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Medium-scale farms for agricultural transformation and poverty reduction: Evidence from Burkina Faso

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Abstract

This study explores how change in land distribution influences agricultural transformation and poverty reduction in Burkina Faso. For this purpose, it highlights the impact of the concentration of medium-scale farms on cash crops production, including groundnuts, cotton and sesame productions, and how this cash cropping affects farm households' poverty. The empirical evidence was provided using survey data from the *Enquete Multisectorielle Continue du Burkina Faso* (EMC-BF) 2014. A probit fractional response model was estimated to analyze the association between the concentration of medium-scale farms and cash cropping while the instrumental variables technique was used to assess the effect of cash cropping on poverty. The study reveals that the concentration of medium-scale farms in a province of Burkina Faso shifts farm household system of production from food crops to cash crops production. Furthermore, the study shows that cash cropping reduces farm households' poverty by improving their welfare. Therefore, land sector reform aiming to change land distribution for medium-scale farms rise is important for boosting agricultural transformation and accelerating poverty reduction in Burkina Faso.

Keywords: Medium scale farms, cash crops, poverty, fractional probit, instrumental variables approach

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1 INTRODUCTION

In Africa, although smallholders continue to make up the largest share of farmers, in many countries the number of medium-scale farms has raised over the past decade. These medium-scale entities are often assimilated to intermediate farms situated between small-scale, semi-subsistence and larger-scale, more commercial farming. However, depending on how government statistical organizations define farm scale categories, typically based on the area under cultivation, the medium-scale farm definition varies. In some countries, entities between 5 and 20 ha are considered as medium-scale farms (Anseew et al. 2016) while in others medium-scale famers are defined as farmers with a total landholding of between 5 and 50 ha or between 5 and 100 ha (Malabo Montpellier Panel 2018). In other words, the cut points to be considered a medium-scale farm vary from one country to another across Africa. Based on the definition of medium-scale farms stating a farm size between 5 and 100 ha, medium-scale farms account for a rising share of total farmland in Africa, and now control roughly 20 percent of total farmland in Kenya, 32 percent in Ghana, 39 percent in Tanzania, and over 50 percent in Zambia (Jayne et al. 2016).

In many African countries, major shifts are taking place in the balance of power over land allocation and resulting change in land institutions. For a long time, customary tenure systems in sub-Saharan Africa were generally designed in a way that not only current generations but also future generations might benefit from the land reserve. However, there is evidence from recent studies showing that these traditional norms are no longer being put in practice in many African countries. In some countries, governments have put in place some new legislations abolishing the customary tenure systems and recognizing themselves as the primary owners of all land in the countries. In other countries, customary tenure systems are weakened by local and foreign interests negotiating successfully with traditional authorities for land. Much of the negotiated land are subsequently secured by investors through a private land title. Farms size distribution patterns can be significantly changed overtime toward more larger farms. Sitko and Chamberlin (2016) report that the share of Zambia's land under customary tenure has declined from 94% at independence to at most 54% in 2015. In Malawi the proportion of land under customary tenure has similarly declined from 87% at independence to an estimated 60% today (Anseeuw et al. 2016).

The rise of medium-scale farms is often seen as an opportunity for African agricultural transformation as these medium-scale farms can generate significant benefits for smallholders operating in their neighborhoods. Many medium-scale farms are a source of dynamism, technical

change, and commercialization of African agriculture (Jayne et al. 2016). For instance, medium-scale farms are more likely to adopt agricultural technologies. In Tanzania, the likelihood to purchase a tractor rises with a land size greater than six hectares and in northern Ghana, half of tractor owners cited land expansion as the primary motivation for investing in tractors. Introduction of new production technologies may facilitate technological spillovers via knowledge transfers and increased access to agricultural technologies. (Malabo Montpellier Panel 2018). The increased number of medium-scale farmers, who are also tractor owners, creates new potential for hiring-out services to cater for the needs of smaller farmers who are otherwise unable to afford investing in larger scale machinery or technologies. Recent studies have found some evidence that smallholder farm households benefit indirectly from being located close to large farms (Deininger and Xia 2016; Lay et al. 2018).

In addition, recent evidence from some African countries indicate that large farms can attract public and private investments that provide neighboring smallholders with better access to markets and services. The surplus of production of relatively large farms can attract private investments in rural areas for purchase, storage, transportation, input supply and crop financing, thus providing indirect benefits to all households in rural areas (Collier and Dercon 2014). For example, Sitko et al. (2018) found that traders had invested in crop-buying stations in areas of Africa with a high concentration of medium-scale farms, due to surplus of production of these entities, thereby improving market access conditions for neighboring smallholders. The political influence of medium-scale farms can also attract government investment in infrastructure development, which would also benefit all farms in a region (von Braun and Meinzen-Dick 2009; Deininger and Xia 2016). However, despite the existence of evidence of important changes taking place in farmland ownership patterns in Africa and driving the rise of medium-scale farms, the consequences of these changes are poorly understood. Therefore, this study aims to analyze how the concentration of medium-scale farms affects farmers' involvement in cash cropping, including groundnuts, cotton and sesame productions, and how this later affects farm households' poverty in the context of Burkina Faso.

This study has many distinguishing features which bring contribution to the current literature. By exploring the effect of concentration of medium-scale farms on cash cropping, this paper contributes to the current literature on the consequences of medium-scale farm rise impact in Africa, which still lacks rigorous empirical evidence to support the alleged effect of medium-scale

farms on farm economy transformation. In fact, production of cash crops is seen as an effective means of fighting poverty in developing countries (Jones and Gibson 2011). In particular, in recent years, African countries are increasingly being encouraged to participate in international trade in order to reap the best profits from these markets, particularly in the agricultural sector. Sustainable development programs and certification standards for cash crop production have increased rapidly. However, despite continued efforts to promote cash crops as a means of reducing rural poverty and food insecurity, the degree to which and under what conditions cash crops achieve their objective remains unclear in the literature (Anderman et al. 2014). Importantly, the study highlights how this involvement in cash cropping affects farm households' poverty. This is crucial, particularly in the case of Burkina, which heavily relies on agricultural development for poverty alleviation in rural areas.

The study continues as follows: after this introduction (in section 1), the context of Burkina is presented in section 2. Next, the methodology is detailed while the data source is presented in section 3. Subsequently, a descriptive analysis of the data is conducted, and the results are discussed in section 5. The study finally ends with a conclusion on the main findings in section 6.

2 CONTEXT OF BURKINA FASO

Burkina Faso's economy has experienced significant progress over the past 15 years and has enjoyed political stability except in 2014 and 2015. Its GDP grew at an average annual rate of 6% thanks to the boom in the mining industry (including gold) and the growth of the cotton sector. The strong economic growth has resulted in a substantial reduction of poverty between 2003 and 2014 (World Bank 2016). Yet, despite this strong poverty reduction, the number of poor people has not decreased due to strong population growth and mortality decrease in the country. The number of poor people increased from 7,012,000 to 7,473,000 between 2003 and 2009, then decreased slightly in 2014 to 7,171,000, which remains above the level of 2003 (World Bank 2016). The agricultural sector in this country occupies more than 80% of the active population and contributes for more than 40% to the formation of the gross domestic product. It is the main source of food and income with so-called traditional cereals, sorghum, millet, maize and, to a lesser extent, fonio consumed by 90% of the population. However, Burkina Faso's agriculture is handicapped by its low productivity and its exposure to several risks, including adverse weather conditions. In recent decades, Burkina Faso has been hit by rising temperatures, reduced average rainfall and increased climate variability, including more frequent major droughts (Druyan, 2011; IPCC, 2013).

With respect to medium scale farms, even if there are no official data available about the share of cultivated land under their control to support the statement of medium-scale farms rise, the land reform that is taking place in Burkina Faso is creating opportunities for the emergence of medium-scale farms. In 2014, smallholders cultivating on less than 5 hectares, despite representing 73.6% of the farmers, only controlled 16% of the cultivated land indicating that most of the land is controlled by medium and large-scale farmers (Grain, 2014). Historically, land markets in Burkina Faso have been thin, and land transactions are mainly informal (Koussoubé, 2013). Land rental markets, including informal markets, besides inheritance, are the most common mode of transferring land rights. However, in recent years, as part of the process of gradually liberalizing the economy, the government of Burkina Faso, is increasingly addressing land tenure security and seeks to improve the transferability of land (Platteau 2000; Brasselle et al. 2002; Koussoubé, 2013). Although still largely informal, circulations of land rights through leasing and sales in

Burkina Faso have been increasing in recent years. There is an increasing acquisition of land in rural areas by urban-based elites (Usaid, 2016).

In addition, although Burkina Faso's agriculture is mainly dedicated to food crops production, there is an increasing uptake in cash cropping, including cotton, sesame and groundnut. The areas planted with cash crops are estimated at 1,54 million ha for the 2014-2015 production season. Cotton occupies the largest area with 651,294 ha or 42.1% of cultivated land under cash crops, followed by sesame and groundnut with respectively 32.7% and 24.3%. Over the last five years, the average annual variation in production of cash crops was 16.7% for cotton, 16.9% for groundnuts and 16.9% for sesame. There is also a substitution between cereals and some cash crops including sesame and cotton. The steep rise in sesame production places Burkina among the leading producers of sesame in Africa with Sudan and Ethiopia, each recording an average annual production of 0.3 million tons. Thousands of smallholders are involved in cash cropping. For instance, groundnut producers are generally members of households using private plots of less than one hectare (PNGT 2011) per farmer. Women traditionally occupy a prominent place in groundnuts production in Burkina Faso. More than 43% of the areas allocated to groundnut production are exploited by them, compared to only 4% for other types of crops. Women use the product for self-consumption or sell it to get cash monetary incomes.

Furthermore, in Burkina Faso the incidence of poverty in rural areas is 3.5 times higher than in urban areas, showing the importance of agricultural transformation for poverty reduction. In fact, rural farm households face several constraints that hinder their ability to improve their agricultural productivity for poverty reduction. For example, the level of mechanization is low in the agricultural sector; therefore, in other words, agriculture is still rudimentary and farmers lack modern agricultural equipment that has a real impact on productivity. The second trap of poverty is related to the low use of fertilizers and pesticides, which also limits agricultural productivity increase. The third constraint is related to the type of crops produced by farm households. Most cultivated areas are mainly used for dry cereals crops that have low yields. Most of these crops are non-tradable and their return is low as they are not high value crops. High value crops have a better impact on productivity and are probably a way to improve farm households' income. Finally, farm households have limited access to market. Half of the households must walk more than an hour to find a means of transport and 38% are more than an hour away from the nearest road. Under these

conditions, even if farmers were able to produce a surplus, they would have difficulty marketing it and selling it at a fair price (World Bank 2016).

3 METHODOLOGY AND DATA SOURCE

3.1 Econometric strategy

Recall that the first research question in this study is how medium-scale farms concentration affects farm households' involvement in cash cropping in Burkina Faso. The considered outcome variable indicates the degree of involvement in cash crop production r_i of household i. The latter, which is neutral relatively to household agricultural production, is defined as the ratio of the value of cash crops (including cotton, groundnut and sesame) to the value of the total agricultural production of the household, following Govereh and Jayne (2003). Food crops were valued using selling prices collected during the survey. However, not all farmers sold a part of their food crops. In cases where selling prices were not reported, the average selling prices in the village were used. Then, the medium-scale farms concentration is measured in each province of Burkina Faso by the share of medium-scale farms in total farms of each province. However, as mentioned earlier, the definition of medium-scale farms varies in the literature. Therefore, we considered different cut points for the definition of the variable indicating medium-scale farms concentration from 5 to 10 ha, from 5 to 20 ha, from 5 to 30 ha, from 5 to 40 ha and from 5 to 50 ha.

To estimate the effect of medium-scale farms concentrations on cash cropping, the cash crops production share is expressed as function of medium-scale farms concentration and other control variables. However, this cannot be straightforward using linear regression, as it requires to take methodological precautions related to the nature of the outcome variable which is a share varying between zero and one. In fact, not all farmers produce cash crops, while some farmers produce only cash crops, including cotton, groundnut or sesame. Therefore, a probit fractional response model was used in the analysis. Another important aspect to take into account is related to rainfall effect as agriculture in Burkina Faso is mainly rainfed. We attempted to capture the short-term and long-term effects of rainfall. As we want to capture the short-term and long-term effects, the Standardized Precipitation Index (SPI) which has been widely used to monitor precipitation conditions on a variety of time scales (Mckee et al. 1993; Topcu and Seckin 2016) was used for the short-term effect, and the ratio of mean of rainfall over the last ten years to the standard deviation over the same period in the provinces was used.

Formally, the log-likelihood function for the fractional model can be written as follow:

$$\log(L) = \sum_{j=1}^{N} r_i \log\left\{G(\alpha + \beta m_p + \gamma x_i + \delta_1 \frac{\overline{z_p}}{\alpha_p} + \delta_2(\frac{z_{pt} - \bar{z}_i}{\alpha_p})\right\} + (1 - r_i)\log\left\{(G(\alpha + \beta m_p + \gamma x_i + \delta_1 \frac{\overline{z_p}}{\alpha_p} + \delta_2(\frac{z_{pt} - \bar{z}_i}{\alpha_p}))\right\} \quad (1)$$

Where N is the sample size, indices p and i refer to the province and household respectively, r_i the dependent variable, m_p is the medium scale farm concentration in province p, $\overline{z_p}$ is the long term average of rainfall, z_{pt} is current the rainfall level in province p, L is the likelihood function. G(.) is the probit function. α, β , δ_1, and δ_2 are the coefficients to estimate, while γ is a vector of coefficient to estimate. With respect to x_i, it is a vector of other variables of control including the share of cash crop production in the province, the household head gender, age, marital status and literacy; it also includes the household size, time to reach a market, total land owned by the household, traction unit of animal, asine hoe, and sprayer.

However, it is important to note that since the data analyzed are cross-sectional, it is not possible to establish a causal connection between cash cropping and medium-scale farms concentration. Thus, while the results presented below may be suggestive of causality, they are best interpreted only as proof of correlation between cash cropping and medium-scale farms concentration.

The second research question in this study is related to the effect of cash cropping on poverty. Household welfare c_i is represented by the nominal consumption expenditure per adult equivalent, which differs from the nominal consumption expenditure per capita as it takes into account differences in need by age, and economies of scale in consumption. This welfare is assumed to be a function of a set of regressors and the variable indicating the degree of involvement in cash crop production r_i of household i. The Logarithmic transformation is used for c_i and r_i in order to interpret the coefficient in terms of elasticity and as it is also a convenient means of transforming the distributions of these variables, which are probably highly skewed to one side, into more approximately normal ones. The reduced form to estimate is expressed as follows:

$$log(c_i) = \theta + \mu_1 \log(r_i) + \mu_2 y_i + \varepsilon_i \quad (2)$$

where μ_1, and μ_1 are the coefficients to estimate; c_i is the welfare indicator, r_i is the cash crop production share, y_i is the vector of variables that vary across households. It is composed of three groups of variables. The first group is related to socio-demographic household characteristics such as household head gender, age, marital status and literacy, and household size. The second group of variables includes the household assets such as total household land and animal traction unit.

The third group includes the ownership of nonfarm enterprise, price indexes and the time to reach a market, and the share of cash crop production in the province.

Equation (1) can be estimated by linear regression but cash crop production may be correlated with unobserved household characteristics ε_i which can lead to biased estimates. For example, the degrees of empowerment of members of a household or their degrees of risk aversion may influence both the production of cash crops and their household welfare. Accordingly, the variable R_i which indicates the degree of household involvement in cash cropping is likely endogenous in this model. To solve this problem, we applied a standard instrumental variables technique (Wooldridge 2003) to correct potential endogeneity bias of cash crop production. An alternative to this approach is the control function approach which relies on the same kinds of identification conditions and has the advantage of being applicable in the nonlinear case (Wooldridge 2015). As in the linear case where an endogenous explanatory variable appears linearly, this approach leads to the same results as the two-stage least squares method (Wooldridge 2015), and accordingly the standard instrumental variables technique just applied.

To obtain consistent estimates in the presence of endogeneity, instruments are needed that are correlated with the cash crop production variable but uncorrelated with ε_i.The variables retained as instruments were animal drawn hoe, sprayer, variables indicating short-term and long-term changes in rainfall and medium-scale farms concentration. This choice was driven by the hypothesis that these variables are strongly correlated with involvement in cash crop production and uncorrelated with household welfare. Indeed, the animal drawn hoe and sprayer may determine the involvement in cash cropping and it is assumed that the direct correlation with household welfare seems weak as the market for these farming tools is not well developed to generate some new income to households. Rainfall effect strongly determines involvement in cash cropping as dependence on rainfall renders agriculture riskier, which may affect involvement in cash cropping requiring more investment. The direct effect of rainfall on household welfare out of agriculture production on farm household welfare seems also weak. Finally, the medium-scale farm concentration seems to affect farm household welfare mainly through agricultural production pathway.

As mentioned above, an instrument must satisfy two requirements: it must be both correlated with the included endogenous variable and orthogonal to the error process. The former condition was tested by reporting the Kleibergen-Paap rk Wald F-statistic and the Stock and Yogo (2005) critical

values to test for weak instruments. For models with a single endogenous variable, this indicator is considered to be sufficiently informative. For the condition-validity to hold, excluded instruments need to be orthogonal to the error in the second-stage regression. As we had more than one excluded instrument and one included endogenous regressor, we tested whether the instruments are uncorrelated with the error process. For that purpose, the Hansen J-statistic and the associated p-value are reported. The recourse to an instrumental variables estimation for consistency must be balanced against the inevitable loss of efficiency (Wooldridge 2003). This loss of efficiency can be justified only if the ordinary least squares (OLS) estimator is biased and inconsistent.

3.2 Data source

To implement the above defined methodology, survey data from the *Enquete Multisectorielle Continue du Burkina Faso* (EMC-BF) 2014 were used. These data were collected within a project which supports and collaborates with the national statistics offices of eight SSA countries (Burkina Faso, Ethiopia, Malawi, Mali, Niger, Nigeria, Tanzania, and Uganda) to design and implement systems of multi-topic, nationally representative panel household surveys with a focus on agriculture. The general setup of the surveys is the same across countries and typically consists of questionnaires related to the household characteristics, agriculture, livestock and community. The generic survey methodology carried out in different countries potentially allows cross country and time series analyses of the data. This is a nationwide survey that took place in four phases. The EMC-BF sample design is a two-stage survey. This survey contains sections on agriculture and socioeconomic characteristics of households. The rainfall data are at province level over the last two decades.

4 FINDINGS

4.1 Descriptive analysis

Table 1 displays the summary statistics of variables that are used in the analysis. The cash crops production average share is 0.228 in farm households' production in cash. The consumption per capita ranges from 38,538.91 FCFA to 1,477,840 FCFA. The shares of medium scale farms based on the definitions of 5-10 ha, 5-20ha, 5-30ha, 5-40ha and 5-50ha are 5.4%, 6.9%, 7.2%, 7.4% and 7.6% respectively. The share of cash crop production at province level is 67.5% in average. With respect to households' characteristics, only 5.9% of farm households are headed by women. The average age of households' head is 45.7 years. The illiteracy rate is high among farm households' heads: only 25.7% of households' heads are literate. The average size of households is 9 members. To reach a food market, 27.5% of households spend between 30 and 50 minutes, while 23.9% of households spend more than one hour. In term of land endowment, in average, the total cultivated land by farm households is 5.407 ha. More than 44.8% of households own a traction unit, 21.2% have an animal drawn hoe but less than 15% of them dispose of sprayer. Nonfarm enterprises are operated by up to 25% of farm households. The ratio of mean rainfall to standard deviation is 6.134, while the standard precipitation index is -0.142, indicating the survey year was drier compared to the normal year.

(Insert Table 1)

4.2 Econometric results

4.2.1 Medium-scale farms concentration's impact on cash cropping

Based on different definitions of medium-scale farm, estimates have been carried out. Important results are found from the regressions. Table 2 displays the results of the fractional regressions. First, it is observed that there is only a slight difference between the different regressions in term. Although the magnitude of coefficients varies according to the definition of medium-scale farm, the signs and significances of the coefficients are identic across the regressions. The variable of interest indicating medium-scale farms concentration shows that in all regressions, medium-scale farms concentration is significantly and positively associated to cash crop production share in farm households at the significance level of 5%. This means that the concentration of medium-scale farms in a province increases the involvement of farm households in cash cropping. Medium-scale

farms concentration appears as a driver of agricultural transformation from subsistence production to market oriented production.

(Insert Table 2)

This result is in line with recent findings in the literature. For instance, evidence show that in East Africa, large-scale traders are attracted to an area by medium-sized and large farms but, once established, even small-scale farmers are more likely to sell to them (Sitko et al, 2018).

With respect to other variables of control, it appears that being a female household head is positively associated to cash crop production at 1%. In other words, being a female household head increases the involvement in cash cropping in Burkina Faso. For example, as mentioned above a large share of smallholder females produces groundnuts. The household head age affects negatively the production of cash crops at 5%. Being an older household head reduces the production of cash crop in farm households. The marital status of the household head also reveals important results. In fact, being a polygamous household head increases the production of cash crops at 5%. However, the size of the households reduces the production of cash crops at 1%. The literacy level of the household head affects positively the production of cash crops at household level at the significance level of 1%. Literate household heads seem more involved in cash cropping than illiterate ones. With respect to production assets, it is found that land endowment affects positively the production of cash crop. In other word, the higher the land endowment, the higher the production of cash crops at farm household level. Possession of a traction unit also increases the production of cash crops at 1% partly due to the facilitation of access to market. However, the ownership of animal drawn hoe is negatively associated to cash cropping at 1%, while that of sprayer is positively correlated to cash crop production at also 1%. The time spent to reach a food market does not seem significant in the regression. Another important result is related to the impact of production of cash crop in the province on the involvement of farm household in cash cropping. The level of cash cropping at farm household level is positively associated to production of cash crops at province level at 1%. Finally, with respect to rainfall, it is found that a short-term change in rainfall affects cash crop production at farm household. An increase of the standardized precipitation index rainfall increases the production of cash crop in Burkina.

4.2.2 Cash cropping impact on farm household poverty

The implementation of the instrumental variable approach provided the first and second regressions results, showing the impact of cash cropping on farm households poverty. Table 3 displays the first regression results. Before interpreting the results, the tests mentioned in the methodology were performed to ensure that the estimated coefficients were not biased. The results of tests of weak identification and validity are also depicted in Table 3. By comparing the Kleibergen-Paap rkWald F statistic in each regression to Stock and Yogo (2005) critical values of 18.37, the weak correlation of the set of instruments with the household welfare variable could be rejected at 5% maximal IV bias. The p-value associated with the Hansen J-statistic is above 0.306 in each regression. In other words, it is not possible to reject the hypothesis that the set of instruments is orthogonal to the errors term, which confirms the validity of the set of instruments. Table 4 shows the results of the second stage regression based on the different definitions of medium-scale farms. In each case, the variable indicating cash crop production share is positive and significant at 1%. The amplitude of the coefficients ranges from 0.382 to 0.407 showing that there is no strong difference among the regressions results. Therefore, cash cropping improves farm household's welfare in Burkina Faso. The crops considered in this study are high value crops including cotton, groundnut and sesame. This result can be explained by the fact that farm households are getting access to better markets and are able to sell at fair price. The highlighted association between cash cropping and medium-scale farms concentration shows that the selling improvement for farmers can be attributed to medium-scale farm rise which brings new opportunities of marketing. In addition, these medium scale farms can improve farm households' access to inputs for cash crop production by attracting in their neighborhood some modern inputs suppliers. This finding also shows the importance of land sector reform in Burkina Faso for agricultural transformation. By reforming access to land through a legislation that guarantees investors' access to land in a more securing way, government can accelerate the rise of medium-sale farms and the adoption of high value crops to transform agriculture for poverty reduction. Estimates based on data from 74 countries with various income levels show that the average farm size is positively linked to income level. Farms larger than 5 ha represent 27% of the farmland in low-income countries, 41% in lower middle-income countries, 93% in the upper middle-income countries (excluding China) and 98% in the high-income countries (FAO, 2017).

With respect to other variables of control, the regressions reveal that cash crop production share at province level affect negatively farm households' welfare at the significance level of 1%.

Although this result is unexpected, it can be explained by the fact that a higher involvement in cash cropping at province level may affect farm household welfare level by decreasing food availability in the province. Even if farm households can sell their produce from cash cropping at a fair price, the generated revenue may not enable them sometime to buy the required quantity of diversified food for their consumption when food supply is not sufficient in the province. Therefore, although cash cropping can be beneficial at farm household level, higher substitution of food crops by cash crops can decrease food availability at province level.

(Insert table 3)

A balance must be found when promoting these cash crops, particularly the industrial ones, among farmers. In addition, it is found that being a female household head is negatively associated to household welfare at 10% in model(5-10ha), model(5-20ha) and model(5-40ha). This indicates that farm households headed by women have lower welfare than male-headed farm households. The age of the household head is significant at 1% and negatively correlated to household's welfare. However, the polygamous status of household head is not significant.

In addition, the literacy level seems to be an important determinant of households' welfare. The variable is positive and significant at 1%. In other words, being a literate household head improves household's welfare. The household's size is also negative and significant at 1%, indicating that having many members in a household reduces household's welfare. This can be explained by the fact that most large households are constituted by younger inactive people, which increases the dependency rate in households and reduces their welfare.

(Insert Table 4)

Another important result is related to market access. It is found that the time spent to access food market (between 30 and 60 minutes) reduces household's welfare at 1%. Therefore, reducing time to access food market is important to improve farm household welfare for poverty reduction. With respect to production assets, the total land endowment of the household is not significant in all regressions. The study also reveals that the ownership of animal traction unit positively affects household welfare at the significance level of 10% in each regression. However, the operation of nonfarm enterprise appears non-significant in the regressions. Finally, the food price index appears as an important determinant of household welfare. An increase in food price index reduces household's welfare at the significant level of 1%. This result indicates that inflation affects negatively farm household welfare in Burkina Faso.

CONCLUSION

The change in land distribution has profound impact on agricultural transformation in Africa by affecting the size of cultivated farms, the type of crops grown and the household welfare. This study provided evidence on how the concentration of medium-scale farms is driving farm household's involvement in cash cropping, including groundnuts, cotton and sesame productions. In addition, it highlighted how this cash cropping affected farm household's poverty. The empirical evidence was provided in the context of Burkina Faso where there exist conditions catalyzing the rise of medium-scale farms using survey data from the *Enquete Multisectorielle Continue du Burkina Faso* (EMC-BF) 2014. The methodology relied on the estimation of a probit fractional response model to analyze the association between cash cropping and concentration of medium-scale farms. The second stage of the analysis used the instrumental variables technique to estimate the effect of cash cropping on poverty.

The study found that the concentration of medium scale farms is significantly and positively associated to cash crops share in farm household's production. This means that the concentration of medium-scale farms in a province shifts farm household production from food crops to cash crops due to better opportunities to sell produce at a fair price. The rise of medium-scale farms in Burkina may drive agricultural transformation from subsistence production to more high value crops production. Furthermore, the study showed that cash cropping reduces farm household poverty by improving their welfare. Therefore, land sector reform aiming to change land distribution is important in Burkina Faso for agricultural transformation. There is a need for adoption of legislation that guarantees investors' access to land in a more securing way to accelerate medium-scale farms rise.

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Tables

Table 1: Summary statistics of variables

Variables	Mean	Standard Deviation	Minimum	Maximum
Cash production share	0.228	0.284	0	1
Consumption per capita (FCFA)	193193.500	103969.2	38538.91	1477840
Share of MSF 5-10 ha	0.054	0.063	0	0.378
Share of MSF 5-20 ha	0.069	0.080	0	0.419
Share of MSF 5-30 ha	0.072	0.084	0	0.465
Share of MSF 5-40 ha	0.074	0.085	0	0.465
Share of MSF 5-50 ha	0.076	0.087	0	0.465
Cash production share at province level	0.675	0.172	0.089	0.910
Household Head female (1=yes)	0.059	0.236	0	1
Household Head Age	45.695	14.821	15	99
Household Head Polygamous (1=yes)	0.379	0.485	0	1
Household Head literate (1=yes)	0.257	0.437	0	1
Household size	9.445	5.452	2	63
Time to market 30-60 min (1=yes)	0.275	0.447	0	1
Time to market more than 60min (1=yes)	0.239	0.426	0	1
Total household land (ha)	5.407	19.432	0.02	200
Transport animal traction unit	0.448	0.497	0	1
Azine hoe	0.212	0.409	0	1
Nonfarm enterprise	0.249	0.128	0	1
Sprayer	0.146	0.353	0	1
mean rainfall / (standard deviation)	6.134	2.128	2.163	11.536
Standardized precipitation index	-0.142	1.212	-1.804	2.154

Source: Autor calculation based on EMC-BF 2014 data

Table 2: Fractional regressions results

Variables	Model (5-10ha)	Model(5-20ha)	Model(5-30ha)	Model(5-40ha)	Model (5-50ha)
Share of MSF	1.767***	1.524***	1.337***	1.313***	1.262***
	(0.222)	(0.179)	(0.169)	(0.167)	(0.163)
Household Head female	0.276***	0.278***	0.276***	0.275***	0.274***
	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)
Household Head Age	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Household Head Polygamous	0.066**	0.064**	0.065**	0.065**	0.065**
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Household Head literate	0.081***	0.080***	0.082***	0.082***	0.083***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
Household size	-0.015***	-0.015***	-0.015***	-0.015***	-0.015***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Total household land	0.155***	0.152***	0.153***	0.153***	0.152***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Transport animal traction unit	0.087***	0.083***	0.084***	0.084***	0.084***
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
Azine hoe	-0.091***	-0.089***	-0.093***	-0.093***	-0.093***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
Sprayer	0.343***	0.340***	0.340***	0.340***	0.337***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Time to market 30-60 min	-0.043	-0.041	-0.041	-0.042	-0.041
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
Time to market more than 60min	-0.004	-0.002	0.001	0.002	0.003
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Cash production share at province level	1.344***	1.319***	1.347***	1.349***	1.355***
	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)
Standardized precipitation index	0.032**	0.027*	0.030**	0.030**	0.032**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
mean rainfall / (standard deviation)	-0.005	-0.001	-0.000	0.000	0.002
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Constant	-1.809***	-1.829***	-1.845***	-1.850***	-1.863***
	(0.086)	(0.085)	(0.085)	(0.085)	(0.085)
Observations	4,961	4,961	4,961	4,961	4,961

Source: Autor calculation based on EMC-BF 2014 data. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3: First stage regression results

Variables	Model (5-10ha)	Model(5-20ha)	Model(5-30ha)	Model(5-40ha)	Model (5-50ha)
Cash production share at province level	0.294***	0.289***	0.296***	0.296***	0.297***
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Household Head female	0.076***	0.077***	0.077***	0.076***	0.076***
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Household Head Age	-0.001**	-0.001**	-0.001**	-0.001**	-0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household Head Polygamous	0.017**	0.017**	0.017**	0.017**	0.017**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Household Head literate	0.024***	0.023***	0.024***	0.024***	0.025***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Household size	-0.005***	-0.004***	-0.004***	-0.004***	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Time to market 30-60 min	-0.013	-0.013	-0.013	-0.013	-0.013
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Time to market more than 60min	-0.001	0.000	0.001	0.002	0.002
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Total household land	0.044***	0.043***	0.043***	0.043***	0.043***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Transport animal traction unit	0.026***	0.024***	0.025***	0.025***	0.025***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Nonfarm Enterprise	0.038	0.043	0.047*	0.047*	0.051*
	(0.027)	(0.027)	(0.027)	(0.027)	(0.028)
Price index	0.114*	0.090	0.100	0.095	0.099
	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)
Azine hoe	-0.028***	-0.028***	-0.029***	-0.029***	-0.029***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Sprayer	0.119***	0.117***	0.117***	0.118***	0.116***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Standardized precipitation index	0.004	0.003	0.003	0.003	0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
mean rainfall / (standard deviation)	-0.004*	-0.002	-0.002	-0.002	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Share of MSF	0.700***	0.607***	0.541***	0.534***	0.518***
	(0.074)	(0.060)	(0.057)	(0.056)	(0.055)
Constant	-0.168**	-0.155**	-0.173**	-0.170**	-0.181**
	(0.075)	(0.075)	(0.074)	(0.075)	(0.074)
Observations	4,953	4,953	4,953	4,953	4,953
R-squared	0.202	0.205	0.203	0.202	0.202
Kleibergen-Paap Wald rk F statistic	53.220	55.937	53.680	53.604	53.494
Stock-Yogo: 5% maximal IV relative bias	18.37	18.37	18.37	18.37	18.37
Stock-Yogo: 10% maximal IV relative bias	10.83	10.83	10.83	10.83	10.83
Stock-Yogo: 20% maximal IV relative bias	6.77	6.77	6.77	6.77	6.77
Hansen J statistic (p-value)	3.519(0.475)	3.177(0.529)	3.918(0.417)	3.515(0.476)	4.823(0.306)
Number of observations	4953	4953	4953	4953	4953

Source: Autor calculation based on EMC-BF 2014 data. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Second stage regression results

VARIABLES	Model (5-10ha)	Model(5-20ha)	Model(5-30ha)	Model(5-40ha)	Model (5-50ha)
Cash production share	0.405***	0.407***	0.396***	0.405***	0.382***
	(0.098)	(0.096)	(0.098)	(0.098)	(0.098)
Cash production share at province level	-0.395***	-0.396***	-0.392***	-0.395***	-0.387***
	(0.051)	(0.050)	(0.050)	(0.051)	(0.051)
Household Head female	-0.050*	-0.050*	-0.049	-0.050*	-0.048
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Household Head Age	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household Head Polygamous	-0.011	-0.011	-0.011	-0.011	-0.010
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Household Head literate	0.114***	0.114***	0.114***	0.114***	0.115***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Household size	-0.025***	-0.025***	-0.025***	-0.025***	-0.025***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Time to market 30-60 min	-0.042***	-0.042***	-0.042***	-0.042***	-0.043***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Time to market more than 60min	-0.023	-0.023	-0.023	-0.023	-0.023
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Total household land	-0.002	-0.002	-0.002	-0.002	-0.001
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Transport animal traction unit	0.025*	0.025*	0.025*	0.025*	0.026*
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Nonfarm Enterprise	0.005	0.005	0.006	0.005	0.006
	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
Price index	-0.452***	-0.453***	-0.449***	-0.452***	-0.444***
	(0.101)	(0.101)	(0.101)	(0.101)	(0.101)
Constant	13.102***	13.103***	13.098***	13.102***	13.092***
	(0.125)	(0.125)	(0.125)	(0.125)	(0.124)
Adjusted R2	0.118	0.117	0.120	0.118	0.124
Number of observations	4953	4953	4953	4953	4953

Source: Autor calculation based on EMC-BF 2014 data. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1