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**Impact of land administration programs on agricultural
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JEL Codes: D23, O13, Q15

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Impact of land administration programs on agricultural productivity and rural development: existing evidence, challenges and new approaches

Jeremie Gignoux, Karen Macours and Liam Wren-Lewis¹

Abstract: Investment in land administration projects is often considered key for agricultural productivity and rural development in developing countries. But the evidence on such interventions is remarkably mixed. This paper reviews the literature and discusses a number of challenges related to the analysis of the impacts of land administration programs, focusing on developing countries where the starting position is one of land administration systems based on the Napoleonic code, with existing individual rights that may be imperfect and insecure. We examine a set of conceptual and methodological challenges including : 1) a conceptual challenge related to the need to unbundle property rights and to establish the plausible causal chain for land administration interventions; 2) the existence of other binding constraints on productivity, implying the need to consider heterogeneities in policy impacts and the complementarity between property rights and other productive interventions; 3) the need to account for spillovers of land interventions on non-targeted households; and 4) methodological challenges related to the causal identification of the impacts of such interventions.

Keywords: Land administration programs, property rights, agricultural productivity, rural development, impact evaluation methods.

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1 Introduction

Insecurity of property rights is often argued to be an important impediment for agricultural productivity, and indeed more broadly for economic growth and prosperity. Land administration programs in many developing countries are designed to address such property rights insecurity, aiming at strengthening the rights of existing owners through clarification and formalization of individual rights, legislative changes, and/or improvements in conflict resolution mechanisms. Recent spikes in food prices have brought renewed attention to interventions that can increase agricultural productivity, and hence land administration programs might seem an attractive avenue for further investment. Yet while donors and governments have invested in titling and other land administration programs for a relatively long time, rigorous quantitative evidence on the impact of such interventions is rare, in particular for rural areas.

Even more remarkably, the existing evidence is very mixed. The standard theoretical argument is that property rights can affect agricultural productivity through investment, credit and land allocation (Feder and Feeny, 1991; Besley 1995). But empirical evidence on impacts of land administration programs on investment and land allocation is inconclusive, and the existing evidence for credit, if anything, mostly suggests no impact. As a consequence, empirically it is far from clear whether, how, and to what extent such programs can contribute to improving agricultural productivity.

This paper reviews the literature and discusses a number of challenges related to the analysis of the impacts of land administration programs that, we believe, can in part explain the mixed evidence, and the confusing implications that may be derived from them. We focus on a set of conceptual and methodological challenges including : 1) a conceptual challenge related to the need to unbundle property rights and to establish the plausible causal chain for a land administration interventions; 2) the existence of other binding constraints on productivity, implying the need to consider heterogeneities in policy impacts and the complementarity between property rights and other productive interventions; 3) the need to account for spillovers of land interventions on non-targeted households; and 4) methodological challenges related to the causal identification of the impacts of such interventions.

The paper focuses on developing countries where the starting position is one of land administration systems based on the Napoleonic code, with existing individual rights that

may be imperfect and insecure.² Such settings are found mainly in Latin America. While differences between regions have frequently been ignored in the literature, the reasons for insecurity, and hence the starting positions for land administration interventions, often vary substantially. For example, the underlying causes of land rights insecurity can be very different in regions such as Sub-Saharan Africa, where groups often have strong pre-existing rights, and where there might be a complete absence of a systematic land administration system. It is unclear to what extent lessons based on evidence from one institutional setting are relevant in another. That said, when discussing methodological challenges, we also draw on studies from other regions when they provide useful examples.

The paper is organized as follows: section 2 reviews the theoretical and empirical literature on land administration interventions in contexts of developing countries with legal systems based on the Napoleonic code. Since the evidence remains inconclusive, we then focus on a set of challenges that can explain this assessment. Section 3 discusses several conceptual challenges including: a) the need to make explicit the links between interventions and changes in rights, b) the presence of other constraints on the outcomes of interest likely to reflect in heterogeneities in the effects of interventions, and c) spillovers of land interventions on non-beneficiary households and/or areas. In section 4, we then turn to the methodological challenges, discussing several methods to investigate the impact of property rights security and referring to previous studies. We discuss both experimental and non-experimental methods, highlighting the challenge of addressing selection bias and establishing causality. Section 5 concludes.

2 Evidence on the effects of land administration interventions

2.1 Unpacking property rights: which rights are changing ?

The land administration interventions we consider may increase the security of property rights, strengthen existing but imperfect individual rights or possibly give transfer rights. Interventions may attempt to achieve this through institutional strengthening (including decentralization) of the cadastral and registration agencies, systematic regularization of all

² Other surveys have focused on land reforms in different contexts (Lawry et al, 2014; Vendryes 2012).

land parcels in a given area, introduction of digital information technology (IT) for managing cadastral and registry information, cadastral survey and mapping (happening typically at a disaggregate level), and property registration and land titling.

There are several channels through which those interventions can change property rights, since property rights can be imperfect or incomplete in many different ways. Indeed, land rights are made up of a bundle of different rights, including the right to use land, the right to derive income from it, and the right to sell, and each of those rights can be imperfect. In order to understand how land administration interventions may have an impact, it is useful to distinguish how they might affect this bundle of land rights along three different dimensions: i) increased expected security; ii) individualization of land rights; and iii) facilitation of transfer.

2.1.1 Increased expected security

This includes any part of an intervention that makes the land rights less likely to be expropriated or contested, or that reduces the perceived likelihood of such events. Here we use expropriation to mean any transfer without the owner's consent, with two typical forms of such transfer being to squatters/tenants, or someone else at the behest of the government (local or central). Interventions may increase the security of all land rights (e.g. by reducing the potential of conflict), or just of certain plots that were previously contested (e.g. by issuing plot specific documents).

2.1.2 Individualization of land rights

This includes any aspect of an intervention that transfers rights from groups (e.g. families, communes, or the state) to individuals. This individualization may be an individualization of usage rights, income rights or transfer rights. In settings with existing individual rights, the latter two are most common, with individualization likely to take one of three forms: a) individualization of family-owned land, i.e. land in co-ownership after inheritance³, b) individualization of government owned land that is already being used by an individual, and c) individualization of communal or collective land that is already being used by an individual.

³ Note that this is in fact land that was fully individualized in the past (and often may have an individual though outdated title on the name of the ancestor).

2.1.3 Facilitation of consensual ownership transfer

This includes any aspect of an intervention that reduces the transaction costs involved for owners of land to sell their land or control its inheritance.

2.2 Mechanisms and evidence on direct outcomes

The theoretical mechanisms motivating land administration interventions start from a set of assumptions about how changes in the bundle of rights above affect the direct outcomes of households that own the land and communities in which they live. One can distinguish five potential direct outcomes of land administration interventions: Investment, credit, transfers of effective rights, time allocation/labor and migration, and conflict. The empirical literature has focused on the impacts on these direct (intermediate) outcomes hypothesized by the theoretical literature.

Below, we discuss the theoretical assumption and the empirical evidence for each of these five potential direct outcomes. Table 1 displays some of the key theoretical mechanisms through which changes to land rights can impact these outcomes. Table 2 gives an overview of the empirical evidence. While Table 1 separates out the three types of property rights changes indicated above, Table 2 only distinguishes between interventions that either mainly affect property rights security, or all 3 types of right together. We do so because empirical evidence separating impacts on only transfer rights or individualization is very scarce.

2.2.1 Investment

Perhaps the most frequently cited benefit of land administration interventions is that increased security will increase the expected time horizon of land-users and hence increase their investment. A slightly more subtle reason why investment may change is that certain investment activities may directly influence the probability of expropriation. For example, leaving land fallow may increase the expropriation probability, or the planting of trees may reduce the probability. Hence interventions that increase security may reduce the need for these security-enhancing actions (de Meza and Gould, 1992; Sjaastad and Bromley, 1997; Goldstein and Udry, 2008). On the other hand, a potentially negative effect of increasing owners' security on investment is that this may reduce the investment incentives of tenants who were hoping for beneficial expropriation (Banerjee and Ghatak, 2004; Besley and Ghatak, 2010). Individualization may also increase investment by reducing moral hazard

(Alchian and Demsetz, 1972) and the tragedy of the commons (Hardin, 1968) or underutilization that characterizes the one of anticommons (Buchanan and Yoon, 2000). Finally, transfer facilitation may also increase the expected time horizon, and hence investment, if it enables land to be passed on to a designated heir or sold on a market.

Some previous evaluations of land administration interventions have found positive impacts on investment. Deininger and Chamorro (2004), Deininger et al. (2011) and Ali et al. (2011) have found investment alongside households reporting lower perceived risks of expropriation, and the range of investments in these studies suggest it is the greater expected time horizon that is the main channel. Castaneda Dower and Pfutze (2013) on the other hand attribute the greater investment they find to the 'reduction in security enhancing actions' channel, since the main investment they find to increase is leaving land fallow which, prior to the intervention, increased the risk of expropriation. In the same vein, de Janvry et al. (2012) find evidence that titling leads to a reallocation of investments in more productive land. As far as we are aware, no study has identified an impact on investment through individualization or facilitation of transfer. Moreover other studies find no effects of other titling interventions on investments (e.g. Fort et al. 2006).

2.2.2 Credit

Following the work of de Soto (2000) and others, it is hypothesized that interventions that facilitate the transfer of land to financial institutions and subsequent land transactions will increase the ability of landowners to receive credit. But empirically there is little evidence of an effect on credit of land administration interventions. Several studies have tested and rejected the presence of such effects (Deininger and Chamorro, 2004; Field et al. 2006). Possible explanations include the existence of credit rationing in the countries where impact evaluations have been carried out, or risk aversion on the part of landowners (Carter and Olinto 2003; Boucher et al. 2005).

2.2.3 Transfers of land rights

Land administration interventions may impact the frequency and nature of three types of land rights transfers: sales, rentals and non-financial transfers.

a) Sales

Facilitation of rights transfer often focuses on improving the market for ownership rights. This is hoped to increase the transfer of land to owners who have a relative advantage, through exploiting economies of scale or a greater capacity for investment (Besley, 1995; Feder and Feeny, 1991). On the other hand, land may also be transferred to those looking to store value and those who are less risk-averse, which may not necessarily be welfare enhancing (Deininger and Feder, 2001). The frequency of sales may also increase if owners use land as a liquid asset to smooth consumption. Interventions that increase expected security may increase sales since they are likely to increase the security of potential purchasers more than that of existing owners. Most empirical studies do not find an impact of land administration interventions on land sales. An exception is Castaneda Dower and Pfütze (2013), who find an increase in sales as a result of the Procede reform in Mexico. They suggest that this is likely to be due to an increase in demand from outsiders as a result of greater security. Lack of evidence for the 'facilitation of transfer' channel may reflect the lack of studies that look specifically at interventions focusing on this channel.

b) Rentals

Increased ownership security may make owners less fearful of renting out their land, and hence reduce the expected transaction costs of rentals (Conning and Robinson, 2007; Macours et al. 2010). This reduction in transaction costs may also lead to rental contracts of longer duration, with more diverse partners and under different contract types. Indeed, several studies have found a positive relationship between property rights security and land rentals, including Alston et al. (2012), Castaneda Dower and Pfütze (2013), Deininger et al (2008), Macours et al (2010), and Macours (2014).

c) Non-financial transfers

Though land administration interventions are not typically aimed at transfers outside of market processes, this may be a potential impact. In particular, land administration interventions may transfer effective rights within the household, thereby empowering women or giving latter generations enhanced inheritance rights. An unintended consequence may also be the transfer of rights in cases of conflict, where rights may be gained by those that can use the intervention to their advantage. Empirically, Ali et al. (2011) find an increase in married women's land ownership as a result of the intervention, which was one of the programme's objectives. To our knowledge there is no direct evidence that land has been unintentionally redistributed through land administration programs, though this may be because it is not

generally looked for. A piece of indirect evidence is given by Selod et al. (2012), who find that in between knowledge of the intervention and its implementation, land security drops rapidly, suggesting perhaps that many owners fear a resulting redistribution.

d) Time allocation and migration

Greater security of ownership is expected to reduce the need to spend time on the land in question, and hence increase the time household members spend on other activities (Field, 2007). This may include greater labor market participation and, in the extreme, migration away from the land in question. Transfer facilitation may also reduce the time spent by landowners on the land, since owners may be more able to sell or rent out their land rather than work on it themselves. Field (2007) and Moura et al. (2011) find empirical evidence that the land administration interventions they studied did increase labor market supply as a result of increased security. Galiani and Schargrodsy (2010) find related effects on the educational outcomes of children in households receiving titles. De Janvry et al. (2012) find evidence of increased out-migration as a result of a land administration intervention, but they do not distinguish as to whether this migration is of people who still own the land (and hence a result of increased security) or people who have transferred the land (and hence a result of the intervention facilitating transfer).

e) Conflict

Greater security of ownership may reduce conflict over land, since the increased certainty should decrease the payoffs of fighting over land. Indeed, the process of providing greater security, e.g. through rights clarifications, might explicitly include efforts to resolve existing conflicts. Individualization may also reduce conflict amongst groups that previously jointly held rights to a piece of land, since the process clarifies the rights of individuals that may previously have been fought over. However, to the extent that stakeholders expect to see their claims recognized, the announcement of a clarification or individual titling intervention may spark latent conflicts in the short run. Facilitation of transfer may have ambiguous effects even in the long run. On the one hand, a greater set of potential transfers may help to resolve conflicts in ways that were previously not possible. On the other hand, the greater possibility of transfer may increase the returns to conflict for non-owners, as well as allow transfers over which there is discord. Evidence is lacking on those effects though, with the exception of preliminary evidence by Selod et al. (2012) of an increase in insecurity in the short run following a titling intervention in Benin.

Table 1: Categorisation of theoretical work on land administration policies: Mechanisms and Direct Outcomes

	Increased (expected) security	Individualization	Facilitation of transfer
Investment	<p><u>Increases expected time horizon / reduces risk</u></p> <p><i>Reduces security enhancing actions (de Meza and Gould, 1992; Goldstein and Udry 2008; Sjaastad and Bromley, 1997)</i></p> <p><i>Reduced effort of tenant farmers (Banerjee and Ghatak 2004, Besley and Ghatak 2010)</i></p>	<p><u>Removes moral hazard (Alchian and Demsetz, 1972)</u></p> <p><u>Removes `Tragedy of commons` / free-riding - (Hardin, 1968) and under-utilisation of `anti-commons` (Buchanan and Yoon 2000)</u></p> <p><i>Reduces economies of scale</i></p> <p><i>Use of low-risk low-return crops/technology</i></p>	<p><u>Increases expected time horizon / reduces risk</u></p>
Credit	<p><u>Can be used as collateral (de Soto, 2000)</u></p> <p><u>Increase in demand for credit</u></p>		<p><u>Can be used as collateral (de Soto, 2000)</u></p>
Transfer of effective rights	<p><u>Increased leasing out (Conning & Robinson, 2007; Macours et al. 2010)</u></p>		<p><u>Consensual ownership changes to those with relative use advantage (i.e. better information, economies of scale, lower</u></p>

			<u>transaction cost) (Besley, 1995; Feder and Feeny, 1991) or those looking to store value and those less risk-averse (Deininger and Feder, 2001)</u> <u>Used as a liquid asset</u>
Time allocation and migration	<u>Reduction of security enhancing actions (Field 2007)</u>	<i>Contracting problems may encourage self-use</i>	<u>Can be sold / rented out by landowners</u>
Conflict	<u>Reduces potential returns to conflict</u>	<u>Reduces previous ambiguity of rights</u>	<u>Allows for transfer as a conflict resolution device</u> <i>Increases possibility of contested transfer</i>

Notes: Papers are classified according to the aspect of land right considered and the main direct outcomes the paper analyses. Impacts that are 'positive' (i.e. roughly equivalent to welfare enhancing) are underlined, and impacts that are negative are italicized.

2.3 Evidence on the impacts on final outcomes

Whilst the above impacts are those that are most likely to result directly from land administration programs, they are not normally the ultimate objective of such interventions. Typically, it is hoped that positive impacts on the above direct variables will lead to improved final outcomes for farms and households, but also for broader communities (municipalities or higher level). The related empirical evidence is also summarized in Table 2.

2.3.1 Agricultural productivity: yields, technical and allocative efficiency

Productivity gains may result from the increased investment as well as from the transfer of land rights to other parties. For example, an increase in land ownership by those less risk-averse may result in more crops with 'high-risk, high-return' profiles. At the same time, there is some risk that agricultural productivity may decline – for example, if land is transferred to owners who are using it mainly as a store of value, or if individualization increases the risk aversion of farmers. The evidence on the effects of titling and other land administration interventions on agricultural productivity and household welfare in the long run is scarce. Field and Torero (2006) consider a major titling program in Peru (PETT) and interpret the empirical results as effects on the type of production, with more land allocated to cash crops, but no effects on other agricultural investments, access to credit or land transactions leaving risk aversion potentially at play.

2.3.2 Household consumption, income levels and stability, and food security

For land rights holders, the largest impact on household consumption levels will probably come about through changes in agricultural productivity. Note however, that non-farm income may also be affected, particularly if there are effects on labor use, resulting for instance from new investments on land and changes in used agricultural technologies. In the short-term, any observed increase in investment may come about through decreased consumption if households are credit constrained. In terms of consumption stability, greater access to credit and the ability to use land as a liquid asset may improve stability. Income fluctuations may, on the other hand, be greater if the intervention results in the adoption of riskier technologies and crops. Individualization of land may also reduce

risk-sharing amongst the group. Finally, changes in land rights may alter the proportion of income received by various members within the household, such that it may be interesting to measure intrahousehold income allocation. At a household level, the impact of land administration interventions on food security is likely to be closely linked to the impacts on income and consumption. At a more aggregate level, total production of food is likely to follow changes in agricultural productivity. An important exception however may be in the case where land is moved away from food crops (for example, due to lower risk aversion). However, here again, the evidence is very thin. Field and Torero (2006) find no statistically significant effects on total household expenditure.

2.3.3 Land values and asset ownership

Increases in owners' rights towards land should increase its value, whilst increases in renters' rights may have the opposite effect. If the intervention means that land can now be used as a liquid asset, this may change households' overall asset portfolio. For example, ownership of land may increase while the ownership of other liquid assets decreases. We are not aware of empirical evidence on those effects.

2.3.4 Political support, increased tax base, and land use planning

Beyond the household-level impacts, there a number of important municipal and higher-level policy impacts that may result from land administrative programs. First, land reforms may have a significant impact on political preferences (Castaneda Dower and Pfutze, 2012; de Janvry et al., 2013). Possible mechanisms may include lower dependence on local elites, support for the party that led the intervention or a greater participation in the market economy. Second, a more accurate and detailed cadastral and registry system will increase the ability of a government to tax land. Moreover, citizens may be more supportive in paying such a tax if they believe that the government is supporting their land rights. Third, land planning provides a number of important benefits, and is likely to be facilitated by clearer land rights. One example is the provision of infrastructure, for which provision to insecure plots can be problematic. While this mechanism may be more important in urban areas, it may also apply to a certain extent in rural areas in cases such as the provision of irrigation schemes.

2.3.5 Natural resource protection

Though not typically considered as investment, similar mechanisms to those outlined above will work for non-depletion of existing assets. However, there may be a concern that individualization of land will disrupt existing mechanisms to preserve natural resources that are common to the group. Moreover, increasing use of inputs such as fertilizers may have the side-product of increasing the pollution of water resources. Again we could not find empirical evidence on those.

Overall, the empirical evidence on the potential benefits from titling and other land administration programs thus remains inconclusive. In particular, considering the main intermediary mechanisms posited there is mixed evidence of effects on investments and land allocation and, if anything, zero impacts found on credit. Moreover, the evidence is mostly lacking on agricultural productivity, and long-run outcomes such as household consumption and food security, land values, or natural resource protection.

Table 2: Categorization of impacts on intermediate outcomes in empirical work on land administration interventions/land titles in Latin America

	Increased security	A combination of channels : security +individualization + transfer rights
Investment (in physical capital)	<p><u>Reduction in security enhancing actions => increase in fallowing and land planted with perennials (Castaneda Dower and Pfutze, 2013)</u> [Non-land investment not affected => no increased in current cultivation practices (Castaneda Dower and Pfutze, 2013)]</p> <p><u>Change in the relative returns to housing investment => improved housing quality (Galiani and Schargrotsky 2010)</u></p> <p><u>Spillovers (= learning from others + scale economies for credit institutions) => increased land-attached investments in areas with high titling density (Fort et al. 2006)</u> [Individual titles have no effect on investment (Fort et al. 2006)]</p> <p><u>Equality of moveable and land-attached investment returns rejected => moving closer to balanced investment portfolio => increase in land-related investment (Deininger and</u></p>	<p><u>Increased time horizon => export oriented-crops (Field et al. 2006)</u> [No effect on other agricultural investments (Field et al. 2006)]</p> <p><u>End of “use it or lose it” rule => increased (Reduced) farmland in high- (low-) productivity areas (de Janvry et al. 2012)</u></p> <p><u>Longer contract durations => increased time horizon => Tenants less likely to grow tree crops than owners; (Bandiera 2007)</u> [Moral hazard => type of tenancy contract not correlated with tree cultivation (Bandiera 2007)]</p>

	<u>Chamorro 2004, Deininger et al. 2011)</u>	
Credit	<p><u>Increase in mortgaging but only for subsamples (Galiani and Schargrodsky 2010)</u></p> <p>[Importance of land as insurance? => no increase in access to credit; small increase in mortgaging probability (Galiani and Schargrodsky 2010)]</p> <p><u>Operational costs of providing loans => Positive relationship between opening of local bank and titling density (Fort et al. 2006)</u></p> <p>[Investment not working through a “credit-market effect” (Deininger and Chamorro 2004)]</p>	<p>[Possibility to put up land as collateral (Field et al. 2006)]</p> <p>[Non-price rationing => No impact on formal credit market participation, except for land-rich households; <i>impact even negative for poorest 40% in Honduras</i> (Boucher et al. 2005)]</p>
Transfer of effective rights	<p><u>Increased leasing out (Alston et al. 2012, Castaneda Dower and Pfitze, 2013; Deininger et al, 2008; Macours et al 2010, Macours, 2014)</u></p> <p><u>Non-transferable rights creating transfer uncertainty => Titling should increase both sales and rentals markets (Lanjouw and Levy 2002)</u></p>	<p><u>Ability to buy and sell land => enhanced price responsiveness => Export oriented-crops (Field et al. 2006)</u></p> <p>[Land transactions (Field et al. 2006)]</p> <p>[History of land reforms? => Increase in land market participation but very low level => Distribution of land operated almost unaffected (Boucher et al.</p>

		2005)]
Migration, time allocation and investment in human capital	<p><u>Reduction in security enhancing actions => Increase in total household labor supply; reduction in probability to run business from home; reduction in child labor (Field, 2007)</u></p> <p><u>Increase in secondary and tertiary education (Galiani and Schargrotsky 2010)</u></p> <p><u>Reduction in security enhancing action => Increase in total household labor supply, significant only around and below the median (Moura et al., 2011)</u></p>	<p><u>End of “use it or lose it” rule => Increased out-migration (de Janvry et al 2012) – could be facilitation of sale or reduction in security enhancing actions</u></p>
Increased land / dwelling value	<p><u>High and significant titling premium; but insufficient to cover inheritance and other transaction fees (Galiani and Schargrotsky 2001)</u></p> <p><u>Transfer uncertainty => Important titling premium, however dampened by strong non-transferable informal rights (Lanjouw and Levy 2002)</u></p> <p><u>Increase in self-assessed land price (Deininger and Chamorro 2004)</u></p>	<p>[Value of dwelling (Field et al. 2006)]</p>

Agricultural productivity / Income / consumption / expenditure	<u>Reallocation of land to cash crops</u> [but no effects on other investments and household expenditure] (Field and Torero 2006) [No increase in household income, and household head income and employment status (Galiani and Schargrotsky 2010)]	[Household total expenditure (Field et al. 2006)]
Politics and conflict	<u>End of vote suppression through expropriation => Increased total electoral participation and votes for opposition</u> (Castaneda Dower and Pfutze, 2012) <u>Electoral gratefulness for incumbent party</u> (Castaneda Dower and Pfutze, 2012; mechanism unclear)	<u>Investor-class and vested interest theories => Increased vote share of pro-market party</u> (de Janvry et al. 2013) [Theory of distributive politics => No “gratefulness effect” benefiting the incumbent (de Janvry et al. 2013)]
Natural resources	(?)	
Gender	[No effect on female labor supply (Field, 2007)] <u>Weak informal rights => Female-headed households cannot rent out without ownership title but can easily sell, larger effect of titling on property value</u> (Lanjouw and Levy 2002)	

Notes: Papers are classified according to the aspect of land right considered and the main outcomes the paper analyses. The potential links between mechanisms and measurable impacts that have been identified by theory. Impacts that are ‘positive’ (i.e. roughly equivalent to welfare enhancing) are underlined, and impacts that are negative are italicized. Characters in square brackets mean insignificant results, and simple characters without brackets indicate results that have indeterminate or unclear effects on welfare).

3 Impact evaluations and conceptual challenges

The lack of conclusive evidence suggests that new approaches are required for better re-examining this assessment and obtaining more conclusive evidence on the effects of land administration interventions. Those should address two sets of challenges.

A first set of challenges to be overcome, before the methodological ones discussed in the next section, are raised by the conceptual analysis of the effects of land administration interventions. This analysis poses several difficulties related to: a) the links between interventions and changes in rights, b) heterogeneity in impacts notably due to other constraints on the outcomes of interest, and c) spillovers of land interventions on non-beneficiary households and/or areas.

3.1 Unpacking property rights: what are we evaluating?

A first conceptual challenge is that property rights have several dimensions that can all (under certain conditions) be affected by a particular land administration intervention. Establishing the links between an intervention and the theoretical arguments on expected impacts, and deriving hypotheses related to the outcomes that can be expected to change and those that are unlikely to be affected, is key to gather meaningful evidence.

In order to understand how land administration interventions may have an impact, it is useful to distinguish how they might affect the bundle of land rights along the three different dimensions discussed above: i) increased expected security; ii) individualization of land rights; and iii) facilitation of transfer. Some land administration interventions may only have impact through one of these channels. For instance, an increase in the capacity of the department responsible for land transfers may simply facilitate ownership transfer without increasing its security or individualizing any group held rights. However, in practice, land administration projects can often change the nature of the property rights in several ways simultaneously. For example, land titling could potentially operate through all three channels: security may be enhanced if titles increase the enforcement of existing individual or group rights; rights could become more individual if the previous *de facto*

arrangement was to treat the rights as belonging to a group (e.g. the family); and transfers may be facilitated if these are allowed by law but were previously prevented due to uncertainty. Which channels a particular project or policy works through will be determined by the specific components of the intervention, but also to a large extent by the country context.

Table 3 below gives a potential mapping of the intervention types described above to the channels they are likely to work through. In each cell, we describe part of the necessary conditions for a particular type of intervention to act through each of the three channels identified above. The channels that operate will be very dependent on the exact nature of the intervention and the context in which it operates. A key first step in evaluating the impact of an intervention is therefore to identify the conditions under which each channel may operate. This will help focusing on the intermediate and final outcomes likely to be affected and identifying heterogeneity that could be useful to exploit in understanding the intervention’s impact.

Table 3: Mapping of land administration interventions to possible channels

	Increased expected security	Individualization of land rights	Facilitation of consensual ownership transfer
Legal and policy changes	Possibly, for instance changes facilitating ownership registration or verification, or changes reducing expropriation risk.	Possibly, for instance changes granting individual use rights on communal land.	Possibly, for instance granting of rights to rent and/or sell plots of land for which only use rights were previously held.
Institutional strengthening (including IT)	If previous institutional weakness led to lack of enforcement. Even then, effect is likely to be slow unless accompanied by	If previous weaknesses led (in some cases) to use of group rights, and strengthened institutions enforce individual rights.	If strengthened institution allows such transfers, and either (a) formal registration of transfers is easier, or (b) relative

	information campaigns.		enforcement of land that's changed ownership is stronger
Systematic regularization	Yes	If 'irregular' system involved use of group rights If transfer of regularized land is permitted and relatively cheap / easy	If transfer of regularized land is permitted
Introduction of digital information technology (IT) for managing cadastral and registry information	Yes, on longer term by keeping cadastral information updated	No	Yes, by facilitating updating of cadastral information reflecting transfer
Cadastral survey and mapping	Possibly, if mapping strengthens existing informal rights	No, unless through sub-division of land in family co-ownership	Possibly, if mapping strengthens existing informal rights
Land-titling	Yes	Only if previous system involved use of group rights	If transfer of titles is permitted and relatively cheap / easy
Registration	If formal enforcement mechanisms are stronger than informal ones	If formal enforcement mechanisms are stronger than informal ones, and informal mechanisms enforce group rights more than formal ones	If transfer of registration is permitted and relatively cheap / easy, and formal enforcement mechanisms are effective

Notes: Potential for specific land administration interventions (listed in rows) to affect different dimensions of property rights (listed in columns), and conditions under which such effects likely occur.

Furthermore, economic theory has worked mostly on the question “what is the impact of a change in land rights?” and typically ignored the question “how do land administration

interventions affect land rights?” This absence is notable given that experience suggests a simple change in the law is neither necessary nor sufficient to change effective rights. An exception is Castañeda Dower and Pfütze (2012), who model how certification may enable a community to coordinate on enforcing a regime with different expropriation rules, and hence increase expected security. Perhaps partly resulting from this theoretical absence, studies rarely explore how a particular intervention changes land rights.

For instance, while most empirical papers study interventions which are intended to increase expected security, there are a number of ways in which a given intervention may do so. Possible mechanisms include:

- (i) Providing information to land users on their existing rights
- (ii) Reducing the cost and/or increasing the expected probability of success in invoking central government enforcement in the case of future conflict (i.e. the courts)
- (iii) Coordinating local enforcement mechanisms
- (iv) Reducing the expectation of future land reform and/or government expropriation

Establishing which of these mechanisms is at work is important to derive policy implications from studies of land administration interventions.

3.2 Heterogeneity of impacts and complementarities with other interventions

A second conceptual challenge stems from heterogeneities in the effects of interventions. The theoretical assumptions discussed in section 2 describe a range of possible impacts of land administration interventions. However, the empirical literature has shown that each of these impacts is not necessarily consistently found across interventions, even when carefully distinguishing how property rights are affected. This points to the fact that the standard models make a range of assumptions about the context from which the hypotheses on the link between land rights and outcomes are derived. Yet the assumptions are not necessarily relevant for all contexts. For instance, credit rationing may prevent both the increase in credit and the increase in investment predicted. Once such assumptions are relaxed in the theoretical models, they point to clear and rather

intuitive predictions on the potential for heterogeneous impacts along a variety of dimensions.

In order to address these concerns and shed light on the relevance of context, empirical studies should explore heterogeneity in impacts across beneficiaries of a project, as a given land administration intervention is likely to have impacts that vary across plots and households. For example, Ali et al. (2011) find that the impact of the intervention they study is greater for female-headed households, whose previous land rights were likely to be the most insecure. Even if the change in rights is uniform across plots and households, there may be variation in impacts due to the necessary conditions for the mechanism to operate. For instance, Carter and Olinto (2003) show that the total investment impact will be greater for wealthier individuals in the presence of credit constraints. Exploiting such heterogeneity can give insights into the mechanism at work.

In some cases, the presence of other binding constraints may even suggest the potential need to complement land administration interventions with other complementary interventions. For instance, in certain contexts, the potential for land administration projects to affect productivity might be limited by lack of access to new technologies or credit. When such complementary interventions can become incorporated in the overall project, or even when they are envisioned to occur in the same region and target population, evaluations can try to shed light on the possible complementarity of these interventions. While this can be very promising, further methodological challenges arise from the need to establish causal inferences regarding both the land administration and these complementary interventions, which we address in section 4.5.

3.3 Spillover effects

The discussion so far has focused on the impact of land administration interventions on households and areas targeted by the intervention. In addition to these direct effects, however, there are also likely to be spillover effects in areas not subject to the intervention. These spillover effects, a third conceptual challenge, are important to consider for two major reasons. First, the spillover effects may be of intrinsic interest.

Second and methodologically, if the spillover effects impact upon a group that is considered as a 'control' - and hence is implicitly assumed not to have been impacted by the program - this may complicate attempts to measure the impact of the intervention on those targeted.

In the case of land administration interventions, there are several possibilities for spillover effects. One group of such effects is likely to be the result of anticipation amongst households not targeted. Since land administration interventions are generally sanctioned by the national government, it is very reasonable for non-targeted households to believe that they will be targeted in the near future. This belief is of particular concern for evaluating land administration interventions due to the importance of *expected* security in the mechanisms outlined above. An intervention such as land-titling may, for example, increase expected security even amongst non-titled households if they believe that in the near-future they will receive such a title. On the other hand, for certain households, expected security may decrease if they believe that there is a high probability someone else may receive the title. The two other channels discussed above - individualization and facilitation of transfers - may also potentially suffer from anticipation effects. If it is believed that an individual rather than a group will soon hold rights over a plot, group members behavior is likely to change in a variety of ways. Meanwhile, if it is believed that transfers will soon be facilitated, this may temporarily reduce land transfers, or households may change the way they use the land if they anticipate a future sale.

Another set of spillovers that may occur are those that result from the relationship between land markets across both targeted and non-targeted areas. If the intervention increases the probability of land being leased, those that lease the land may come from outside the targeted area. An increase in the value of land that benefited from the intervention may result in a decrease in the value of non-targeted land. Migration and labor supply decisions may also lead to spillover effects if they are large enough. This set of spillovers should be noted in particular when measuring the impact of interventions on

land transactions, since such transactions can easily involve households from outside of the treatment group.

4 Methodological challenges

Besides the conceptual challenges discussed above, another possible reason for the mixed evidence on the effects of land administration interventions is the large number of empirical studies that are likely to suffer from severe endogeneity bias.

Indeed much of the empirical evidence is based on associational-based evidence from observational studies. These tend to investigate the correlations at a given point in time between the distribution of land rights and individual outcomes. In such observational studies, interpreting the relationship between land rights and outcomes as the causal effect of a specific policy change relies on strong assumptions, as many unobserved confounding factors could drive the observed correlations. For instance, landowners with formal titles usually differ in many ways from those without such documents, so that attributing their different behaviors and outcomes to their land ownership status is simply not credible.

Selectivity into treatment is the main methodological challenge to be addressed. Because land tenure interventions tend to affect the rights of specific sub-groups of individuals, e.g. those with initially more insecure tenure or farmers in regions with a higher agricultural potential, the potential outcomes of beneficiaries with or without the intervention are likely to differ. Simple comparisons of the outcomes of beneficiaries with those of non-beneficiaries are thus unlikely to produce unbiased estimates of the intervention's impacts.

Rigorous evidence can only be produced if the evaluation data was collected in ways that carefully account for the allocation of treatment and allow identifying a comparison group that provides a valid counterfactual for the outcome of program participants in the absence of the intervention. If, in some favorable instances, natural experiments can

provide robust evidence, prospective impact evaluations of interventions are the most promising way for obtaining a valid comparison group, and thus credible estimates of the impacts of land interventions. Such evaluations may also allow isolating the impacts of specific changes in rights or examining complementarities that accrue when removing several different constraints.

A prospective impact evaluation can be done by using experimental (i.e. randomized assignments) or non-experimental methods. Experimental methods require fewer assumptions and often provide a clean causal interpretation, but can be challenging to implement. For non-experimental methods, more assumptions will need to be made, and hence evaluations will require careful checking and the provision of evidence in support of the validity of these assumptions. Below, we discuss the main options for impact evaluations, natural experiments, and ways to account for heterogeneities and spillovers. We refer to previous empirical studies and try to derive recommendations for future ones.

4.1 Identification based on randomized assignment

The most rigorous, and in some senses the most straightforward, way to assure that one can identify the causal impact of a land administration intervention is to assign the intervention randomly among a large group of villages or individuals that is eligible for the intervention. By making sure that assignment to the treatment group is independent from potential outcomes, randomized controlled trials (RCT) provide an adequate comparison group to the group of beneficiaries, i.e. a group from which one can learn about the potential outcomes of beneficiaries had they not been treated. In general, RCTs therefore provide the most reliable evidence on the causal effects of interventions. The general advantages of RCTs have been discussed in much detail elsewhere (e.g. Duflo, Glennerster and Kremer, 2008) and certainly hold for the case of land administration interventions.

However, given the sensitivity of land rights in many contexts, political will is key to implementing a rigorous RCT of a land rights intervention. Moreover, the use of RCTs

for such evaluations raises several issues regarding implementation modalities and statistical power, internal validity issues, and external validity considerations.

First consider implementation aspects. There are several ways to implement RCTs, and notably different possible units of randomization, and those have bearings for both the measurement of impacts and the operations. On the one hand, because land interventions, in particular those that seek to clarify rights, involve activities that are performed at the level of communities (such as information campaigns, surveying, conflict resolution), and because the externalities they generate between neighbors are likely to be strong (due for instance to changes in local land conflicts, anticipation of future eligibility, or land markets equilibrium), randomization generally must be conducted at the level of some sort of geographic cluster (which could be localities or communes). On the other hand, to ensure the balance of characteristics between the two treatment groups and achieve a given statistical power, randomization needs to be performed at the level of sufficiently numerous (and thus small) areas. Thus, for land interventions with clarification activities, a design that accounts for both local externalities and statistical power may need to consist of several hundreds of geographic clusters.

However, such RCTs may imply considerable constraints on operations. In most cases, it may seem difficult to implement a land intervention in dispersed small geographical clusters and not in other neighboring clusters. The typical solution is therefore to implement the RCT through the context of a staggered phase-in where control clusters would be incorporated in a second phase. Operations would then have to be adjusted to accommodate the RCT. In particular, the surveying and clarification operations that involve a pre-cadastral sweep of covered clusters have to be adapted to involve at least two sweeps. That will be easier to do when the program administration is centralized so that the schedule of phase-in is controlled.

We are aware of only two RCTs having been implemented for evaluating the impacts of a land tenure intervention. The first is an ongoing evaluation of a pilot land surveying and certification program (“Plans Fonciers Ruraux”) implemented by the government of

Benin with support from the MCC. A preliminary impact evaluation was conducted by Selod et al. (2012). The randomization was conducted at the village level within each commune (the control group should benefit from the program when it will be scaled-up nationally). Also in an African country, but now in an urban setting, Ali, Collin, Deininger, Dercon, Sandefur and Zeitlin (2011) have implemented a RCT for evaluating the variation of a titling component of a tenure securization program. The RCT was run in two urban slums in Dar es Salaam, Tanzania, and consisted of providing access to formal land titles to informal settlers at randomized prices. The randomization into the treatment group was conducted at the level of ‘blocks’ (contiguous groups of approximately 40 parcels).

The second set of issues to take into account relates to internal validity. Because some of the program components and effects are likely to affect behaviors of households and farmers whatever the cluster they live in, it is important to be able to distinguish the direct effects of the surveying and/or formalization of the plots owned by individuals in the treatment group from broader program and spillovers effects. Broader program effects are likely to occur in particular if public awareness and information campaigns on the importance of secure lands rights and responsibilities of land owners and occupants that precede the pre-cadastral sweep will cover the entire pilot communes. As little evidence is available on those, disentangling direct effects from indirect and/or spillover effects would be of interest (more on this below).

The third set of considerations relate to the external validity of RCTs. The specificities of the areas selected for the evaluation might limit the external validity of the results, as applies to any evaluation of a small-scale program. A concern more specific to RCTs is the length of the experiment: the effects of land interventions can take time to appear, so that it is important to observe the outcomes of the treatment and control groups after a sufficiently long period of time. A staggered phase-in might put limits on the time before the control clusters are incorporated, while two to three years, depending on the context, seems a minimum to observe impacts on some investments (e.g. land improvements or tree planting) or income (e.g. perennial cultivations).

Fourth, unexpected political developments might complicate and possibly endanger compliance with the experimental design. Given the political sensitive nature of land rights, it might be hard in the first place to convince government counterparts to agree on a randomized allocation. Moreover, once the intervention has started, local pressures might increase and demands by households in the control areas possibly could mean that the experimental control group also receives land rights, leading to contamination of the experimental design. On the other hand delays, logistical, administrative or political problems could imply that part of the treatment group does not receive the land rights in time. To avoid such complications, researchers conducting an evaluation will need strong buy-in from the implementation partners.

In case there are program components that in theory could affect the whole population, but in practice might have limited impact without additional complementary interventions, the randomized addition of such complementary interventions can help to evaluate their impact. For example, it would be possible to randomize information about a certain legislative change that increases tenure security to analyze the impact of increased security. Similarly, it would be possible to randomize subsidies for a titling program that implies cost for individual households in such a way that increases (randomly) demand by households for such titles, thereby allowing an evaluation of the impact of titles. The evaluation in Tanzania referred to above uses such a design. Such evaluation designs are referred to as encouragement designs. While they allow establishing causality, they only show impacts for the population of people that change behavior because of the encouragement, and hence only allow estimating a local average treatment effect. In addition, they may have low statistical power, as take-up among the “encouraged” population might be low. As such, they are not a first best strategy, but they should be considered as a possible option for components or interventions that because of their large scale or reach do not allow identifying another plausible counterfactual.

4.2 Non-experimental prospective approaches

a) Regression Discontinuity Design

In many cases, a second-best approach for obtaining credible estimates of impacts of titling interventions would be based on a regression discontinuity (RD) design (Lee and Lemieux 2010).

The RD design can be applied for obtaining estimates of the impacts of land administration programs in several ways, depending on program implementation. For example, the targeting of land interventions might rest on some explicit criteria that are effectively enforced and generate a discontinuity in treatment assignment that does not correspond to any substantial differences between the two groups. For instance, some titling program might target smallholders cultivating parcels of a size below a given threshold, so that farmers with slightly larger parcels are excluded. In designing prospective impact evaluations, it is hence important to understand how the program will be targeted, based on which data eligibility will be determined, and whether there exist an eligibility rule for which such a threshold can be found. Indeed, prior to finalizing the program design, it can be helpful to introduce such thresholds specifically for the evaluation, for instance in making intended targeting rules more precise and in assuring that data will be systematically collected to apply those targeting rules.

One application includes land surveying and titling interventions that are implemented at a small scale during a pilot phase covering areas delimited by precise borders, such as a few communes or municipalities. One can then compare the outcomes of individuals owning or exploiting parcels lying on the two sides of the borders. This approach was followed by Ali, Deininger and Goldstein (2011) to estimate the impacts of a pilot land titling program in Rwanda. One concern with this type of discontinuity is that the borders of the selected pilot areas could correspond to specific geographical barriers (river or mountain range) that could be associated with changes in some determinants of agricultural production (such as climatic or soil conditions).

Another potential application of RD can be when legal rules might generate thresholds determining which, and in what ways, different parcels or individuals are affected by the

intervention. Vranken et al (2011) thus consider the effects of the restitution of land to former owners and their heirs at liquidation of former communist cooperatives and state farms in the early 1990s in Bulgaria. They exploit the discontinuity generated by a law preventing excessive land fragmentation, which had plots below a given size (0.3 acres) remain undivided in co-ownership among the different heirs.

A limitation of RD design estimates is their limited external validity. Indeed the effects of assignment to the intervention are estimated only locally around the threshold, i.e. for individuals that may have specific characteristics and do not compare well to other potential beneficiaries. For instance, estimates exploiting a geographical threshold would inform on the impact of an intervention for individuals with parcels of land near the border. One can then document the extent to which those groups look similar or differ from other potential beneficiaries.

b) Difference in difference evaluations

The main alternative non-experimental method consists in using comparison groups of non-beneficiaries who have similar (or sufficiently close) observable characteristics to the ones of beneficiaries of the land rights intervention. The program impacts are then obtained using regression or matching estimation econometric techniques. As these evaluations rest on more assumptions, which by definition cannot be tested, they provide much less credible estimates of the intervention impacts. For assessing the validity of the comparison group and improving the quality of the estimates, it is critical to use both pre- and post-intervention data. Hence this type of evaluation, and the associated data collection, also has to be planned before the intervention.

A difference-in-difference (DiD) scheme, possibly combined with matching, is feasible when an intervention is phased-in sequentially and the impact evaluation is planned sufficiently in advance, so that baseline data can be collected among some program participants before they benefit from the intervention. However, these evaluations require surveying large samples (see below), and ideally include data from multiple survey rounds, and may therefore be costly.

In a DiD setting, the key assumption is one of common trends, so that any unobserved factors that affect changes in outcomes would affect in the same ways the changes in outcomes of treatment and control individuals. This assumption, which is related to the one of unconfoundedness used in simple regression or matching models, is not testable. Any unobserved heterogeneity that is not time invariant would lead to different trends and hence bias the results. For instance, suppose that land titles have been delivered first in poorer areas and that some catching-up would be taking place independently of the intervention. In this case, farmers' productivity and income would increase faster in those areas, and this would bias the estimates of the effects of titling. Variations in climatic conditions could similarly drive differences in trends. Moreover, identifying potential beneficiaries at baseline in control areas will be key to control for individual selection into treatment, which represents a challenge as soon as the treatment depends on beneficiaries' characteristics and potential outcomes. Matching estimates can increase the plausibility of the common trend assumption when the probability of benefiting from an intervention differs a lot across the treatment and comparison group (i.e. overlap is imperfect). However, the comparison group will be likely poorer when it is drawn in geographical areas that are more remote from the treatment areas, or in different administrative divisions, and in this case it will be more likely that confounding factors drive some different trends in the two groups.

Several non-experimental studies of the effects of titling interventions have relied on DiD estimates. Field, Field and Torrero (2006) for instance investigate the effects of the Special Rural Cadastre and Land Titling (PETT) program, which was implemented in Peru starting in 1993 and consisted in a complete securization process with surveying and titling of parcels and establishment of a cadastre in rural areas. Zegarra et al (2007) combine matching with DiD estimates for the same program. And de Janvry, et al. (2012) examine the effects on migration of Procede, a large-scale land certification program implemented in Mexico from 1993 to 2006.

The identification assumption is not testable, but its plausibility can and should be assessed. One approach for this consists of testing for the presence of pre-intervention trends (similar to a pseudo-outcome) when data is available for several points in time prior to treatment (e.g. de Janvry et al, 2012, 2013). Another approach (similar to a pseudo-treatment) consists of testing for differences in outcome changes across different sub-groups of control individuals, e.g. two groups of areas that will be covered by a land titling intervention at two different future dates.

4.3 (Non-prospective) natural experiments

A last type of evaluations, which consist of exploiting sources of arbitrariness in the allocation of treatment, can be performed in some favorable settings. In certain cases, whether some individuals are treated by a policy intervention depends on some exogenous factors that are independent from the potential benefits and costs treatment would incur for them. For instance, in the case of land titling programs, some arbitrary rules in program administration might determine which areas are treated first and which ones only later without an explicit targeting based on observable characteristics and related to potential outcomes. Castaneda Dower and Pfutze (2013) thus argue that, for the Mexican certification program *Procede*, the timing of the first contact made by program staff with *Ejidors* was determined without an explicit targeting strategy, but mainly depending on distance to the state capital where the staff were based (which they assume is not associated with potential outcomes of program beneficiaries). In other instances, whether the program is actually implemented or not depends on factors that are independent from individuals' choices and outcomes. Galiani and Schargrodsky (2010) study the case of squatters who occupied from 1981 urban land that they partitioned into small parcels; while the squatters believed the land belonged to the state, it was actually private property of 13 landowners. In 1984-1986, the Congress of the Province of Buenos Aires passed a law to expropriate these parcels and allocate them to the squatters with a monetary compensation to the former owners, but, while 8 owners immediately accepted the expropriation and associated compensation, the other 5 contested the decision in courts. As a result, some squatters obtained formal land titles in 1991 while others had to wait until the dispute was settled in 1998. Other historical accidents, such as political

changes affecting the content and implementation of interventions, might provide similar conditions for “natural experiments” whereby some exogenous factors influence the allocation into treatment.

Natural experiments allow the identification of the causal effects of interventions for subpopulations that have their treatment status modified by the exogenous factor. While these subgroups are not necessarily the most interesting, they can nevertheless provide internal valid evidence on the local effects of some land administration interventions.

4.4 Measuring and controlling for spillover effects

While the evidence remains limited, measuring and controlling for spillover effects should be an important part of evaluating the impact of any land administration intervention, and the data collection strategy must account for this. One way of doing so is to consider heterogeneity amongst the control group, particularly spatial heterogeneity if it is believed that those closer to the targeted areas are more likely to feel spillover effects. In practice, a smart design that combines two control groups, with and without exposure to externalities, can allow both to identify an intervention’s impact and to detect externalities. Anticipation effects may also be measured by having one control group that knows it will be treated in future, and another one that does not. The optimal way to ensure such heterogeneity may be through using a two-stage randomized control trial. In this case, the evaluators first randomly select geographical areas to be benefited by the intervention (in which the spillovers are more likely to take place) and then within these areas they pick individuals or smaller areas that will benefit directly from the program.

4.5 Complementarity with other interventions

Heterogeneity analysis can be done by estimating impacts for specific subgroups (e.g. large versus small farmers). Yet the identification concerns are equally relevant for heterogeneity analysis. In order to rigorously explore heterogeneity, potentially interesting variables should thus be identified prior to sampling and the sample stratified on those variables, e.g. if we are interested in the differential impact of titling on female owners, the sampling frame should purposely include enough female owners.

When heterogeneity of impacts is expected to depend on interactions with other interventions, impact evaluations can go one step further and specifically analyze the complementarity between interventions, by defining strategies to identify the causal impact of each of the interventions and of the interactions. For instance, if the impact of titling on credit uptake is expected to depend on the availability of credit, a simultaneous evaluation of a titling and a credit intervention would be needed, designed in a way that allows separating their effects and consider their complementarity. When evaluations are designed prospectively, and especially when randomized allocation is an option, two interventions could notably be randomized orthogonally on each other.⁴

5 Conclusions

We have reviewed studies of the effects of land administration interventions on agricultural productivity, household welfare and local development. While theoretical models have produced strong predictions on the effects of titling and related interventions, the empirical evidence of those effects remains mixed. More empirical studies and innovative approaches are thus required to obtain more conclusive evidence on the effects of those interventions.

This paper discussed a number of challenges to be addressed by those studies. We first focused on a set of conceptual challenges to be overcome when analyzing of the effects of land administration interventions. One such challenge relates to the need to unbundle property rights that encompass several dimensions, including the level of security they provide, whether they are individual, and their transferability. A key first stage will be asking how the interventions of interest, and its specific components, may change effective land rights and, based on theoretical models, how the changes in land rights lead to changes in intermediate and final outcomes. Identifying the conditions under which each channel may operate will help the data collection be tailored to the potential

⁴ Gignoux, Macours and Wren-Lewis (2013) describe a possible example.

mechanisms at work. Then, to understand which components of an intervention have the largest effects, and what are the mechanisms at work, it is also important to collect data on intermediate outcomes, such as conflicts and perceived security, agricultural practices and other labor activities, investments, financial and land transactions. In addition, evaluation designs should plan for explaining the non-results as well as the potential positive results. This is particularly relevant for land administration programs, for which the available empirical suggests that expected impacts seem often lower than what would be theoretically expected.

We then insisted on the existence of other binding constraints on productivity, implying the need to consider heterogeneities (across space or households) in the effects of interventions, and the complementarity between property rights and other productive interventions. Methodologically, RCTs allow examining heterogeneities and evaluating (notably through orthogonal randomizations) the separate impacts and complementarities of different interventions, e.g. property rights and agricultural development interventions (such as subsidies, access to credit or extension).

Spillovers also constitute a conceptual challenge. They can occur when non-targeted households believe they will be treated in the future or through the equilibrium of land (or other, e.g. labor) markets. While the existing evidence is limited, empirical studies should plan to document these effects, notably through designs that allow their identification, e.g. by controlling for information release of the local density of treatment.

We then discussed the methodological challenges related to the causal identification of the impacts of such interventions, and suggested several ways for addressing those. Smart designs combining several methods might be needed to obtain rigorous estimates of both short and long-term results, and both are key for good evaluations of land titling programs. RCTs bring strong internal validity, and can be complemented with non-experimental control groups for evaluating long-term impacts. This will also allow testing for the presence of possible spillovers and side-effects (e.g. information campaigns) of

interventions. Studies based on a RD design and natural experiments can also in some favorable cases provide rigorous evidence.

High quality monitoring and administrative data are also necessary inputs for good impact evaluations, as it will allow documenting what exactly happened in terms of the implementation of the interventions on the ground. In addition, qualitative data evaluations designed to be complementary to the quantitative evaluations can allow answering how the intervention affected expected outcomes. Given the complexities in the causal chain related to land titling programs (where latent conflicts and perceptions of tenure insecurity can sometimes be hard to capture in quantitative surveys) this can be especially important.

Studies of the effects of land administration projects can serve not only to evaluate the overall impact of interventions, but also to provide information on their optimal design, allow comparison of different designs and possible sequencing, and provide the opportunity to test complementarities with other interventions. This can make them more relevant for policy makers. It also makes them more attractive for research, as it opens the black box, sheds light on mechanisms of impact, and therefore provides information on generalizability of results.

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