

Modes of Access to Land, and Gender-Related Productivity Gap in Burkina Faso

Gniza Innocent Daniel

Research Paper 444

AFRICAN ECONOMIC RESEARCH CONSORTIUM
CONSORTIUM POUR LA RECHERCHE ÉCONOMIQUE EN AFRIQUE

Modes of Access to Land, and Gender-Related Productivity Gap in Burkina Faso

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AERC Research Paper 444
African Economic Research Consortium, Nairobi
July 2021

THIS RESEARCH STUDY was supported by a grant from the African Economic Research Consortium. The findings, opinions and recommendations are those of the author, however, and do not necessarily reflect the views of the Consortium, its individual members or the AERC Secretariat.

Published by: The African Economic Research Consortium
P.O. Box 62882 - City Square
Nairobi 00200, Kenya

ISBN 978-9966-61-142-0

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Abstract

This study analyses the sources of gender-related productivity gap, and measures the impact of land access patterns on the productivity gap in Burkina Faso. The data used in this research are drawn from the latest available study on living standards in Burkina Faso with respect to integrated agricultural surveys carried out in 2013-2014 in Burkina Faso. Like most countries in the Sub-Saharan region, Burkina Faso is essentially an agricultural economy. As such, knowing the causes of the productivity gap between genders is crucial for the formulation of policies designed to empower women. The econometric approach used in this work is based on the estimation of the Oaxaca-Blinder model, which explains the agricultural productivity gap by three (3) clusters of effects: the endowment effect, the structural effect, and the interaction effect. The results indicate that women farm managers are 26% less productive compared to men. Breaking down the sources of productivity gap reveals that the mode of access to land accounts for -300% of the endowment effect and 211.54% of the structural effect, with land purchase and renting being the statistically significant modes of access to land. This implies that policy makers need to reform the customary laws that exclude women from land ownership.

Keywords: *gender-related productivity gap, mode of access to land, Oaxaca-Blinder model.*

1. Introduction

Land is the main factor of production in agrarian economies (Obeng-Odoom, 2012). Consequently, the way in which it is accessed, allocated or transferred, controlled and used is an important factor in socio-economic policies and associated activities. This is a fundamental issue for socio-economic development planning, often at the root of conflict, especially within the political economy of any country. Inequality in land rights stemming from different status, religion, customary and local norms disadvantages women and perpetuates poverty and deepens gender inequalities. Women account for only 15% of farm owners in Africa (FAO, 2011). Land has always been recognized as a primary source of wealth, social status and power. It provides housing, food and economic activities. It is the main source of employment in rural areas and is an increasingly scarce resource in urban areas. Access to water and other resources, and to essential services such as sanitation and electricity, is often dependent on access to land rights. The willingness and ability to make long-term investments in arable land and housing depends directly on the protection that a society gives to owners of land rights. Therefore, access to and security of land rights is a key element of any concept of sustainable development (FAO, 2003) and, access to land is an important aspect of power in decision-making at family, community and national levels.

According to FAO (2003), access to land is governed by land tenure. Land tenure refers to the relationship, legal or customary, that people as individuals or as groups have with respect to land resources. Land tenure arrangements define how land ownership rights are to be distributed within societies along with the associated responsibilities and limitations. More simply, land tenure systems are used to determine who can use what resources, for how long and under what conditions. Although there may be a broad and varied range of rights, rights of access to land can take three main forms. First, use rights: the right to use the land for grazing, food crops, gathering of small forest products, etc. Secondly, control rights: the right to decide how the land is to be used and to receive the proceeds from the sale of crops, etc. Thirdly, transfer rights: the right to sell or mortgage land, to transfer it through intra-community reallocations or inheritances, and to redistribute rights of use and control (FAO, 2003). In many cases, the poor in the community only have use rights. For example, a woman will have the right to cultivate land to feed her family, but her husband will benefit from the proceeds of selling crops in the market. While such

clarifications may be useful, the exact way in which land rights are apportioned and used can be extremely complex.

In Burkina Faso, from the colonial period to the present day, modern or affirmative law and customary law have coexisted in land matters, sometimes leading to contradictions. At the legal level, existing international, regional and national legal texts, in particular the Convention on the Elimination of All Forms of Discrimination against Women¹ in its Article 14, ratified by Burkina Faso in 1987; the Protocol to the African Charter on Human and Peoples' Rights on the Rights of Women² in Africa, in Article 15a; the Constitution³ of June 1991, in Articles 1 and 15, and the Land and Agrarian Reform (RAF), in Article 62⁴, call for equal access to land for all social categories without discrimination (FAO, 2008). Marriage and inheritance are the main modes of access to land for women in Burkina Faso under customary law (Mariatou, 2011).

It was observed, however, that women's access to land in rural areas is hampered by a multitude of factors, which include customary barriers, illiteracy and land conflicts caused by population pressure, soil degradation and overgrazing. Illiteracy leads to inaccessibility and ignorance of legal instruments related to land. This situation perpetuates perceptions and practices that disadvantage women's access to land resources (Serdev, 2016). Any conflict at the community level is settled according to customary laws. However, these customary norms are unfavourable to women at the grassroots level in terms of access to land. Some conflicts may result in prohibition of land use for a widowed woman or a woman who has left her husband (Serdev, 2016).

In general, these factors differ significantly depending on whether the land is in remote areas or developed areas. In "remote areas", access to land is based on customary laws, in an unequal social relationship of dependency, negotiation and precariousness for women. According to Françoise (2004) study on "Rural women and access to information and institutions for securing land rights: Case study of Burkina Faso", "the exclusion of women from control over land management is one of the major characteristics of customary rights". The main cause is that a woman comes from another family lineage that owns land in her native village. Thus, in general, women do not have a right of ownership, but only an "authorization", a tolerance for the use of land, and nothing more. Not only do women have less access to land than men, but their access is also often restricted to what are known as secondary land rights, which means that these rights are held by male family members. Women therefore risk losing their rights in the event of divorce, widowhood or the migration of their husbands.

Disparities also exist in other areas that widen the productivity gap. For example, at the school level, the proportion of female enrolments at different levels of education and training remains generally low. The literacy rate was 29.4% for men and 12.5% for women in 2003. This situation is because the socio-cultural system in Burkina Faso has often been unfavourable to girls' education, women's literacy and even their vocational training (World Bank, 2003).

It therefore appears that increasing women's access to land is crucial in the fight against hunger and poverty. Existing evidence strongly links land tenure to increased investment in land and improved agricultural productivity (Deere and Doss, 2006). The overall objective of this study is to analyze the effect of women's access to land on the gender-related agricultural productivity gap and technical effectiveness.

Specific objective 1: Identify the causes of the gender-related productivity gap.

Specific objective 2: Measure the impact of land access mechanisms on the gender-related productivity gap.

2. The context of Burkina Faso

Burkina Faso's economy is essentially based on agriculture, livestock and forest resources, which account for nearly 40% of the Gross Domestic Product (National Institute of Statistics of Burkina Faso, 2009). The rural sector plays a dominant role in the national economy; nearly 80% of the population lives in rural areas and depends on land uses and other natural resources (water, forests, grazing land) for their livelihoods (FAO, 2007). According to the 2003 Burkina Faso Household Living Conditions Survey (EBCVM), 46.4% of the population were living below the absolute poverty line, which was estimated at 82,672 CFA per person per year. Poverty is much more pronounced among women (47.1%) than men (45.7%). There are many ethnic groups with varied customs and traditions, namely the Mossi (the most populous, representing 50% of the population), the Tuareg, the Fulani, the Lobi, the Gourmantché and the Bobo. The coexistence of different religions such as animism, Christianity and Islamism is permeated in the population and influences the distribution of land rights (FAO, 2008). Indeed, religious beliefs have often had the effect of protecting women and rescuing wives from land grabbing, through other means other than, for example, the equal sharing of land assets. For example, under Islamic law, girls can receive, as a dowry, half of the land assets inherited by boys on the death of their father. Also, sons are responsible for providing for their unmarried sisters and mother, which in theory requires more land (FAO, 2003). In most societies in Burkina Faso, customary habits confine women to household chores. This excludes them from income-generating activities, while men are seen as heads of households and breadwinners (Lonkila, 2009).

Agriculture in Burkina Faso, mainly dependent on rainfall, is geared towards the production of food and subsistence crops, 60% to 70% of which are intended for household consumption (World Bank, 2008). Regarding human development, 17% of the population is undernourished (FAOStat, 2004). Life expectancy is 52.9 years for women and 49.8 years for men. Data on literacy rate shows a significant gap between women with a rate of 16.6% and men with a literacy rate of 31.4% (UNDP, 2007). AIDS prevalence in 2005 was estimated at 2% for people between 15 and 49 years old (UNDP, 2007). According to UNDP (2007), the female economic activity rate reached 77.6% in 2005 and about 95.0% of women in rural areas practise subsistence farming, with the use of very rudimentary techniques and non-mechanized inputs. Work is divided along gender lines; women spend up to 16 hours a day on domestic work, including

vegetable supply, harvesting food crops and preparing food for daily meals, while men focus more on the economic administration of the household (FAO, 2005).

Regarding land, the Law on Agrarian and Land Reorganization (RAF), which governs land tenure, stipulates that land belongs to the State and access to it is in principle regulated by the State. The essence of this law was the creation of a single land block--the National Land Sector (NLS)--and the attribution of exclusive ownership to the State. This is the essence of Articles 1 to 3 of the RAF (Herman and Brice, 2015). The NLS is made up of land formerly held by traditional owners, land title holders and the State itself. But there are deficiencies within it that limit women's equitable access to land. Firstly, Article 46 of the 1996 RAF stipulates that at the village level, the allocation, evaluation and withdrawal of land falls within the jurisdiction of village land management commissions, organized into specialized sub-commissions whose members are elected and/or designated "according to historical, social and cultural realities" (Diallo, 2002). These are not favourable to women's participation in land management as discussed above. Secondly, these elected members form the Village Development Council (VDC) and Act No. 2007-032 on the powers, composition, organization and functioning of local land management structures, Article 3 of which stipulates that within the VDCs, out of 12 members, there be two (2) representatives responsible for the advancement of women. The VDC is the "gathering of all the vital members of the village". This is a real contradiction that disadvantages women in the local decision-making body in terms of access to land and land rights.

However, in 2007, the country adopted a National Policy for Land Security in Rural Areas (PNSFMR) aimed at formalizing access to land rights and thus offering a legal guarantee and better financial prospects for people living and working in rural areas (International Development Law Organization, 2008). This policy is marked by three major points. First, is the notion of land tenure security. This involves the merging of modern and customary rights: legality and legitimacy of land tenure. Second is land tenure security and decentralization, which means considering local realities. Third is the issue of securing women's land tenure in the ongoing process (Herman and Brice, 2015). However, this policy has shortcomings in terms of communication and awareness-raising around the national policy on land tenure security in rural areas, and has been confronted with resistance from local populations opposed to modern land management laws. Thus, the situation of women's access to land has not changed. Also, despite the positive discrimination measures provided for to allow and promote women's access to rural land, particularly in areas developed by the State, the application of this law remains difficult. It does not provide explicit guidelines on women's land rights. In practice, community laws prevail; a woman depends on her husband, who is considered the head of the family and the one who owns the land, the one who determines its use and distributes the work among family members (Diallo, 2002).

The Government's commitment to reducing these gender inequalities has materialized with the adoption of the National Gender Policy (NGP) in July 2009. The NGP is part of a long-term process (2009-2019) and is based on the various

commitments made by the Government of Burkina Faso at the international and regional levels, and on the provisions made at the national level in favour of gender equality and equity. The overall objective of NGP is to “promote participatory and equitable development of women and men, ensuring them equal and equitable access to and control over resources and decision-making spheres, in respect of their fundamental rights” (Serdev, 2016). The implementation of the NGP has led to significant advances, particularly in the area of policy, with the introduction of a 30% gender quota for women. However, in the areas developed by the State, the specifications do not always consider the specificities of women. The plots allocated to village women’s groups are often located in poorly levelled areas and the allocations do not take into account the number of group members (FAO, 2008). For example, according to the World Bank in 1994, the proportion of arable land allocated to women was barely 8% to 16%. However, women in Burkina Faso bear 90% of the domestic burden and rural women devote 90% of their time to agricultural activities, thus contributing significantly to food production. This situation hinders women’s increased productivity compared to their male counterparts. The poverty rate among women is 54.3% compared to 45.7% for men (Lonkila, 2009). In addition to the NGP, the State has adopted the National Policy for Land Security in Rural Areas, which aims to ensure equitable access to land for all rural actors, the guarantee of their investments and the effective management of land disputes to contribute to poverty reduction, the consolidation of social peace and achievement of sustainable development.

Additionally, in traditional communities, the right of ownership is exercised by the chief of the land, called “Tengsoaba” in the Mossi community (which represents 53% of the ethnic groups in Burkina Faso). The Tengsoaba is the intermediary between the ancestors and the living (Burkina Faso Human Development Index, 2007). . This function, which customarily only men and indigenous people can exercise, is due to the general recognition of the land rights of the first occupants, namely the ancestors (FAO, 2007). In general, the chief of the land, the eldest of the lineage, ensures the lineage management of the land, which guarantees the preservation and transfer of the land heritage from one generation to the other. This function covers two dimensions: a religious and mythical dimension, concerning links with ancestors and peace, and a judicial dimension, which concerns the management of conflicts and the distribution of patrimony/land ownership.

In addition, the powers of the chiefs of lands, as masters of land management, extend beyond the boundaries of the village area (Bary et al., 2005). Thus, the chief of land or lineage as an agent of the community or rights-holders, and not the owner of the land, is in charge of tasks that can be summarized in five points : i) performing agrarian rites that ensure peace and productivity for the village community; ii) ensuring the sustainable and equitable management of the common land heritage, including land reserves and the distribution of land reserves among the lineage members of the community; iii) allocating land to “outsiders”; iv) monitoring the proper use of natural resources; v) arbitrating the settlement of land disputes within the community or land disputes with neighbouring villages (Bary et al., 2005). A distinction should be made

between customary authorities responsible for land management and customary political authorities, including the village chief (Bary et al., 2005). While in the Central Plateau, the chief of land and the village chief represent two distinct roles, in the West, the chief of land may be the village chief at the same time. Where the two functions are separated, the land chief reports to the village chief (Ouédraogo and Sorgho, 2007).

Even if land belonging to ancestors is occupied and ownership assumed on behalf of the entire ethnic, clan or family group, women are excluded in terms of land acquisition (Ministry of Agriculture-B, 2007). Indeed, according to the customary distribution of land and resource rights, women and youth have no control over land management in the sense that land can be taken away from them at any time. Within this framework, customary marriage practices offer some protection (FAO, 2005). Women who do not have direct rights to land have access to it through their husbands and male relatives. Every married man has an obligation to give his wife a piece of land for her own agricultural activities. In this regard, women have control over the produce they grow in their own fields - even if these crops are to be used for household subsistence needs - and a portion of the produce they grow in the fields belonging to their husbands (FAO, 2007). In the specific case of Comoé Province, young wives have to work in their husbands' farms in addition to the work they do in their own fields. The extent of the above-mentioned obligation varies according to population groups, but it is particularly important among the Turka and Gouin. In general, women are released from these obligations around the age of 45, when their children are old enough to provide their own labour force (FAO, 2007).

As another example, in the Province of Seno, custom occupies a predominant place in social organization and appears to be the driving force behind social relations. This custom excludes women of this community from land management. The Peuhle tradition is strongly dominated by patriarchy. This type of social organization recognizes the full power of men and considers women as having to obey and submit (Serdev, 2016). In fact, in the event of a man's death, his sons share the cultivated land at the expense of their sisters because the women will marry and leave. Their shares are with their husbands. However, in-laws give women access to land for their small farms but securing land for their benefit poses a problem because of their lineage. Sahelian women, therefore, have no right of inheritance on the land. Production is culturally the responsibility of men, given their status as heads of households with the responsibility for feeding the family, and women play the role of reproductive health. In this community, the generally accepted explanation is that if women were to have access to land, there would be no more memories of the land. One would no longer know to which family lineage this or that land belonged. It would be the death of the tradition. For example, women cannot trace genealogies because of their status (The Research and Action Group on the Land, 2006). Thus, while Peuhl women may have access to land for agricultural production, they remain excluded from land ownership, which undermines their secure access to land.

In contrast to this culture, in the Gurounsi community, every person in the family is entitled to a piece of land through family inheritance. Thus, when a father passes on

land to his children upon his death, it is divided indiscriminately between his daughters and sons (Sidwaya, 2014). But this is an exception in communities in Burkina Faso.

As for divorced women, they could remarry to access the new husband's land and could benefit from land allocated by their family of origin. Alternatively, they can access land by borrowing land from non-family members, although they will have no security of tenure and their rights of use will be limited, such as prohibition from planting trees (FAO, 2007). Widows may, depending on the levirate, remarry the brother of the deceased husband. If the woman refuses the levirate, she can return to her family of origin, but she is supposed to leave her sons with the family of the deceased husband and she loses any kind of right to the land (Diallo, 2002).

Inheritance is still the main mode of access to land, especially within local communities. Current local practices provide for the inheritance of land from father to son. The rights of the eldest child to all lineage lands are becoming less and less effective (Bary et al., 2005). Women, whether wives or daughters, generally do not inherit land, although in some areas they enjoy more extensive inheritance rights. Even Muslim women, who under Muslim law generally inherit half the share of land from men, tend to give up their rights in favour of their brothers (FAO, 2007). A widow may return to her family of origin and receive land, marry a younger brother of her deceased husband, according to the levirate, or remain with in-laws as a widow. In the latter two cases, the widow retains her access to her husband's family land. Women's degree of freedom in levirate choices varies, ranging from almost compulsory marriage in some groups to considerable freedom of choice in others. Levirate marriage is formally prohibited by affirmative law as provided for in Article 234 of the Persons and Family Code (FAO, 2007).

Women usually have access to some of the land left by the deceased. However, widows are guaranteed enjoyment of the right to use the land left by their husbands. Widows with young children are usually dispossessed of their land by their brothers-in-law (Françoise, 2004 and WILDAF, 2002). This is very often the case in the village of Mogtédo in Burkina Faso. Girls often give up their legitimate inheritance rights over land to their brothers, on whom they often depend (FAO, 2007), with a few exceptions within the lowland areas where rice fields are customarily passed on from mother to daughter, but this original exclusive right of women is being put into question.

Migrants, even temporary right owners, sometimes enjoy the right to inherit land on their farms through succession to their children (Bary et al., 2005). A woman is generally excluded from inheriting ancestral land. At the same time, the modes of transfer of ancestral land heritage are changing from the traditional practice of exogamy, where a woman is supposed to leave her original family lineage to marry into another family, to the current mode of transfer of ancestral land heritage from elder son to elder son, to the paternal mode of succession from father to son (Bary et al., 2005).

In view of the above, contradictions or discrepancies between statutory and customary laws exist. Even if there is a palaver record, with the presentation of an official document signed by the administrative authority when the allocation of

land is requested, in practice conflicts and disputes are settled outside the official institutional legal framework. Consequently, affirmative law intervenes only as a last resort and as the ultimate sanction if the disputing parties do not find common ground (Françoise, 2004). The Agrarian and Land Reorganization (RAF), in itself, is full of contradictions that strengthen the continuity of customary logic; for example, article 505 of the decree of 6 February 1997 states that “persons using land in the National Land Reserve Area for agriculture, animal husbandry and forestry activities at the time of publication of the decree, shall continue to use it”. However, new farm acquisition is mandatorily subject to the prior authorization by the administration and can only be carried out under the supervision of competent authorities and services (Françoise, 2004). Regarding inheritance, Article 733 of the Personal and Family Code stipulates that women and men inherit property without discrimination as to sex or origin of descent. In customary practice, however, women do not inherit property. In order to enjoy the right and have access to land, women are supposed to marry and leave their family of origin to join the husband’s family (FAO, 2007). Although the Land Reorganization Act provides for equal land rights for both men and women, regardless of their marital status, in practice, married women have major benefits and their access to land is more protected compared to divorced or widowed women. Moreover, although levirate is prohibited by the Persons and Family Code, as provided for in Article 234, this custom is widely practised (FAO, 2007).

Finally, we have noted that during the rainy season in the Sahel, agricultural land is allocated both by family lineage segments or individuals, and after the harvest, it is allocated to “communal easements” according to well-established rules (Bary et al., 2005). In this regard, local practices for accessing land in rural areas include inheritance, open-ended or short-term land rentals, and lease/sale (Asséta, 2002).

3. Literature review

The most common modes of access to land in Burkina Faso are inheritance, marriage, land tenancy, leasing and sale (Asséta, 2002). The mode used affects women's agricultural productivity in two ways. First, land tenancy, leasing and access through inheritance puts women in a situation of insecurity in terms of land ownership, since they can be expelled from their land at any time (Françoise, 2004; WILDAF, 2002; FAO, 2007). However, the most obvious effect of insecurity of land tenure is the increased uncertainty as to whether the farmer will be able to benefit from the investments he or she makes in terms of equipment, irrigation infrastructure or land conservation measures to maintain or improve the productivity of his or her farm. Since investment is negatively related to uncertainty of land ownership, increased uncertainty leads to reduced investment incentives, and therefore preference on the current use of land. With lower capital accumulation, the demand for additional variable inputs to capital is reduced. If, for example, the acquisition of machinery allows for rapid land preparation, more land can be double-cultivated and the demand for variable inputs such as labour and fertilizers will increase (Feder et al., 1988).

Furthermore, although some women have access to land through loans or inheritance, access to legal and secure land title is limited, as the idea of female land ownership is still a taboo due to socio-cultural influences (Bary et al., 2005; FAO, 2007). Since there are no clear legal title mechanisms, it is hard to mortgage land while a secure title can indeed facilitate access to credit, especially for lenders who do not have personal or detailed information about the borrower (Feder et al., 1988). Land has several attributes that make it a desirable collateral asset. A land title is often a mandatory precondition for commercial or official bank loans. However, without credit, it will be difficult for women to make investments that can increase their productivity (FAO, 2003), while men have easy access to land title and, in return, access to credit, which enables them to increase their productivity through investments in new technology (World Bank, 2005).

Finally, the second way in which the mode of access to land influences women's productivity is through the quality and size of the land available to women. Indeed, when they have land, the quality of that land is usually poor and the size is very small, thus limiting their productivity, unlike men who have access to land of good quality and sufficient size (Bary et al., 2005; FAO, 2007).

The literature on the gender productivity gap does not focus on the influence of the mode of access to land on the gender productivity gap. However, several studies focus on the impact of limiting women's access to land on productivity. For example, some authors show that limiting women's access to land and other productive resources such as modern inputs, technology and financial services may explain the productivity gap. According to Kilic et al. (2013), when equal access to land and other factors of production is simulated, the gender gap almost always disappears. For example, in their study of agricultural productivity in Burkina Faso, Udry et al. (1997) compared about 4,700 agricultural plots and found that women's yields were 20% to 40% lower for vegetables and sorghum compared to men's yields, but these large differences were mainly due to their lower use of production inputs attributed to gendered social norms.

Udry (1996) and World Bank (2005) show that differential access to assets of production such as land and inputs is a distortion in the sense that "women's activities" are underfunded and undercapitalized while "men's activities" are comparatively overfunded and overcapitalized. Because of the decline in marginal returns and/or loss due to lack of economic resources among skilled women, such a distortion reduces overall productivity. Such gender disparities could not only lead to stagnation and inefficiency, but also reduce effective investment in new technologies (Jones, 1986; von Braun and Webb, 1989) and the maintenance and improvement of assets, especially land.

In addition, Goldstein and Udry (2002) show that agricultural farms managed by women receive much less fertilizer and other inputs than those managed by men, and if these inputs were standardized, aggregate productivity would increase by 10% to 15%. Tiruneh et al. (2001) find a productivity disadvantage of 26% for the agricultural production of female-headed households. They conclude that the difference in productivity is mainly due to reduced access to inputs, including land. In particular, if female-headed households used the average amounts of inputs used by male-headed households, their estimates would predict a 1.3% higher productivity for female-headed households.

In addition, differences in the quality of inputs such as land, the use of different production functions or techniques, differences in food security strategies, risk aversion and knowledge gaps are additional factors that may contribute to differences in productivity (Peterman et al., 2011). Since some of these gender differences are due to everyday inequalities that are difficult to measure, it also means that differences in productivity between men and women may well remain, even when observable differences in access to resources are considered. These day-to-day inequalities will also affect any empirical analysis, as the effect of changes in access to one or more of the observed resource indicators will depend on other inequalities observed in the same study (Kassie et al., 2015).

4. Methodology

Data Sources

To analyse the productivity differentials between genders, this paper uses variables developed from the latest available study on measuring living standards - Integrated Surveys on Agriculture (LSMS-ISA) conducted in 2013-2014 in Burkina Faso. This is because few studies have been conducted for the Sahel region, to our knowledge. LSMS-ISA datasets are implemented by the national statistical agencies in each country under the overall management and supervision of the World Bank. The LSMS-ISA datasets are nationally representative and cover all geographical regions of the countries. They apply a relatively similar survey design and survey questionnaire, which is extremely important for country comparative analyses. The surveys have collected information on almost all aspects of household and community activities. In total, the 2013-2014 survey collected data from 10,860 households, of which 475,238 individuals were interviewed. These individuals are in both urban and rural areas. After removing observations with missing data, and observations containing collectively managed land parcels, we finally considered a total of 571 individuals. The survey includes three instruments: household questionnaire, agriculture questionnaire and consumer goods and services price questionnaire. The different modules of the questionnaires contain information on socio-demographic characteristics of households, the different means of access to land used by individuals, and other information that allows for calculation of variables used in this study.

The data structure of LSMS-ISA allows us to identify farm managers and to locate those using GPS. All analyses in this study are done at the level of the farm manager. The choice of farm manager in lieu of household head is justified as follows. First, the use of farm management instead of ownership implies the integration of intra-household dynamics concerning agricultural activities. Indeed, male and female managers in the same household may have completely different approaches or perspectives regarding land use, the type of input to be applied, or whether or not to hire labour (Croppenstedt and al., 2013). Second, many peasant households own several pieces of land that are not necessarily adjacent to or at equal distance from their family property. In this case, it is reasonable to assume that other family members may also be responsible for some pieces of land at the same time as the household head (Adamon and Adeleke, 2015). Third, as many empirical studies have recently

shown, non-agricultural employment is increasingly becoming an important source of income, especially in rural areas. In many cases, it is the head of the household who is engaged in non-agricultural employment activity or salaried employment, while the wife or another family member manages the agricultural land (Adamon and Adeleke, 2015). Therefore, the use of the farm manager represents a more realistic view of actual agricultural practices and the division of labour within the household. In addition, for simplicity, we limited the analysis to pieces of land with a single manager and thus excluded co-managed pieces of land. In this study, productivity will be measured by the amount of production (in kg) per unit of cultivated land (ha). Table 1 below shows the descriptive statistics of the variables used in this study.

Table 1: Descriptive statistics and testing of average differences by gender for farm managers

Burkina Faso			
	Managers men	Managers women	Differences
Agricultural productivity (kg/ha)	355.73	172.79	182.94***
Mode of access to land[#]			
Donation	0.50	0.02	0.48***
Inheritance	0.34	0.57	-0.23
Purchase	0.87	0.81	0.06*
Land rent	0.13	0.19	-0.06
Marriage	0.03	0.20	-0.17
Other	0	0.005	-0.005
Characteristics of the manager			
Age	48.58	50.38	-1.8
Literate	0.21	0.05	0.16***
Years of schooling	1.28	0.37	0.91
Marital status[#]			
Divorced/Separated	0.01	0.009	0.001
Monogamy	0.61	0.16	0.45***
Polygamy	0.35	0.02	0.33***
Cohabitation	0.01	0.002	0.008
Widower	0.007	0.81	-0.803
Single	0.007	0	0.007*
Household characteristics			
Household size	8.63	3.18	5.45***
Male adults (15-65)	1.85	1.96	-0.11
Female adults (15-65)	1.42	1.75	-0.33***
Children (aged below 15)	0.8	1.28	0.48***
Expenditure per household member (F CFA)	142,683	210,905	68,222***

continued next page

Table 1 Continued

Burkina Faso			
	Managers men	Managers women	Differences
Non-labour inputs			
Use of manures#	0.94	0.04	0.90***
Use of household waste #	0.62	0.05	0.57***
Use of organic fertilizers#	0.15	0.14	0.01
Use of phytosanitary products#	0.11	0.58	-0.47
Quantity of manures (g/ha)	13.65	0.07	13.58***
Quantity of urea (g/ha)	5.98	1.63	4.36
Quantity of NPK(g/ha)	9.10	1.72	7.38
Quantity of DAP/other chemical fertilizers	0.06	1.34	-1.28***
Quantity of pesticides (g/ha)	0.07	0.02	0.05
Improved seeds (g/ha)	49.79	29.43	20.36
Labour inputs			
Use of household labour force#	0.99	1	0.01
Household male adult labour force (person-day/ha)	60.73	31.86	28.87***
Household female adult labour force (Person-day/ha)	37.47	20.04	17.43***
Household labour force by children (person-day/ha)	7.67	10.29	-2.62
Non-household labour force male adult (person-day/ha)	0.05	0.27	-0.22
Non-household labour force adult female (person-day/ha)	0	0.08	-0.08
Non-household labour force by children (person-day/ha)	0	0.08	-0.08
Observations	150	421	
	26.27%	73.73%	

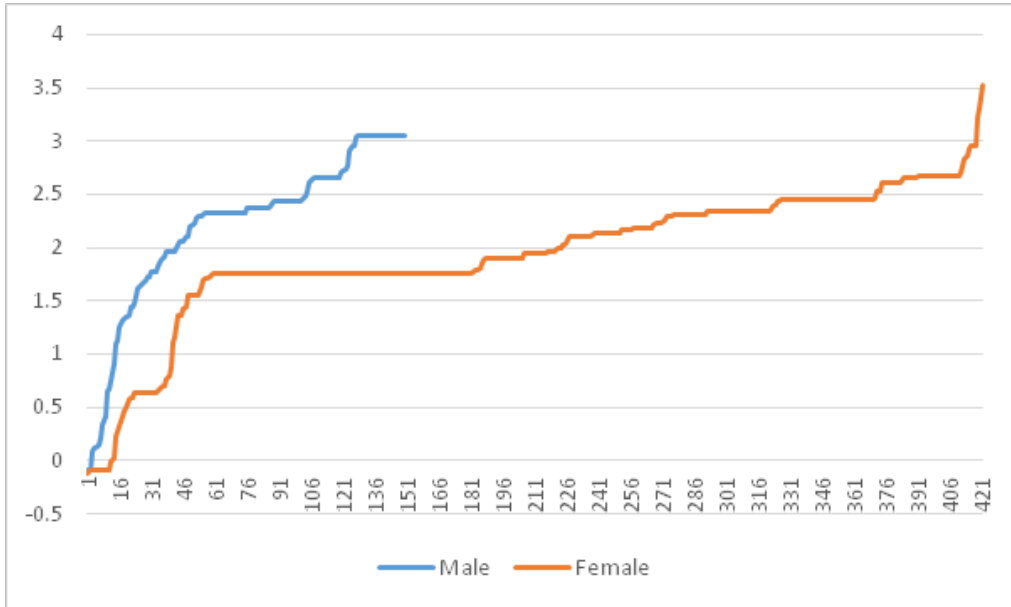
Source: Author, based on LSMS-ISA 2013-2014 data

Note: (***), (**) and (*) denote significance at 1%, 5% and 10%, respectively; (#) denotes category variables.

Descriptive statistics and test results on average differences between male and female farm managers are presented in Table 1. Table 1 and Figure 1 thus provide some initial indications of the (unadjusted) productivity gap between male- and female-managed farms in Burkina Faso.

First, women are considered to be less productive than their male counterparts, with the (unadjusted) gender productivity gap of 51.5% at the farm level in Burkina Faso. Second, the observed productivity gaps between men and women can be correlated to differences in land, management and household characteristics, and differences in the use of inputs such as labour and other inputs.

Figure 1: Agricultural productivity gap between men and women in Burkina Faso (2013-2014)

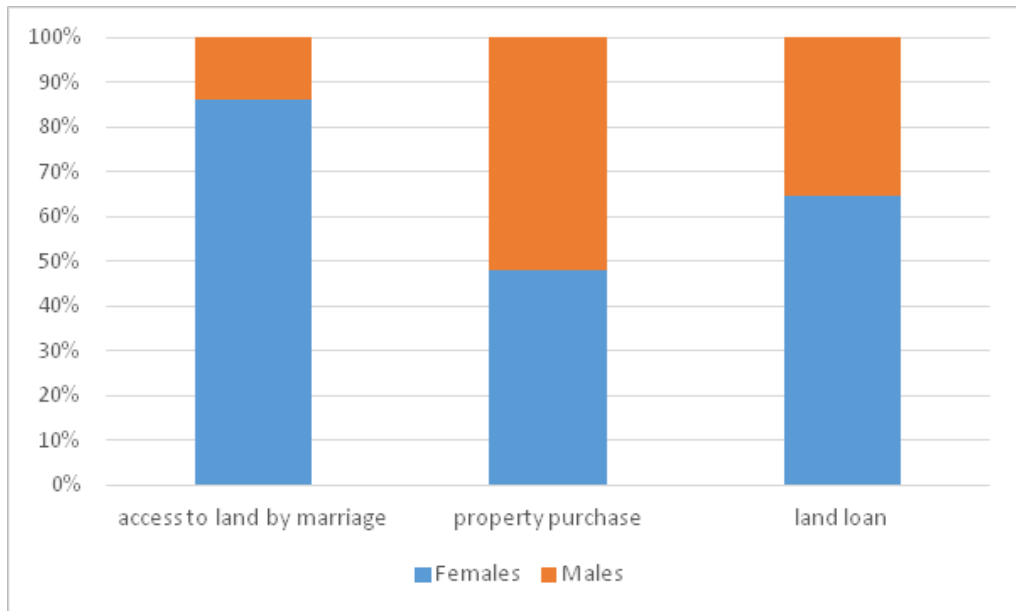


Source: Author, based on LSMS-ISA 2013-2014 data for Burkina Faso

With regard to mode of access to land, 81% of women had access to land ownership through purchase, compared to 87% of male managers; 2% of women managers had access to land through donations, compared to 50% of male managers; and 19% of women benefited from land rentals, with a significant gap of 8% in favour of women (Table 1 and Figure 2).

In terms of land characteristics, plots managed by men are located much more in the bush with plains topography than those of their female counterparts that are usually smaller. The soil types of female farm managers are mostly sandy and clay. In addition, 71% of land held by women managers are ploughed manually and 55% of these parcels have no security. On the other hand, 74% of parcels owned by male managers have security of tenure, with a very significant difference of 49%.

Figure 2: Modes of access to agricultural land by gender in Burkina Faso (2013-2014)



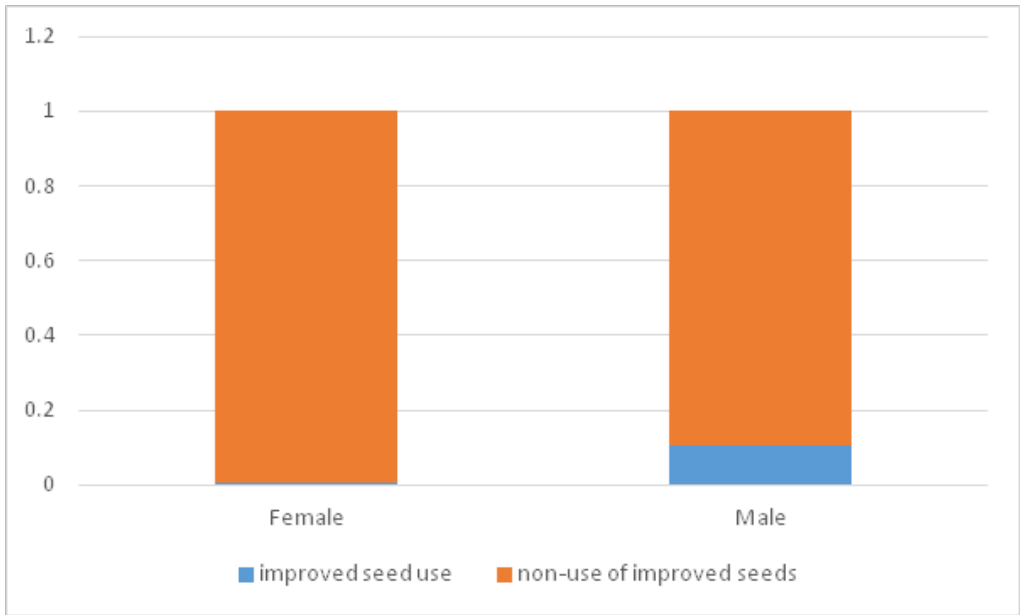
Source: Author, based on LSMS-ISA 2013-2014 data for Burkina Faso

In terms of manager characteristics, female farm managers are, on average, 1.8 years older and have 0.91 years less of schooling than men. Some 61% of men and 16% of women are monogamous while 35% of men versus 2% of women are polygamous. Furthermore, Table 1 shows that women live in households with an average of 5.45 fewer members than men. Male farm managers have monthly consumption expenditure per household member, on average 47.81% higher than their female counterparts.

Finally, Table 1 and Figure 3 show drastically different dynamics between land managed by women and land managed by men with respect to input use in Burkina Faso. The use of inputs other than labour, such as organic and inorganic fertilizers, improved seeds and pesticides, is generally considered to be positively correlated with land productivity (Adamon and Adeleke, 2015). Thus, we observe that men use much more inputs than women. Consequently, we see confirmation of the importance of labour inputs in the production process. Male managers use the household labour force much more than women.

In summary, in accordance with these descriptive statistics, we find that the observed unadjusted gender productivity differences exist and are partly attributable to a variety of factors, some of which put women farm managers at a distinct disadvantage.

Figure 3: Use of improved seeds by farm managers



Source: Author, based on LSMS-ISA 2013-2014 data for Burkina-Faso.

Models of productivity gap between men and women

All subsequent analysis in this paper will be done at the agricultural land manager’s level. We use the Oaxaca-Blinder (OB) decomposition model to examine the causes of productivity differentials between male and female managers, as per Kilic et al. (2013), Aguilar et al. (2013) and Backiny-Yetna and McGee (2015). The disaggregation begins with equation (1), which is estimated for the aggregated sample, and by the gender of the farm manager as follows:

$$y_g = \sum_{j=0}^K \alpha_{gj} x_{gj} + \mu_g \tag{1}$$

With $g = \{m; f\}$ and μ_g being the random gender error term assumed to be independently and identically distributed, with a mean of 0 and a variance σ^2 , y is the normal logarithm of the gross value of agricultural production per unit of land (our measure of productivity), a dimension vector $K+1$, including variables such as land, managers, household characteristics, mode of access to land, labour inputs and non-labour inputs, and α parameters to be estimated. The objective of the OB decomposition approach is therefore to show the magnitude of the gap.

$G = E(y_m) - E(y_f)$, with $E(y_m)$ and $E(y_f)$ denoting the expected values of agricultural productivity by male and female farm managers, is explained by gender differences in the levels and outputs of co-variables X . According to Daymont and Andrisani (1984) and Jann (2008), the gender productivity differential G can also be written as:

$$G = E(y_m) - E(y_f) = \underbrace{[E(X_m) - E(X_f)]\beta_f}_a + \underbrace{E(X_f)(\beta_m - \beta_f)}_b + \underbrace{[E(X_m) - E(X_f)](\beta_m - \beta_f)}_c \quad (2)$$

According to equation (2), three factors can explain the gender-related productivity differential:

- Differences between male and female managers at observable variables levels X . Therefore, the first component of equation (2) gives the proportion of the estimated productivity gap explained by differences between men and women in the levels of these variables and is called the endowment.
- Differences in outputs of variables X . The second term, called the structural effect or coefficient, measures the fraction of the productivity differential attributable to differences in the outputs with respect to variables (including the estimated coefficient of the fixed variable).
- Finally, the last component, the interactive effect, captures the fraction of the productivity differential arising from simultaneous differences in the predictors and their estimated coefficients. A positive value of the second component implies that male managers have a structural advantage over female managers on the specific variable, while a negative value suggests a female structural advantage. The same reasoning is valid for the other partial effects of equation (2).

5. Results

This section presents empirical results regarding factors of agricultural productivity, analyses the differential impact of various variables on land managed exclusively by men and women, and breaks down the causes of the estimated productivity gaps.

Preliminary analysis

As explained above, it is assumed that farm productivity is a function which depends on the characteristics of the farm manager, labour inputs, non-labour inputs and land characteristics. The coefficient of the gender indicator will generally be interpreted as the productivity gap between men and women. Thus, Table 2 shows the results of the least squares estimates for the combined sample, i.e., results from equation (1), to understand the impact of gender on the farm manager and other variables on agricultural productivity. As described in the methodology, these estimates are one of the main components of the Oaxaca-Blinder decomposition model.

Table 2: OLS baseline regression results supporting mean disaggregation

Female manager	-0.09*	0.05
Mode of land acquisition#		
Donation	0.15	0.13
Inheritance	-0.04	0.10
Ownership	0.64***	0.21
Land rental	0,40*	0.21
Characteristics of the manager		
Age	0.01**	0.00
Years of schooling	-0.03**	0.01
Characteristics of the manager		
Household size	-0.01*	0.01
Male adults (15-65)	0.11***	0.03
Females adults (15-65)	-0.09***	0.03
Children (aged below 15)	-0.03	0.03
Expenditure per household member (F CFA)	-0.25	0.20

continued next page

Table 2 Continued

Non-labour inputs		
Use of manures#	0.06	0.13
Use of household waste#	0.04	0.11
Use of organic fertilizers#	0.01	0.01
Use of phytosanitary products#	-0.04	0.11
Use of improved seeds#	0.30	0.19
Quantity of manures(g/ha)	0.01	0.02
Quantity of NPK(g/ha)	-0.01	0.01
Quantity of DAP/other chemical fertilizers (g/ha)	0.02**	0.01
Quantity of pesticides (g/ha)	0.06*	0.04
Improved seeds (g/ha)	0.01***	0.00
Labour inputs	0.30	0.19
household labour force- male adult (person-day/Ha)	0.00	0.00
Household labour force- female adult (person-day/ha)	-0.00***	0.00
Household labour force - child (person-day/ha)	0.00	0.00
Non-household labour force – male adult (person-day/ha)	-0.00	0.01
R-squared	0.47	
Observations	571	

Source: Author, based on LSMS-ISA 2013-2014 data from Burkina Faso

Note: (***), (**) and (*) denote significance at 1%, 5% and 10% respectively; (#) denotes the category variables. Values in parentheses represent standard errors.

Table 2 provides the following five (5) key messages:

- (i) The gender of the farm manager has a negative and significant effect on agricultural productivity in Burkina Faso. In other words, being a female manager is a significant obstacle to achieving higher levels of productivity in Burkina Faso. This result is congruent with the empirical findings of Adamon and Adeleke (2015).
- (ii) Table 2 shows the impact of non-labour inputs, particularly with respect to use and intensity of modern inputs. The use of modern inputs such as pesticides and improved seeds has a significant impact on agricultural productivity. However, the marginal value of most of the variables capturing the use and intensity of non-labour inputs is indicative of the low application rates of these inputs by African farmers, both men and women (Adamon and Adeleke, 2015). The impact of improved seeds, pesticides and chemical fertilizers such as Diammonium Phosphate (DAP) fertilizer is positive and significant (1%) on farm productivity. But this impact is very minimal.

- (iii) Regarding the mode of access to land, formal purchase (ownership) has a positive and significant effect on agricultural productivity in Burkina Faso. On average, access to land through purchase increases productivity by 66%. This could suggest that this mode of access appears to be the most secure for managers and induces an increase in investment on their part since, when farmers buy land, they acquire titles that are legally recognized by the local authorities. In addition, land rentals have a positive and significant effect on the aggregate production of farms. This could be explained by the fact that most of the land rent arrangements are provided by community leaders or close relatives. This gives farmers some assurance regarding the stability of their investments.
- (iv) The use and intensity of household and paid labour force has no statistical influence on the value of productivity. This could be explained by the lack of skilled human resources in agricultural production techniques.
- (v) Variables associated with manager and household characteristics affect productivity differently. Thus, when the number of adult women increases by 1, productivity falls by 0.10 kg/ha. However, when the number of adult men increases by 1, productivity increases very significantly by 0.13 kg/ha. This could be due to lack of experience on the part of women. Household size has a negative and significant impact on productivity. Years of schooling have a negative and significant influence on productivity, while the age of farm managers has a positive and significant but minimal effect on productivity.

Breakdown of the causes of productivity gaps between men and women

Table 3 presents results of the Oaxaca-Blinder decomposition model with respect to productivity gaps between men and women in Burkina-Faso; that is, results of equation 2. A negative sign of the estimated coefficient implies an advantage in favour of farms managed by women, while a positive sign indicates an advantage in favour of farms managed by men.

The results indicate a gender productivity differential of 26%. The magnitude of this gap is consistent with those recently estimated in other Sub-Saharan African countries collecting data sets such as LSMS-ISA. In Niger, Backiny-Yetna and McGee (2015) scored 18.3%; Adamon and Adeleke (2015) scored 18.4%, 27.4% and 30.6% for Nigeria, Tanzania and Uganda, respectively. These recurrent results thus point to a consistent feature of African agriculture, where female farm managers are generally less productive. In most societies, and particularly in Burkina Faso, women are mainly entrusted with household chores and childcare, although norms in this regard vary according to cultural traditions and may change over time. According to surveys conducted on time-use patterns in a wide range of countries, women are responsible

for the preparation of household meals, accounting for 85% to 90% of the total time spent on this activity, and are also responsible for childcare and other household chores. The combined duration of household chores and agricultural work places a particularly heavy burden on the shoulders of African women (FAO, 2012). Thus, women typically grow crops, care for animals, process and prepare food, work for pay in agricultural or rural enterprises, fetch fuel and water, engage in commercial activities, care for family members and do housework (FAO, 2012).

The second part of Table 3 shows the reasons for this calculated discrepancy. First, the endowment effect and the interaction effect have the same positive sign, indicating that the productivity gap between men and women is mainly caused by endowments of different groups and interactions between them. Second, the endowment effect; that is, the proportion of productivity gap between men and women due to differences in observable levels between men and women, accounts for 7.69% of the gender gap in favour of men, while the interaction effect explains 192.31% of the productivity gap in favour of men. Third, the structural effect; that is, the share of the gender gap attributable to the output of the same observables, explains 100% of the magnitude of the gender gap in favour of women; that is, structural variables reduce the gender gap. However, not all of these effects are significant.

Thus, before developing policy interventions to reduce or close this gap, emphasis should be placed on identifying and understanding the fundamental causes by which women are disadvantaged in agricultural production processes. The last part of Table 3 provides a detailed breakdown of the three (3) causes of the gender gap.

Given the property of additional linearity, it is possible to determine the contribution of each component to endowment, structure and aggregate effects. The endowment effect is explained by access to land through loans (-300% of the total endowment effect and -23.1% of the total gap), the number of school years (-250% of the total endowment effect and 19.23% of the total gap), household size (-1,750% of the total endowment effect and -134.61% of the total gap), the ratio of household expenditures (-750% of the total endowment effect and -57.69% of the total gap) and improved seeds (80% of the total endowment effect and 61.54% of the total gap). At the level of the structural effect and the interaction effect, access to land through formal purchase (ownership) (211.54% of the total structural effect), age (-380.77% of the structural effect), child in the household (-138.46% of the total structural effect and -28% of the total interaction effect), the ratio of household expenditures (4,100% of the structural effect and 78% of the interaction effect), improved seeds (-107.69% of the structural effect and 38% of the interaction effect) and female labour (107.69% of the structural effect and -48% of the interaction effect) are the most significant explanatory variables. Finally, the fact that differences in non-work-related inputs do not explain any of the components of the OB decomposition is indicative of their use by only a small proportion of farmers in Burkina Faso. Indeed, in our sample, only 3.15% of farm managers use improved seeds.

Table 3: Causes of productivity gaps between men and women in Burkina Faso

1/ Gender gap			
Average male productivity		2.19 (0.06)***	
Average female productivity		1.94 (0.03)***	
Productivity gap between genders		0.26 (0.13)***	
2/Aggregated decomposition			
	Endowment effect	Structural effect	Interaction effect
Total	0.02 (0,38)	-0.26(0,30)	0.50 (0,45)
Share of total variance	7.69%	-100%	192.31%
3/Comprehensive breakdown			
Mode of land acquisition#			
Donation	0.15 (0.11)	0.01 (0.01)	0.17 (0.24)
Inheritance	-0.01 (0.06)	0.15 (0.18)	-0.06 (0.08)
Ownership	0.06 (0.05)	-0.54* (0.38)	-0.04 (0.06)
Land rent	-0.06* (0.04)	-0.06 (0.11)	0.03 (0.06)
Characteristics of the farm manager			
Age	0.01 (0.02)	0.99** (0.57)	-0.04 (0.03)
Years of schooling	-0.05*** (0.02)	0.01 (0.01)	0.02 (0.04)
Household characteristics			
Household size	-0.35* (0.20)	0.12 (0.14)	0.20 (0.24)
Male adults (15-65)	-0.00 (0.02)	0.26 (0.23)	-0.01 (0.02)
Female adults (15-65)	0.03 (0.03)	0.04 (0.23)	-0.01 (0.04)
Children (aged below 15)	0.06 (0.04)	0.36* (0.20)	-0.14* (0.08)
Expenditure per household member (F CFA)	-0.14* (0.09)	-9.55*** (3.87)	0.38*** (0.14)
Non-labour inputs			
Use of manures#	0.69 (0.81)	-0.03 (1.70)	-0.69 (1.35)
Use of household waste#	-0.18 (0.36)	0.04 (1.05)	0.47 (1.09)
Use of organic fertilizers#	0.30 (0.70)	-0.27 (1.12)	-0.32 (1.70)
Use of phytosanitary products#	-0.00 (0.21)	0.14 (0.54)	-0.11 (0.41)

continued next page

Table 3 Continued

Non-labour inputs <i>continued</i>			
Use of improved seeds#	-0.22 (0.32)	0.01 (0.38)	0.18 (0.71)
Quantity of manure(g/ha)	-0.06 (1.61)	-0.03 (0.48)	-0.07 (1.64)
Quantity of NPK(g/ha)	0.17 (1.84)	-0.00 (0.39)	-0.01 (1.87)
Quantity of DAP/other chemical fertilizers (g/ha)	-0.02 (0.03)	-0.10 (0.20)	0.10 (0.19)
Quantity of pesticides (g/ha)	-0.00 (0.01)	-0.01 (0.02)	0.00 (0.01)
Improved seeds (g/ha)	0.16*** (0.07)	0.28*** (0.12)	0.19** (0.10)
Labour inputs			
Family labour force – male adult (Person-day/ha)	0.03 (0.19)	0.01 (0.24)	0.01 (0.21)
Family labour force – female adult (Person-day/ha)	0.01 (0.08)	-0.27*** (0.13)	-0.24** (0.14)
Family labour force - child (Person-day/ha)	0.00 (0.01)	-0.16 (0.16)	0.04 (0.06)
Non-family labour force –male adult (Person-day/ha)	0.00 (0.01)	0.02 (0.07)	-0.01 (0.06)
Observations	571		

Source: Author, based on LSMS-ISA 2013-2014 data from Burkina Faso

Note: (***), (**) and (*) denote significance at 1%, 5% and 10%, respectively; (#) denotes category variables. The values in brackets represent standard errors.

6. Conclusion and policy implications

The structural transformation of African agriculture is a prerequisite for improving agricultural productivity, food security and poverty reduction on the continent. However, gender equality is an essential element of this transformation, given its potential impact on social inclusion and job creation. It is a fact that Africa's agricultural landscape is characterized by disproportionate gender inequalities against women. These gender-related differences range from access to productive resources to low rates of technology adoption. Thus, a good understanding of the magnitude and origins of gender productivity gaps is critical to the success of policy interventions aimed at empowering women (Adamon and Adeleke, 2015). This research analysed the causes of the gender productivity gap, the technical effectiveness of producers, and measured the impact of land access patterns on the gender productivity gap.

Using available microeconomic surveys, within the framework of the Integrated Study of Living Standards Measurement - Agricultural Surveys (LSMS-ISA), we have highlighted some empirical results. The main results suggest that in Burkina Faso, female farm managers are clearly disadvantaged in most of the contributory factors to agricultural productivity, such as the quality of the land being farmed and the use or intensity of inputs. The analysis reveals that agricultural land managed by women is, on average, 26% less productive compared to that managed by their male counterparts. But there are several reasons for this discrepancy.

Breaking down the causes of productivity differences between men and women indicates that in Burkina Faso, access to land through land purchase and loan, the quality and quantity of land used and the use of improved seeds are the levers that can be used to reduce the productivity gap between farms managed by men and those managed by women.

On the policy side, there are important implications. Elimination of gender disparities in agriculture could unleash the productivity potential of women and improve their social status as their incomes increase. For this to happen, policy-makers must take the necessary steps to improve and secure women's access to land. First, as this research shows, access to land through formal purchase significantly reduces the productivity gap. However, in Burkina Faso, customs are a real obstacle for many women to acquire and/or conserve land. Therefore, improving land tenure systems and addressing inequitable laws and constraints on access to land are essential if we are to target the gender productivity gap. Second, reforming rural land rights, by

addressing all the contradictions within it as mentioned in section 2 of this paper, which are often developed at the expense of women can help increase women's inheritance and ownership of land. Finally, reducing the productivity gap between men and women will require addressing problems of access to inputs through increased extension services and improving levels of human and social capital to enable broad adoption of technology to improve farm productivity.

Notes

1. Available in French on the following site: http://www.unesco.org/education/pdf/WOMEN_F.PDF.
2. Available in French on the following site: http://www.achpr.org/files/instruments/women_protocol/achpr_instr_proto_women_fra.pdf.
3. Article 1 of the Constitution: “All Burkinabe are born free and equal in rights. All are equally entitled to enjoy all the rights and freedoms guaranteed by this Constitution. Discrimination of any kind, including discrimination based on race, ethnicity, region, colour, sex, language, religion, caste, political opinion, property and birth is prohibited”.

Article 15 of the Constitution: “The right to property is guaranteed. It may not be exercised contrary to social utility or in such a way as to prejudice the safety, freedom, existence or property of others. It may be infringed only in cases of public necessity established by law. No one may be deprived of its enjoyment except in the public interest and subject to fair compensation determined in accordance with the law. Such compensation must be paid prior to expropriation, except in cases of emergency or force majeure”. Available at: https://www.assembleenationale.bf/IMG/pdf/loi_072_portant_revision_de_la_constitution.pdf.

4. Article 62 of the law relating to the Agrarian and Land Reorganization (RAF): “Rural ... land in the national land tenure system shall be allocated to natural persons, without distinction as to sex or marital status, and to legal entities under the conditions laid down by the laws in force”. Available at: <http://www.droit-afrique.com/upload/doc/burkina/Burkina-Loi-1996-14-reorganisation-agraire-fonciere.pdf>.

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Annex

Annex 1: Definitions of key variables used in the decomposition model

Category	Variables	Definition
Size of land	Land (ha)	Cultivated land in hectare
Mode of access to land	Property purchase	1 if farm manager had access to land via purchase
	Inheritance	1 if the farm manager inherited the land
	Donation	1 if the farm manager had access to land via donation
	Land rental	1 if the farm manager had access to land via land rental
Characteristics of the farm manager	Age	Age of farm manager in full years
	Years of schooling	Manager's full year of school
	Household size	Number of household members
	Male adults (15-65)	Number of male adults aged from 15 to 65 years
Characteristics of the household	Female adults (15-65)	Number of female adults aged from 15 to 65 years
	Children (aged below 15)	Number of children aged from 0 to 15 years
	Expenditure per household member (F CFA)	Ratio of expenditures per household member in F CFA
	Quantity of manures (g/ha)	Quantity of manure used per hectare
	Quantity of urea(g/ha)	Quantity of urea used per hectare
	Quantity of NPK (Nitrogen, Phosphorus, Potassium) (g/ha)	Quantity of NPK used per hectare
Inputs	Quantity of DAP/other chemical fertilizers	Quantity of chemical fertilizers used per hectare
	Quantity of pesticides used per (g/ha)	Quantity of pesticides used per hectare
	Improved seeds (g/ha)	Quantity of improved seeds used per hectare
Labour force	Household labour force – male adult (person-day/ha)	Man-days per hectare of household labour force – male adult
	Household labour force – female adult (person-day/ha)	Man-days per hectare of household labour-force-female adult
	Household labour force - child (person-day/ha)	Man-days per hectare of household labour force - child
	Non-household labour force-male adult (Person-day/ha)	Man-days per hectare of non-household labour force – male adult

Annex 2: Correlation matrix of explanatory variables used in the study

	Productivity	Female	Land size	Bush	Hut	Camp	land ownership	Land loan	Demarcation	Lease	Operating licence	Minutes	Property
Productivity	1.00	-0.17	-0.44	-0.07	0.07	-0.03	0.24	-0.28	-0.04	0.00	0.03	0.01	0.31
Female	-0.17	1.00	0.10	-0.10	0.10	-0.05	-0.45	0.10	-0.07	-0.07	0.03	0.03	-0.08
Land size	-0.44	0.10	1.00	-0.08	0.07	0.05	-0.23	0.00	-0.03	0.01	-0.02	-0.01	-0.01
Bush	-0.07	-0.10	-0.08	1.00	-0.99	-0.07	0.22	0.38	-0.04	0.05	-0.04	0.05	-0.40
Hut	0.07	0.10	0.07	-0.99	1.00	-0.10	-0.22	-0.38	0.04	-0.05	-0.05	-0.05	0.40
Camp	-0.03	-0.05	0.05	-0.07	-0.10	1.00	-0.02	0.02	0.00	0.00	0.50	0.00	-0.02
land ownership	0.24	-0.45	-0.23	0.22	-0.22	-0.02	1.00	-0.35	-0.03	-0.03	-0.03	-0.03	0.35
Land loan	-0.28	0.10	0.00	0.38	-0.38	0.02	-0.35	1.00	-0.02	-0.02	-0.02	-0.02	-0.95
Demarcation	-0.04	-0.07	-0.03	-0.04	0.04	0.00	-0.03	-0.02	1.00	0.00	0.00	0.00	0.02
Lease	0.00	-0.07	0.01	0.05	-0.05	0.00	-0.03	-0.02	0.00	1.00	0.00	0.00	-0.09
Operating licence	0.03	0.03	-0.02	-0.04	-0.05	0.50	-0.03	-0.02	0.00	0.00	1.00	0.00	0.02
Minutes	0.01	0.03	-0.01	0.05	-0.05	0.00	-0.03	-0.02	0.00	0.00	0.00	1.00	0.02
Property	0.31	-0.08	-0.01	-0.40	0.40	-0.02	0.35	-0.95	0.02	-0.09	0.02	0.02	1.00
Cost-free lending	-0.31	0.09	0.01	0.39	-0.39	0.02	-0.34	0.96	-0.02	-0.02	-0.02	-0.02	-0.99
Rents	0.00	-0.07	0.01	0.05	-0.05	0.00	-0.03	-0.02	0.00	1.00	0.00	0.00	-0.09
Donation	0.23	-0.60	-0.13	-0.11	0.11	0.02	0.52	-0.19	-0.02	-0.02	-0.02	-0.02	0.19
Legacy	-0.02	0.21	0.22	-0.45	0.45	0.00	-0.44	-0.46	0.04	-0.04	0.04	-0.04	0.47
wedding	0.12	0.21	-0.18	0.31	-0.30	-0.04	0.47	-0.20	-0.02	-0.02	-0.02	-0.02	0.20
Purchase	0.01	0.03	-0.01	0.05	-0.05	0.00	-0.03	-0.02	0.00	0.00	0.00	1.00	0.02
age	0.15	0.07	0.00	0.17	-0.15	-0.13	0.17	-0.25	-0.05	0.11	-0.04	-0.01	0.20
Study year	-0.11	-0.21	0.04	0.02	-0.03	0.04	0.20	0.12	-0.01	-0.01	-0.01	-0.01	-0.11
Household size	0.13	-0.62	-0.12	0.31	-0.32	0.02	0.42	0.06	0.04	0.01	-0.02	-0.03	-0.07
Male adult (aged 15-65)	0.17	0.04	0.06	-0.48	0.48	-0.03	-0.19	-0.50	-0.07	-0.03	-0.03	0.00	0.50

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Annex 2 Continued

	Productivity	Female	Land size	Bush	Hut	Camp	land ownership	Land loan	Demarcation	Lease	Operating licence	Minutes	Property
Female adult (aged 15_65)	-0.12	0.16	0.03	-0.14	0.16	-0.10	-0.15	-0.07	-0.03	-0.07	-0.03	-0.07	0.07
Children (aged below 15)	-0.08	0.18	0.11	-0.25	0.27	-0.08	-0.46	-0.22	-0.04	-0.04	-0.04	-0.04	0.23
Household expenditure	-0.13	0.51	0.18	-0.29	0.29	0.02	-0.34	-0.14	0.04	-0.08	0.07	-0.02	0.14
Organic fertilizer (kg/ha)	0.19	-0.48	-0.15	0.03	-0.04	0.08	0.21	-0.09	0.04	0.00	-0.01	-0.01	0.09
Inorganic fertilizer (kg/ha)	0.10	-0.10	-0.07	0.07	-0.06	-0.01	-0.10	0.17	-0.01	-0.01	-0.01	-0.01	-0.15
NPK fertilizer (Nitrogen N, Phosphorus P, Potassium K) per hectare	0.09	-0.11	-0.07	0.08	-0.08	-0.01	-0.09	0.17	-0.01	0.00	-0.01	-0.01	-0.16
Diammonium phosphate (DAP/ha)per hectare	0.19	0.16	-0.18	0.35	-0.34	-0.02	0.37	-0.13	-0.01	-0.01	-0.01	-0.01	0.13
Pesticide per hectare	-0.06	-0.07	-0.01	0.09	-0.09	0.02	0.10	-0.04	0.00	0.18	0.00	0.00	0.02
Seeds per hectare	0.46	-0.21	-0.42	0.14	-0.14	0.02	0.32	-0.04	0.07	-0.02	0.00	-0.02	0.04
Family labour	-0.02	0.07	0.02	-0.05	0.05	0.00	0.03	0.02	0.00	0.00	0.00	0.00	-0.02
Male hired labour (person-day/hectare)	0.43	-0.23	-0.30	-0.19	0.19	0.00	0.29	-0.25	-0.03	-0.03	-0.01	-0.03	0.25
Female hired labour (person-day/hectare)	0.34	-0.21	-0.36	0.07	-0.07	0.01	0.43	-0.12	0.09	-0.03	-0.01	-0.03	0.13
Children hired labour (person-day/hectare)	0.12	0.03	-0.13	0.04	-0.03	-0.02	-0.06	0.04	-0.01	-0.01	-0.01	-0.01	-0.03
Non family labor male adult (person-day/hectare)	0.10	0.03	-0.04	0.03	-0.03	0.00	-0.01	-0.03	0.00	0.00	0.00	0.00	0.03

	Cost-free lending	Rents	Donation	Legacy	Wedding	Purchase	Age	Study year	Household size	Male adult (aged 15_65)
Productivity	-0.31	0.00	0.23	-0.02	0.12	0.01	0.15	-0.11	0.13	0.17
Female	0.09	-0.07	-0.60	0.21	0.21	0.03	0.07	-0.21	-0.62	0.04
Land size	0.01	0.01	-0.13	0.22	-0.18	-0.01	0.00	0.04	-0.12	0.06
Bush	0.39	0.05	-0.11	-0.45	0.31	0.05	0.17	0.02	0.31	-0.48
Hut	-0.39	-0.05	0.11	0.45	-0.30	-0.05	-0.15	-0.03	-0.32	0.48
Camp	0.02	0.00	0.02	0.00	-0.04	0.00	-0.13	0.04	0.02	-0.03
land ownership	-0.34	-0.03	0.52	-0.44	0.47	-0.03	0.17	0.20	0.42	-0.19
Land loan	0.96	-0.02	-0.19	-0.46	-0.20	-0.02	-0.25	0.12	0.06	-0.50
Demarcation	-0.02	0.00	-0.02	0.04	-0.02	0.00	-0.05	-0.01	0.04	-0.07
Lease	-0.02	1.00	-0.02	-0.04	-0.02	0.00	0.11	-0.01	0.01	-0.03
Operating licence	-0.02	0.00	-0.02	0.04	-0.02	0.00	-0.04	-0.01	-0.02	-0.03
Minutes	-0.02	0.00	-0.02	-0.04	-0.02	1.00	-0.01	-0.01	-0.03	0.00
Property	-0.99	-0.09	0.19	0.47	0.20	0.02	0.20	-0.11	-0.07	0.50
Cost-free lending	1.00	-0.02	-0.19	-0.47	-0.20	-0.02	-0.22	0.12	0.07	-0.49
Rents	-0.02	1.00	-0.02	-0.04	-0.02	0.00	0.11	-0.01	0.01	-0.03
Donation	-0.19	-0.02	1.00	-0.42	-0.18	-0.02	-0.15	0.32	0.49	0.06
Legacy	-0.47	-0.04	-0.42	1.00	-0.45	-0.04	0.06	-0.20	-0.35	0.63
Wedding	-0.20	-0.02	-0.18	-0.45	1.00	-0.02	0.27	-0.14	-0.06	-0.38
Purchase	-0.02	0.00	-0.02	-0.04	-0.02	1.00	-0.01	-0.01	-0.03	0.00
Age		-0.22	0.11	-0.15	0.06	0.27	-0.01	1.00	-0.10	0.10
Study year	0.12	-0.01	0.32	-0.20	-0.14	-0.01	-0.10	1.00	0.09	-0.15
Household size	0.07	0.01	0.49	-0.35	-0.06	-0.03	0.10	0.09	1.00	-0.08
Male adult (aged 15-65)	-0.49	-0.03	0.06	0.63	-0.38	0.00	0.04	-0.15	-0.08	1.00
Female adult (aged 15-65)	-0.06	-0.07	-0.30	0.33	-0.08	-0.07	0.00	-0.10	-0.30	0.22

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	Cost-free lending	Rents	Donation	Legacy	Wedding	Purchase	Age	Study year	Household size	Male adult (aged 15_65)
Children (aged below 15)	-0.22	-0.04	-0.23	-0.28	0.54	-0.22	-0.12	-0.21	-0.28	0.34
Household expenditure	-0.13	-0.08	-0.14	-0.46	0.49	-0.07	0.00	0.06	-0.54	0.15
Organic fertilizer (kg/ha)	-0.09	0.00	-0.09	0.31	-0.08	-0.09	-0.06	0.07	0.33	-0.03
Inorganic fertilizer (kg/ha)	0.15	-0.01	0.15	-0.06	-0.02	-0.06	-0.07	0.00	0.00	-0.08
NPK fertilizer(Nitrogen N, Phosphorus P, Potassium K) per hectare	0.16	0.00	0.16	-0.05	-0.04	-0.06	-0.07	0.00	0.02	-0.09
Diammonium phosphate (DAP/ha)per hectare	-0.13	-0.01	-0.13	-0.12	-0.29	0.65	0.38	-0.09	-0.04	-0.22
Pesticide per hectare	-0.04	0.18	-0.02	-0.02	0.05	-0.04	0.10	0.02	0.25	0.08
Seeds per hectare	-0.04	-0.02	-0.04	0.18	-0.24	0.20	-0.01	-0.01	0.12	-0.17
Family labour	0.02	0.00	0.02	0.02	-0.04	0.02	0.04	0.01	-0.01	0.07
Male hired labour (person-day/hectare)	-0.25	-0.03	-0.25	0.44	-0.09	-0.03	0.00	0.05	0.22	0.24
Female hired labour (person-day/hectare)	-0.13	-0.03	-0.13	0.31	-0.29	0.24	-0.01	0.04	0.13	-0.06
Children hired labour (person-day/hectare)	0.03	-0.01	0.03	-0.08	0.03	0.00	-0.13	-0.07	-0.05	-0.05
Non-family labour male adult (person-day/hectare)	-0.03	0.00	-0.03	-0.02	0.06	-0.03	-0.03	-0.02	-0.02	-0.06

End of correlation matrix

	Female adult (aged 15_65)	Children (aged below 15)	Household expenditure	Organic fertilizer (kg/ha)	Inorganic fertilizer (kg/ha)	NPK fertilizer (Nitrogen N, Phosphorus P, Potassium K) per hectare	Diammonium phosphate (DAP/ha) per hectare	pesticide per hectare	Seeds per hectare	Male hired labor (person-day/hectare)	Female hired labor (person-day/hectare)	Children hired labor (person-day/hectare)	Non family labor male adult (person-day/hectare)
Productivity	-0.12	-0.08	-0.13	0.19	0.10	0.09	0.19	-0.06	0.46	0.43	0.34	0.12	0.10
Female	0.16	0.18	0.51	-0.48	-0.10	-0.11	0.16	-0.07	-0.21	-0.23	-0.21	0.03	0.03
Land size	0.03	0.11	0.18	-0.15	-0.07	-0.07	-0.18	-0.01	-0.42	-0.30	-0.36	-0.13	-0.04
Bush	-0.14	-0.25	-0.29	0.03	0.07	0.08	0.35	0.09	0.14	-0.19	0.07	0.04	0.03
Hut	0.16	0.27	0.29	-0.04	-0.06	-0.08	-0.34	-0.09	-0.14	0.19	-0.07	-0.03	-0.03
Camp	-0.10	-0.08	0.02	0.08	-0.01	-0.01	-0.02	0.02	0.02	0.00	0.01	-0.02	0.00
Land	-0.15	-0.46	-0.34	0.21	-0.10	-0.09	0.37	0.10	0.32	0.29	0.43	-0.06	-0.01
Land loan	-0.07	-0.22	-0.14	-0.09	0.17	0.17	-0.13	-0.04	-0.04	-0.25	-0.12	0.04	-0.03
Demarcation	-0.03	-0.04	0.04	0.04	-0.01	-0.01	-0.01	0.00	0.07	-0.03	0.09	-0.01	0.00
Lease	-0.07	-0.04	-0.08	0.00	-0.01	0.00	-0.01	0.18	-0.02	-0.03	-0.03	-0.01	0.00
Operating licence	-0.03	-0.04	0.07	-0.01	-0.01	-0.01	-0.01	0.00	0.00	-0.01	-0.01	-0.01	0.00
Minutes	-0.07	-0.04	-0.02	-0.01	-0.01	-0.01	-0.01	0.00	-0.02	-0.03	-0.03	-0.01	0.00
Property	0.07	0.23	0.14	0.09	-0.15	-0.16	0.13	0.02	0.04	0.25	0.13	-0.03	0.03
Cost-free lending	-0.06	-0.22	-0.13	-0.09	0.15	0.16	-0.13	-0.04	-0.04	-0.25	-0.13	0.03	-0.03
Rents	-0.07	-0.04	-0.08	0.00	-0.01	0.00	-0.01	0.18	-0.02	-0.03	-0.03	-0.01	0.00
Donation	-0.30	-0.28	-0.46	0.31	-0.06	-0.05	-0.12	-0.02	0.18	0.44	0.31	-0.08	-0.02
Legacy	0.33	0.54	0.49	-0.08	-0.02	-0.04	-0.29	0.05	-0.24	-0.09	-0.29	0.03	0.06

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End of correlation matrix Continued

	Female adult (aged 15_65)	Children (aged below 15)	Household expenditure	Organic fertilizer (kg/ha)	Inorganic fertilizer (kg/ha)	NPK fertilizer (Nitrogen N, Phosphorus P, Potassium K) per hectare	Diammonium phosphate (DAP/ha)per hectare	pesticide per hectare	Seeds per hectare	Male hired labor (person-day/ hectare)	Female hired labor (person-day/ hectare)	Children hired labor (person-day/ hectare)	Non family labor male adult (person-day/ hectare)
Wedding	-0.08	-0.22	-0.07	-0.09	-0.06	-0.06	0.65	-0.04	0.20	-0.03	0.24	0.00	-0.03
Purchase	-0.07	-0.04	-0.02	-0.01	-0.01	-0.01	-0.01	0.00	-0.02	-0.03	-0.03	-0.01	0.00
Age	0.00	-0.12	0.00	-0.06	-0.07	-0.07	0.38	0.10	-0.01	0.00	-0.01	-0.13	-0.03
Study year	-0.10	-0.21	0.06	0.07	0.00	0.00	-0.09	0.02	-0.01	0.05	0.04	-0.07	-0.02
Household size	-0.30	-0.28	-0.54	0.33	0.00	0.02	-0.04	0.25	0.12	0.22	0.13	-0.05	-0.02
Male adult (aged 15_65)	0.22	0.34	0.15	-0.03	-0.08	-0.09	-0.22	0.08	-0.17	0.24	-0.06	-0.05	-0.06
Female adult (aged 15_65)	1.00	0.47	0.27	-0.15	0.12	0.12	-0.20	-0.08	0.06	-0.14	-0.02	0.21	0.00
Children (aged below 15)	0.47	1.00	0.34	-0.15	0.21	0.19	-0.29	-0.01	-0.12	-0.12	-0.22	0.34	-0.02
Household expenditure	0.27	0.34	1.00	-0.22	0.01	0.00	-0.05	-0.02	-0.06	-0.08	-0.12	0.06	0.00
Organic fertilizer (kg/ha)	-0.15	-0.15	-0.22	1.00	0.05	0.05	-0.08	0.04	0.28	0.30	0.27	-0.02	-0.01
Inorganic fertilizer (kg/ha)	0.12	0.21	0.01	0.05	1.00	1.00	-0.04	0.01	0.25	-0.02	-0.06	0.32	-0.01
NPK fertilizer(Nitrogen N, Phosphorus P, Potassium K) per hectare	0.12	0.19	0.00	0.05	1.00	1.00	-0.04	0.02	0.25	-0.03	-0.06	0.32	-0.01
Diammonium phosphate (DAP/ha)per hectare	-0.20	-0.29	-0.05	-0.08	-0.04	-0.04	1.00	-0.03	0.16	0.11	0.28	-0.08	-0.02

continued next page

End of correlation matrix *Continued*

	Female adult (aged 15_65)	Children (aged below 15)	Household expenditure	Organic fertilizer (kg/ha)	Inorganic fertilizer (kg/ha)	NPK fertilizer (Nitrogen N, Phosphorus P, Potassium K) per hectare	Diammonium phosphate (DAP/ha) per hectare	pesticide per hectare	Seeds per hectare	Male hired labor (person-day/hectare)	Female hired labor (person-day/hectare)	Children hired labor (person-day/hectare)	Non family labor male adult (person-day/hectare)
pesticide per hectare	-0.08	-0.01	-0.02	0.04	0.01	0.02	-0.03	1.00	-0.01	0.10	0.01	0.00	0.00
Seeds per hectare	0.06	-0.12	-0.06	0.28	0.25	0.25	0.16	-0.01	1.00	0.61	0.74	0.41	0.25
Family labor	0.07	0.04	0.03	-0.79	0.01	0.01	0.01	0.00	0.00	0.03	0.03	0.01	0.00
Male hired labor (person-day/hectare)	-0.14	-0.12	-0.08	0.30	-0.02	-0.03	0.11	0.10	0.61	1.00	0.74	0.15	0.10
Female hired labor (person-day/hectare)	-0.02	-0.22	-0.12	0.27	-0.06	-0.06	0.28	0.01	0.74	0.74	1.00	0.39	0.12
Children hired labor (person-day/hectare)	0.21	0.34	0.06	-0.02	0.32	0.32	-0.08	0.00	0.41	0.15	0.39	1.00	0.15
Non family labor male adult (person-day/hectare)	0.00	-0.02	0.00	-0.01	-0.01	-0.01	-0.02	0.00	0.25	0.10	0.12	0.15	1.00



Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

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