Impact of land tenure security through customary law on agricultural productivity in Burkina Faso: Propensity score matching approaches

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Research Article

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Abstract

Land tenure security plays an important role in agricultural production systems. The objective of this paper is to empirically assess the impact of land tenure security through customary law on agricultural productivity in Burkina Faso. We use panel data of 15,627 agricultural households over the period 2019–2021. Four propensity score matching methods are used: the nearest neighbor method, the stratification method, the radius method and the kernel method. The instrumental variables technique was used to control for endogeneity. Overall, the results indicate that household land security improves agricultural productivity. The minimum gain in agricultural productivity is estimated to be 50,030 FCFA per agricultural asset per season for households with customary land tenure. In terms of economic policy implications, the results call on the authorities in charge of conducting agricultural policies to promote comprehensive land policies by adapting them to local contexts through the recognition of customary institutions for rural land management.

JEL Classification: Q12, Q15, K11

Introduction

In developing countries, the issue of land is of crucial importance because of the significant impact of agriculture on economic growth and poverty reduction. In general, the opportunity cost of land is increasingly important. In this context, there is the problem of guaranteed access to land, a guarantee of secure production. Land tenure security is defined as the certainty that a person's rights to land are recognized by others and protected in case of specific difficulties (FAO, 2022a). It is generally stated that land tenure security can be achieved through the formalization of legal land rights, or the recognition of customary law (Bambio & Agha, 2018).

The study of land tenure security and its effects on agricultural productivity is not new, but it is particularly challenging given that there are many types of land tenure systems. Furthermore, how land tenure security impacts farmers is not easy to understand, and it is perceived that land tenure security problems may be the most important (Place, 2009).

From a theoretical perspective, land tenure security is generally considered as a prerequisite for land investment to promote agricultural growth (Besley, 1995; Lawryv et al., 2014). Thus, it is assumed to positively affect agricultural productivity through investment incentives and improved access to credit (Besley, 1995).

While there seems to be a theoretical consensus on the positive effects of formal land tenure security on agricultural productivity, this is not the case at the empirical level. Empirically, there are divergences as to the effects of land tenure security on agricultural productivity. On the one hand, it is found that stronger land rights and the presence of land titles are often associated with a higher probability of making certain types of agricultural investments (Bambio & Agha, 2018; Deininger et al., 2006; Place & Otsuka, 2001; Gavian & Fafchamps, 1996; Besley, 1995). On the other hand, some authors have questioned the positive
effects of legal land tenure on agricultural productivity by pointing to the existence of negative effects (Deininger & Castagnini, 2006; David, 1990).

Similarly, authors who have examined the implications of traditional land tenure systems, recognized by customary law, on agricultural productivity have reached contradictory results. Place and Hazell (1993) found that with few exceptions traditional land rights do not have significant effects on agricultural investments. In contrast, Sossou and Mbaye (2018) showed that customary law ownership increases the likelihood of investing in agricultural equipment compared to households with no land ownership.

Since 2012, Burkina Faso has embarked on a process of securing land tenure through Law No. 034-2012/AN on agrarian and land reorganization in Burkina Faso. The major innovations of this law are, on the one hand, the abolition of the State's monopoly on land and the recognition of the property rights of individuals and local authorities, and, on the other hand, the recognition of customary land rights. Thus, a dual land tenure system exists in Burkina Faso: legal and customary land tenure. Despite this law, only legal titles can be used as collateral with financial institutions. Despite this, according to statistics from the Ministry of Agriculture, over the period 2011–2020 more than 90% of agricultural land was under customary tenure (MAAHAM, 2021). Meanwhile, according to the same source, agricultural productivity per farm worker is declining from 150,639 FCFA in 2014 to 107,918 FCFA in 2019.

The key question of this research is how land tenure security through customary law impacts the agricultural productivity of rural households in Burkina Faso. Although there is research on the impacts of land tenure security on agricultural productivity, the authors in their analyses of the impacts of land tenure security on agricultural productivity have focused more on legal rights (land titles) while paying little attention to customary rights, which are the most widespread in rural Africa. Recent analyses of the impact of land tenure security on agricultural productivity in Burkina Faso are rare. Rather, the few that do exist have focused more on the impact of land tenure security through formal law, particularly land titles, on agricultural investment. This was the case of Bambio and Agha (2018) who found that stronger land rights increase land-related investment. However, the low representativeness of public institutions in rural areas especially accentuated in a context of growing insecurity related to terrorist attacks that Burkina Faso has been experiencing since 2015, requires addressing customary aspects of land security.

The attention paid to land tenure and its perceived effects on agricultural productivity varies considerably in the empirical literature. In light of the literature reviewed, it appears that authors have almost forgotten customary land tenure in their analyses. Instead, they have focused on formal land tenure in their investigations. Moreover, from a methodological point of view, the different methods used by the authors suffer from a lack of robustness, as they are generally based on descriptive analyses alone. Agricultural investment is roughly used to measure agricultural productivity. Thus, by learning from the limitations of the previous literature on land tenure in Africa, this research contributes to enriching the literature by assessing only the impact of customary land tenure on agricultural productivity. Furthermore, beyond simple descriptive statistics, the paper adopts a rigorous methodological approach of propensity score matching.
The rest of the paper is structured in four sections. The first section presents the theoretical and empirical literature review. The second section presents the methodological approach adopted. The third section presents and discusses the main results. The fourth and last section concludes and identifies the main policy implications.

1. Literature Review

Theoretical and empirical reviews related to the field of analysis are developed in this section.

1.1. Review of theoretical literature

The theoretical framework for analyzing the impact of land security on agricultural productivity is in line with the New Institutional Economics of transaction costs. It is a scheme for the generalization of land titles materializing private property. Indeed, security of tenure increases incentives to invest, improves access to credit and rationalizes the functioning of the land market (Feder, 1988; Place & Hazell, 1993). The theoretical arguments concerning the relationship between land tenure security and agricultural productivity have been formalized by Feder (1988).

In his conceptual model linking land title and productivity in Thai agriculture, Feder (1988) highlights three important economic relationships between land title and agricultural productivity. First, title can be used as collateral to improve access to credit for agricultural investments. Second, title could increase farmers’ security of tenure and enhance their willingness to make medium- and long-term investments in their land and thus increase agricultural productivity. Third, land titling can stimulate land markets that will facilitate the transfer of land resources to the most productive farmers. Land security will then facilitate land transactions and allow the land market to allocate land to the most productive farmers.

The theoretical literature also points out that agricultural investment is important as a key factor in agricultural productivity and sustainability. Similarly, land security can incentivize land investment through (i) a stronger claim to the return on land investment (insurance effect), (ii) the exchange of land from less efficient users to more efficient users (transferability effect), (iii) better access to capital by using land as collateral in the process of accessing credit (collateralization effect), and (iv) greater freedom to innovate (Ma-Heerink et al. 2013; Fenske, 2011; Brasselle et al. 2002; Besley, 1995). The main channel of land security on investment would be the insurance effect because the land market and credit under land collateral are very weak in West Africa (Fenske, 2011).

Despite the beneficial theoretical effects of land tenure security, particularly through legal rights, on agricultural productivity, it has also been theoretically demonstrated that an increase in land tenure security may marginally reduce incentives to invest if the landowner expects beneficial expropriation (Banerjee & Ghatat, 2004). Furthermore, Heath (1993) indicates that a likely hypothesis would be that security of tenure through legal rights is a necessary but not sufficient condition for the adoption of measures to maintain or increase production. The author adds that there is no basis for believing that a
system of individualized land rights would necessarily have a more positive impact in terms of economic efficiency and, from an equity perspective, traditional land tenure systems (customary rights) are, in his view, potentially superior to legal rights.

Following the theoretical debates, authors have empirically tested the possible effects of land tenure security on agricultural productivity.

1.2. Empirical literature review

The results of empirical studies relevant to our field of analysis are mixed. The attention paid to land tenure and its perceived effects on agricultural productivity varies considerably in the empirical literature. On the one hand, there is evidence that land tenure security can have positive effects on agricultural productivity through agricultural investment (Place & Otsuka, 2001; Gavian & Fafchamps, 1996; Besley, 1995). For these authors, the possession of title to land increases the likelihood that the landowner will increase agricultural investment. Deininger et al. (2006) found a positive impact of land security variables on productivity in Uganda through the investment impact channel. Using the mixed process technical approach (MPT) applied to 626 farm households, Sossou and Mbaye (2018) analyzed the impact of land tenure on household agricultural productivity in Benin. The authors found that certificate ownership increases the probability of investing in agricultural equipment by 0.238, while customary law ownership increases this probability by 0.374 compared to households without any land ownership. Goldstein and Udry (2008) study the relationship between land rights and agricultural investment in Ghana. The authors show that individuals with a comfortable position in the political hierarchy enjoy land security and invest more in land fertility and have significantly higher production.

Although many authors have highlighted the positive effects of land tenure security on agricultural productivity, other authors have expressed reservations. Indeed, David (1990), based on a synthesis of the literature from many regions of Africa, questions the conventional view that legal land tenure systems promote investment and agricultural growth. Moreover, some authors conclude that land tenure security has no impact on agricultural productivity. This is the case in Uganda and Kenya where no impact of land tenure security on agricultural productivity was found (Pender et al., 2004). Similarly, Place and Hazell (1993), using available data for three countries including Ghana, Kenya and Rwanda, find that with few exceptions, land rights have no significant effects on investment, land management and conservation, input use, access to credit or agricultural yields.

While theory has shown a positive impact between land security and agricultural productivity, empirical studies have been ambiguous in Africa.

2. Methodological Approach
2.1. Theoretical model for assessing the impact of land tenure security on agricultural productivity

Rubin (1974) proposed the reference theoretical model for impact evaluation. It is based on the fundamental assumption that there is no diffusion of the treatment effect (T) in the population. The present research consists of measuring the impact of land security on agricultural productivity. The approach uses the matching technique. Formally, we compare the agricultural productivity of farm households with customary land rights to those of their counterparts with no customary land rights.

The problem can be formalized as follows. Let be the agricultural productivity that a household would have if it had customary ownership of its land and the agricultural productivity of the same household if it had no customary ownership of its land.

The indicator variable takes the value 1 if the household has customary ownership of its land and 0 otherwise. Thus, for a given household, the observed agricultural productivity is:

\[ Y_i = Y_{0i} + D_i(Y_{1i} - Y_{0i}) \]

Here, only the productivities induced by the different states are observed. Then, it is necessary to estimate the productivities that would have resulted from a different state. To achieve this, we estimate:

- the average effect of the average treatment: \( ATE = E(Y_1 - Y_0) \) which is the average of the difference in agricultural productivity between the two groups;
- the average treatment effect for the untreated: \( ATN = E(Y_1 - Y_0)/D = 0 \) which is the difference between the expected agricultural productivity that households with no customary land tenure would have achieved if they had customary land tenure (\( E(Y_1) \)) and those they actually own;
- the average treatment effect for the treated: \( ATT = E(Y_1 - Y_0)/D = 1 \) which measures the difference between the actual productivity of households with property rights to their land and the productivity they would achieve if they had no property rights to the land.

If the hypothesis of independence between the potential outcomes and the treatment is not verified then the estimator \( ATT \) would be affected by selection bias. Selection bias arises because the average counterfactual outcome for households with land tenure rights would not be the same as for households without land tenure rights in the absence of the treatment. The best counterfactual is obtained with a randomized control trial (RCT), but this requires the evaluation design to be in place before the intervention. Given that we are not dealing with a randomized trial, this research uses a quasi-experimental method by adopting an approach that reduces selection bias as much as possible.

2.2. Strategy for identifying the impact of land tenure security on agricultural productivity
One of the major challenges facing any impact evaluation is the elimination of selection bias. In this research, several propensity score matching methods are used. In addition, the definition of relevant variables and tests of difference on observable characteristics were used to identify and minimize any selection bias.

### 2.2.1. Propensity score matching method

The assumption of independence between potential outcomes and the treatment variable is highly unlikely when non-experimental data are available. The treatment and comparison groups differ in the distribution of their observable characteristics that presumably affect the treatment variable. The propensity score matching method balances the distribution of observable characteristics between the treatment and comparison groups to minimize selection bias due to the difference in observable characteristics.

To this end, Rosenbaum and Rubin (1983) proposed an equivalent and feasible estimation strategy based on the concept of propensity scores. Propensity scores, which represent the probabilities of being in the different states, have two important properties:

- the balancing property of the explanatory variables constituting the vector $X$, given the propensity score: $D \perp X \mid P(X)$. This assumption states that the distributions of observable characteristics for individuals with the same propensity scores are the same regardless of treatment;
- the property of independence between potential outcomes and treatment assignment conditional on observables: $(Y_0; Y_1) \perp D \mid X$. This hypothesis states that if the outcome variable is independent of access to treatment conditional on the observables $X$, then it is also independent of treatment conditional on the propensity score. Therefore, it is sufficient to match individuals on the basis of their propensity scores.

These assumptions allow us to match two individuals based on propensity scores. To execute the propensity score estimation strategy and its properties, two consecutive steps are required:

- The first step consists in estimating the propensity score. This step is justified by the fact that the "true" propensity score is unknown and therefore must be estimated;
- the second step consists in estimating the average treatment effect, given the propensity score. But, logically, in this step one would like to match the treated and the controls with exactly the same (estimated) propensity score in order to calculate the treatment effect for each value of the propensity score and obtain the average of these conditional effects. In practice, however, it is rare to find two units with exactly the same propensity score. However, there are several alternative and feasible procedures to perform this step. These methods are: the nearest neighbor method, the stratification method, the ray method and the kernel method. These different methods were used in this research to ensure the robustness of the results.
2.2.2. Definition of variables and data sources

2.2.2.1. Definition of variables

Assessing the impact of land tenure security on agricultural productivity of farm households requires defining relevant variables to capture the outcome, treatment and minimize selection bias.

i) Output variable

Yabi and Afari-Sefa (2009) define agricultural productivity as agricultural output per unit of input. Input can take many forms. It can be labor, land or capital. In this research, the input is captured by agricultural labor. Agricultural productivity is therefore the variable of interest in the impact assessment of land security. It is measured by the monetary value of total agricultural productivity per worker at the household level. Unlike the productivity of the land factor captured by the agricultural yield, which can only measure the yield of a single crop, the valuation of agricultural production allows for the aggregation of all crops produced in the household.

ii) Treatment variables

Given that the study seeks to assess the impact of land tenure security through customary law on agricultural productivity, land tenure through customary law is the treatment variable. Households that have customary tenure over their land even though they do not have legal title, i.e., customary ownership, are classified in this category. The treatment variable is captured by a binary variable that takes the value 1 if the household is in the treatment group and 0 otherwise. Theoretically, households with only customary ownership of their land are assumed to have a lower level of security than legal owners. The right to transfer is limited since the household does not have legal title. Property transfers here cannot take place legally except at significant transaction costs. The control group here is composed of households with no customary holdings of their land.

iii) Variables that affect treatment and outcome

The choice of observable variables that can significantly reduce selection bias is key to the quality of propensity score matching between treated and untreated households. Only variables that simultaneously influence the participation decision and the outcome variable are able to correct for the selection bias associated with the difference in outcome between the two groups in the absence of treatment (Caliendo & Kopeinig, 2008).

In this research, the variables that are able to influence both the type of land tenure and agricultural productivity of households are: (i) the gender of the household head which takes the value 1 if the
household head is male and 2 otherwise, (ii) the age of the household head, (iii) the age squared of the household head, (iv) the education level of the household head which takes the value 1 if the household head has no education, 2 if the household head has primary education, and 3 if the household head has secondary education or higher, (v) the number of agricultural assets in the household, vi) the marital status of the head of the household which takes the value 0 if the head of the household is single and 1 if he/she is married, vii) the use of chemical fertilizers which takes the value 0 if the household does not use chemical fertilizers and 1 if the household uses chemical fertilizers (viii) the total area sown by the household, all crops combined, (ix) access to agricultural credit, which takes the value 0 if the household has no access to agricultural credit and 1 if it does, and (x) the total amount of non-agricultural household income in CFA francs.

2.2.2.2. Data source

The data used for this study come from the permanent agricultural survey (EPA) conducted annually by the Ministry of Agriculture in Burkina Faso. The EPA is a stratified sample survey with a panel sample, i.e., a fixed sample of households followed over a given period of time, generally not exceeding 5 years. The sample design was based on household information from the General Census of Population and Housing and the General Census of Agriculture. The sampling method was a two-stage stratified survey.

The data used in this research are panel data from the Permanent Agricultural Survey of the last three years: 2019, 2020 and 2021 of the Ministry in charge of agriculture in Burkina Faso. They concern 15,627 agricultural households.

3. Results And Discussions

3.1. Test of collinearity of the variables

The correlation matrix of the variables was used to assess the collinearity of the variables. The correlation matrix showed a low correlation between the variables. Therefore, the different explanatory variables can be introduced together without risk of collinearity in the estimates.

3.2. Test for comparison of means between treatment and control groups

Table 1 shows that there is a statistically significant difference at the 10% level between the agricultural productivity of households with customary land tenure and households with no customary land tenure.
3.3. Analysis of the quality of matching by propensity scores

3.3.1. Probability of having customary land tenure

The main objective of estimating the probability of having customary land rights is to satisfy the condition of balancing observable characteristics between treatment and control groups (Dehejia & Wahba, 2002; Rosenbaum & Rubin, 1983). To do this, it is useful to estimate a decision model.

Table 2 presents the results of estimating the probability of having customary land ownership using a logit model. The likelihood ratio test indicates that the model is globally significant at the 1% level. The individual significance tests indicate that male household heads are more likely to have customary land tenure than female household heads. The same is true for household heads with no education compared to those with at least primary school education. The marital status of the household head and the total area cultivated by the household are also variables that positively and significantly influence the probability that the household has customary tenure over its agricultural land.
3.3.2. Distribution of Propensity Scores and Test of Matching Quality

The common support and the test of balance of observable characteristics between the treatment and the control group allow to justify the relevance of the matching by propensity scores.

i) Construction of common support by the density curve

The common support problem concerns the extreme ends of the propensity score distribution and is a potential source of bias in the estimation of the net treatment effect (Heckman, Ichimura, & Todd, 1998). To do this, it is important to eliminate from the sample all treated individuals with a propensity score higher than the maximum propensity score of untreated households, as well as all untreated individuals with a propensity score lower than the minimum propensity score of treated households. In total, 10 treated households are eliminated from the common support and no households at the level of the untreated. Figure 1 shows an overlay of the density curves of the two groups, attesting to a good distribution of propensity scores between treated and untreated households.

After propensity score matching, it is necessary to test the quality of the match.
ii) Difference-in-difference test on observable characteristics

The difference test on observable characteristics is performed between the treatment and control groups to ensure that selection bias is reduced. Table 3 shows that selection bias is significantly reduced on observable characteristics.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Matching quality test</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR chi2</td>
<td>p &gt; chi2</td>
</tr>
<tr>
<td>5.65</td>
<td>0.08</td>
</tr>
<tr>
<td>Source: Author based on estimation results</td>
<td></td>
</tr>
</tbody>
</table>

3.4. Net impact of land tenure security on agricultural productivity

3.4.1. Impact estimation results and robustness of the results

To ensure the quality of the results, this research uses several propensity score matching methods to estimate the impact of land tenure security through customary law on agricultural productivity of farm households in Burkina Faso. To ensure the robustness of the results, we performed the estimations using the robust option. Table 4 presents the results of the estimations with the robust option in the estimations.

The nearest neighbor matching method uses the closest untreated households to each treated household to increase the precision of the estimates. The results indicate a significant gain at the 10% threshold in agricultural productivity of about 95,396 CFA francs per farm worker.

The radius matching method imposes a tolerable distance between the treated household and its closest neighbors. In constructing the counterfactual, it assigns the same weight to all untreated households within a predefined radius of the treated households. The results indicate a significant gain at the 5% threshold in agricultural productivity of about 101,000 CFA francs per farm worker.

The kernel method uses all observations from the control group in the construction of the counterfactual. The results indicate a significant gain at the 10% level in agricultural productivity of 85,776 CFA francs per farm worker. This result can be refined by taking into account the distribution of households according to optimal blocks of similar characteristics.
The stratification matching method determines the average result per block: on the one hand, that of the treated and on the other hand that of the untreated, and the difference between these average effects per stratum constitutes the causal effect per stratum. The final average effect is obtained by the sum of the effects per stratum weighted by the weight of the strata treated in the identified optimal blocks (Combary, 2014). The results indicate a significant gain at the 10% threshold in agricultural productivity of about 53,030 CFA francs per farm worker. Table 4 presents the net impact according to the methods for assessing the impact of land security through customary law on agricultural productivity.

Table 4
Results of the net impact of land tenure security through customary law on agricultural productivity

<table>
<thead>
<tr>
<th>Stratification Method</th>
<th>Number of households treated</th>
<th>Number of control households</th>
<th>ATT</th>
<th>t-statistique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matching by nearest neighbors</td>
<td>3812</td>
<td>1294</td>
<td>95396*</td>
<td>1.6</td>
</tr>
<tr>
<td>Radius matching</td>
<td>3779</td>
<td>1674</td>
<td>1.010000*</td>
<td>1.81</td>
</tr>
<tr>
<td>Matching by kernel function</td>
<td>3812</td>
<td>1689</td>
<td>85776**</td>
<td>1.96</td>
</tr>
<tr>
<td>Stratified matching</td>
<td>3812</td>
<td>1689</td>
<td>53030*</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Source: Author based on estimation results

*** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level

3.4.2. Endogeneity test and discussion of results

- Endogeneity test

Before discussing the results, it is useful to check the endogeneity of the variables to ensure that no explanatory variable has been omitted from the estimation. To do this, the mode of land acquisition and the mode of land tenure are used as instruments. The mode of land acquisition takes two forms: it takes the value 1 if the household acquired the land by inheritance and 0 if not. Thus, this variable affects the household's land tenure security without affecting the outcome variable, which is the household's agricultural productivity.

The test of endogenity given by the likelihood ratio gives \( \rho = 0 \): \( \chi^2 (1) = 17.31 \) and \( \text{Prob} > \chi^2 = 0.0031 \). This result indicates that the chosen instrument is globally good. We can therefore conclude that there is no endogeneity in the choice of variables.

Discussion Of The Results
The results obtained by the different matching approaches on propensity scores show that land tenure security of the agricultural household, as measured by its customary hold on agricultural land, significantly increases agricultural productivity by at least 53,030 CFA francs per agricultural worker at the 10% threshold.

The positive impact of land tenure security through customary law on agricultural productivity is consistent with certain theoretical predictions. Indeed, theoretically, land tenure security is supposed to positively affect agricultural productivity through investment incentives and improved access to credit (Besley, 1995). Empirically, our results agree with those of Sossou and Mbaye (2018). Indeed, these authors showed that customary law ownership increases the probability of investing in agricultural equipment compared to households without any land ownership. Our results are also consistent with those of Sjaastad and Bromley (Sjaastad & Bromley, 1997) who state that most African farmers with customary land rights do not face a high risk of eviction from their land. In addition, some land improvements (such as tree planting) are undertaken to increase the level of security (Brasselle, Gaspart, & Platteau, 2002).

In the African context in general and that of Burkina Faso in particular, our results would be largely explained by the peasant character of agriculture. Agriculture is still under the sway of traditional social forces, where land has several social functions. Indeed, for the rural population in general and farm households in particular, land has a social and cultural identity. In these conditions, the peasant as landowner has a certain intimacy with the land. In addition, the possession of land by customary law appears more secure in the eyes of peasants than that by modern law. It is not uncommon, in rural areas, to see farmers who hold certificates of land ownership being dispossessed of their land because they have no customary right to the land. This situation is becoming more frequent in recent years due to the scarcity of agricultural land. It should also be noted that in most African countries, land tenure security is a matter of institutions with socially validated principles guaranteeing them; in these specific conditions beyond the economic order, social and cultural aspects are generally more taken into account in land tenure security.

It is also recognized that in most African countries land acquisition is done on the basis of customary arrangements. Collective and individual rights of members of society are governed by clan or family affiliations derived from customary land tenure (Bambio & Agha, 2018). This customary system and its practices known to local people are less costly and more reliable methods of ensuring land security than bureaucratic and legal land registry systems.

**Conclusion And Policy Implications**

The objective of this research was to empirically assess the impact of land tenure security through customary law on agricultural productivity in Burkina Faso. Four propensity score matching approaches were used to assess the impact. The results obtained from the different matching approaches show that land tenure security through customary law of the agricultural household significantly increases
agricultural productivity. On average, households with customary land tenure improve their agricultural productivity by 53,030 CFA francs per farm worker. In terms of economic policy implications, the results call on the authorities in charge of conducting agricultural policies to promote comprehensive land policies by adapting them to local contexts through the recognition of customary institutions for rural land management.

Declarations

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- **Conflict of interest/Competing Interests**

“The authors have no relevant financial or non-financial interests to disclose.”

- **Author Contributions**

“he article was entirely written by the sole author TN”

References


**Figures**
Figure 1

Distribution of propensity scores by the density curve

Source: Author based on estimation results