

LAND RIGHTS AND RISK SHARING IN RURAL WEST AFRICA¹

Abstract. Despite arduous efforts of advancing land rights in Africa, most of the continent experiences low levels of ownership security.² Land reforms introduced by the state have failed to deliver the desired results of officially recognized property. I propose a novel contextualization of land rights that motivates a theoretical model to account for land reforms' effects when implemented in weak institutional environments with high risk. In environments such as rural Africa, communities have developed informal mechanisms of risk-sharing to provide households with a safety net. Therefore, when a land reform, aiming at granting individual property rights, takes place, it operates in a highly antagonistic way to the established informal insurance mechanisms. I use survey data from a land reform initiated in Burkina Faso in 2009 to evince the interaction between land holdings and transfers among community members. Subsequently, I build a model of risk-sharing with limited commitment to explain the competing forces developed between statutory land reforms and customary risk-sharing networks at a community level. The model shows that a land reform increases the share of surplus that a villager can extract from a risk-sharing contract among community members and decreases the profits of the community. Additionally, it shows a non-monotonic relation between land allocation and productivity pointing towards a trade-off between output efficiency and size of risk-sharing. It accurately accounts for the low participation rates from rural population to the Burkina Faso land reform and it provides a reasoning for potential land misallocation.

Keywords: land reforms, property rights, one sided limited commitment, optimal recursive contracts

¹ I would like to acknowledge Brais Álvarez Pereira for his immense help and Alessandro Ferrari for his insightful comments.

² See Figure 3.



I. INTRODUCTION

Agricultural village communities in rural areas across Africa have developed informal mechanisms of risk sharing in order to overcome the high-risk environment within which they operate. These informal mechanisms are mostly comprised of borrowing and lending or gift and loans in the form of consumption units, among members of the community.³ These insurance transfers are developed at a local level, since they are mostly based upon spatially concentrated characteristics such as family kinship, ethnic descent or tribal belonging.

At the same time, development economics have emphasized the critical role of strong property rights in economic growth. The main benefits from individual ownership can be summarized into three broad categories.⁴ The assurance effect, which would provide the necessary incentives to productively invest to land, since land is securely owned by the rights' holder. The transferability effect, which would allow more efficient land users to gain access to land through purchases.⁵ The collateralization effect, which would allow the owner to pledge the plot as a collateral and hence gain access to credit.⁶ However, the existing theory on benefits of property rights overlooks the already established mechanisms in the affected African communities. Pre-colonial institutions at an ethnic level strongly live up until today in rural Africa, creating conflict between statutory institutional interventions stemming from state initiatives and customary norms deeply rooted in African history.⁷

Even though, property rights are crucial for agricultural production, and rural African communities are mostly based on agriculture, the risk-sharing informal institutions do not require of firm individual property rights. Land ownership is reassured in the context of the community, but not formally. Villagers-farmers perceive their land as their own even without an official certificate of land ownership issued by a state authority. Since agricultural activity in rural Africa is usually confined in the limits of the village with production mostly aimed for household consumption, land ownership is sufficiently recognized at a communal level.

³ Platteau, 1991.

⁴ Bambio and Bouayad Agha 2018; Brasselle *et al.* 2002.

⁵ Bambio and Bouayad Agha 2018.

⁶ Feder and Nishio 1998.

⁷ Michalopoulos and Papaioannou 2013.



The claim of the paper is that land reforms initiated by governmental authorities aiming at firmly establishing individual property rights, constitute an antagonistic mechanism to the risk reduction arrangements at a communal level. The theoretical premise lies on the fact that reforms attempting to render land as privately owned, interact with the main production factor (land) that forms the basis of the risk-sharing mechanism.

The case of Burkina Faso constitutes an illustrative example of a state that implemented a land reform aiming at establishing strong individual property rights. The reform was initiated by the enactment of a truly innovative and inclusive rural land law, allowing individuals to register their plots and obtain a certificate of official recognition. The legislation was followed by an extended effort to disseminate information about the formal procedure to be followed by individuals that wanted to register their plot. At the same time, the law did recognize the role of customary norms in land management. In order to include the affected communities and avoid the emergence of land disputes, it allowed for a period in which any objections to individual registration could be raised. In other words, it allowed for the approval of the community for individually enacted land registration. It has to be noted that this governmental plan to reform land management was closely assisted by the Millennium Challenge Corporation, which was actively engaged in all stages of implementation. Regarding the evaluation of the success of the Burkinabe plan, the results were not as expected. The number of approved land registrations and the number of agricultural households receiving certificates of ownership recognition were far below the set targets. Indeed, according to the United States Agency for International Development,⁸ the land management almost a decade after the enactment of the law keeps on being under customary norms and community control.

To theoretically account for risk-sharing and land reform as competing mechanisms, I employ a model of optimal recursive contracts with limited commitment. A principal, head of the community and an agent, the individual farmer engage into reciprocal stage contingent transfers of consumption units. While the principal is fully committed, the agent can renege the contractual agreement at any point in time. Hence, in order for the risk-sharing mechanism to be sustainable, the principal must offer the agent a consumption path that is at least equal to her outside option. The outside option is the interaction channel between statutory land reform and community risk-sharing. Within this framework, I model the individual farmer as a small agricultural

⁸ USAID, 2017.



household, which uses land as a production factor. In order to accurately trace the practices of African communities, I allow the fraction of land allocated to each household to be decided centrally by the principal. This is consistent with the practice of periodic redistribution of land in rural West African villages. This extension renders land as an additional insurance mechanism coexisting with consumption transfers inside the contract. In the presence of a land reform and limited commitment, the outside option of the household is to register the fraction of land that was lastly allocated within the contract and renege the contractual agreement. This distorts the incentives of the community to allocate land according to idiosyncratic productivity levels in order to render the contract sustainable. The antagonistic force stemming from the existence of a land reform entails efficiency costs on the functioning of the communal risk-sharing mechanism.

The paper unfolds as follows. In section 2, the related literature is presented. In section 3, the background of the 2009 land reform in Burkina Faso motivates the study. In section 4, empirical regularities from Burkinabe survey data before and after the reform evince the interaction between land holdings and risk-sharing. In section 5, the theoretical model of a second generation optimal contract with limited commitment is presented, in order to account for land re-allocation. Lastly, section 6 draws policy inferences and concludes the study.

2. LITERARY REVIEW

A large strand of literature advocates the importance of property rights in economic development. De Soto explicitly stresses the importance of property rights in alleviating poverty.⁹ He considers secured property rights as the means to higher investment, easier access to credit and higher surplus value creation. Besley and Ghatak extensively study multiple channels through which property rights affect economic activity and how property rights are endogenously determined.¹⁰ Based on this premise, in an attempt to quantify the effect of strong property rights on the access to credit markets (de Soto effect). Besley *et al.* are challenging the ‘magic bullet’ nature of property rights reforms, when they are applied to environments with weak institutional frameworks.¹¹

⁹ De Soto 2001.

¹⁰ Besley and Ghatak 2010.

¹¹ Besley *et al.* 2012.



Moving from the general study of property rights into the narrower field of land rights and agricultural production in rural Africa, Besley provides empirical evidence from Ghana.¹² According to this study, strong property rights incentivize investment through multiple theoretical channels. However, strong property rights might emerge endogenously as the result of increased investment. Along the same lines, Goldstein and Udry have emphasized the effect of the unclear property rights regime on agricultural investment taking advantage of fallowing as a common and beneficial practice in rural Africa.¹³ However, the link between property rights and investment is yet to be solidly established. Brasselle *et al.* make an exhaustive review on the empirical studies conducted in rural Africa, attempting to link property rights and investment incentives.¹⁴ They infer there is no systematic pattern across Sub-Saharan countries. This is due to the simultaneity that property rights and investment exhibit. Making long-term investments on a land plot constitutes a way of establishing ownership over it. On the other hand, having secured property rights allows the producer to make long-term investments. This two-way relationship is hard to disentangle in the data and reach a conclusive result.

The present paper links the concept of property rights with the distinctive characteristic of risk-sharing in rural communities. The particular environment of small communities engaging into transfers of consumption units to tackle adverse shocks has been a fruitful field to apply theories of optimal contracts. Townsend explores the magnitude of risk sharing in Indian villages.¹⁵ He finds a substantial flexibility from the side of community to adapt to adverse shocks, concluding that the assumption of perfect insurance in village communities is not absurd. Ligon *et al.* build on the model of risk-sharing with limited commitment in order to explore the imperfect insurance observed in village economies.¹⁶ The form of transfers among the members of the community is studied by Platteau and Abraham and Udry that find that loans can actively serve as a risk-insurance mechanism.^{17 18}

The theoretical premise of this paper is that land rights reforms and community risk-sharing are competing forces. In particular, I study an environment of risk-sharing, in the spirit of Thomas and Worrall and Kocherlakota, in which the main friction is

¹² Besley 1995.

¹³ Goldstein and Udry 2008.

¹⁴ Brasselle *et al.* 2002.

¹⁵ Townsend 1994.

¹⁶ Ligon *et al.* 2002.

¹⁷ Platteau and Abraham 1987.

¹⁸ Udry 1994.



limited commitment.^{19 20} However, models of this class assume an exogenous outside option, set at the level of autarky. In the theoretical framework presented in this paper, the level of the outside option is endogenous and depends on the functioning of the contract. More theoretical works that relate the contract allocation to the outside option are Ligon *et al.*, in which the self-insurance outside option is determined by storage opportunities within the contract and Cooley *et al.* who set the value of repudiation of financial contracts being dependent on the level of investment that took place within the contract.^{21 22} The closest paper to mine is Koepl who studies the third party enforcement of contracts which is costly and its cost depends on resources allocated to it, within the contract.²³

The paper in hand provides a novel contextualization of property rights and risk insurance mechanisms in small agricultural communities as competing mechanisms. It identifies the channel of transmission of land reform effects on risk-sharing contracts through the increase of the outside option. This results in land reforms jeopardizing the insurance networks by increasing the bargaining power of the individual within the community. Concerning the theoretical literature on optimal contracts with limited commitment, the contribution of the present paper lies on the interaction between the outside option and the functioning of the contract. This creates trade-off dynamics between the incentives of the principal to gain more and the incentives of the agent to deviate from the agreement.

3. BACKGROUND ON THE LAND REFORM IN BURKINA FASO

A motivating example for the present study is the case of Burkina Faso, a landlocked country in the Western Africa's Sahelian zone. The economy of Burkina Faso is mostly based on agriculture (Fig. 4), with a recent increase of mining activities due to a gold mining boom in 2009-2010. The vast majority of working population is engaging to rural activities (90%). The predominant form of agricultural production is small-scale farming, managed by members belonging to the same lineage or family.²⁴

¹⁹ Thomas and Worrall 1988.

²⁰ Kocherlakota 1996.

²¹ Ligon *et al.* 2000.

²² Cooley *et al.* 2004.

²³ Koepl 2007.

²⁴ USAID 2017.



Land use in Burkina Faso faces considerable problems mainly due to rapid increase of population fueling competition for available land, high internal migration and climate change. While those threatening factors are in place, land tenure security scores are at a record low relative to other African countries (Fig. 3). After independence in 1960, management of Burkinabé land was following entirely customary norms with the government only managing protected areas.²⁵ The concept of private property over land appears in 1984 with the introduction of *Réorganisation Agraire Foncière* (RAF). This legislation granted all land to the state in an attempt to disrupt the control of traditional chiefs over land and allowed rural population to gain access to land following government's rules.²⁶ Amendments of this law (1991, 1996) introduced a type of private ownership through granting user-rights over plots of land.

3.1 *Loi 034/2009*

Much legislative progress has been achieved since the 1980s regarding land tenure. In 2009 Burkina Faso adopted an inclusive and genuine piece of rural land tenure legislation (*Loi 034/2009*). This law's application locus is rural land and aims at equitable access to land, enhancing productivity, sustainable management and social peace (Article 1, *Loi 034/2009*). The legislative procedure was preceded by the establishment of the National Committee for Secure Land Tenure (CNSFMR) under the ministry of Agriculture aiming to coordinating rural land policy reform. The plan's most striking characteristic was inclusiveness, in terms of reconciliation between statutory land management based on national laws and customary land tenure referring to local norms. Rather than alienating all informal land practices, it integrated them in a formal national legislation.

In the attempt of introducing, implementing and monitoring the new legislation the Burkinabé government was assisted by the Millennium Challenge Corporation (MCC). This partnership led to a 5-year compact plan (2009-2014) of \$58 million under the title Rural Land Governance Project (RLG) (see section 4.1). Three activities took place under the Rural Land Governance plan. The first activity comprised of legal and procedural changes and dissemination of the details on the new legislation to rural communities. Activity 2 focused on developing the necessary institutional

²⁵ Ouedraogo 2002.

²⁶ Hughes 2014.



changes and capacity building, while activity 3 performed site-specific land tenure interventions.²⁷

3.2 Rural Land Certificate of Possession (APFR)

The aforementioned inclusive character of the 2009 land reform was reflected in the ability provided to individual farmers of issuing the so called Rural Land Certificate of Possession (Attestation de Possession Foncière Rurale, APFR). Articles 36-50 of the 039/2009 law outlines the procedures to be followed for the issuance of the APFR. The predominant characteristic of the APFR is that the community in which the individual, requesting the certificate, belongs to is strongly engaged in the procedure and has the capacity to veto it.

The APFR can be issued to either individuals or collective associations. The issuing period is 75 days conditional on no objections being raised by the community. Essentially, the community has to approve the request of the certificate before it is granted. The cross checking that the referred parcel does not belong to another individual is made with the direct involvement of the customary and traditional authorities.²⁸

The APFR differs from full land title on the capacity that grants to the holder regarding sale of the allocated parcel. Productive use of land which can lead to profiting out of it is allowed, however, sale of the parcel to a third party is forbidden. Transfer of the certificate to members of the same family is allowed with no additional cost (Article 47, *Loi 034/2009*). Moreover, APFRs may be used to obtain bank loans depending on the bank's requirements.²⁹

3.3 Assessment of the results of the RLG

However inclusive and innovative the land tenure legislation was, its results concerning grant of private ownership were not as expected. The Millennium Challenge Corporation (MCC), the organization responsible also for the monitoring and the implementation of the new legislation in close collaboration with the Burkinabé government, issued reports on the progress of the program.

²⁷ IMPAQ 2015.

²⁸ Hughes 2014.

²⁹ *Ibidem*.

**TABLE 1 • RESULTS FROM LAND REFORM IN BURKINA FASO** ³⁰

Indicators	Actually achieved (July 2014)	Target	(%)
Number of APFRs approved by the local government	2167	6000	36.1%
Number of HHs receiving APFRs	403	3000	13.4%

In Table 1 the results after the end of the 5-year plan are presented regarding the issuances of the APFRs. The difference between the actually achieved numbers and the targets set by the MCC is striking. A little more than one third of the set target of APFRs were approved by the local government, while the number of households actually receiving APFRs is a little more than one tenth of the target. Along these lines, the United States Agency for International Development (USAID) in its report on Burkina Faso in 2017, explicitly states: “Although the 2009 Rural Land Law and the 2012 RAF provide the mandate and mechanisms to formalize and secure a variety of tenure types in rural Burkina Faso, most rural land continues to be governed according to customary, informal rules, which differ between communities”.³¹

In order to examine deeper the result of the land tenure reform in the region, I use survey data from the World Bank and in particular the Burkina Faso Enquête Multi-sectorielle Continue 2014 which belongs to the collection Living Standards Measurement Surveys (LSMS).³² The study was conducted between 2014-2015 (5 years after the introduction of the reform) and it is nationally representative. Among many survey units there is the module referring to parcels which includes questions on the cultivating land each household holds. In Fig. 1, the responses to the method of land security are presented. It is striking that the option ‘Land Title’ which would correspond to an APFR is only answered by 177 respondents. From Fig. 1 it is apparent that the predominant land tenure regime is the ‘Possesseur Terrien’, which represents

³⁰ Even though by the end of the compact the target of 6000 APFRs approved by local authorities was not met, the MCC asserts that the project resulted to 13,447 filed applications for APFRs.

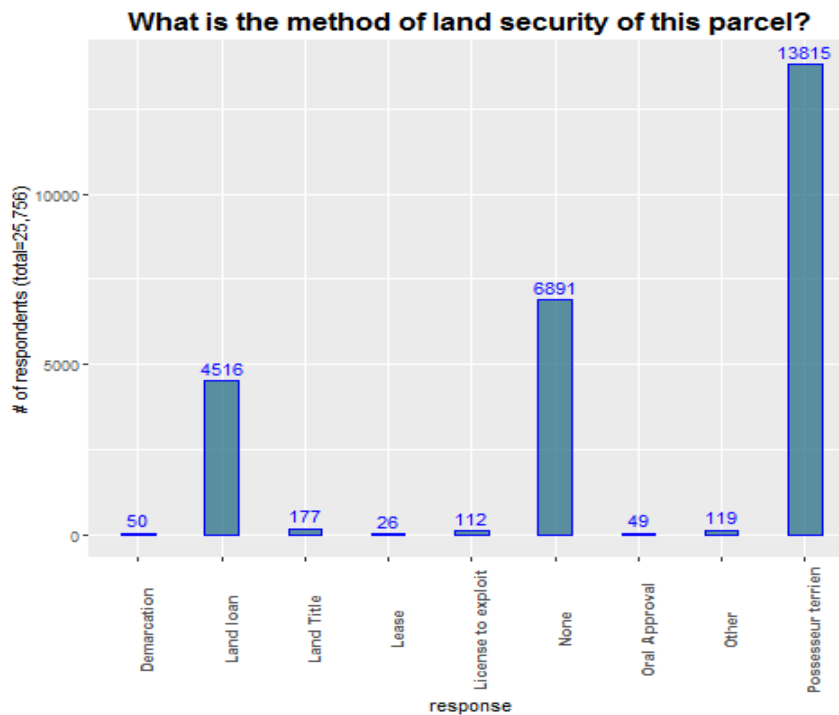
³¹ USAID 2017.

³² Institut National de la Statistique et de la Démographie. Enquête Multisectorielle Continue (EMC) 2014. Ref. BFA_2014 EMC_v01_M, <https://microdata.worldbank.org/index.php/catalog/2538/get-microdata>.



all native people that have inherited land from their family.³³ The second most answered option is 'None' indicating a complete absence of any official document certifying ownership.

FIGURE 1 • BURKINA FASO ENQUÊTE MULTISECTORIELLE
CONTINUE 2014 - LSMS - WORLD BANK



The Burkina Faso land reform constitutes an illustrative case of the puzzle under examination. Economic theory has long advocated the benefits from establishing strong individual property rights. However, in the case of Burkina Faso, a puzzling phenomenon is observed. People are offered the opportunity to officially register their land plots, however they choose not to or they are prevented by local authorities. The reasoning behind this observation lies on the core of the present study. The premise which the theory builds upon is that land reforms introduced by the state act as a competing mechanism to the risk-sharing network developed in a community level.

³³ Ouedraogo 2002.



4. DATA FROM BURKINA FASO

4.1 Rural Land Governance Project

The empirical analysis is exploiting the Millennium Challenge Corporation (MCC) compact with the government of Burkina Faso. The ultimate aim of this project was alleviation of poverty by boosting economic growth. This 5-year plan, agreed in July 2008, consisted of four distinct projects aiming at different targets. The rural land governance (RLG) project, the agricultural development project, the roads project and the Burkinabé response improvement of girls' chances to succeed to schools' projects (BRIGHT II).

The present study focuses on the first project, the rural land governance. The motivation of the project was the pervasiveness of land conflicts due to scarcity of land resources and tension between statutory laws and customary norms regarding land tenure. Its primary target was to establish a legal framework through which rural population could gain easier access to local land governance and administration.

The RLG consisted of three main activities implemented in a sequential manner. The first activity focused on the legal and procedural change and communication. The second addresses the institutional development and capacity building and the third attempted site-specific land tenure interventions (see Table 3).

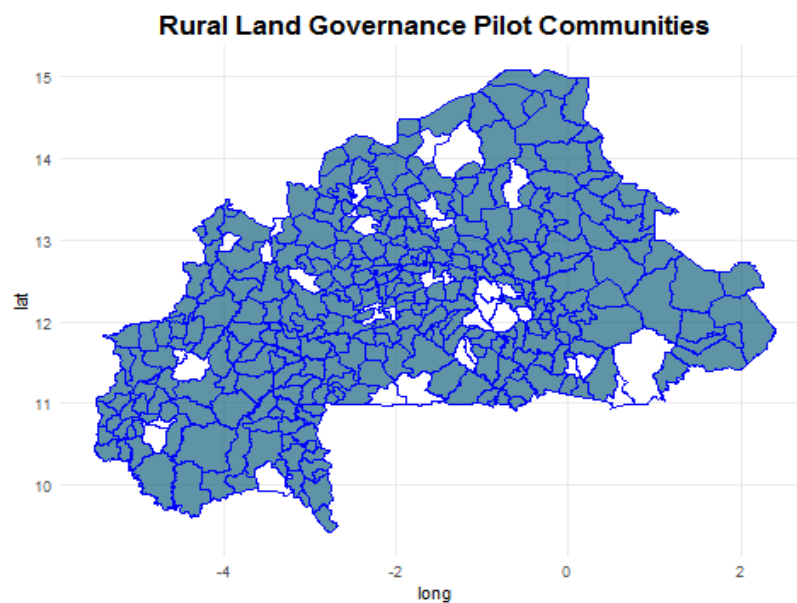
The time span of the compact was 5 years, from 2009 to 2014. The project was divided in two phases in which the prescribed activities took place sequentially. Phase I of the program lasted from 2009-2012. This phase focused on 17 pilot communes, where it implemented activity 1's plan and started implementing the actions described in activity 2 and 3. In Phase II the implementation of the plan was extended to 30 additional communes, counting in total 47 communes for which the MCC implemented the RLG project.

4.2 Monitoring the progress of RLG project

The MCC assigned the evaluation of the project to an independent organization IMPAQ. The evaluation consists of collection of survey data from the 17 pilot communes treated in Phase I. The survey is divided in baseline and interim, which refer to pre-reform and post-reform time periods respectively. However, the interim survey is conducted at the ending year of Phase I, so it does not capture the effects of Phase II activities. As a result, only the legal initiation of the reform, the dissemination of information regarding this legal option to rural population and some early option of APFR issuance is evaluated.

The methodology adopted by the evaluator is a difference-in-difference approach. For the difference-in-difference design a control and a treated group is needed. As mentioned, there were 17 pilot communes that were treated, and there were 17 additional control communes (Fig. 2) usually adjacent to ensure comparability.

FIGURE 2 • BURKINA FASO, IN WHITE ARE 34 CONTROL AND TREATED COMMUNES (SURVEYED)



The baseline and interim survey consist of four questionnaires focusing on different levels. Household, individual, parcel and production are the topics covered in the questionnaires. The size of the sample is 3,352 households from all 34 communes, accounting for more than 10,000 individuals and more than 6,000 land plots used for cultivation.

4.3 Empirical regularities in Burkina Faso

The purpose of this section is twofold. First, I am using the data to verify that the two pillars of the study namely risk-sharing and land re-allocation take place in the surveyed areas. Second, I use the survey data in hand in order to uncover the patterns that govern the interaction between risk-sharing and land allocation, in the presence of a reform that aims to establish strong individual ownership rights.



Before proceeding in describing the dataset I define the key variables of the analysis.

Risk-Sharing: consists of transfers of consumption units among members of an extended family or the same community.

In the survey data at an individual level, respondents are asked about the sources of income outside agricultural activities. The possible answers capture all types of extra income that do not come from production. More than 1500 (1396) respondents accounting for 14.6% (13.61%) answered that they have received a *transfer* in the past 12 months in the baseline (interim) survey. The range of the transfers ranges from 1000 to 300,000 (FCFA) with a mean of 5,413 (FCFA). The amount of the average transfer explicitly shows the high intensive margin of transfers, on top of non-agricultural income (see Table 2).

TABLE 2 • NON AGRICULTURAL INCOME (IN FCFA)

Fo2c2 (Income Non-Agricultural)		
	Baseline	Follow-Up
Paie/Salarie	45,803,350	47,202,545
Commerce	1.656e+08	2.25e+08
Transfers	55,629,835	56,763,714
Pensions	5,243,750	5,827,390
Elevage	2.605e+08	2.103e08
Forestiers	13,287,561	22,794,247
Artisant	16,027,523	13,900,070

The small extensive margin of individuals engaging into transfers in the sample size can be rationalised due to the individual character of this specific section of the survey. If instead of individuals, I check for villages that at least one of the residents has received a transfer, this would account for 365 villages out of the whole sample of 447. In other words, a 81.6% of the villages in the sample have at least one member that has received a transfer in the past 12 months. Additionally, the sample is consisted of individuals that belong to the same household, in which the head of the household is in control. This means that it is most likely that the transfer targets one person from each household and then it can be distributed to its members.

Land Size: The size of the plot, which the individual exploits for agricultural production.



In both surveys the size of the land plot used by holders of a single parcel, varies a lot. I can infer that the majority of the sample is consisted of small-farm owners less than 1 hectare. 60.4% have a parcel ranging from 0.1 to 1 hectare. Another 20.4% from 1 to 2 hectares, 12.3% from 2 to 3 hectares, a 5.8% holds a parcel of size between 3 and 4 hectares, a 3% of the sample between 4 and 5 hectares and another 5% cultivates a parcel over 5 hectares.

Since the survey is aiming at evaluating the effect of the Rural Land Project, the information captured by the survey questions are really detailed regarding the size and the number of plots, each individual exploits.

In Table 4 results are presented regarding different specifications of a linear probability model accounting for the effects of several individual characteristics on receiving a transfer both in the baseline and the interim survey. Being male reduces the probability of receiving a transfer under all specifications, showing that a large portion of the transfers being made are targeting the female part of the population. Being the head of the household increases the probability of receiving a transfer consistently under different versions of the specification. Also, age plays a critical role, the older you are the more likely to receive a transfer. Those results reveal the nature of transfers. They seem to be targeting the head of the household but at the same time work as an insurance mechanism. This is inferred by the observation that sensitive parts of the sample, such as female and old people are more likely to receive a transfer.

Additionally, table 4 reveals the effects of the reform to the probability of receiving a transfer. Under specification 4 (Model 4), a dummy variable showing whether the commune in which the individual resides was part of the implementation of the RLG project is added. Consistently, an individual in a treated area has less probability of receiving a transfer - also before and after the implementation of the project. However, the level after the end of Phase I is lower.

The interesting result relies on the comparison between specification 4 and specification 5. Under specification, all controls described above have been added, but also now the model includes the effect of the size of the land that an individual with a single parcel cultivates. In both pre-reform and post-reform specifications the increase of land size by one unit decreases the probability of receiving a transfer. However, post-reform, this effect turns statistically significant. This observation points

towards the direction, that size of land parcels acquire more importance when the option of registering it as individually owned becomes available.

Moreover, adding land size to the specification, turns other control variables, such as sex and being the head of the household, insignificant. This can be interpreted as the targeting of transfer is taking into account the land holdings of the individual more than whether the individual belongs to a sensitive group.

Finally, the land size also affects the effect of the treatment on the probability of receiving a transfer. In both, pre and post reform specifications, the effect of belonging to a community where RLG was implemented becomes statistically insignificant, when land size is added. The explanatory power of being treated is absorbed by the size of land. This is effectively explained by the functioning of the theoretical model presented in the paper. The community's reaction to a land reform that aims to establishing strong individual property rights is primarily based on land re-allocation which is largely determined by the head of the community.

5. ONE-SIDED LIMITED COMMITMENT WITH LAND RE-ALLOCATION

The theoretical part of the present study models the functioning of risk-sharing informal contracts among members of rural communities and their interaction with land reforms when land re-allocation is in place. To motivate the assumptions of the model I need to define certain customary aspects of the social structure in rural communities of Western Africa.

Customary land management in Burkina Faso is generally considered homogeneous. A predominant social figure at a community level is that of the land chief (*chef de terre*).³⁴ The land chief is a religious figure with legal power and has the complete control over land on behalf of the community.³⁵ One of the main duties of the land chief is the periodic redistribution of land. This land re-allocation takes place among the members of the same community/village but also to foreigners in case they arrive. This practice aims at preventing the creation of monopolies in land-use or underuse of land plots. The periodic redistribution of land is decided upon the needs of the members of the community.

In the theoretical model presented in this section, the land chief is the principal of the risk-sharing contract (one side of the two-sided contract). The informal contract I am addressing does not only prescribe production units allocation among community

³⁴ The predominance of the land chief can be seen in Fig. 5.

³⁵ Ouedraogo 2002.

³⁶ The land chief is considered to be descended from lineage of the group of the first occupants of the earth.



members but also land re-allocation among the members. The ultimate target of the model is to trace the interaction between those two components and its welfare implications.

Two takeaways from the survey findings determine the structure of the model presented in this section. First, in agricultural communities, land is the major production factor. Second, land re-allocation together with exchange consumption units form the nature of risk-sharing in those communities.

The theoretical framework presented here attempts to shed light on the diverse views expressed regarding the land regime policy that should be followed in the African continent. Illustrative of the diversity of the land policy in Africa is the position that the World Bank has held. During the mid-1970s the World Bank was advocating a firm regime of strong individual property rights in Africa. It was persuaded by most of the literature's theoretical arguments relating land tenure security and agricultural productivity.³⁷ However, this stance evolved over time, resulting to the adoption of a more favourable view towards customary land tenure systems. The flexibility and efficient adaptation of indigenous land systems were appreciated.³⁸

The environment builds on Ljunqvist and Sargent.³⁹ The contract prescribes the pooling of all households' resources in the hands of the principal who allocates consumption back to them. The principal after allocating consumption, invests the remainder outside the village at a risk free rate $R = \frac{1}{\beta}$, where β is the common to all discount factor. The principal is the only one that can borrow and lend resources outside the community, the households rely only on the risk-sharing mechanism.

The community is consisting of a large number of villagers with the preferences over consumption.

$$E_{-1} \sum_{t=0}^{\infty} \beta^t u(c_t)$$

³⁷ Udry 2011.

³⁸ Migot-Adholla *et al.* 1991.

³⁹ Ljunqvist and Sargent 2000.



where $u(c)$ is increasing and strictly concave and β is the common discount factor $\beta \in (0,1)$. Each villager receives a stochastic idiosyncratic productivity each period $\{z_t\}_{t=0}^{\infty}$. Idiosyncratic productivity is iid with $\text{Prob}(z_t = z_s) = \Pi_s$, with $s \in \{1,2, \dots, S\}$ satisfying the property, $z_s < z_{s+1}$.

The villager is considered as a small agricultural household which produces output using a fraction of land as the primary production function. The technology is model as follows:

$$y_s = z_s f(\kappa_s \bar{l})$$

where z_s is the idiosyncratic productivity, $\bar{l}$ denotes land, which is in fixed supply normalized to 1 and κ_s is the variable of interest. It is the fraction of land that each period the principal decides for the villager to productively use it ($\kappa_s \in [0,1]$). κ_s effectively captures land re-allocation as a mechanism of risk sharing. Technology $f(\cdot)$ is increasing in the fraction of land, κ_s ($f'(\cdot) > 0$), strictly concave ($f''(\cdot) < 0$) and I assume that with no land there is no produced output $f(0) = 0$.

Participation of the household to the community risk sharing mechanism entails transfers towards and from the community. The budget constraint of each individual household is:

$$c_s = y_s + \tau_s, \forall i \in N$$

If $\tau_s > 0$ then the household is receiving transfer from the community which adds up to the disposable income, while if $\tau_s < 0$, the household is rendering part of its output to be granted as transfers to other members of the community.

The land chief (principal) maximizes her stream of profits, which consists of the contemporaneous difference between the pooled output and the consumption allocation, and the discounted future profits stream. In a recursive form, the objective function is

$$P(v) = \max_{\{c_s, \kappa_s, w_s\}} \sum_{s=1}^S \Pi_s [(y_s - c_s) + \beta P(w_s)]$$

or equivalently substituting the villager's budget constraint



$$P(v) = \max_{\{\tau_s, \kappa_s, w_s\}} \sum_{s=1}^S \Pi_s [(-\tau_s) + \beta P(w_s)]$$

where v is the expected discounted future utility previously promised to the villager and w_s is the promised value with which the agent will enter next period, given that $z_t = z_s$.

In the absence of commitment frictions the economy reaches its first best.

Proposition 1: *Given a promised utility v , the first best allocation satisfies the following properties. The consumption and promised utility sequences are constant and equal to the levels $c^{fb}(v)$ and $w^{fb}(v)$, while κ^{fb} is constant at its maximum level.*

Proof: see Appendix.

In the case of a commitment friction, while the head of the community is committed to the agreement, the villager is not. However, what fundamentally changes is the outside option of the villager. The primary channel of interaction between the land reform that aims to establishing strong individual property rights and the contractual agreement among community members emerges through the workings of the outside option. Assumption 1 defines the rationale behind the modelling of the outside option.

Assumption 1: *The land reform allows the agent-villager to register the fraction of land she was last allocated with, inside the contract.*

Assumption 1 determines the form of the outside option of the agent-villager.

$$u(z_s f(\kappa_s)) + \beta v^{\text{aut}}(\kappa_s)$$

First, notice that the fraction of land allocated to productive use is endogenous and it is determined within the contract. Second, due to the limited commitment friction, the agent-villager can leave the contract at any state. If she does so, due to the existence of a land reform, she can register the last allocated fraction of land (from within the contract) as individual property.

The continuation value of autarky takes the following form:

$$v^{\text{aut}}(\kappa_s) = \sum_{t=0}^{\infty} \beta^t \sum_{r=1}^S \Pi_r u(z_r f(\kappa_s))$$



Note that the level of fraction of land is constant and equal to what was last decided within the contract.

The participation constraint of the contract takes the form:

$$u(c_s) + \beta w_s \geq u(z_s f(\kappa_s)) + \beta v^{\text{aut}}(\kappa_s)$$

The head of the community is choosing consumption allocated to the agent-villager, fraction of land and promised utility, in order to maximize her stream of profits.

$$P(v) = \max_{c_s, \kappa_s, w_s} \sum_{s \in S} \Pi_s [(z_s f(\kappa_s) - c_s) + \beta P(w_s)]$$

where v is the promised utility that agent-villager enters the current period with and carries all past histories, in order to recursify the problem.

The maximization problem of the principal takes the following form:

$$P(v) = \max_{c_s, \kappa_s, w_s} \sum_{s=1}^S \Pi_s [(z_s f(\kappa_s) - c_s) + \beta P(w_s)]$$

$$\sum_{s=1}^S \Pi_s \{u(c_s) + \beta w_s\} \geq v \quad [PKC]$$

$$u(c_s) + \beta w_s \geq u(z_s f(\kappa_s)) + \beta v^{\text{aut}}(\kappa_s) \quad [PC] \forall s$$

$$\kappa_s \in [0, 1]$$

$$w_s \in [v^{\text{aut}}, \bar{v}]$$

Proposition 2: For a given promised utility v , when the participation constraint is non-binding, the consumption and promised utility allocations are constant and equal to $c_s = g_1(v)$ and $w_s = v$, while the fraction of land reaches the first best ($\kappa_s = \kappa_{\text{max}}$).

When the participation constraint binds then consumption, promised utility and fraction of land satisfy equations 1, 2 and 3 respectively.

$$u'(c_s)[\theta + \phi_s] = 1 \quad (1)$$

$$P'(w_s) = -(\theta + \phi_s) \quad (2)$$

$$u'(z_s f(\kappa_s)) = \frac{1}{\phi_s} - \frac{1}{z_s} \frac{\beta}{1-\beta} E_r u'(z_r f(\kappa_s)) z_r \quad (3)$$

Proof: see Appendix.



The model as delineated above presents an interesting trade-off which encompasses the core interaction between land rights and risk sharing when seen as competing mechanisms. Notice that the level of fraction of land (κ_s) has two opposing effects on the model. First it raises the revenues of the community. This can be seen from the objective function of the principal-head of the community. A higher level of κ_s will increase the produced output for a given realisation of z_s and consequently the size of the pie to be allocated among consumption to households and profits for the principal. At the same time, κ_s is on the right-hand side of the participation constraint. A higher fraction of land allocated to the villager makes the outside option more attractive, increasing deviation incentives.

In order to characterize the nature of the land tenure system under the contract in the presence of a land reform as an outside option, I define the following possible land regimes:

Definition: A land regime is **productive** if it adjusts fraction of land positively to idiosyncratic productivity ($\frac{\partial \kappa_s}{\partial z_s} > 0$). It is **rigid** if it does not adjust fraction of land to changes in idiosyncratic productivity ($\frac{\partial \kappa_s}{\partial z_s} = 0$) and it is **counter-productive** when it adjusts fraction of land opposite to idiosyncratic productivity ($\frac{\partial \kappa_s}{\partial z_s} < 0$).

By manipulating the optimality condition with respect to fraction of land, I can obtain an optimal response of the κ_s to realisations of idiosyncratic productivity.

Proposition 3: For a given v and for each $s \in S$ that leads to a binding participation constraint, there exists threshold z_s^* which determines the nature of the land regime under the contract.

Land Regime		z_s
Productive	$\frac{\partial \kappa_s}{\partial z_s} > 0$	$z_t > z_s^* = \frac{1 - \phi_s u'(z_s^* f(\kappa_s))}{\phi_s u''(z_s^* f(\kappa_s)) f(\kappa_s)}$
Rigid	$\frac{\partial \kappa_s}{\partial z_s} = 0$	$z_t = z_s^* = \frac{1 - \phi_s u'(z_s^* f(\kappa_s))}{\phi_s u''(z_s^* f(\kappa_s)) f(\kappa_s)}$
Counter Productive	$\frac{\partial \kappa_s}{\partial z_s} < 0$	$z_t < z_s^* = \frac{1 - \phi_s u'(z_s^* f(\kappa_s))}{\phi_s u''(z_s^* f(\kappa_s)) f(\kappa_s)}$

Using the following functional forms for utility and technology that satisfy the conditions on monotonicity and concavity,

$$u(c_s) = \frac{c_s^{(1-\alpha)}}{1-\alpha}$$

$$y_s = z_s f(\kappa_s) = z_s \kappa_s^{1-\gamma}$$

the above proposition takes the following form:

Land Regime		z_s
Productive	$\frac{\partial \kappa_s}{\partial z_s} > 0$	$z_t < z_s^* = [(1 - \alpha)\phi_s]^{\frac{1}{\alpha}} \kappa_s^{-(1-\gamma)}$
Rigid	$\frac{\partial \kappa_s}{\partial z_s} = 0$	$z_t = z_s^* = [(1 - \alpha)\phi_s]^{\frac{1}{\alpha}} \kappa_s^{-(1-\gamma)}$
Counter Productive	$\frac{\partial \kappa_s}{\partial z_s} < 0$	$z_t > z_s^* = [(1 - \alpha)\phi_s]^{\frac{1}{\alpha}} \kappa_s^{-(1-\gamma)}$

Proof: see Appendix.

The result from proposition 3 illustrates the variability of the customary land tenure regime. In the presence of a land reform as an outside option, the principal responds strategically to the allocation of land to the agent such that to keep the contract sustainable at all times. This means that given an allocation of consumption, promised utility and a realisation of idiosyncratic productivity, the contract might optimally adjust fraction of land downwards, upwards or not at all. This is due to the strategic way of the principal to enforce contract participation. The land chief when proceeding to redistribution of land weighs those two opposing effects. How much allocated land, increases the size of the pie (her revenues) and how much the incentives of the villager to deviate. This essentially depends on how close to a realisation of productivity that would lead to a binding participation constraint the current idiosyncratic productivity is. This is when the threat of reneging the contract from the side of the villager becomes credible.

This strategic behaviour regarding allocation of land, entails efficiency costs. In the absence of the limited commitment friction, the incentives of the principal would be in line with a flexible land tenure regime. A flexible land tenure regime would increase principals revenues and would increase the size of the pie to be distributed among the members of the community. A land reform distorts those incentives, and induces a strategic allocation of land, which might lead to productive villagers being allocated smaller fraction of land, due to the threat of deviating from the contract.

6. POLICY PRESCRIPTION AND CONCLUDING REMARKS

The study of the interaction between land reforms and customary risk-sharing mechanisms as illustrated in section 5 provides valuable lessons regarding policy design of land reforms in weak institutional frameworks.

Attempts for reforming land rights should take into serious consideration the pre-existence of customary safety networks. This is critical in cases of ethnic minorities,



or vulnerable groups of people that have to rely solely to the community for tackling risk. Those customary norms prescribe transfers of production units and land re-allocation as ways to insure their members against risk. If these two mechanisms constitute the predominant means of risk-sharing in the affected communities, then a land reform can distort the functioning of the customary contract.

As shown in section 5 the land reform's effect on the outside option can bring efficiency costs. It creates a clear trade-off between the amount of risk-sharing and production efficiency. In order for the communities to maintain the existence of their informal contracts they can manipulate land allocation in a counter-productive way. In this case, a land reform can lead to misallocation of land, an inefficiency that would have been avoided, were the community was unaffected by land reforms.

Lastly, the present study provides a potential theoretical justification of the World Bank's stance on land rights in Africa. The international organization, since the early 1990s has adopted a more inclusive and integrating policy stance regarding the functioning of local communities regarding land management. Based on section 5 it is explicit that the land tenure regime under the informal contract can achieve a certain flexibility of adjustment to productivity leading to a more efficient allocation of land. To conclude, the implementation of a land reform aiming at granting private property should be preceded by a careful documentation and examination of the way local communities operate. The effect of a reform on the rural population might be beneficial if it strengthens the bargaining position of the villager, but also could bring detrimental effects regarding output efficiency.

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APPENDIX

PROPOSITION 1

Proof: Under the first best, commitment friction is absent, hence in the optimization problem, the principal-head of the community does not take into account the participation constraint of the agent-villager. Hence the problem becomes:

$$P(v) = \max_{c_s, \kappa_s, w_s} \sum_{s \in S} \Pi_s [(z_s f(\kappa_s) - c_s) + \beta P(w_s)]$$

$$\sum_{s \in S} \Pi_s \{u(c_s) + \beta w_s\} \geq v \quad [PKC] \quad (\theta)$$

$$\kappa_s \in [0, 1]$$

$$w_s \in [v^{aut}, \bar{v}]$$

Assigning the designated lagrange multipliers above, the lagrangian becomes:

$$\mathcal{L} = \sum_{s \in S} \Pi_s [(z_s f(\kappa_s) - c_s) + \beta P(w_s)] +$$



$$\theta \left[\sum_{s \in S} \Pi_s [u(c_s) + \beta w_s] - v \right] +$$

$$\Pi_s v_{1s} \kappa_s + \Pi_s v_{2s} (1 - \kappa_s) = 0$$

Deriving optimality conditions with respect to the choice variables:

$$\frac{\partial \mathcal{L}}{\partial c_s} = 0 \rightarrow -1 + \theta u'(c_s) = 0 \rightarrow u'(c_s) = \frac{1}{\theta} \text{ [constant]}$$

and

$$\frac{\partial \mathcal{L}}{\partial \kappa_s} = 0 \rightarrow z_s f'(\kappa_s) + (v_{1s} - v_{2s}) = 0 \rightarrow f'(\kappa_s) = \frac{(v_{2s} - v_{1s})}{z_s}$$

since $f(0) = 0$ then $v_{1s} = 0$

$$f'(\kappa_s) = \frac{v_{2s}}{z_s}$$

since $f'() > 0$ then $v_{2s} > 0$ so $\kappa_s = 1$

and

$$\frac{\partial \mathcal{L}}{\partial w_s} = 0 \rightarrow \beta P'(w_s) + \theta \beta = 0 \rightarrow P'(w_s) = -\theta \text{ [constant]}$$

PROPOSITION 2

Proof: The maximization problem in the presence of the commitment friction takes the following form:

$$P(v) = \max_{c_s, \kappa_s, w_s} \sum_{s=1}^S \Pi_s [(z_s f(\kappa_s) - c_s) + \beta P(w_s)]$$



$$\sum_{s=1}^S \Pi_s \{u(c_s) + \beta w_s\} \geq v \quad [PKC]$$

$$u(c_s) + \beta w_s \geq u(z_s f(\kappa_s)) + \beta v^{\text{aut}}(\kappa_s) \quad [PC] \forall s$$

$$\kappa_s \in [0,1]$$

$$w_s \in [v^{\text{aut}}, \bar{v}]$$

Assigning the Lagrange multipliers as above, the Lagrangian reads:

$$\mathcal{L} = \sum_{s \in S} [(z_s f(\kappa_s) - c_s) + \beta P(w_s)] +$$

$$\theta \left[\sum_{s \in S} \Pi_s [u(c_s) + \beta w_s] - v \right] +$$

$$\Pi_s \phi_s [u(c_s) + \beta w_s - u(z_s f(\kappa_s) - \beta v^{\text{aut}})(\kappa_s)] +$$

$$\Pi_s v_{1s} \kappa_s + \Pi_s v_{2s} (1 - \kappa_s) = 0$$

Before deriving the optimality conditions, I derive the following:

$$\frac{\partial v^{\text{aut}}}{\partial \kappa_s} = \frac{1}{1 - \beta} \sum_r \Pi_r u'(z_r f(\kappa_s)) z_r f'(\kappa_s)$$

$$\frac{\partial v^{\text{aut}}}{\partial \kappa_s} = \frac{1}{1 - \beta} f'(\kappa_s) \sum_r \Pi_r u'(z_r f(\kappa_s)) z_r$$

$$\frac{\partial v^{\text{aut}}}{\partial \kappa_s} = \frac{1}{1 - \beta} f'(\kappa_s) \underbrace{E_r u'(z_r f(\kappa_s)) z_r}_{\omega > 0}$$

$$\frac{\partial v^{\text{aut}}}{\partial \kappa_s} = \frac{1}{1 - \beta} f'(\kappa_s) \omega$$



Deriving the focs:

$$\frac{\partial L}{\partial c_s}: \quad \Pi_s(-1) + \theta \Pi_s u'(c_s) + \phi_s \Pi_s u'(c_s) = 0 \rightarrow u'(c_s)[\theta + \phi_s] = 1$$

$$\frac{\partial L}{\partial w_s}: \quad \Pi_s \beta P'(w_s) + \theta \Pi_s \beta + \phi_s \Pi_s \beta = 0 \rightarrow P'(w_s) = -(\theta + \phi_s)$$

$$\frac{\partial L}{\partial \kappa_s}: \quad \Pi_s z_s f'(\kappa_s) - \Pi_s \phi_s \left[u'(z_s f(\kappa_s)) z_s f'(\kappa_s) + \beta \frac{\partial v^{\text{aut}}}{\partial \kappa_s} \right] + \Pi_s v_{1s} - \Pi_s v_{2s} = 0$$

$$\begin{aligned} \Pi_s z_s f'(\kappa_s) - \Pi_s \phi_s \left[u'(z_s f(\kappa_s)) z_s f'(\kappa_s) \right. \\ \left. + \beta \frac{1}{1 - \beta} f'(\kappa_s) \sum_r \Pi_r u'(z_r f(\kappa_s)) z_r \right] + \Pi_s v_{1s} - \Pi_s v_{2s} = 0 \end{aligned}$$

$$z_s f'(\kappa_s) [1 - \phi_s u'(z_s f(\kappa_s))] - \phi_s \frac{\beta}{1 - \beta} f'(\kappa_s) \omega + [v_{1s} - v_{2s}] = 0$$

Assume that constraints on κ_s are slack - corner solutions excluded $v_{1s}, v_{2s} = 0$

$$z_s [1 - \phi_s u'(z_s f(\kappa_s))] = \phi_s \frac{\beta}{1 - \beta} f'(\kappa_s) \omega$$

$$[1 - \phi_s u'(z_s f(\kappa_s))] = \frac{\phi_s}{z_s} \frac{\beta}{1 - \beta} \omega$$

$$\phi_s u'(z_s f(\kappa_s)) = 1 - \frac{\phi_s}{z_s} \frac{\beta}{1 - \beta} \omega$$

$$u'(z_s f(\kappa_s)) = \frac{1}{\phi_s} - \frac{1}{z_s} \frac{\beta}{1 - \beta} \omega$$



PROPOSITION 3:

Let the following functional forms:

$$u(c_s) = \frac{c_s^{(1-\alpha)}}{1-\alpha}$$

and

$$y = z_s f(\kappa_s) = z_s \kappa_s^{1-\gamma}$$

First, I derive the $\frac{\partial v_{aut}}{\partial \kappa_s}$ under those functional forms.

$$\frac{\partial v_{aut}}{\partial \kappa_s} = \sum_{t=0}^{\infty} \beta^t \sum_{r=1}^S \Pi_r u'(z_r f(\kappa_s)) z_r f'(\kappa_s)$$

$$\frac{\partial v_{aut}}{\partial \kappa_s} = \frac{1}{1-\beta} f'(\kappa_s) \sum_{r=1}^S \Pi_r u'(z_r f(\kappa_s)) z_r$$

$$\frac{\partial v_{aut}}{\partial \kappa_s} = \frac{1}{1-\beta} f'(\kappa_s) \underbrace{\sum_{r=1}^S \Pi_r u'(z_r f(\kappa_s)) z_r}_{\omega > 0}$$

Using the functional forms to get ω

$$\omega = \sum_r \Pi_r u'(z_r f(\kappa_s)) z_r = E_r u_c(z_r f(\kappa_s)) z_r$$

plugging the functional forms of u, f

$$\omega = \sum_r \Pi_r z_r^{-\alpha} f(\kappa_s)^{-\alpha} z_r$$

$$\omega = \sum_r \Pi_r z_r^{-\alpha} (\kappa_s^{1-\gamma})^{-\alpha} z_r$$



$$\omega = \kappa_s^{-\alpha(1-\gamma)} \sum_r \Pi_r z_r^{-\alpha}$$

$$\omega = \kappa_s^{-\alpha(1-\gamma)} \xi$$

Now plug this expression to the foc wrt κ_s :

$$u_c(z_s f(\kappa_s)) = \frac{1}{\phi_s} - \frac{1}{z_s} \frac{\beta}{1-\beta} \omega$$

$$[z_s f(\kappa_s)]^{-\alpha} = \frac{1}{\phi_s} - \frac{1}{z_s} \frac{\beta}{1-\beta} \kappa_s^{-\alpha(1-\gamma)} \xi$$

$$z_s^{-\alpha} [\kappa_s^{1-\gamma}]^{-\alpha} = \frac{1}{\phi_s} - \frac{1}{z_s} \frac{\beta}{1-\beta} \kappa_s^{-\alpha(1-\gamma)} \xi$$

$$z_s^{-\alpha} \kappa_s^{-\alpha(1-\gamma)} = \frac{1}{\phi_s} - \frac{1}{z_s} \frac{\beta}{1-\beta} \kappa_s^{-\alpha(1-\gamma)} \xi$$

Now I want to derive a relationship between κ_s and z_s from the above relationship which is the optimal rule for setting the fraction of land

Step 1: Multiply by z_s :

$$z_s^{1-\alpha} \kappa_s^{-\alpha(1-\gamma)} = \frac{z_s}{\phi_s} - \frac{\beta}{1-\beta} \kappa_s^{-\alpha(1-\gamma)} \xi$$

Step 2: Multiply by ϕ_s :

$$\phi_s z_s^{1-\alpha} \kappa_s^{-\alpha(1-\gamma)} = z_s - \phi_s \frac{\beta}{1-\beta} \kappa_s^{-\alpha(1-\gamma)} \xi$$

Step 3: Transfer everything to the RHS and name it $\mathcal{H}(\kappa_s, z_s)$ on which you apply the IFT

$$\mathcal{H}(\kappa_s, z_s) = z_s - \phi_s z_s^{1-\alpha} \kappa_s^{-\alpha(1-\gamma)} - \phi_s \frac{\beta}{1-\beta} \kappa_s^{-\alpha(1-\gamma)} \xi = 0$$

From the IFT i know the following:



$$\frac{\partial \kappa_s}{\partial z_s} = - \frac{\frac{\partial \mathcal{H}(\kappa_s, z_s)}{\partial z_s}}{\frac{\partial \mathcal{H}(\kappa_s, z_s)}{\partial \kappa_s}}$$

where

$$\frac{\partial \mathcal{H}(\kappa_s, z_s)}{\partial z_s} = 1 - (1 - \alpha) \phi_s \kappa_s^{-\alpha(1-\gamma)} z_s^{-\alpha}$$

and

$$\begin{aligned} \frac{\partial \mathcal{H}(\kappa_s, z_s)}{\partial \kappa_s} = & - \left(-\alpha(1 - \gamma) \phi_s z_s^{1-\alpha} \kappa_s^{-\alpha(1-\gamma)-1} \right) \\ & - \left(-\alpha(1 - \gamma) \phi_s \frac{\beta}{1 - \beta} \kappa_s^{-\alpha(1-\gamma)-1} \xi \right) \end{aligned}$$

$$\frac{\partial \mathcal{H}(\kappa_s, z_s)}{\partial \kappa_s} = \alpha(1 - \gamma) \phi_s z_s^{1-\alpha} \kappa_s^{-\alpha(1-\gamma)-1} + \alpha(1 - \gamma) \phi_s \frac{\beta}{1 - \beta} \kappa_s^{-\alpha(1-\gamma)-1} \xi \rightarrow$$

$$\rightarrow \frac{\partial \mathcal{H}(\kappa_s, z_s)}{\partial \kappa_s} = \alpha(1 - \gamma) \phi_s \kappa_s^{-\alpha(1-\gamma)-1} \left(z_s^{1-\alpha} + \frac{\beta}{1 - \beta} \xi \right)$$

Hence the IFT becomes as follows:

$$\begin{aligned} \frac{\partial \kappa_s}{\partial z_s} = & - \frac{\frac{\partial \mathcal{H}(\kappa_s, z_s)}{\partial z_s}}{\frac{\partial \mathcal{H}(\kappa_s, z_s)}{\partial \kappa_s}} = - \frac{1 - (1 - \alpha) \phi_s \kappa_s^{-\alpha(1-\gamma)} z_s^{-\alpha}}{\alpha(1 - \gamma) \phi_s \kappa_s^{-\alpha(1-\gamma)-1} \left(z_s^{1-\alpha} + \frac{\beta}{1 - \beta} \xi \right)} \\ \frac{\partial \kappa_s}{\partial z_s} = & \frac{(1 - \alpha) \phi_s \kappa_s^{-\alpha(1-\gamma)} z_s^{-\alpha} - 1}{\alpha(1 - \gamma) \phi_s \kappa_s^{-\alpha(1-\gamma)-1} \left(z_s^{1-\alpha} + \frac{\beta}{1 - \beta} \xi \right)} \end{aligned}$$

Note that the sign of the relationship between κ_s and z_s depends on the sign of the nominator:

Flexible Land Regime: $\frac{\partial \kappa_s}{\partial z_s} > 0$



$$(1 - \alpha)\phi_s \kappa_s^{-\alpha(1-\gamma)} z_s^{-\alpha} - 1 > 0$$

$$(1 - \alpha)\phi_s \kappa_s^{-\alpha(1-\gamma)} z_s^{-\alpha} > 1$$

$$(1 - \alpha)\phi_s \kappa_s^{-\alpha(1-\gamma)} > \frac{1}{z_s^{-\alpha}}$$

$$z_s^\alpha < (1 - \alpha)\phi_s \kappa_s^{-\alpha(1-\gamma)}$$

$$z_s < [(1 - \alpha)\phi_s]^{\frac{1}{\alpha}} \kappa_s^{-(1-\gamma)}$$

Rigid Land Regime: $\frac{\partial \kappa_s}{\partial z_s} = 0$

$$z_s = [(1 - \alpha)\phi_s]^{\frac{1}{\alpha}} \kappa_s^{-(1-\gamma)}$$

Counter Productive Land Regime: $\frac{\partial \kappa_s}{\partial z_s} < 0$

$$z_s > [(1 - \alpha)\phi_s]^{\frac{1}{\alpha}} \kappa_s^{-(1-\gamma)}$$

To summarize the above result, the risk-sharing contract within the community might end up with a land allocation regime that falls within one or more of the following categories, depending on the relation between idiosyncratic productivity and fraction of land allocated to the villager at the time of the land reform implementation.

FIGURE 3 • TENURE INSECURITY IN AFRICAN COUNTRIES (“PRINDEX”, 2018),
TENURE INSECURITY: % OF PEOPLE WHO BELIEVE IT IS SOMEWHAT OR VERY LIKELY
THAT THEY COULD LOSE THEIR RIGHT TO USE PROPERTY OR PART OF IT AGAINST
THEIR WILL IN THE NEXT 5 YEARS.

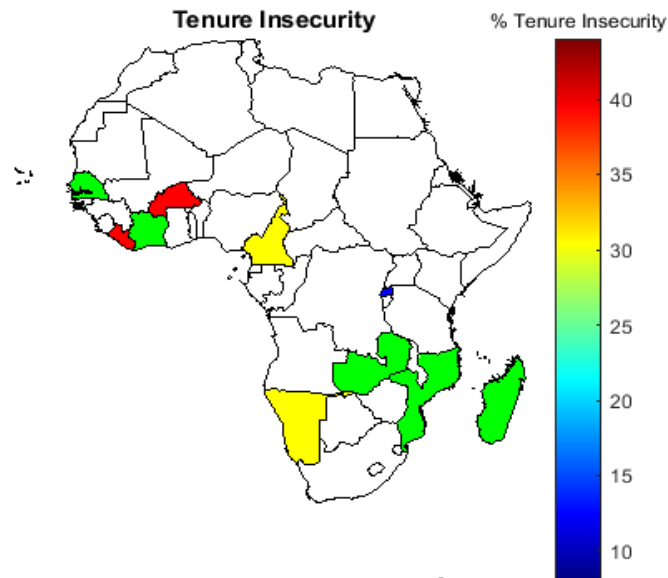


FIGURE 4 • SOURCE: WEST AFRICA: LAND USE AND LAND COVER DYNAMICS
AND UNITED NATIONS

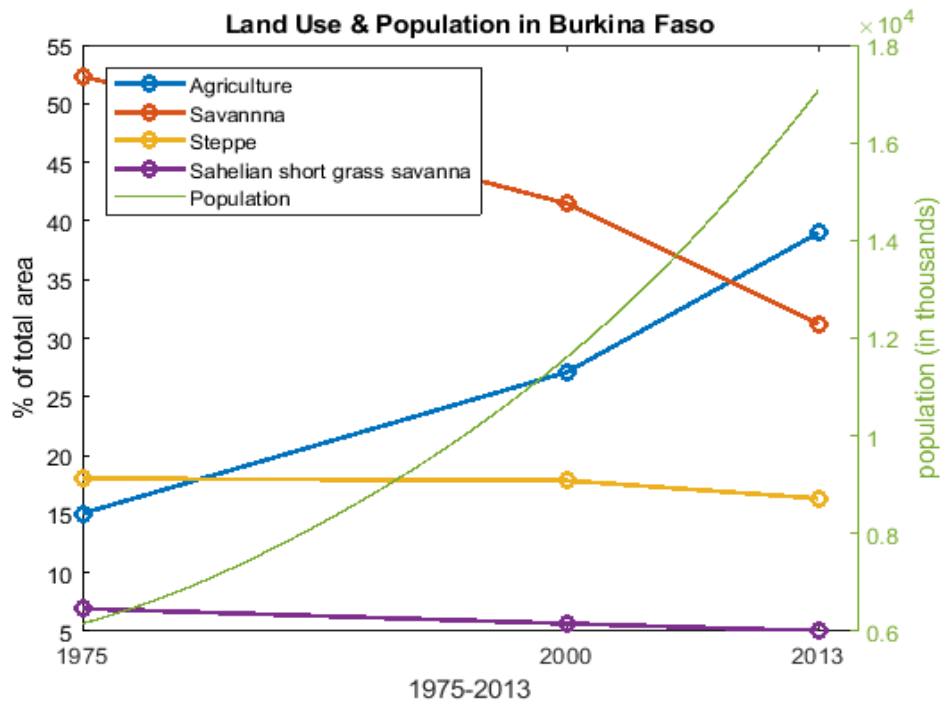


TABLE 3 • BURKINA FASO RURAL LAND GOVERNANCE PROJECT IMPACT EVALUATION (IMPAQ, 2015)

Rural Land Governance Project		
Activities	Title	Phases
Activity No 1	Legal and Procedural Change and Communication	Phase I (2009-2012) (national level)
1. Support government's efforts to develop and implement improved rural land legislation and to develop, revise and implement other legal and procedural frameworks. 2. Significant public outreach program to inform people about the new legislations and its expected benefits		
Activity No 2	Institutional Development and Capacity Building	Phase I (2009-2012) (17 communes) Phase II (2012-2014) (additional 30 communes)
1. Improve institutional capacity to deliver land services in rural areas. 2. Funding of series of land registration, mapping and decentralization services.		
Activity No 3	Site-Specific Land Tenure Interventions	Phase I (2009-2012) (17 communes) Phase II (2012-2014) (additional 30 communes)
1. Site specific land rights formalization sub-activities 2. Provision of APFR certificates 3. Preparation of land titles and leases in selected project areas.		



TABLE 4 • DEPENDENT VARIABLE: PROBABILITY OF RECEIVING A TRANSFER

Variables	(1) Model 1		(2) Model 2		(3) Model 3		(4) Model 4		(5) Model 5	
	Baseline	Interim	Baseline	Interim	Baseline	Interim	Baseline	Interim	Baseline	Interim
<i>sex (1=Male, 0: Female)</i>	-0.00413 (0.007)	-0.0172** (0.00685)	-0.0604*** (0.00958)	-0.0769*** (0.00921)	-0.0398*** (0.00971)	-0.0489*** (0.00921)	-0.0384*** (0.00972)	-0.0483*** (0.00921)	-0.0774*** (0.0273)	-0.0348 (0.0217)
<i>chef de menage (1: True, 0: False)</i>			0.0873*** (0.0102)	0.0954*** (0.00990)	0.0386*** (0.0111)	0.0293*** (0.0109)	0.0369*** (0.0111)	0.0286*** (0.0109)	0.0373 (0.0291)	0.00692 (0.0232)
<i>Age</i>					0.00251*** (0.000230)	0.00316*** (0.000231)	0.00252*** (0.000230)	0.00317*** (0.000231)	0.00301*** (0.000538)	0.00379*** (0.000439)
<i>treated</i>							-0.0230*** (0.00699)	-0.0210*** (0.00677)	-0.00820 (0.0157)	-0.0153 (0.0125)
<i>Land Size</i>									-0.00458 (0.00474)	-0.00862** (0.00346)
<i>Constant</i>	0.148*** (0.00463)	0.143*** (0.00446)	0.145*** (0.00463)	0.140*** (0.00445)	0.0506*** (0.00977)	0.0185* (0.00991)	0.0635*** (0.0105)	0.0302*** (0.0106)	0.0328** (0.0241)	0.0131 (0.0201)
Observations	10,361	10,258	10,361	10,258	10,361	10,258	10,361	10,234	2,018	3,138
R-squared	0.000	0.001	0.007	0.0258	0.018	0.027	0.019	0.028	0.024	0.030

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1



FIGURE 5 • MCC - BASELINE SURVEY - CONFLICT RESOLUTION

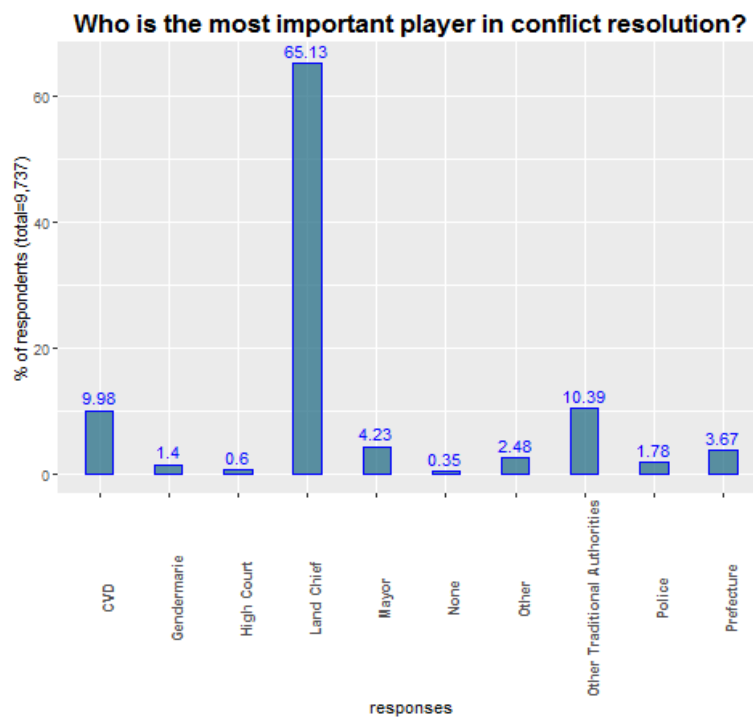


FIGURE 6 • LAND ALLOCATION AND PRODUCTIVITY

