive to the producers and employers, and on the other hand, should help in improving the living conditions of the workers and their families.

Our empirical analysis in Ethiopia and Tanzania finds that there is a room for improving the productive capacity of smallholder producers with the given technology and available resources. From the mean technical efficiency score of the farm households, a 32% to 45% improvement in the efficiency of use of resources could be achieved. Our findings also indicate that, under certain circumstances, diversification in production activities can contribute to farm technical efficiency gain. Hence, the advantages from diversification in many production activities can outweigh the benefits of specializing in one production activity. Farms in our sample have a relatively small scale of production and seem to be diversified within a given production activity, such as producing a wide range of crop types or engaging in different livestock activities. In such contexts, expansion in a production activity (such as the size of livestock operation) might require farmers to have a certain level of managerial skills and might also create competition over labour and other resources. Furthermore, farms in the sample are operating in decreasing returns to scale (DRTS) which would imply that, on average, some of the inputs are used beyond the optimal level. Considering agricultural resource constraints and high population growth rates in Ethiopia and Tanzania, it would seem advisable to look deeper at the use of inputs in the production process. Possible reasons could be the excess labour supply that is directed to agricultural production due to limited employment opportunities in other off- and non-farm activities. Therefore, there would be a room for policy interventions that aim to promote labour demand in the rural areas of sub-Saharan Africa, such as favouring rural entrepreneurship, complemented with public employment programs and labour supply side interventions, like skills development.

Skills development and education emerges as an important area for policy intervention, as the empirical findings confirm that adequate agro-technical skill levels are vital in the decision making process in resource allocation for agricultural production. In our sample, literacy of household heads is associated with higher technical efficiency. More advanced farming technologies are more demanding in terms of skills from farm workers. We would also expect entrepreneurial skills, such as in management and marketing, gain increasing relevance as the farm units become more commercially-oriented. As the rural economy diversifies, rural workers may be required to gain a more varied set of skills. Given the low levels of observed educational attainment among the rural adult population, technical efficiency in the countries could benefit from improving their technical skill and general educational levels. In that regard, though not explicitly analyzed in this paper, prevailing demographic patterns in sub-Saharan African countries underline the need to look at skills development programmes for young farmers, in view of their key role in the rejuvenation and modernization of the sector. It is important to strengthen the outreach of agricultural extension services, also by supporting other ways for transferring of agricultural knowledge, such as farmer field schools and experience sharing visits.

We do find that access to road and credit contributes to improved technical efficiency, and that the role of infrastructure along the value chain, from access to agricultural input to market supply is vital. Poor and underdeveloped infrastructure in sub-Saharan Africa impedes resource use efficiency; by limiting their access to the major factor and output markets, and their flexibility in decision making. The challenging credit market also contributes to low level of agricultural production efficiency, and this can also be exacerbated with the limited off-farm and non-farm rural employment opportunities. Attempts towards improving production and productivity in sub-Saharan Africa can benefit from considering the existing level of infrastructure and factor market conditions.

To our knowledge, this paper has been the first in its type to explicitly raise the issue and role of precarious employment in the efficiency of smallholder agriculture. Precarious forms of employment and the prevalence of child labour ratio prevent smallholder farms from achieving greater technical efficiency. From a human rights perspective, child labour is to be prevented, especially its most hazardous forms, in line with international labour norms. Furthermore, child labour should be prevented as it perpetuates a cycle of poverty for the children involved, their families and the community as a whole. Low level of employees' motivation related to the seasonality and casual nature of the work, dissatisfaction with wage payments or the employees' low skills and experience could contribute to low levels of production efficiency. The productive capacity and motivation of agricultural workers can be improved by supporting more stable contractual arrangements, and improved access to social protection.

Access to social protection in Ethiopia and Tanzania has contributed to the improvement of agricultural production efficiency. Improved access to social protection in the rural areas of the developing world might contribute to reduce liquidity constraints and prevent families from falling into poverty trap, which is the classical problem in the study areas. PSNP and food for work programs do not only support the households in coping with shocks, but also add to the resource base of subsistence farmers. These programmes can also serve as a means to transfer implicit knowledge, skills and experience. This cash or food transfer from the productive safety net and food for work programs can either be used for consumption or could otherwise be invested in agriculture for the production purpose.

Overall, our empirical findings verified the implication of decent rural employment to improve the levels of agricultural production efficiency in two case countries in sub-Saharan Africa (Ethiopia and Tanzania). The results support the notion that addressing decent rural employment issues (e.g., increasing work participation by working-age family members on on-farm activities, expanding access to social protection in rural areas, providing access to skills development and formal education, and improving the quality of employment) can make a positive contribution both in terms of increasing efficiency in the smallholder subsistence agriculture sector and in providing and improving the livelihood of the poor. Governments and other organizations should support policies and programs that increase decent rural employment opportunities in sub-Saharan Africa to reduce rural poverty by simultaneously improving agricultural production efficiency and rural livelihoods. As our findings suggest, there are significant differences across farm units and rural settings, which need to be accounted for in the design of such interventions. Finally, future research could further elaborate the findings of this paper with improved rural labour data, especially using panel datasets, and thus enrich the analysis by expanding to other dimensions of decent rural employment.

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Appendix 1

	Gross margin	Land productivity[14]	Labor prod.		Gross margin	Land prod.	Labor prod.
Ethiopia	10082.91	18817.55	206.08	Tanzania	9.83e+06	7.91e+06	1.84 e+05
Tigray	9576.04	12213.28	135.79	Region 1	3.3 e+06	1.4 e+06	3.35 e+04
Afar	16037.60	57438.40	644.43	2	6.2 e+06	7.4 e+06	1.43 e+05
Amhara	7522.31	9057.41	146.36	3	6.4 e+06	1.32e+07	8.56 e+05
Oromia	12786.61	15810.56	245.60	4	7.05e+06	1.96e+06	6.24 e+05
Somalie	9533.74	63548.43	440.13	5	2.8 e+06	2.9 e+06	5.81 e+04
Benshangul	13370.21	7522.68	152.09	6	5.1 e+06	5.7 e+06	1.99 e+05
SNNP	9843.83	18093.62	206.39	7	1.33e+06	1.83e+07	1.85 e+05
Gambella	10509.44	50916.45	382.04	8	5.5 e+06	3.5 e+06	3.53 e+04
Harari	18997.98	38778.59	243.54	9	6.2 e+06	6.6 e+06	1.93 e+05
Diredawa	6610.48	12455.60	76.11	10	5.0 e+06	7.7 e+06	7.96 e+04
				11	3.9 e+06	4.1 e+06	1.22 e+05
				12	6.7 e+06	5.3 e+06	9.78 e+04
				13	3.1 e+06	1.3 e+06	1.88 e+04
				14	6.2 e+06	2.1 e+06	3.51 e+04
				15	1.3 e+06	3.2 e+06	2.37 e+04
				16	5.1 e+06	2.48e+06	2.69 e+05
				17	8.8 e+06	2.6 e+06	9.93 e+05
				18	6.4 e+06	9.1 e+06	6.05 e+04
				19	8.4 e+06	2.28e+07	2.28 e+05
				20	2.6 e+06	4.2 e+06	2.20 e+04
				21	2.19e+07	2.98e+07	6.08 e+05
Wald chi2 (x^2)	47.37^{***}	76.35^{***}	55.06^{***}		0.75	1.22	0.67

[14] Productivity is measured as value of production per hectare.

Abstract

Promoting decent rural employment, by creating new jobs in rural areas and upgrading the existing ones, could be one of the most efficient pathways to reduce rural poverty. This paper systematically investigates the impact of decent rural employment on agricultural production efficiency in sub-Saharan African countries, taking Ethiopia and Tanzania as case countries. The analysis applies an output-oriented distance function approach with an estimation procedure that accounts for different technological, demographic, socio-economic, institutional and decent rural employment indicators. Data of the most recent round of Living Standards Measurement Study-Integrated Surveys on Agriculture (LSMS-ISA) for the two countries are used, and a set of indicators are derived to proxy core dimensions of decent rural employment. The findings of our analysis show that decent rural employment contributes to agricultural production efficiency.

Keywords: decent work, rural employment, distance function, efficiency, poverty reduction.

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