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Moving towards pro-poor systems of land administration:

Challenges for land and asset distribution in Africa

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1. Introduction

There are three reasons why land policies in Africa are attracting greater amounts of attention. First, it is recognized that enhancing smallholder productivity is critical for sustainable and broad-based growth as well as poverty reduction (World Bank 2007). However, land-related investment, technology adoption, establishment of processing, markets, and value chains, all are unlikely to come about unless land tenure is secure. Moreover, increased productivity will be capitalized in land values and unless explicit attention is devoted to traditional land rights and land access by weaker groups, in particular women, interventions aiming to increase agricultural productivity may have negative social consequences. This is particularly relevant in contexts where current interpretations of customary systems define women's rights only through their relationship with men and women are often unable to inherit land which is considered the property of their husband's lineage. Negative implications for productivity can be severe, in particular if, as almost everywhere, women make a major contribution to agricultural production and its management.

Second, demand for land, and in many cases land prices, have vastly increased with population growth, urbanization, and overall economic development. While higher land values makes land registration more rewarding, leaving land rights undefined increases the risk of having them appropriated by outsiders in a way that may neither be consistent with principles of equity nor conducive to the most productive use of this resource.

Third, in a decentralized setting, land administration can not only help provide public goods and improve government finance but also that are rural areas will not develop based on agriculture alone. Non-agricultural development will imply migration of households out of agriculture that requires secure land rights so as to allow transfer of land rights, either through rental on a temporary basis or through sale, to others who are able to make more effective use of it without the fear of losing it. In many cases, this is now complemented by demand for land by investors who want to use it for food production, bio-fuels, or in anticipation of carbon payments has increased significantly in the wake of recent commodity price booms. It has highlighted that, without clear processes to process requests or assign of land rights, land acquisition by outsiders may end up fostering corruption and leading to inequality and dispossession of traditional land users rather than as a positive force for growth.

This paper examines the theories identifying channels through which land rights can affect socio-economic outcomes, points to realities which often prevent such effects from materializing, summarizes

quantitative evidence on the actual impact of land registration interventions to assess the validity of theoretical arguments, and derives conclusions that can help guide applied work in this area. An example from Ethiopia is used to illustrate the potentially far-reaching impacts of 'new' models of formalizing land rights and a number of policy conclusions are drawn.

2. Conceptual framework and empirical evidence

Especially at low levels of development when, due to prevalence of land-based economic activities, land constitutes one of the most important assets and a key safety net, the way in which land rights are defined and access to it gained will affect the productivity of resource use, the power structure and social as well as economic opportunities, and the scope for long-term development. To secure property rights and fully realize the benefits from such security, governments need to perform three functions, namely (i) clear definition and enforcement of property rights; (ii) provision of reliable information to reduce transaction cost associated with decisions relating to land markets; and (iii) cost-effective management of externalities. This section discusses benefits from this in four areas that build on each other sequentially, namely (i) reduction of the cost of enforcing land rights; (ii) land-related investment; (iii) productivity-enhancing land transfers; and (iv) use of land as collateral for credit. After describing the conceptual basis, we provide empirical evidence on each of these impacts.

2.1 Clarification and centralized enforcement

Property rights are social conventions, backed by the enforcement power of the state (at various levels) or the community, that allow individuals or groups to lay "a claim to a benefit or income stream that the state will agree to protect through the assignment of duty to others who may covet, or somehow interfere with, the benefit stream" (Sjaastad and Bromley 2000). If property rights are secure, well-defined, and publicly enforced, actors need to spend little time or resources guarding the assets thus protected. Systems for documentation and verification of land ownership enhance tenure security and thus benefit individuals and society as a whole. The magnitude of private and social gains from measures to secure property rights will depend on the extent to which these measures induce higher levels of tenure security and the nature, magnitude, and opportunity cost of the resources (to protect or resolve rights) thus freed up, compared to the cost of the apparatus needed for administration and enforcement of property rights.

Public intervention to secure property rights to land is justified by the fact that enforcement allows to realize economies of scale and has external benefits beyond individual landowners that are non-rival (i.e. one person's enjoyment will not reduce others' ability to benefit), though some of them allow exclusion of others, characteristics generally associated with a club good (Shavell 2003, Lueck and Miceli 2006). This is important as privately optimal amounts of spending on protection will often be excessive from a social

point of view (Feder and Feeny 1991, Malik and Schwab 1991, De Meza and Gould 1992).Moreover, as investments to secure property, such as guards and fences, often have little direct social or productive value, they can divert resources from productive uses or lead to rent dissipation (Allen and Lueck 1992). Clarification of boundaries and legal measures to minimize land-related conflicts or deal with them in an expeditious manner, reduces the incidence of conflict and the cost associated with resolving them. Also, neither payments for environmental services nor land use planning nor restrictions on certain land uses through zoning regulations (which then can facilitate more effective provision of infrastructure) will be possible without spatially referenced information on land ownership and location.

Efforts to clarify the nature and improve the ability to enforce property rights to land will be of greatest value in situations where increasing demand for or expected appreciation of land (e.g. due to expected investment in infrastructure, introduction of improved technology, land use change, or shift in demand patterns) implies a high risk of expropriation. As expropriation risk often emanates from the state or its agents, programs to increase tenure security will be fully effective only if the rights thus confirmed can be enforced against the state as well as private parties.

As expending resources to secure land rights is particularly difficult for the poor who therefore would be particularly at risk of losing their rights if land becomes more valuable, public efforts to secure land rights will have important equity effects and in general be pro-poor. Similarly, women often access land through their relationship with men and thus enjoy lower tenure security, something that has been shown to have significant impacts on productivity of land use (Udry 1996). Beyond production, women's ability to hold on to jointly owned land in case of divorce or death of their husband is often restricted, with implications for allocation of household spending among different uses, women's bargaining power and their participation in different types of activities (e.g. the non-agricultural economy) and the returns to their labor, as well as the pattern of intergenerational accumulation of assets (Quisumbing and Maluccio 2003). The underlying patterns of behavior are complex and not always amenable to quick change even though constitutional amendments. Still, legal changes to increase women's entitlement to land have been shown to affect inheritance patterns (Deininger and Goyal 2009). If implemented effectively, models of land registration favoring females, e.g. through joint certificates or separate identification of women's rights can be expected to contribute to women's social and economic empowerment (Joireman 2008; Deere and Leon 1994; Katz and Chamorro 2002).

Empirically, the potentially far-reaching impact of land registration is illustrated by a natural experiment where title was given to a subset of squatters with identical initial conditions in Argentina. Some 14 years after the intervention, those who had benefited by chance adopted more individualistic and materialistic

attitudes than those who were not regularized.[1] The estimated size of the effect is equivalent to an additional 4.4 years of education by the household head with the result that, despite their much inferior socio-economic background, beneficiaries' beliefs are indistinguishable from the population average.

In Peru, benefiting from land titling efforts in urban areas was associated with a significantly increased perception of tenure security. Moreover, in contrast to other welfare programs that generally reduce labor force participation, land titling resulted in a large increase of labor supply to the formal market that is likely to be due to the fact that individuals were no longer required to invest in a range of informal activities to maintain tenure security (Field 2007). The magnitude of estimated effects is large; initially labor supply is estimated to have increased by about 13.5 hours per week, rising to 45 hours or about 50 percent four years after the program. The finding, though less robust, of a reduction in demand for child labor, can be explained as resulting from a comparative advantage of adults in home protection or a reduction in the productive value of children (e.g. due to better old age insurance, credit access).

Securing land rights through titling or other means, especially if it provides women with independent property rights, can directly enhance their bargaining power with impacts on a range of outcomes, such as child nutrition birth rates and family size. Indeed, in Peru squatters who received property titles experienced a fertility reduction of 22% compared to those who did not and females who received joint title experienced twice the reduction in the probability of having a child than those where the title is in one name only (Field 2003) [2] In Buenos Aires, similar findings of reduced family size -although via reduced presence of extended family members- and lower fertility, as well as improved educational outcomes by children of titled vs. untitled squatters are found (Galiani and Schargrodsky 2005).

If household resources for education are fixed, lower numbers of children could allow greater human capital investment. Indeed, kids of titled squatters had higher levels of school attendance and achievement (of 0.4 days/week above and 0.42 years, respectively) than those in the control group. The size of this impact is similar to what was estimated for Progresa, a Mexican conditional cash transfer program, illustrating the potentially large effects of clarifying land rights. Similarly, teenage pregnancy rates and children's short-term nutritional indicators (weight for height but not height for age) are better on titled as compared to untitled parcels, taken to suggest that titling allows families to improve investment in human capital (Galiani and Schargrodsky 2004).

A large body of evidence supports similar findings in a way that is less rigorous quantitatively. In Nepal a study finds a positive association between higher levels of women's land rights, their socio-economic empowerment, and the health of their children with the magnitude of the impact of land ownership

[1] Among others, they were more likely to believe that people can succeed economically on their own, that money is important to be happy, and that others can be trusted. No significant differences emerge regarding the belief that those who put in effort will do better economically.
[2] A similar nutritional effect, though only on children's weight but not height, is found in another study using the same data (Vogl 2007).

comparable to that of formal employment or education (Allendorf 2007). In India, access to land allows women to escape significant gender discrimination by choosing self-employment on their land instead (Deininger *et al.* 2006), in line with qualitative evidence on the importance of land for women's social status (Panda and Agarwal 2005). In the Punjab, joint titling made women more assertive of their rights, increased attachment to their homes, and enabled them to use formal rather than informal means (courts) to counter (hypothetical) land sales by their husbands (Datta 2006). In Gujarat, land ownership was a key determinant of women's empowerment that increased stated propensity to invest in land (Baruah 2007).

Although most of the literature has emphasized impacts of registering individual plots, sustainable use of communal areas will in many contexts be of equal or greater importance. In areas where land is relatively plentiful, if community membership and decision-making rules are well defined, adhered to, and publicly accessible, adjudication of land to communities can draw on models traditionally applied to individuals but cover larger areas at lower cost. From 1992, Mexico's *ejido* reforms aimed to address inefficient land use and clientelism and in rural areas together with chaotic informal settlement and low levels of investment in peri-urban ones by combining institutional innovations with a program (PROCEDE) of systematic adjudication and registration of individual and communal land rights for all ejidos (with an area of some 100 mn has). The former included steps to increase accountability and decision-making, expand the sets of decisions that could be taken by the ejido (including joint ventures or dissolution), and separation of power within the ejido. Beneficiaries identified conflict reduction, greater transparency, and better opportunities to make use of economic opportunities inherent in provision of environmental services as important impacts (World Bank 2002). Similar efforts to better assign rights to land as a means to reduce deforestation and provide the basis for communities to benefit from and thus have the right incentives for providing environmental benefits are currently explored in Brazil.

Given its immobility and virtual indestructibility, taxing land is an effective way for local governments to generate resources to finance public services, discourage speculation, and generate incentives for effective land use (Bird and Slack 2002), and better governance. Although difficult politically, decentralization can help remove some of the obstacles. In the Indian state of Karnataka, computerization of textual records is estimated to have saved users US$16 million in bribes annually (Lobo and Balakrishnan 2002). Using this as a basis to automate registration and the associated valuation allowed cuts in stamp duty from 14 % to 8 % and quadrupled tax revenue from US$120 to US$480 million.

2.2 Land-related investment and land values

Reducing expropriation risk increases land users' confidence in their ability to enjoy the fruits of their labor, thus making it ore rewarding to manage land sustainably or make long-term investment attached to the land (Besley 1995). The impact of tenure security on investment incentives have been quantified by

numerous studies, e.g. in China (Jacoby *et al.* 2002), Latin America (Kazianga and Masters 2006, Bandiera 2007), Africa (Deininger and Jin 2006, Goldstein and Udry 2006), and Eastern Europe (Rozelle and Swinnen 2004). What is controversial, especially in relatively land-abundant settings, is whether or when land registration interventions can enhance tenure security - and how they have to be designed to so most effectively. In Madagascar, formal title had no effect on plot-specific investment and little impact on productivity and land values are estimated to increase by at most 6 percentage points due to titling, suggesting that either the increment in tenure security provided by title is low or that the cost of land titling will have to be very low for such a measure to be justified economically (Jacoby and Minten 2007).

On the other hand, in an area of Uganda where overlapping property rights, within-household analysis of new investments on owned as compared to merely occupied *(mailo)* plots by owner-cum-occupants points to significant and quantitatively large investment effects of full ownership: shifting from *mailo* occupancy to ownership is predicted to double the likelihood of soil conservation and increase that of tree investment five-fold. Tenant registration is estimated to have no investment-effect while measures to strengthen occupancy rights attenuate -but fail to fully eliminate- investment-disincentives originating in overlapping rights (Deininger and Ali 2008). In Ghana, tenure insecurity is shown to lead to reduced investment in the form of fallowing, estimated to reduce output by about one third and leading to very large aggregate efficiency losses (Goldstein and Udry 2008) . While this supports the importance of secure land tenure, it suggests that the magnitude of possible impacts can vary widely and that interventions aiming to increase tenure security need to be context specific to be effective.

In urban settings, good housing is one of the most important land-related investments. In Buenos Aires, regularized squatters were by 40% more likely than the comparison group to have good walls or 'good' housing quality (Galiani and Schargrodsky 2005). In Peru, rates of house renovation increased more than two thirds above baseline levels for titled households as compared o the comparison group though most of the increase was financed out of pocket rather than through credit (Field 2005). In Peru's rural areas, titling contributed to significantly increased investment, particularly for initially insecure households for whom the propensity to invest in land almost quadrupled although the 97% of investments were financed out of pocket rather than through credit, As the titling density within a district affected infrastructure investment, external effects are likely (Fort 2007). Receipt of title is also estimated to have had a highly significant and positive effect on export crop adoption (Field *et al.* 2006). All of this is consistent with the hypothesis that the shift from use to ownership rights increased investment incentives but not overall wealth or the transferability of land and associated access to credit.

If adjustments are made for the effects of risk and imperfections in capital markets (Feder and Feeny 1991), price differences between registered and unregistered land can provide a measure of the social

gains from land registration. In Ecuadorian slums, title increases the expected market value of a plot by 23%, increasing to more than 50% in recently invaded settlements that lacked political protection and thus enjoyed low levels of tenure security. Comparing hypothetical benefits to the cost of regularization suggests positive returns. Particularly large benefits to households with women only are interpreted as indicating that there is need for interventions to incorporate gender concerns (Lanjouw and Levy 2002).

In Nicaragua, full registration of a plot after the 1990 revolution had a significant investment-enhancing impact, resulting in an increased propensity to invest by between 8% and 9%. Land values for plots with registered title are higher by 30% (Deininger and Chamorro 2004) and, with some 29%, marginal returns to land-attached investment are much higher than those to investment in mobile capital, pointing towards underinvestment that could be remedied through higher tenure security. Reduced form regressions lead to similar conclusion regarding the need for full title and enhanced land values, investment in perennials, and higher crop yields (Broegaard 2005). The presence of an investment incentive effect independent from credit also emerges from a land settlement program in Guatemala (Schweigert 2007).

Beyond Latin America, In Thailand land ownership titles induced higher investment in farming capital (attached investments and other capital), and titled land had significantly higher market values and higher productivity per unit. Output was 14 to 25 percent higher on titled land than on untitled land of equal quality (Feder *et al.* 1988). A comparison of housing prices between the non-squatter, formal residential areas and the informal areas of the city of Davao in the Philippines revealed that prices were 58 percent higher in the formal area than in the informal one and rents were 18 percent higher (Friedman *et al.* 1988). In Jakarta, registered land was up to 73 percent more valuable than similar land held by a weak claim (Dowell and Leaf 1992).

Vietnam has, the 1993 to 2000 period, gradually expanded users' rights to include transfer, inheritance, exchange, lease, and mortgage and awarded about 11 million land use certificates (LUCs) through land registration efforts (Do and Iyer 2008). Difference in difference estimation at district level points towards much higher investment in perennials (7.5 percentage points for complete coverage, despite restrictions to keep part of the area in rice) and expansion of non-farm activities (11-12 weeks) where titling had progressed further. The last effect is more pronounced for the poor, and most of it is due to diversification of households' income portfolio rather than specialization. There is, no evidence of a credit effect, consistent with the notion that, without complementary changes in banking and rules for land transactions, titling alone is unlikely to set off big changes in economic structure.

2.3 Information access and functioning of markets

Availability of reliable information on land rights in a public registry will not only reduce the risk of illegitimate challenges to owners' rights (especially if land has been rented out for some time) but also obviate the need to conduct costly searches to verify the rightful owner of a tract of land. Both reduce the transaction cost for exchanging land in markets due to informational asymmetries. Such problems are less likely to arise if transactions are largely confined to members of the same community who have reliable information on the legitimacy of land claims even without formal records., the fact that, even in this case, land transactions are often conducted in writing and with presence of witnesses illustrates the importance of publicity to prevent fraud or opportunistic behavior. Once land transactions go beyond the community, verifying the legitimacy of land claims becomes more difficult and benefits from formal records increase.

If there are differences in owners' ability to make use of land, the ability to transfer land to others, either through rental or sale, will increase productivity of land use. Land owners who rent out can participate in the non-farm economy without losing their assets or closing off the possibility of returning to farming while those who remain in farming can increase their income by cultivating larger areas (Carter and Yao 2002, Kung 2002, Deininger 2003). Registered documents to prove ownership can help remove perceived risks of engaging in transactions by lowering enforcement cost in case of dispute, thus allowing more rental transactions, possibly at a lower rental price. In sales markets, reliable information on land ownership can eliminate the risk of future land loss that would reduce equilibrium prices and transaction volumes. In both cases, the magnitude and economic impact of lack of information will depend on the extent to which insecurity prevented realization of productivity-enhancing land transactions and the magnitude of the productivity differential between those involved. In rural settings, the latter is likely to increase once the non-agricultural economy develops.

In China, land rental contributed to diversification of the rural economy (Deininger and Jin 2008b) and productivity. However, if land rights are not sufficiently secure, land owners may be averse to renting out because they fear that land may be taken away from them (Yang 1997, Holden and Yohannes 2002). The associated reduction of the level of transactions below the optimum led to significant efficiency losses (Benjamin and Brandt 2002). In Vietnam, having long-term use rights secured through registration will increase the tendency to rent out to non-relatives but does not affect the propensity to rent out to relatives, consistent with the notion that land registration can substitute for informal enforcement through social capital. Moreover, and in line with the expectation that the smaller number of partners who can be trusted in informal markets reduces the scope for efficiency-enhancing transactions, only rentals among non-relatives help significantly increase efficiency (Deininger and Jin 2008a).

In Tigray, land certification contributed to higher levels of land rental market participation, especially by female-headed households (Holden *et al.* 2008b) and considerably enhancing opportunities for women to

benefit from land rental (Bezabih and Holden 2006). Drawing out tenure-induced increases in land rental market activity and their impact on diversification of economic activity especially in rural areas is an important topic for future research. Moreover, as it makes it easier to liquidate and recoup the full value of investments in case of unexpected shocks (Ayalew *et al.* 2005, Deininger and Jin 2006), transferability is likely to increase investment incentives.

In the Dominican Republic, insecure property rights not only reduce the level of activity on the land rental market, but also induce market segmentation. Landlords who have reasons to fear loss of land restrict renting to narrow local circles of confidence. This segmentation further reduces rental activity by limiting opportunities to find suitable tenants. Simulations suggest that improving tenure security would increase total area rented by the poor by 63% (Macours *et al.* 2004). Similarly, in Nicaragua producers who have a title are significantly more likely to rent out their land, providing opportunities for efficient producers to increase their cultivated area (Deininger *et al.* 2003).

Given that sale markets are not available in many countries, study of potential impacts of land registration on sales markets are more limited and mostly based on descriptive comparison of the situation before and after interventions. In Eastern Europe, registration of land rights was generally followed by considerable and often rapid growth in land market transactions and, in the case of urban land and real estate, mortgages, but construction of a counterfactual is difficult, and therefore the evidence only suggestive. In St. Lucia, sales market activity and the number of registered mortgages increased immediately after introducing the system (and remained high in peri-urban areas). However, the marginal increase in formal land market activity after introduction of the title system was not sustained over time (Barnes and Griffith-Charles 2007), suggesting limited impacts.

2.4 Credit access

Provision of credit for investment is risky due to the uncertainty regarding the borrower's ability or willingness to repay. Informational asymmetries due to the fact that the latter has better information on this than the lender lead to credit rationing in equilibrium and a lower volume of lending, as well as fewer worthwhile investments, than in a world of perfect information (Stiglitz and Weiss 1981). The use of collateral, i.e. an asset the ownership of which will be transferred to the lender in case of non-repayment has emerged as a universal practice to reduce the extent of credit rationing, making everybody better off.

Given its immobility and relative indestructibility, land is an ideal form of collateral. Its usefulness for this can be enhanced if a formal and low-cost way to unambiguously identify land ownership without the need of physical inspection, inquiry with neighbors, or interaction with an extensive bureaucracy, is available. Such easy access to reliable information on land rights reduces the transaction cost of selling

the land in case of default and, if land sales markets are sufficiently liquid, will make it easier for banks to use land as collateral for credit. It has been repeatedly emphasized that, in the absence of other obstacles to operation of financial markets and the exercise of land rights, formalizing and registering land tenure can thus encourage development of financial markets, including more sophisticated financial instruments that draw on the abstract representation of property rights provided by formal titles (de Soto 2000).[3] This can increase the efficiency of credit markets as it facilitates loans whose true risk is less than that perceived by lenders in the absence of collateral. To the extent that this allows more worthwhile investments to take place, there will be an improvement in overall economic efficiency.

While this channel for an impact of land rights formalization has been widely publicized, empirical evidence in its favor is more limited. One reason is that in many contexts land sales may not be allowed,[4] land markets illiquid or non-existent for other reasons, or the cost of registering mortgages or foreclosing on them very high. Also, while land registration can reduce the cost of borrowing, it is unlikely to increase availability of 'good' and bankable projects or agents' willingness to take risks. Imperfections in markets for credit and insurance may also limit the potential of land registration to lead to expansion of credit to cover poor land owners in rural or in undocumented urban areas or slums. Such imperfections will imply that in many of the contexts affecting poor or rural populations, the conditions for operation of credit markets that include the poor, will not be met and expecting large credit-related benefits from land registration unrealistic.

In rural areas of developing countries, covariance of risk, i.e. the dependence of outcomes on weather and natural phenomena (e.g., pest attacks) introduce risks that are spatially correlated across large numbers of would-be borrowers and that limit the ability of the lenders to diversify and increasing the risk of rural lending. As this implies that a bad outcome will lead to default by many borrowers at once, flooding the land market with foreclosed properties the value of which may be much diminished, this reduces the value of land as collateral. While there are ways to deal with this (e.g. spatial diversification of loan portfolios) in the formal market, it does increase transaction costs.[5] This, together with the transaction

[3] *** besley ***

[4] Such restrictions are not always undesirable. The reason is that, at low levels of development land is not only a productive asset but also performs important functions as a social safety net and old age insurance. Many communities adopted rules to limit land alienation to outsiders in an effort to reduce myopic land sales by individuals who would squander the proceeds and then rely on community-support for sustenance in a way that creates negative social externalities (Andolfatto 2002). As long as such rules are the product of a conscious choice and the group has clear and transparent mechanisms for changing the land tenure regime, they are less likely to be harmful. As traditional social ties loosen or the efficiency loss from the sales restriction becomes too high, groups are likely to move towards a gradual individualization and sales to outsiders. The recent constitutional reform of the land rights system in Mexico provide an example where the fact that the transition towards individual rights can only made by a 75% majority of the whole group provides a safeguard against land grabs. The fact that less than 15% of *ejidos* -mostly those in peri-urban areas where land had *de facto* already been individualized- made use of this opportunity suggests that, even at relatively high levels of per capita income, the spatial reach of insurance mechanisms to replace the safety net function of (communal) land ownership remains more limited than is often thought (Zepeda 2000).

[5] Policy-induced restrictions on the transferability of land can further increase the transaction cost associated with use of formal land records as a means to improve credit access, as is the case in Tanzania.

costs of collateral registration may often exceed the benefit they generate for the relatively small loans undertaken for seasonal (short term) purposes.

Urban credit markets are typically more developed than rural ones. Residential credit often relies on collateralized long-term loans to finance housing acquisition, and documented land ownership is important to facilitate such transactions. However, use of residential property, in contrast to commercial land, to finance business investments is less common and may be constrained by banks' likely difficulty of repossessing low quality dwellings in poor neighborhoods. In both rural and urban areas credit market effects will also be limited by the availability of promising 'bankable' projects as well as the scope for 'risk rationing', i.e. the fact that potential credit worthy borrowers are unwilling to use titles for fear of losing them in case their project is unsuccessful (Boucher *et al.* 2008).

For example in Peru, the political nature of the land titling program may well have reduced the scope for lenders to foreclosure on squatters' land, consistent with the finding that, its positive investment effect notwithstanding, it only increased access to credit via the state bank but not the private sector with more than one thirds of titled households completely rationed out from formal credit (Field and Torero 2006), in line with what was found for rural areas in Peru (Field *et al.* 2006, Fort 2007). In Buenos Aires, despite significant effects on house-related investment and other variables, no credit effect is found, implying that even with titles, households will be unable to fully insure consumption or take up entrepreneurship, suggesting that growth implications of titling programs may be overstated (Galiani and Schargrodsky 2005). Positive credit-effects in Indonesia appear to be due to self-selection of more entrepreneurial types into the titling program (Dower and Potamites 2005).

This does not imply that credit effects will necessarily be absent or can not accrue to the better off. In Thailand, where informal credit markets had already operated and land markets functioned relatively well before the intervention land titling had significant positive impacts on credit access (Feder *et al.* 1988). In Paraguay, a significant credit supply effect of titling accrued only to medium and large landowners whereas those below 20 hectares remained cut off from credit (Carter and Olinto 2003), parallel to what was found in Guatemala (Mushinski 1999). In Eastern Europe, establishment of land administration systems is associated with remarkable expansion of mortgage lending although no detailed household surveys have been used to establish causality or assess the distribution of credit access across socio-economic groups in the population (Adlington and Stanley 2008). This suggests that distributional effects of credit access should be considered explicitly. Also, for rural areas and the poor in Africa, credit effects are unlikely to materialize provide a justification for land registration efforts in the short term (Payne *et al.* 2008). Using access to credit, rather than other benefits (investment incentives or transferability), to rationalize land registration may thus be unrealistic and risk disappointment.

3. Why formalization is not a panacea

The above illustrates a number of benefits from well-defined and enforceable land rights. Still, to realize these benefits, efforts to formalize such rights need to be cognizant of a number of potential obstacles. In particular, (i) systems governing property rights to land have evolved over long time periods in adaptation to the local environment and efforts to introduce new systems that neglect existing ones are unlikely to be sustainable; (ii) formalizing land tenure will not alter existing power relations and, if not done carefully can eliminate existing rights, especially secondary ones in a way that is detrimental to the poor; (iii) land registration rights will be sustainable only if the cost of establishing and maintaining registries is lower than (or at least commensurate to) the benefits realized from doing so.

3.1 Pre-existing right structures

Virtually all societies define property rights to land in some ways. In indigenous societies where land is relatively abundant, transfers beyond the local community limited, and state capacity weak, such rules may secure tenure at lower cost and in a more effective way than a formal system.[6] In such situations, a simplistic and undifferentiated call for 'formalization' that prescribes 'solutions' without clear diagnosis (Easterly 2008) and that lacks awareness of the complexity and history of existing arrangements can make matters worse (Bromley 2008).[7] It could eliminate incentives for households to make limited investments to secure land rights (Sjaastad and Bromley 1997, Brasselle *et al.* 2002; Colin and Ayouz 2006) and replace them with rent-seeking instead.[8] Instead, efforts at formalization will need to be justified by analysis pointing to increased scarcity of land -due to factors such as population growth, urbanization, and demand for non-agricultural land- that undermine investment, lead to conflicts, and may reinforce pre-existing cleavages along lines of gender, ethnicity, or wealth.

For example, large inflows of cash from outside have been shown to erode the relatively egalitarian land ownership pattern of customary regimes through a trickle of transactions (Chimhowu and Woodhouse 2006). With weak governance, land sales by chiefs who re-interpret their trusteeship as ownership and

[6] In fact, from the earliest days of recorded human history, awareness of the social and economic benefits from secure and well-defined land rights and of publicly recorded transactions led many societies to develop customs or pass laws to define content and nature of land rights and to establish registries to record such rights (often to obtain tax revenue) and or and police to enforce them (Powelson 1988). A social as well as economic need for such intervention is currently visible in situations where, e.g. in the context of rapid recent food and commodity price hikes and demand for land by outside investors or in post-conflict contexts, failure to define property rights or inability to enforce them effectively could leave traditional land users in a very vulnerable situation.

[7] In 2005, the World Bank was supervising a portfolio of more than 1 bn that had shown significant growth. The standard type of intervention, often referred to as "land titling" project, includes elements of legal and institutional reform, upgrading of land registries, and large-scale adjudication of individual land rights together with publicity campaigns and mechanisms (e.g. mobile tribunals) to resolve disputes quickly and at low cost, normally to be followed by issuance and registration of rights to land at the individual or group level - and not always as title.

[8] Numerous examples show that supply-driven establishment of land administration institutions that are intended -though with limited state presence often not capable of- replacing traditional actors, will at best create a parallel system with the consequence that, instead of complementing each other, "traditional" and "modern" systems compete with each other as was the case in Kenya (Atwood 1990). This will increase transaction costs and give the better-off or -informed an opportunity to resort to "institutional shopping", by, for example, pursuing conflicts in parallel through a variety of channels (Firmin-Sellers 2000) and increase conflict (Berry 1997, Fred-Mensah 1999).

pocket the receipts are common and risk undermining traditional social safety nets (Lavigne-Delville 2000). In much of West Africa, where the descendants of migrants can be easily identified as "outsiders", increased land values provide a strong incentive for "locals" to renege on earlier sales contracts. In the case of Cote d'Ivoire, land access is interlinked with questions of nationality and the ability of only nationals to own land, which can give rise to conflicts that extend far beyond the area of land (Lavigne-Delville *et al.* 2002). Also, in Rwanda, where extreme land scarcity coincided with accumulation of land by individuals with access to non-agricultural incomes, this has led to land conflict being one of the principal reasons that finally fed into the outbreak of violence in 1994 (Andre and Platteau 1998). One of the reasons for such failure is that, while they are well suited to resolve conflicts within the same community, customary systems have limited capacity to effectively address conflicts that cut across groups, ethnicity, and type of land use such as pastoralists and sedentary agriculturalists (van den Brink *et al.* 1995). Also, under traditional systems, women are often disadvantaged as access to institutions for land administration is biased by gender and wealth (Henrysson and Joireman 2007).

Where such factors make that formal recognition of rights desirable, it will in most cases be desirable to proceed in a systematic fashion (i.e. community by community). In particular in high-risk environments, individualization of communal land rights that neglects the safety net function of such arrangements may entail loss of the flexibility essential for risk management and insurance, thus leaving everybody worse off (Baland and Francois 2005). As communal rights are -intentionally or unintentionally- often curtailed in the process of land right formalization, care needs to be taken for such processes to not trigger either premature individualization of or encroachment on common property resources (Meinzen-Dick and Mwangi 2008) by having them demarcated and registered before individual land holdings. Efforts to 'formalize' tenure have alos often eliminated or weakened secondary land rights, e.g. the right to temporary use of arable land for grazing by pastoralists' animals after the crop harvest or fuel wood collection by the poor. Without measures to recognize and if necessary record them, secondary rights or women's entitlements may be eliminated- with negative consequences for those who had benefited from them.

3.2 Inequality and deficiencies in governance

If land ownership structures are highly unequal, most likely because of colonial intervention (Binswanger *et al.* 1995, Conning and Robinson 2007), registration is more likely to cement existing inequalities than overcome them.[9] The negative consequences of high inequality -across countries (Easterly 2007, Galiani *et al.* 2008) and smaller administrative units within the same country- are well documented. Historically, these arose because landholding elites were not willing to give up political power (Baland and Robinson

[9] Land registration can help overcome inequality through better operation of land markets but in many of the situations of high inequality, those who could benefit from such markets are unlikely to have the resources to translate latent into actual demand.

2003) or provide the broad access to education (Verdier 2000) or finance (Rajan and Ramcharan 2008) that could have fostered broader development at the cost of undermining their economic and political power. In such situations, a land registration system may not provide broad-based security of land access and, unless it is accompanied by redistributive efforts, may not be socially beneficial in the long term. Land registration will also need to be complemented by legislative and other means in situations that have recently experienced large shifts in land ownership, either through land acquisition by powerful elites (Government of Kenya 2004) (Kato 1998, Leuprecht 2004) or in post-conflict environments (World Bank 2003) to make a positive contribution to overall development.

Introduction of systems to systematically register land may by itself trigger speculative land acquisition on a large-scale and set off a polarization of land ownership structures (Benjaminsen and Sjaastad 2002, Peters 2004) as powerful individuals use their informational and other advantages to acquire land. High cost of acquiring information on the legal regime or the way in which rights can be enforced has a similar effect. The iniquities and opportunities for abuse that can be created by unequal access to information if land rights are adjudicated are well documented (Jansen and Roquas 1998, Feder and Nishio 1999). Well--informed individuals may use their access to information to speculatively acquire land in anticipation of formalization-induced price increases or try to register claims to communal or individual land that did not actually belong to them. Lack of access to information can also prevent those who would normally be empowered by certain legislation -often women or members of disadvantaged groups- from exercising their rights. Consequently, the inherent opportunities to improve equity -and often also efficiency of land use- may not be fully utilized. In Uganda, for example, laws to augment security of customary rights had the desired impact only if individuals knew about them but such awareness was very limited (Deininger *et al.* 2008a). Land rights formalization will thus need to be preceded by systematic information campaigns.

Even without large inequalities in land access, effectiveness of land administration institutions depends on enforcement of the rules through competent and impartial institutions e.g. courts and a honest bureaucracy, something often referred to as ‘good governance’, to enforce rights, are critical to make property rights effective and ensure that positive impacts from land administration interventions can be realized. Absence of a judiciary that is accessible and impartial to allow actions by the state be challenged effectively, ineffective government institutions with overlapping mandates that may issue conflicting documents regarding the same plot, and unclear and contradictory policies that make enforcement unpredictable and costly, can render a land registration system ineffective. In such situations, it will be difficult to rely on state-issued documents and uncertainty of property rights, the elimination of which was the goal of setting up a registry system in the first place, is likely to persist. Often, it will be weaker and poorer segments of society who suffer the negative consequences of land titling in situations of

ineffective or dishonest government, e.g. because the better connections between the wealthy and government officials and their ability to bribe and obtain results that may disadvantage the poor. This could undermine security of property rights in several respects, e.g. by confining direct benefits from land administration to the well-off.

3.3 Affordability and cost-effectiveness

Although the high cost of surveying were the root cause for the colonial US administration's failure to establish a functioning land administration system in the Philippines (Maurer and Iyer 2008) and high cost of registering transactions has undermined the sustainability of many land registries and prompted users to revert to informality (Barnes and Griffith-Charles 2007), discussion of the cost-effectiveness with which land administration services are provided has been surprisingly scant.[10] There are three factors in such costs, i.e. (i) the cost of boundary survey which increases exponentially with precision requirements; (ii) the recurrent cost of running land administration institutions; and (iii) the registration methodology.

While establishment of land registries is an important investment in infrastructure, in most projects for first-time registration, more than three fourth of the resources are spent on surveying, an item the resource requirements for which increase exponentially with precision. Widespread confusion of tenure security with precision of boundary measurement, prompted by survey professionals' lobbying, have often led to the imposition of survey standards far beyond local implementation capacity and with little relationship to land values. In many of the early projects financed by bilateral or multilateral institutions, the cost of first time registration was very high, in some cases significantly above US $ 100 per parcel, possibly in excess of land values, with costs on average ranging between US$ 20 to 60 per parcel (Burns 2007). This has limited the speed of progress, coverage and outreach, and the ability to subsequently keep the register up to date. Recent advances in satellite imagery together with a general boundary concept that is sufficient for most rural applications (and does not prevent those wanting higher precision surveys to pay for them) offer opportunities to drastically reduce these costs and thus make land administration affordable for Africa {English and Sagashya 2009; Mejis and Kapitango 2009}.

Especially in resource-constrained environments such as Africa, imposing requirements for creation of decentralized institutions that exceeded available fiscal resources even under optimistic assumption has been a reason for failure to implement progressive legislation, as in Uganda (Hunt 2004). Greater reliance on existing institutions and careful consideration of existing capacity and expected workloads is thus likely to be warranted. However, even under existing arrangements, and in the most optimistic scenario regarding access (i.e. the capital city), the costs associated with registering property in many countries are

[10] Land administration is defined as the set of activities related to demarcation and survey of land boundaries, registration and record keeping, adjudication of rights, resolution of conflicts, and land management (UNECE 1996).

very high: the mean in 173 countries included in the World Bank's 2008 'Doing Business' amounts to 6.6% of the property values and 81 days of waiting time.[11] In addition to operational inefficiencies and unrealistically high survey standards, costs are normally increased by the need to involve lawyers in transactions and stamp duties levied on land transfers. In Eastern Europe, dramatic improvements in operational efficiency were achieved by making registries financially independent, their information publicly available on the internet, involving private surveyors, reducing staff, and increasing salaries, (Dabrundashvili 2006). Similarly, in India, large reductions in stamp duties were actually associated with higher total revenue. Informal 'fees' can further increase these costs, with possibly far-reaching consequences for users' ability to access information and their confidence in the land registry. For example, in India, the costs of registering even inheritances is exorbitant and a recent study estimated bribes paid annually on land administration to amount to $700 million (Transparency International India 2005), three-quarters of India's total public spending on science, technology, and environment.

The two most common forms of land registration are deeds and titles. A *deeds* registration system is a public repository where documents to provide evidence of land transactions are lodged, numbered, dated, indexed, and archived. Recording will give public notice of the transaction, serve as evidence for it, and may assign priority to recorded rights in the sense that, in most contexts, registered deeds take priority over unregistered ones, or any deeds registered subsequently. At the same time, registration of a deed does not guarantee the legal validity of the underlying transaction. By contrast, under registration of *titles*, the register itself serves as the primary evidence of ownership as commonly identified by three attributes, namely (i) the mirror principle indicating that the situation in the registry is an exact reflection of reality; (ii) the curtain principle, implying that anybody interested in inquiring about the title status of a given property will not have to engage in a lengthy search of documents but can rely on the evidence from the title registry being definitive; and (iii) the assurance principle according to which the government will indemnify for damages incurred as a consequence of errors in the registry.[12]

[11] The World Bank's 'doing business' survey has rightly has identified the cost of registering property as a key impediment to private sector activity by including this as one of the indicator variables in its global survey. As these figures are based on expert opinion for an unencumbered property in the capital city, they should be used only with proper care (Arrunada 2007) and are likely to constitute a lower bound for the cost of registration faced by the average land holder. For example, a field-based study in St. Lucia found transaction cost for what was considered a "typical" transaction by the local population to be almost three time the 7% given in the doing business survey (Griffith-Charles 2004). Also, note that the cost of registering property is highly bimodal; while it is 2% or less of property value in 32 cases, it amounts to 5% or 10% and more of property values in 92 and 41 of the cases (53% and 24%), respectively (World Bank 2007). To make such figures more representative and bring them closer to the cost of service provision, the World Bank is undertaking efforts to link this to administrative data. Doing so is likely to provide a more precise measure that could be used to track changes over time.

[12] To illustrate, if, under title registration, A fraudulently sells a piece of land (which actually belongs to C) to B who purchases in good faith, B becomes the rightful owner and any claims by C are extinguished as soon as the sale is registered. The only recourse open to C would be to demand compensation, but not restitution of the property, from the state which in turn has the option to sue A. The need to ensure that the responsibility taken up by the state can be met is one of the reasons why title registration systems are normally associated with a guarantee fund to facilitate payment of such compensation. By contrast, under a deeds system, it is B's responsibility to investigate the veracity of A's ownership claims and C will be able to demand restitution of the property from B, implying that B will incur the loss.

A deeds system is cheaper to operate but provides a less comprehensive service as the residual risk of verifying ownership information remains with the transacting parties who incur the cost of due diligence. By contrast, to be able to assume responsibility for the accuracy of information in the registry, the state will have to assume responsibility, implying higher setup as well as operating cost.[13] As land owners fail to register transactions if the cost of doing so is too high compared to the benefit (i.e. the reduction in residual risk) it implies, a title registration system will be socially optimal if land values are high whereas for lower land values a deeds system is more appropriate (Arrunada 2003). Most land registration projects funded by multilateral agencies recommend adoption of a title registration system -and in some cases even the conversion from a system based on deeds towards one based on title- although this has rarely been substantiated by rigorous analysis of the associated costs and benefits and, possibly as a result, not always led to the desired outcome.[14] Measures such as standardization of deeds, parcel-based indexing, compulsory registration, and a requirement for registrars to perform basic checks on deeds and the persons presenting them before accepting them for registration all offer opportunities to strengthen deeds systems. With access to computerized information about the chain of deeds and other instruments pertaining to a given parcel, differences between the deeds and title registration systems have narrowed significantly. From an applied perspective, deeds systems are also more robust and good systems, as in the Netherlands or South Africa offer most if not all of the features of well-run titling systems. Also, even in titling systems, a regulatory framework that fails to disclose relevant rights or encumbrances in the registry can question the integrity and usefulness of the land registration system. In cases where the failure to register potentially long-standing rights allows these to be ignored in practice, there have been very negative social impacts.[15] This suggests that, in addition to the type of recording, scrutiny of the information captured by the land registration system is needed.

4. Impacts of improving land administration: An illustration from Ethiopia

[13] The specific historical circumstances of the US, which operates under a deeds system, have given rise to a system of 'title insurance' where private companies, rather than the state, have developed a comprehensive record of all land transactions that enables them to examine the legal validity of transactions and insure against defects. Given the long time it took to assemble the required information this is not an option for developing countries (Arrunada and Garoupa 2005).

[14] While a number of well-functioning systems with high land values (Hong Kong, Britain, Scotland, various Canadian provinces) have successfully made the transition from a deeds to a titling system, though often over a long period of time, attempts to shift from a deeds system to one of title registration in developing countries do not have a good record. A project in Sri Lanka failed to put in place the legal, regulatory, and institutional framework for systematic adjudication of land parcels and instead accomplished only very limited survey and titling of parcels which no conflict, with limited economic benefits (World Bank 2007). In St. Lucia, households received provisional documents that were supposed to be replaced by full titles after 12 years but 75% of titles were never collected by their owners (Griffith-Charles 2004). In Ghana, where a new title registration system has been introduced, less than 1,000 titles were issued per year and the rate at which titles entered the system was below that of new transactions to be registered, implying a widening gap between the registry and reality and increasing levels of informality (Nettle 2006).

[15] The case of tenants on *mailo* land in Uganda is a particularly striking example. Although these tenants had in many cases been on the land for more than a generation, their presence was not indicated on landlords' titles. Banks who lent against such titles discovered that such presence of tenants with far-reaching rights on the land they had accepted as collateral made liquidation impossible, making it difficult even for owners of unencumbered land to use it as collateral, thereby undermining the value of existing titles and making the state guarantee (which extends to ownership only) worthless from their point of view (Deininger and Ali 2008).

Existing empirical literature on land tenure in Africa falls short of considering these new developments in three important aspects, namely (i) it mostly equates securing land tenure with titling based on a legal and institutional structures that had changed little since colonial days, thus neglecting more recent approaches to recognize and help gradually evolve existing or communal forms of tenure; (ii) where interventions were analyzed, they were often supply-driven and centralized interventions that did not consider existing demand, were costly, lacked scalability, and due to a failure to include systematic information campaigns, often had unfavorable equity impacts and limited productivity effects; (iii) unitary household models were the norm, making it difficult to discern impacts on the way in which assets and bargaining power is distributed within the household and the associated effects on productivity of land use, how income is spent, and capital accumulation across generations.

To illustrate not only how programs have changed but also that analyzing these new experiences can provide relevant insights, we this section reviews Ethiopia's program of land certification. This is one of the largest land registration programs in the world,[16] three of Ethiopia's four main regions have, over the last five years, registered some 20 million parcels of rural land to some 6 million households.[17]

4.1 Program characteristics and hypotheses on program impact

The essence of the Ethiopian program is the award of certificates confirming their property rights to land in a systematic process, village by village, that includes boundary delimitation and conflict resolution. While the activities are similar to those under standard land titling projects, conventional wisdom is turned on its head and allow interesting 'hypothesis tests' in at least three ways. First, rather than being driven by outside experts, responsibility for advancing with the process is entirely at the village level. Given Ethiopia's severe land scarcity, this allows us to explore to what extent rent-seeking and land grabbing may undermine the scope for drawing on elected local structures to clarify land tenure at large scale. Second, land policy in Ethiopia is far from the ideal: Institutional responsibilities are unclear and often overlapping, there is a considerable threat of expropriation that is unlikely to be entirely eliminated by certification, land can not be sold, and in three of the four regions households can not rent out more than 50% of their holding. We can thus check whether land administration reform can have an impact in an environment where policy is quite imperfect. Finally, contrary to the emphasis on high precision recording of boundaries which, thanks to strong surveyor lobbies, has become a hallmark of debates on land administration reform (and a major cost item) in many countries, the Ethiopian model dispenses with geographic references altogether. Though not necessarily ideal, this allows assessing links between maps

[16] The program is similar in size to the 11 million certificates awarded in Vietnam from 1993 to 2000 and the issuance of 8.7 million titles in Thailand during 1980-2005. Its accomplishments compare favourably to what was achieved by other land administration programs, e.g. the 2.7 million titles (1.2 million urban and 1.5 million rural) issued in Peru from 1992 to 2005 and the 1.8 million titles issued in Indonesia since 1996.

[17] The fourth largest region in Ethiopia, Tigray, had implemented a similar program in 1998 (Holden *et al.* 2008a). Although a number of modifications were undertaken, the relative success of this program was one of the reasons for other regions to initiate certification programs.

and textual records in general and the options to use low-precision index maps to dramatically reduce the cost and complexity of first-time registration as well as subsequent registry maintenance.

Land certification is initiated by a team of experts from the *woreda* that guides the process from a village meeting to the election of an independent village land use and administration committee (LAC).[18] The LAC then assumes responsibility for systematic field-based adjudication of rights through a public process with the presence of neighbors and help from elders to resolve conflicts. The adjudication process produces preliminary registration certificates that identify size and neighbors for each of a holder's plots.[19] Results are then displayed in public and, after a period for raising complaints, entered into registry books, copies of which are to be kept at *kebele* and *woreda* levels. Thereafter, certificates with pictures of the land holders (husband and spouse in case of joint ownership) are issued by the *woreda*. Certificates also include space for maps and spatial information is then expected to be added in a 'second stage'.

Evidence suggests that decentralized and participatory implementation with emphasis on the provision of information, issuance of certificates rather than titles, and a focus on gender equality helped avoid some of the problems raised in the literature on land titling in Africa. A nation-wide survey (Deininger *et al.* 2008c) highlights evidence that access to information and certificates was neither biased against women nor the poor. It also suggests that the process was generally implemented as planned; in particular (i) public meetings were held before and during the certification process; (ii) land use committees (LACs) represented most of the sub-*kebeles*; and (iii) adjudication relied on village elders to resolve disputes and included demarcation in the field with neighbors present. Survey data suggest that the quality of the certification process was high; certificates could be issued in 95% of cases where there were no disputes about ownership, compared to 80% in many titling projects. Case study evidence also points to reductions in conflict when registration involved identification of borders and systematic conflict resolution.[20] Also, at less than US $ 1 per parcel, program cost is an order of magnitude lower than the US $20–$60 per parcel for traditional titling reported in the literature. In fact, more than 80% of sample households were willing to pay an amount in line with the cost of service provision to replace certificates if lost or to transfer it, suggesting that the program could be self-sustaining.

[18] The fact that the LAC is directly elected in a democratic fashion rather than being part of the (often politicized) administrative structure was mentioned repeatedly as an important merit in interviews with groups as well as individual villagers.

[19] Although LAC members repeatedly emphasized the demanding nature of this task, it is critical to ensure transparency, especially in the identification of communal areas. This reduces the scope for error that could arise from the use of office records that may not be up to date.

[20] In one site, the volume of court cases is reported to have reduced from 20 to at most two per week (Adal 2008). This is important as, according to local government statistics, land conflict accounts for some 80% of rural crime. It also has a relevant gender aspect as in some cases widows were able to win court cases to hold on to their land rather than, as dictated by local tradition, have it revert back to the husband's lineage at the point of his death. In polygamous settings, the requirement to have separate certificates for any spouses beyond the first one is linked to a reduction in (reported) polygamy. Even male farmers acknowledge that joint titling increased their wives' willingness to work and invest as official co-owners. Households in areas where urban expansion is imminent are reported to be particularly eager to get certificates that could help them substantiate their claims for compensation if their land is taken for urban expansion. In fact, observers link the ability to use certificates for demanding compensation to the emergence of innovative, in-kind compensation arrangements in a number of peri-urban areas.

To assess possible impacts, it is important to note that, in Ethiopia, land is state property that can neither be sold nor mortgaged, implying that we would expect no credit effects from land certification. Land rental also remains restricted in all regions except Amhara. There is, however, scope for positive impacts by increasing tenure security due to two factors. First, the constitutional guarantee of land access by every adult and the government's ability to resort to often discretionary land redistribution to implement it has long been a threat to land users.[21] In Amhara, where our survey was undertaken, a highly politicized land redistribution in 1997 reduced tenure security and increased conflict on a large scale (Ege 1997).[22] The topic acquired new urgency recently when Tigray region began enforcing a proclamation (law) to take away land from rural residents who had left their village for more than two years. Second, urban expansion and government-supported land grants to investors continue apace. In both cases, possession of a certificate can improve negotiating power or at least provide a basis for compensation, again implying that certification could lead to potentially large tenure security effects.

4.2 Data, identification strategy, and econometric approach

To assess program impact, we use data from four waves of a panel survey of rural households conducted in September–October 1999, July–August 2002, September–November 2004, and July–August 2007 in the East Gojjam zone of the Amhara region.[23] In each round, the survey, which was undertaken by the Department of Economics of Addis Ababa University in collaboration with Gothenburg University, EDRI, and the World Bank, includes information on a panel of 900 households who had been randomly selected in the first phase, and more than 4,000 plots cultivated by these same households although the plots cannot be matched over time.[24] All sample villages are part of a SIDA-supported pilot that aimed to certify land and were therefore eventually covered by land certification.[25] The first three rounds of the panel covered the period before certification. At the time of the fourth round, some villages (referred to as treatment villages below) had been certified for more than 12 months so that certificates will have affected not only perceptions of tenure security but also decisions on investment and land market participation in the reference period for the survey.

[21] The proclamation (law) in Amhara allows land redistribution if properly researched and decided upon at the community level. Tigray has recently started redistributing the land of anybody absent from the village for more than two years with a minimum income (US$ 100 per month).
[22] Data from the study villages confirm the widespread nature of the government sponsored land redistribution in Amhara region in 1997. The first round data that was collected in 2000 show that about 46% and 48% of the sampled households experienced a decrease and an increase in their holdings, respectively, since the formation of their household. Of this more than 80% of the changes occurred due to village level land redistribution and reallocation, and about 61% of the decreases and 33% of the increases in landholdings had happened in 1997. The fact that the highest percentage of parcels (22% while the second highest was just 10% in 1975, i.e., right after the radical land reform) were acquired in 1997 is an additional evidence for changes in landownership in the region in the specified year.
[23] The East Gojjam zone was selected purposefully to represent surplus producing areas of the region. The districts and the villages in each district were also selected based on similar criteria while the households in each village were selected randomly.
[24] Information from one of the sampled villages is available only in the last two rounds, as it was added to the sample during the third round. For production information, the reference period was the main agricultural season (*meher*, i.e., from June-February) of 1998/99, 2000/01, 2003/04 and 2006/07 agricultural years.
[25] In view of the pilot's success, the program was expanded and has by now covered the entire region.

Household evidence on process in the top panel of table 1 reinforces earlier notions: 85% in certified and 78% in control villages attended an average of 3.5 public information meetings, and 85% and 68%, respectively, thought they were well informed about the program. At the time of the survey, 87% of households in treatment villages had received a certificate, which they had held for an average of 17 months, compared to 36% and 8 months in controls, with 77.5% in treatment and 2.3% in control areas having held certificates for longer than 12 months so that it could affect decisions (e.g. on investment) during the 12 month-recall period of our survey. Plot level data in the table's bottom panel point towards some implementation differences. Almost all the plots (92%) in treatment villages were measured (95% with rope) in the field with the presence of more than half of neighbors in 60% of the cases and between one third and half in 20% of the cases. However, field measurement was done for less than two thirds of registered plots in control villages; 35% of these cases involved eye estimation only, and more than half or more than one third of the neighbors were present only in 35% and 11% of cases, respectively.

The village level certification process follows a sequence of information campaign and LAC formation, field adjudication and distribution of registration receipts, and eventually issuance of final certificates. Selection of villages to be certified was the responsibility of *woreda* officials who determined a roll-out plan in campaign-style moving from village to village to maximize targets. However, the fact that field work is possible only during the dry season (January to July/August) when agricultural labor demands are limited creates a discontinuity which we can utilize for identification. Thus, in most cases the process was initiated after the harvest and registration completed before the start of the next growing season. *Woreda* officials then used the agricultural growing season to complete the paperwork and distribute certificates as and when they were ready and road conditions permitted.[26]

Table 2 illustrates the timing of program implementation for the 7 villages (*kebeles*) in the three districts (*woredas*) of our survey. With the exception of two 'pilot' villages (Telma and Gozamim), one in the treatment and one in the control, the program was introduced in treatment villages in early 2004 and in early 2005 or even 2006 in control villages.[27] In 'regular' villages it took an average of 11 months to complete registration and another five months for the issuance of certificates. Three control villages had completed registration and two had started issuance of certificates at the time of the survey. In those that had started certification, the process commenced some 15 months later than in treated ones. The fact that even in villages which we define as certified (as the majority of households received certificates) some

[26] A number of factors that can range from delays in delivery of printed certificates to the *woreda* to the sequencing of batches to sign or the lack or loss of owners' pictures can lead to delays in issuance of final certificates to individuals even in villages where the registration process has been completed and a majority received certificates.

[27] Both A. Gullit (treatment) and Telma (control) were used to pilot different methods of certification. In the former, high precision surveys were conducted with advanced technology including GPS and total stations, leading to a delay of 28 months between the start of the program and issuance of the first certificate. In the latter, some of the participatory processes were initially tested and the fact that the woreda would not be able to count it towards its achievement led to its temporary abandonment. Dropping either does not affect the substantive results reported here; results from doing so are available upon request.

households may be excluded for reasons unknown to us raises the question of whether the intervention should be defined at the household- or the village-level. To account for this, we report estimates that are based on either the village or the household being the relevant unit of observation throughout.

We use a difference-in-difference (DID) approach comparing difference between pre- and post-program outcomes together with a phased and discontinuous roll-out. This will provide an unbiased estimate of program effects if there are no unobserved differences between treatment and control units that could affect changes in outcome variables over time. While this cannot be tested, an ability to show that unobservable differences between villages did not affect the rate of change in outcome variables before the program had been announced will increase our confidence in this condition being satisfied. We explicitly test the assumption of parallel trends in pre-intervention years for key variables of interest.

Our strategy is conservative in two ways. First, by defining treatment as receipt of a certificate rather than completion of the registration process which is certain to lead to a certificate, we implicitly assume that registration has no effect and that the expectation of a certificate will not impact behavior. As illustrated in table 2, at the time of the fourth round of our survey all villages had received information about the program and many households in 'non-certified' villages had undergone the registration process. If this led them to modify their behavior, it would reduce the size of the effect estimated here, implying that our estimate will constitute a lower bound of the true certification impact. Second, to the extent that we define the intervention at the village rather than the household level, our 'treated' category includes households who did not receive a certificate. If there is self-selection so that the benefit of receiving certificates for recipients is above the average, this would exert downward bias on the estimated effects of certification.

To estimate program impacts on perceived tenure security, we use data from all four rounds to estimate

$$y_{it} = \lambda_t + \tau w_{it} + \mathbf{x}_{it}\boldsymbol{\gamma} + c_i + u_{it}, \quad (1)$$

where y_{it} is a dummy variable that takes a value of one if household *i* expects an increase (or a decrease) of its landholdings due to administrative intervention in the five years following the survey; w_{it} is the policy variable of interest (one for post-treatment period if household *i* lives in a 'treated village and zero otherwise; and equivalently for the case where treatment is defined at the household level); $\mathbf{x}_{it}$ is a vector of controls at the household level that include the head's age, gender, education, household assets (oxen, value of other livestock, roof material), and land size;[28] c_i captures household specific unobserved effects, λ_t is a full set of time dummies; and u_{it} is an *iid* error term. The null hypothesis that certification

[28] To allow for relative rather than absolute land size to affect the risk of expropriation, we use the amount of owned land per adult equivalent relative to the median of this variable in the village although results are similar if absolute land size is used.

increases tenure security would imply that τ is negative and significant. A random effects probit model is appropriate if c_i is normally distributed with mean zero and variance σ_u^2 and independent from all right-hand side variables. As this may be unrealistic, we use Chamberlain's random effects probit (Chamberlain 1980, Wooldridge 2001) which relaxes this by allowing correlation between c_i and the means of time-varying covariates at the household level according to

$$c_i = \psi + \bar{\mathbf{x}}_i \boldsymbol{\xi} + a_i,$$

where $\bar{\mathbf{x}}_i$ is the vector of the average of time-varying household covariates for household *i* over all periods and a_i is an error term. All that is required is that $\mathbf{x}_{it}$ and a_i are independently and normally distributed with mean zero and variance σ_a^2. Adding $\bar{\mathbf{x}}_i$ as an explanatory variables to equation (1) in each time period allows estimation of the parameters λ, τ, $\boldsymbol{\gamma}$, ψ, $\boldsymbol{\xi}$ and σ_a^2 in a random effects probit model. In addition to the Chamberlain random effects probit, we also use a conditional logit model with household fixed effects as a robustness check.

While we are able to control for time-invariant fixed effects, τ will be an unbiased estimate of program impact only if there are no unobservable factors that affect changes in outcome variables differently between control and treatment villages. Although this assumption itself is not testable, data from the survey rounds prior to certification can be used to test whether during this period, outcome variables moved in parallel in the two sets of villages. To do so, we estimate different intercept terms for the treatment and control villages for each year and then test for the equality of the differences in the intercept terms between treatment and control villages over all the periods.

In contrast to the household-level analysis in equation (1), impacts of certification on land-related investment are assessed at the plot level. Dependent variables for land-related investment take the value of one if the plot received soil or water conservation investment during the past 12 months or the number of hours spent in undertaking such investment during the past 12 months. Using the notation introduced above, the random effects probit or tobit (depending on the choice of the dependent variable) model for land-related investment on plot *j* by household *i* is specified as:

$$y_{jit} = \psi + \lambda_t + \tau w_{it} + \mathbf{x}_{it}\boldsymbol{\gamma} + \mathbf{p}_{jit}\boldsymbol{\delta} + \bar{\mathbf{x}}_i\boldsymbol{\xi} + a_i + u_{jit}, \qquad (2)$$

where the only difference is the inclusion of $\mathbf{p}_{jit}$, a vector of plot level characteristics that includes size, soil quality, slope, and length of possession, and the addition of a plot specific error term u_{jit}. The

hypothesis that certification increases incentives for land-related investment translates into $\tau > 0$. As earlier rounds did not include comparable information, our analysis is limited to the last two rounds.

Similar random effects probit and tobit specifications for participation on either side of the rental market and the amount of land transferred, respectively, are estimated for our rental market outcomes. As rental market participation may be persistent over time, for example due to non-convex transaction costs (Holden *et al.* 2008b), we also estimate a specification that allows for state dependence of rental market participation. The implied need to include the lagged dependent variable on the right-hand side of equation (1) gives rise to a nonlinear dynamic model that may suffer from the initial condition problem, i.e., the correlation between the unobserved effect and the initial observation of the dependent variable. To account for this, the distribution of the unobserved effect is modeled conditional on the initial observation in addition to the time-varying household level covariates (Wooldridge 2005). The reduced form equation to be estimated is

$$y_{it} = \psi + \lambda_t + \tau w_{it} + \mathbf{x}_{it}\boldsymbol{\gamma} + \rho y_{i,t-1} + \xi_0 y_{i0} + \bar{\mathbf{x}}_i\boldsymbol{\xi} + a_i + u_{it}, \quad (3)$$

where y_{it-1} is the lagged dependent variable and y_{i0} is the first realization of the dependent variable. The parameters in equation (3) are estimated using standard random effects probit or tobit, depending on the type of the dependent variable. As this procedure requires data from at least four periods, we are forced to drop one of the villages (A. Gulit) which was added to the survey during the third round. The hypothesis of a positive impact of certification on the propensity to rent out land translates into $\tau > 0$ in the probit and tobit equations for renting out or the area rented out. Again, we can test for the parallel trend assumption between treatment and control areas.

4.3 Econometric results

Results corresponding to the three main hypotheses suggest that, despite the limited time elapsed since its completion, certification has had a positive economic impact and improved tenure security, investment, and supply of land to the rental market. Even conservative estimates and a rough calculation of monetary benefits suggest that benefits exceed the cost significantly, allowing us to discuss ways in which the sustainability of impacts could be enhanced and other countries could benefit from Ethiopia's lessons.

Perceived tenure security: We find that, although certification failed to eliminate tenure insecurity, it has significantly reduced fear of land loss by some 10 percentage points, an estimate that is robust across specifications. Table 3 reports results from estimating equation (1) to identify the impact of certification on perceived risk of land loss or gain through administrative redistribution over the next five years. We report random effect probit estimates with treatment defined at village and household level (col. 1 & 4

and col. 2 &5, respectively) as well as conditional logit estimates with household fixed effects (col. 3 and 6). In all cases, results suggest that land tenure for treated households is significantly more secure as evidenced by the fact that they expect less administrative intervention. Estimated marginal effects from the Chamberlain specification with village level treatment indicator suggest that certification leads to a decrease of about 14 percentage points in the share of those expecting to gain and of about 9 percentage points in the share of those expecting to lose from land redistribution. The estimated size of impact with treatment defined at the household level is the same for land loss and slightly lower for land gain.[29] Although not directly comparable in terms of marginal effects, conditional logit estimates point in the same direction. Tests of the parallel trend assumption (appendix table 2) imply that the share of those who expected to lose land through administrative interventions, arguably the more relevant indicator in our context, had moved in parallel during all of the three pre-treatment periods. The share of households expecting an increase in land holdings moved in parallel between 1999 and 2002 but started to diverge in the 2002-2004 period, consistent with the notion that initial dissemination of the certification program in some villages before September–November 2004 had given rise to speculation about possible increases in land endowments.

Signs for coefficients on other variables are largely as expected. Coefficients on the time trend are highly significant and of large magnitude for gains but less significant for land losses, in line with descriptive evidence that points towards a reduction over time in the share of households who expect their holdings to increase rather than those that expect to lose land. Older household heads are more likely to fear land loss, consistent with the notion that administrative measures aim to redistribute productive assets among generations. A higher per capita land endowment relative to the village median increases fear of land loss and reduces perceived likelihood of gains, as expected in a system that aims to distribute a limited amount of overall land equitably among rural residents. The opposite is true for higher shares of good quality land, which could suggest that officials are either not good at assessing land quality or do not take it into account in making their decisions. Non-land physical assets, oxen, education, or possession of an iron roof have little impact on the perceived threat of land loss or gain. Interactions between the treatment dummy and assets, land, or the head's gender are insignificant throughout, providing little support to the notion that certification-induced tenure security effects are differentiated by wealth or gender.

Land-related investment: From an economic point of view, higher tenure security should manifest itself in land-related investment. Table 4 reports estimated marginal effects from probit and tobit models and conditional logit fixed effects for new investment in or repairs of conservation structures over the last 12

[29] The sign and significance of the estimates from the conditional logit model (col. 3 and 6) also confirm the results of the random effects probit analysis although we cannot directly compare the magnitudes due to the difficulty of estimating marginal effects for the conditional logit model. Hence the rest of the discussion is based on the random effects model.

months. Results from the Chamberlain specifications with village and household level treatment indicators (cols. 1 and 2 for probit and 4 and 5 for tobit) point towards significant and economically meaningful impacts. This is consistent with the conditional logit estimates (col. 3). According to our estimates, the propensity to invest in soil and water conservation measures increases by between 20 and 30 percentage points while the number of hours spent on such activities increases by between 72% and 136%. Even considering the low base of investment, this is a very large effect, making it of interest to assess its (potential) economic impact.

Coefficients on other variables suggest that the propensity to make land-related investment increases with plot size but decreases in overall holding size. This is consistent with the notion that the presence of some fixed cost element increases payoffs from investment in conservation for larger fields but that, on larger holdings, there is increased competition among plots for investment. The propensity to undertake investment is significantly lower on flat plots, consistent with the fact that such plots are less prone to erosion and land degradation than hilly plots, implying less need to guard against these through adoption of soil conservation measures. As the investments considered do not involve any cash outlays, there is little reason to expect impacts to be differentiated by wealth, as is suggested by the lack of significance of the certification dummy's interaction with the various measures of wealth (not reported) throughout.

Given the recent nature of certification, such investment will not yet have affected agricultural production as reported in our survey. Thus, to obtain a measure of the size of the investment impact, we estimate a household-fixed effects production function with a dummy for the presence of a functioning conservation structure. Results, as reported in appendix table 1, suggest that such a structure increases output by about 9 percentage points, implying that, with mean annual output of ETB 3,300 (with 9.6 ETB to the US $), investment-induced certification impacts are between ETB 56 and 87/hectare (0.29 or 0.19*0.09*3,330). Even if we assume that some of the investment actually involves repairs of existing structures, our conservative estimate implies that the increment in output from certification-induced investment in the first year alone could be sufficient to cover program costs (US$ 1 per plot or US$ 3.2/ha). Although a few issues, such as the addition of a cadastral index map, inclusion of common property resources, and a mechanism to keep records up to date, will need to be added to ensure sustainability of Ethiopia's program, these are unlikely to increase the cost beyond what would be warranted in light of the benefits obtained, which could possibly be further increased by appropriate changes in policy.

Rental market participation: Rental markets are likely to become of increased importance as a catalyst of the local non-farm sector and having a certificate can, in principle, be an important incentive for farmers to rent out. Tables 5 and 6 present results from probit and tobit estimates of equation (3) that allow us to test whether, as expected, certification affected the propensity to rent out but left demand for land rental

unaffected. In both cases, results from the Chamberlain specifications of the rent-out regressions in col. 1-3 (with treatment defined at village or household level) strongly support our hypothesis. Estimated marginal effects suggest that certification consistently increases the amount of land rented out by about one tenth of a hectare at the mean and the propensity to rent out by 13 or 9 percentage points for treatment defined at village or household level, respectively. Estimated impacts for renting in are insignificant as expected if treatment is defined at the village level and marginally negative if treatment is defined at the household level (table 8, col. 6). Our dynamic analysis (cols. 2-3 and 5-6 in both tables) suggests that participation decisions and the amount of land transacted on both sides of the rental market are strongly and positively state-dependent. Thus, policy interventions affecting market participation at any given point in time will affect households' long-term trajectories.

Our results also point towards a significant impact of land endowments on renting out (positive) and renting in (negative) as would be expected if rental markets contribute to equalization of factor input ratios. Total owned area has a positive and significant effect in the leasing-out regressions as compared to a negative and significant effect on the leasing-in regressions. However, the absolute value of the marginal effect of total owned land on the amount of land rented out or in (table 6) is less than one, indicating that rental market participation allows only partial adjustment towards desired area of cultivated land (Bliss and Stern 1982). Contrary to what is found in studies from other countries, but consistent with evidence from Ethiopia (Deininger *et al.* 2008b), rental markets transfer land from relatively resource-poor households (mainly in terms of oxen power) that are often female-headed, to comparatively resource-rich households. Appendix table 2 demonstrates that the parallel trend assumption holds throughout the pre-intervention period for renting out (col. 3 and 5), the variable of primary interest in our analysis, implying that unobserved factors did not lead to differential evolution of this variable over time in treatment and control villages.

Rental markets in Ethiopia also have strong gender implications, as socio-cultural norms and factor market imperfections make self-cultivation of land by female headed households extremely rare, implying that they either rent out their land or, often due to insecure tenure, leave it fallow (Adal 2005). This is borne out by our results where gender of the household head and the number of oxen have significant impacts on the nature and magnitude of rental market transactions in terms of encouraging renting in and discouraging renting out. Older households are more likely to rent out and literate households are more likely to rent out larger areas of land. The significant coefficient on possession of an iron roof in the rent-in equation may point in the same direction by highlighting imperfections in financial markets that make renting in easier for those with greater wealth. To the extent that they allow productive use of plots that had been left uncultivated, or greater freedom in the choice of transaction partner to transfer land to those

with higher levels of ability, certification-induced rental market effects could enhance productivity of land use. Such impacts can come about if (female) landlords were able to enter into longer term contracts or to select more productive tenants beyond their immediate social network due to the increased security provided by certificates. As virtually all land is rented under sharecropping contracts, any productivity effects would translate directly into improved welfare for (female) landlords. Although beyond the scope of this paper, further study of impacts on women would be of interest.

5. Conclusion and policy implications

We started this review with an account of reasons why land tenure and administration is likely to become more important in Africa. Such increased demand is accompanied by three important changes on the supply: First, there has been significant progress in policy formulation to adjust laws to reality and to develop policies that would open the scope for more participatory practices and better implementation (Alden-Wily 2003). This has led to models of land registration that can deal with a continuum of rights, allow communal and individual rights to be registered, and in general, aim to use law to recognize existing ground realities rather than trying to make reality fit certain pre-conceived legal norms. Growing importance and country interest are also supported by the fact that the AU has recently adopted a 'framework and guidelines' document for land policy formulation. Second, virtually all developing countries have gone through major efforts at administrative decentralization. While this has created significant capacity gaps in the short term, it allows land administration to rely on local governments, and even to provide revenues that can help support local governments financially. Finally, technology, especially in terms of satellite imagery and IT systems has evolved significantly with rapidly decreasing cost which, for the first time, allows establishment of national systems for land administration at a cost that is affordable for African countries. While the tools to do so are still under development, this also offers the prospect of being able to recognize and possibly even register overlapping rights in a more systematic manner. In fact, there is now an increasing number of countries (including Benin, Burkina Faso, Ethiopia, Kenya, Nigeria, Madagascar, Mozambique, Rwanda, Tanzania, and Uganda) that are now experimenting with new forms to secure tenure and administer land. Accompanying these processes and evaluating them in a way that allows rapid feedback to policy makers is a significant challenge, but also a great opportunity, for research.

Table 1: Program characteristics at household and plot levels

	Certificates issued?	
	No	**Yes**
Household level data		
A member of the household attended public information meetings	0.78	0.85
Number of meetings attended	3.50	3.60
Well informed about the program	0.68	0.85
Has landholding certificate	35.55	87.47
Number of months since certified	8.07	17.15
Plot level data[1]		
Plot area was determined in the field	0.64	0.92
Plot area was determined at *kebele* office referring to previous records	0.35	0.05
Plot measured using tape and rope, if determined in the field	0.65	0.95
Plot measured using eye estimation, if determined in the field	0.35	0.00
More than half of the neighbors were present when measured	0.35	0.59
Half or less than half of the neighbors were present were present	0.11	0.20
Plot has a certificate	0.30	0.75
Number of months since certified (for certified plots only)	8.19	16.93
Plot is jointly certified with head and spouse (for certified plots only)	0.83	0.77
Number of households	481	359
Number of plots	2369	2143

Source: Own computation from AAU/Gothenburg/WB Survey.
[1]As registration was almost complete in all the survey villages, more than 99% of the plots were already registered at the time of the survey.

Table 2: Program characteristics by village

	Certificates issued 12 months before survey?						
	No				Yes		
District (*Woreda*) name	Gozamin		Enemay		Machakel		Gozamin
Village (*Kebele*) name	Kebi	Wolkie	Telma	S. Debir	Amanuel	D. Elias	A. Gulit
Kebele area in ha	630	2670	1964	2560	4373	1790	2172
No of households	1094	1050	1464	1275	1151	906	890
Program introduced	May 2005	Sep. 2006	Oct. 2003	Jun. 2005	Feb. 2004	Feb. 2004	Feb. 2003
Competed registration	Dec. 2005	NC	Aug. 2006	Dec. 2006	Jun. 2004	Jul. 2004	May 2005
Start of certificate distribution	Aug. 2006	NS	Sep. 2006	NS	Feb. 2005	Feb. 2005	Jun. 2005
No. of LAC members	15	20	21	35	14	14	18
Training days to LAC members	3	5	8	8	9	4	6
Number of village meetings	4	4	6	2	5	3	3

Source: Own computation from AAU/Gothenburg/WB Survey

NC=Not completed at the time of the survey. NS=Not started at the time of the survey.

Table 3: Impact of certification on perceived land tenure security: Marginal effects

	Expect an increase			Expect a decrease		
	Chamberlain RE probit		Cond. logit	Chamberlain RE probit		Cond. logit
	$T_{Village.}$	$T_{Household}$	$T_{Village}$	$T_{Village.}$	$T_{Household}$	$T_{Village}$
Land use certificates issued	-0.135***	-0.099***	-0.941**	-0.095***	-0.095***	-0.598***
	(-4.13)	(-2.577)	(-2.567)	(-4.43)	(-4.292)	(-2.696)
Relative land size	-0.106***	-0.106***	-0.334**	0.041***	0.042***	0.066
	(-7.30)	(-7.245)	(-2.482)	(4.26)	(4.357)	(0.689)
Share of good quality land	0.070***	0.071***	0.283	-0.055**	-0.055**	-0.092
	(2.66)	(2.696)	(1.425)	(-2.35)	(-2.357)	(-0.465)
Number of dependents	-0.001	-0.001	0.006	0.019	0.019	0.107
	(-0.05)	(-0.104)	(0.061)	(1.57)	(1.557)	(1.314)
Number of adult male	0.008	0.008	0.076	0.027	0.026	0.154
	(0.37)	(0.366)	(0.536)	(1.52)	(1.474)	(1.299)
Number of adult female	-0.033	-0.033	-0.144	0.026	0.026	0.122
	(-1.55)	(-1.553)	(-1.010)	(1.44)	(1.440)	(1.004)
Number of oxen	0.003	0.004	0.020	-0.008	-0.008	-0.082
	(0.27)	(0.296)	(0.231)	(-0.78)	(-0.780)	(-1.028)
Value of other animals x 10^{-3} (Birr)	0.008	0.008	0.014	0.003	0.003	0.013
	(1.42)	(1.320)	(0.414)	(0.55)	(0.578)	(0.380)
Roof corrugated iron sheet	-0.020	-0.018	-0.241	0.032	0.033	0.237
	(-0.57)	(-0.534)	(-1.159)	(1.06)	(1.090)	(1.106)
Age of household head (years)	-0.016***	-0.016***	-0.008	0.010***	0.011***	0.070
	(-3.70)	(-3.689)	(-0.156)	(2.64)	(2.706)	(1.423)
Age of household head squared	0.000***	0.000***	-0.000	-0.000	-0.000	-0.000
	(2.75)	(2.755)	(-0.621)	(-1.41)	(-1.479)	(-0.731)
Female headed household	0.021	0.022	-0.308	-0.063	-0.065	-0.345
	(0.36)	(0.366)	(-0.789)	(-1.45)	(-1.512)	(-1.028)
Household head can read and write	0.013	0.010	0.022	0.020	0.019	0.119
	(0.40)	(0.307)	(0.110)	(0.66)	(0.642)	(0.626)
Year = 2002	-0.097***	-0.098***	-0.533***	-0.021	-0.021	-0.145
	(-4.95)	(-4.954)	(-4.147)	(-0.98)	(-0.979)	(-0.999)
Year = 2004	-0.252***	-0.254***	-1.591***	-0.070***	-0.070***	-0.362**
	(-13.32)	(-13.346)	(-8.271)	(-3.07)	(-3.062)	(-1.991)
Year = 2007	-0.333***	-0.346***	-2.309***	0.012	0.003	0.110
	(-15.50)	(-16.770)	(-8.873)	(0.36)	(0.085)	(0.484)
Number of observations	3042	3042	2031	3042	3042	1,658
Number of households	882	882	532	882	882	436
Log lik.	-1461.590	-1464.87	-527.30	-1502.370	-1502.92	-603.86
Chi-squared	517.886	522.775	483.713	126.407	126.719	34.718
Rho	0.070	0.071		0.047	0.041	
sigma_u	0.274	0.276		0.221	0.208	
Lik.-ratio test of rho=0	-1463.695	-1467.041		-1503.399	-1503.692	
Chibar2	4.209	4.348		2.059	1.539	

Note: The dependent variable is whether the household expects an increase or decrease in landholdings over the coming 5 years due to land redistribution and reallocation. The Chamberlain random effects (RE) specification includes the mean value of the time-varying household level variables (Chamberlain 1980), coefficients for which are not reported. A constant term is included in all the regressions. $T_{Village.}$ and $T_{Household}$ indicate that treatment is defined at the village and the household level, respectively. Absolute value of t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Impact of certification on propensity and magnitude of investment in soil & water conservation: Marginal effects

	Repairs and new investment last 12 months			Hours spent last 12 months	
	Chamberlain RE probit		Cond. logit	Chamberlain RE tobit	
	$T_{Village.}$	$T_{Household}$	$T_{Village}$	$T_{Village.}$	$T_{Household}$
Land use certificates issued	0.291***	0.191***	2.345***	1.359***	0.723***
	(10.32)	(6.853)	(15.427)	(10.22)	(5.521)
Parcel size in hectares	0.061***	0.063***	0.255*	0.522***	0.519***
	(3.80)	(3.828)	(1.877)	(4.35)	(4.348)
Number of years possessed	0.000	0.000	-0.002	0.009**	0.007*
	(0.61)	(0.157)	(-0.363)	(2.34)	(1.724)
Good soil quality	-0.013	-0.016	-0.111	-0.055	-0.072
	(-1.14)	(-1.380)	(-1.062)	(-0.64)	(-0.834)
Medium soil quality	-0.013	-0.016	-0.122	-0.096	-0.098
	(-1.23)	(-1.407)	(-1.223)	(-1.17)	(-1.199)
Flat land	-0.121***	-0.134***	-0.806***	-1.009***	-1.026***
	(-5.89)	(-6.335)	(-5.575)	(-8.19)	(-8.264)
Gently sloped land	-0.023	-0.028*	-0.122	-0.217*	-0.216*
	(-1.57)	(-1.823)	(-0.836)	(-1.89)	(-1.874)
Irrigated land	0.019	0.014	0.086	0.078	0.082
	(0.83)	(0.600)	(0.455)	(0.48)	(0.501)
Total owned land in hectares	-0.062***	-0.051***		-0.355***	-0.316***
	(-7.24)	(-6.062)		(-6.89)	(-6.478)
Value of livestock x 10^{-3} (Birr)	-0.003*	-0.002		-0.013	-0.011
	(-1.91)	(-1.404)		(-1.17)	(-0.976)
Corrugated iron roof	-0.035	-0.043		-0.343*	-0.398**
	(-1.21)	(-1.433)		(-1.85)	(-2.139)
Number of dependents	0.024***	0.030***		0.244***	0.278***
	(2.60)	(3.171)		(3.75)	(4.267)
Number of adult male	0.015	0.022*		0.047	0.097
	(1.26)	(1.763)		(0.54)	(1.101)
Number of adult female	0.018*	0.033***		0.075	0.167**
	(1.66)	(2.956)		(0.95)	(2.102)
Age of household head (years)	0.007	0.006		0.044*	0.039
	(1.50)	(1.284)		(1.80)	(1.636)
Age of household head squared	-0.000***	-0.000**		-0.001***	-0.001***
	(-2.65)	(-2.535)		(-3.22)	(-3.383)
Female headed household	0.068	0.079*		0.514*	0.619**
	(1.47)	(1.657)		(1.80)	(2.131)
Head can read and write	0.010	0.012		0.047	0.107
	(0.56)	(0.606)		-0.265***	(0.817)
Year = 2007	-0.052***	-0.015	-0.708***	(-3.00)	0.029
	(-4.39)	(-1.354)	(-8.316)	8671	(0.346)
Number of observations	8671	8671	5045	856	8671
Number of households	856	856	478	-9686.428	856
Log likelihood	-3596.791	-3655.45	-1955.69	425.423	-9733.98
Chi-squared	387.139	298.990	389.623	0.588	341.367
Rho	0.647	0.621		6.923	0.564
sigma_u	1.354	1.281		7.023	6.702
Lik.-ratio test of rho=0	-4555.374	-4565.755			
$Chibar^2$	1917.167	1820.611			

Note: The Chamberlain specification includes the mean value of the time-varying household level variables (Chamberlain 1980), coefficients for which are not reported. A constant term is included in all the regressions. $T_{Village.}$ and $T_{Household}$ indicate that treatment is defined at the village and the household level, respectively. Absolute value of t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

[a]The dependent variable is log((number of hours spent on repairs and new investment last 12 months + 0.01)/0.01).

Table 5: Certification impact on rental market participation: marginal effects from Chamberlain RE probit models

	Rented-out			Rented-in		
	$T_{Village.}$	$T_{Village.}$	$T_{Household}$	$T_{Village.}$	$T_{Village.}$	$T_{Household}$
Land use certificates issued	0.135**	0.127**	0.114**	-0.014	-0.011	-0.071*
	(2.36)	(2.38)	(1.984)	(-0.34)	(-0.24)	(-1.700)
Total owned land in hectares	0.065***	0.055***	0.057***	-0.103***	-0.091***	-0.088***
	(5.34)	(4.79)	(5.083)	(-5.89)	(-5.82)	(-5.714)
Share of good quality land	-0.013	-0.030	-0.034	-0.051	-0.053	-0.053
	(-0.32)	(-0.70)	(-0.796)	(-1.15)	(-1.19)	(-1.198)
Number of dependents	-0.005	0.002	0.002	-0.029	-0.019	-0.018
	(-0.21)	(0.08)	(0.071)	(-1.20)	(-0.80)	(-0.775)
Number of adult male	-0.029	-0.033	-0.029	-0.060*	-0.043	-0.040
	(-0.82)	(-0.90)	(-0.811)	(-1.68)	(-1.22)	(-1.134)
Number of adult female	0.006	0.021	0.022	-0.015	-0.008	-0.005
	(0.20)	(0.70)	(0.733)	(-0.48)	(-0.26)	(-0.165)
Number of oxen	-0.086***	-0.091***	-0.091***	0.075***	0.088***	0.086***
	(-3.76)	(-4.05)	(-4.061)	(3.30)	(3.83)	(3.749)
Value of other animals x 10^{-3} (Birr)	-0.002	0.004	0.004	0.011	0.008	0.009
	(-0.20)	(0.38)	(0.365)	(1.60)	(1.00)	(1.169)
Roof corrugated iron sheet	-0.055	-0.076	-0.076	0.105**	0.114**	0.116**
	(-0.85)	(-1.16)	(-1.146)	(2.11)	(2.16)	(2.218)
Age of household head (years)	-0.012*	-0.011*	-0.011*	0.004	0.007	0.007
	(-1.69)	(-1.65)	(-1.659)	(0.42)	(0.86)	(0.831)
Age of household head squared	0.000*	0.000*	0.000*	0.000	-0.000	-0.000
	(1.72)	(1.67)	(1.711)	(0.02)	(-0.52)	(-0.492)
Female headed household	0.143	0.226**	0.231**	-0.149**	-0.177***	-0.175***
	(1.39)	(2.19)	(2.243)	(-2.54)	(-2.62)	(-2.578)
Household head can read and write	0.082	0.090	0.093	0.019	0.038	0.042
	(1.42)	(1.55)	(1.586)	(0.37)	(0.73)	(0.799)
Initial year participation as landlord		0.124***	0.123***			
		(2.84)	(2.813)			
Lagged participation as landlord		0.331***	0.330***			
		(7.48)	(7.466)			
Initial year participation as tenant					0.174***	0.175***
					(5.29)	(5.335)
Lagged participation as tenant					0.273***	0.279***
					(7.45)	(7.585)
Year = 2007	0.067**	0.032	0.043	0.164***	0.171***	0.184***
	(2.08)	(0.89)	(1.256)	(4.77)	(4.66)	(5.121)
Number of observations	1424	1302	1302	1424	1302	1302
Number of households	736	657	657	736	657	657
Log lik.	-553.486	-462.047	-463.05	-645.492	-553.622	-552.40
Chi-squared	213.926	408.790	407.158	157.204	348.470	348.577
Rho	0.425	0.038	0.038	0.502	0.038	0.039
sigma_u	0.859	0.199	0.199	1.003	0.200	0.201
Lik.-ratio test of rho=0	-567.517	-461.536	-462.532	-668.248	-553.266	-552.082
Chibar2	28.061	1.021	1.045	45.511	0.711	0.645

Note: The Chamberlain specification includes the mean value of the time-varying household level variables (Chamberlain 1980), but not reported. A constant term is included in all the regressions. $T_{Village.}$ and $T_{Household}$ indicate that treatment is defined at the village and the household level, respectively. Absolute value of t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Certification impact on size of land rented: marginal effects from Chamberlain RE tobit models

	Land rented-out			Land rented-in		
	$T_{Village.}$	$T_{Village.}$	$T_{Household}$	$T_{Village.}$	$T_{Village.}$	$T_{Household}$
Land use certificates issued	0.089***	0.092***	0.102***	0.007	0.020	-0.012
	(2.78)	(2.83)	(2.864)	(0.28)	(0.75)	(-0.451)
Total owned land in hectares	0.087***	0.075***	0.076***	-0.061***	-0.051***	-0.049***
	(11.14)	(9.61)	(9.925)	(-6.49)	(-5.47)	(-5.318)
Share of good quality land	0.015	-0.001	-0.004	0.007	0.006	0.005
	(0.56)	(-0.04)	(-0.134)	(0.30)	(0.24)	(0.215)
Number of dependents	-0.001	-0.003	-0.003	-0.014	-0.018	-0.017
	(-0.05)	(-0.18)	(-0.207)	(-0.98)	(-1.27)	(-1.221)
Number of adult male	-0.017	-0.028	-0.027	-0.041**	-0.039*	-0.038*
	(-0.76)	(-1.24)	(-1.192)	(-1.99)	(-1.87)	(-1.833)
Number of adult female	0.008	0.017	0.016	-0.004	-0.003	-0.001
	(0.42)	(0.84)	(0.814)	(-0.19)	(-0.16)	(-0.065)
Number of oxen	-0.098***	-0.099***	-0.098***	0.041***	0.042***	0.041***
	(-6.46)	(-6.49)	(-6.479)	(3.23)	(3.22)	(3.157)
Value of other animals x 10^{-3} (Birr)	-0.003	0.004	0.003	0.009**	0.006	0.007
	(-0.47)	(0.55)	(0.517)	(2.09)	(1.37)	(1.495)
Roof corrugated iron sheet	-0.053	-0.060	-0.060	0.063*	0.073**	0.075**
	(-1.36)	(-1.49)	(-1.499)	(1.83)	(2.18)	(2.246)
Age of household head (years)	-0.009**	-0.008*	-0.007*	0.001	0.002	0.002
	(-2.28)	(-1.79)	(-1.776)	(0.24)	(0.48)	(0.446)
Age of household head squared	0.000**	0.000**	0.000**	0.000	-0.000	-0.000
	(2.31)	(1.99)	(2.029)	(0.34)	(-0.05)	(-0.017)
Female headed household	0.076	0.095*	0.101*	-0.120**	-0.123**	-0.119**
	(1.41)	(1.67)	(1.771)	(-2.37)	(-2.48)	(-2.392)
Household head can read and write	0.063*	0.088**	0.089**	0.003	0.016	0.018
	(1.70)	(2.27)	(2.292)	(0.09)	(0.51)	(0.579)
Initial value of rented-out land in ha		0.035	0.032			
		(1.58)	(1.461)			
Lag of rented-out land in hectares		0.079***	0.078***			
		(3.36)	(3.327)			
Initial value of rented-in land in ha					0.112***	0.110***
					(6.34)	(6.285)
Lag of rented-in land in hectares					0.137***	0.139***
					(8.38)	(8.470)
Year = 2007	0.047**	0.040*	0.044**	0.083***	0.077***	0.086***
	(2.35)	(1.85)	(2.111)	(4.15)	(3.51)	(4.004)
Number of observations	1424	1302	1302	1424	1302	1302
Number of households	736	657	657	736	657	657
Log lik.	-958.803	-818.433	-818.23	-987.544	-863.260	-863.45
Chi-squared	525.993	538.083	540.750	329.679	442.058	440.150
Rho	0.326	0.198	0.197	0.289	0.000	0.000
sigma_u	0.605	0.453	0.451	0.506	0.000	0.000

Note: The Chamberlain specification includes the mean value of the time-varying household level variables (Chamberlain 1980), but not reported. A constant term is included in all the regressions. $T_{Village.}$ and $T_{Household}$ indicate that treatment is defined at the village and the household level, respectively. Absolute value of t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix table 1: Determinants of value of crop output: household fixed effect estimates

	Value of crop output (log)
Plot has soil and water conservation structures	0.091***
	(5.60)
Plot size (hectares)	0.276***
	(23.56)
Male adult labor (days)	0.334***
	(21.84)
Female adult labor (days)	-0.001
	(0.09)
Hired labor (days)	0.023
	(1.16)
Oxen (days)	0.128***
	(10.96)
Chemical fertilizer (kg)	0.155***
	(14.54)
Manure (kg)	0.027**
	(2.27)
Dummy female family labor[a]	-0.011
	(0.31)
Dummy hired labor[a]	-0.087**
	(2.33)
Dummy chemical fertilizer[a]	0.125***
	(3.40)
Dummy manure[a]	0.213***
	(2.92)
Number of year possessed	-0.000
	(0.02)
Good soil quality	0.185***
	(9.55)
Medium soil quality	0.110***
	(6.12)
Flat land	0.031
	(0.97)
Gently sloped land	0.055*
	(1.70)
Irrigated land	0.138***
	(3.47)
Year = 2002	-0.884***
	(42.02)
Year = 2004	0.383***
	(18.25)
Year = 2007	0.671***
	(32.09)
Constant	4.259***
	(40.46)
Number of observations	11689
Number of households	844
R^2	0.554

Note: Absolute value of t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.
[a]The value of the dummy is 1 if the input is not used, and the value is 0 if the input is used. All inputs are in logs.

Appendix table 2: Test of parallel trend assumption using pre-treatment data for perceived tenure security and rental market participation: Marginal effects from Chamberlain specification

	Probit				Tobit	
	Expect an increase	**Expect a decrease**	**Rented-out**	**Rented-in**	**Rented-out**	**Rented-in**
Total owned land in hectares	-0.123***	0.039***	0.027***	-0.062***	0.050***	-0.015
	(-6.257)	(3.247)	(2.731)	(-3.517)	(5.635)	(-1.535)
Share of good quality land	0.088**	-0.079***	-0.025	0.013	0.003	0.017
	(2.326)	(-2.653)	(-1.002)	(0.343)	(0.154)	(0.881)
Number of dependents	-0.027	0.006	-0.017	0.030*	-0.017	0.018*
	(-1.364)	(0.383)	(-1.367)	(1.681)	(-1.549)	(1.869)
Number of adult male	-0.028	0.016	-0.014	0.021	-0.026	0.003
	(-0.882)	(0.671)	(-0.709)	(0.743)	(-1.450)	(0.184)
Number of adult female	-0.075**	0.006	-0.017	0.020	-0.021	0.008
	(-2.409)	(0.258)	(-0.971)	(0.691)	(-1.325)	(0.484)
Number of oxen	0.015	-0.012	-0.048***	0.050***	-0.061***	0.011
	(0.904)	(-0.952)	(-3.866)	(3.216)	(-5.269)	(1.540)
Value of other animals x 10^{-3} (Birr)	-0.001	0.005	-0.007	0.000	-0.007	0.003
	(-0.102)	(0.731)	(-0.778)	(0.031)	(-0.792)	(0.551)
Roof corrugated iron sheet	-0.065	0.048	0.015	0.085***	0.005	0.044***
	(-1.390)	(1.333)	(0.720)	(2.784)	(0.267)	(2.602)
Age of household head (years)	-0.019***	0.014***	-0.000	-0.011	-0.003	-0.007*
	(-2.997)	(2.796)	(-0.001)	(-1.644)	(-0.994)	(-1.890)
Age of household head squared	0.000**	-0.000**	0.000	0.000	0.000	0.000
	(2.283)	(-2.342)	(0.105)	(0.799)	(1.405)	(1.246)
Female headed household	-0.056	-0.109**	0.218**	-0.094	0.082*	-0.049
	(-0.712)	(-2.266)	(2.525)	(-1.429)	(1.816)	(-1.125)
Household head can read and write	0.038	0.017	0.016	0.015	0.014	0.005
	(0.816)	(0.469)	(0.552)	(0.364)	(0.500)	(0.242)
Treated, Year=2000	0.690***	-0.286***	-0.050	0.323	-0.069	0.130
	(18.287)	(-16.947)	(-0.842)	(1.612)	(-1.073)	(1.386)
Treated, Year=2002	0.624***	-0.284***	-0.068	0.043	-0.074	0.033
	(10.324)	(-16.675)	(-1.416)	(0.278)	(-1.159)	(0.434)
Treated, Year=2004	0.588***	-0.290***	0.008	0.135	0.024	0.079
	(8.197)	(-17.182)	(0.088)	(0.763)	(0.307)	(0.951)
Control, Year=2000	0.733***	-0.384***	-0.072	0.193	-0.087	0.111
	(13.002)	(-11.755)	(-1.213)	(1.073)	(-1.357)	(1.282)
Control, Year=2002	0.692***	-0.396***	-0.098**	0.057	-0.100	0.044
	(10.456)	(-12.356)	(-1.986)	(0.366)	(-1.615)	(0.574)
Control, Year=2004	0.532***	-0.408***	-0.049	-0.029	-0.053	0.000
	(5.331)	(-12.457)	(-0.730)	(-0.215)	(-0.796)	(0.003)
Number of observations	2,096	2,096	2,095	2,095	2,095	2,095
Number of households	742	742	741	741	741	741
Log-Likelihood	-1211.42	-986.98	-737.32	-997.41	-1,164.72	-1,406.77
Chi-squared	373.088	656.293	303.506	296.983	545.533	353.759
rho	0.112	0.038	0.407	0.426	0.165	0.233
sigma_u	0.355	0.198	0.829	0.862	0.438	0.414
Lik.-ratio test of rho=0	-1210.942	-1023.220	-761.404	-1,041.222		
Chibar2	0.959	72.484	48.176	87.633		
Test of parallel trends 2000 & 2002	2.64	1.69	0.11	3.92*	0.08	0.67
Prob > Chi2	0.10	0.19	0.74	0.05	0.78	0.41
Test of parallel trends 2000, 2002, 2004	7.95**	1.78	1.07	9.55***	3.49	8.55***
Prob > Chi2	0.02	0.41	0.58	0.01	0.17	0.01

Note: The dependent variables are as defined in tables 6, 8 and 9. All the specifications include the mean value of the time-varying household level variables (Chamberlain 1980), coefficients for which are not reported. Absolute value of t statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Reference List

Acemoglu, D. and S. Johnson. 2005. "Unbundling institutions." *Journal of Political Economy 113* (5): 949-95.

Acemoglu, D., S. Johnson, and J. Robinson. 2004. "Institutions as the Fundamental Cause of Long-Run Growth." NBER Working Paper 10481. Cambridge, MA: National Bureau of Economic Research.

Acemoglu, D., S. Johnson and J. A. Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review 91* (5): 1369-401.

Adal, Y. 2005. "Rural women's access to land in Ethiopia." . Addis Ababa: Forum for Social Studies.

Adal, Y. 2008. "Rural Land Certification in Ethiopia." Working Paper. Addis Ababa: Insitute of Development Research.

Alden-Wily, L. 2003. "Governance and Land Relations. A Review of Decentralization of Land Administration and Management in Africa." IIED Issues Paper 120. London: International Institute for Environment and Development.

Alden-Wily, L. 2008. "Custom and commonage in Africa: Rethinking the orthodoxies." *Land Use Policy 25* (1): 43-52.

Allen, D. and D. Lueck. 1992. "Contract Choice in Modern Agriculture: Cash Rent versus Cropshare." *Journal of Law and Economics 35* (2): 397-426.

Allendorf, K. 2007. "Do Women's Land Rights Promote Empowerment and Child Health in Nepal?" *World Development 35* (11): 1975-88.

Andolfatto, D. 2002. "A Theory of Inalienable Property Rights." *Journal of Political Economy 110* (2): 382-93.

Andre, C. and J. P. Platteau. 1998. "Land Relations under Unbearable Stress: Rwanda Caught in the Malthusian Trap." *Journal of Economic Behavior and Organization 34* (1): 1-47.

Antle, J. M., D. Yanggen, R. Valdivia, and C. Crissman. 2003. "Endogeneity of Land Titling and Farm Investments: Evidence from the Peruvian Andes." Working Paper. Bozeman, MT: Montana State University.

Arrunada, B. 2003. "Property Enforcement as Organized Consent." *Journal of Law, Economics, and Organization 19* (2): 401-44.

Arrunada, B. 2007. "Pitfalls to Avoid When Measuring Institutions: Is Doing Business Damaging Business?" *Journal of Comparative Economics 35* (4): 729-47.

Arrunada, B. and N. Garoupa. 2005. "The Choice of Titling System in Land." *Journal of Law and Economics 48* (2): 709-27.

Atwood, D. A. 1990. "Land Registration in Africa: The Impact on Agricultural Production." *World Development 18* (5): 659-71.

Ayalew, D., S. Dercon, and M. Gautam. 2005. "Property rights in a very poor country: Tenure insecurity and investment in Ethiopia." GPRG-WPS-021. Oxford University: Global Poverty Research Group Working Paper Series.

Baland, J. M. and P. Francois. 2005. "Commons as Insurance and the Welfare Impact of Privatization." *Journal of Public Economics 89* (2-3): 211-31.

Baland, J. M. and J. A. Robinson. 2003. "Land and Power." Discussion Paper 3800. London: Centre for Economic Policy Research.

Bandiera, O. 2007. "Land Tenure, Investment Incentives, and the Choice of Techniques: Evidence from Nicaragua." *World Bank Economic Review 21* (3): 487-508.

Banerjee, A. V. and L. Iyer. 2004. "History, Institutions, and Economic Performance: The Legacy of Colonial Land Tenure Systems in India." MIT Working Paper 02-27 Cambridge, MA.

Barnes, G. and C. Griffith-Charles. 2007. "Assessing the formal land market and deformalization of property in St. Lucia." *Land Use Policy 24* (2): 494-501.

Baruah, B. 2007. "Gendered Realities: Exploring Property Ownership and Tenancy Relationships in Urban India." *World Development 35* (12): 2096-109.

Benjamin, D. and L. Brandt. 2002. "Property Rights, Labour Markets, and Efficiency in a Transition Economy: The Case of Rural China." *Canadian Journal of Economics 35* (4): 689-716.

Benjaminsen, T. A. and E. Sjaastad. 2002. "Race for the Prize: Land Transactions and Rent Appropriation in the Malian Cotton Zone." *European Journal of Development Research 14* (2): 129-52.

Berry, S. 1997. "Tomatoes, Land and Hearsay: Property and History in Asante in the Time of Structural Adjustment." *World Development 25* (8): 1225-41.

Besley, T. 1995. "Property Rights and Investment Incentives: Theory and Evidence from Ghana." *Journal of Political Economy 103* (5): 903-37.

Bezabih, M. and S. Holden. 2006. "Tenure Insecurity, Transaction Costs in the Land Lease Market and their Implications for Gendered Productivity Differentials."

Binswanger, H. P., K. Deininger and G. Feder. 1995. "Power, Distortions, Revolt and Reform in Agricultural Land Relations." *Handbook of development economics 3B* 2659-772.

Bird, R. M. and E. Slack. 2002. "Land and Property Taxation Around the World: A Review." *World Bank Land Workshop in Budapest, Hungary*.

Bliss, C. J. and N. H. Stern. 1982. *Palanpur: The Economy of an Indian Village*. Oxford: Clarendon Press.

Boucher, S., M. R. Carter and C. Guirkinger. 2008. "Risk rationing and wealth effects in credit markets: Theory and implications for agricultural development." *American Journal of Agricultural Economics 90* (2): 409-23.

Brasselle, A. S., F. Gaspart and J. P. Platteau. 2002. "Land Tenure Security and Investment Incentives: Puzzling Evidence from Burkina Faso." *Journal of Development Economics 67* (2): 373-418.

Broegaard, R. J. 2005. "Land Tenure Insecurity and Inequality in Nicaragua." *Development and Change 36* (5): 845-64.

Bromley, D. W. 2008. "Formalising property relations in hte developing world: The wrong prescription for the wrong malady." *Land Use Policy forthcoming*.

Burns, T. A. 2007. "Land Administration: Indicators of success and future challenges." Agriculture & Rural Development Department. Washington: World Bank.

Carter, M. R. and P. Olinto. 2003. "Getting Institutions "Right" for Whom? Credit Constraints and the Impact of Property Rights on the Quantity and Composition of Investment." *American Journal of Agricultural Economics 85* (1): 173-86.

Carter, M. R. and Y. Yao. 2002. "Local versus Global Separability in Agricultural Household Models: The Factor Price Equalization Effect of Land Transfer Rights." *American Journal of Agricultural Economics 84* (3): 702-15.

Chamberlain, G. 1980. "Analysis of Covariance with Qualitative Data." *Review of Economic Studies 47* 225-38.

Chimhowu, A. and P. Woodhouse. 2006. "Customary vs private property rights? Dynamics and trajectories of vernacular land markets in sub-Saharan Africa." *Journal of Agrarian Change 6* (3): 346-71.

Colin, J. P. and M. Ayouz. 2006. "The Development of a Land Market? Insights from Cote d'Ivoire." *Land Economics 82* (3): 404-23.

Conning, J. H. and J. A. Robinson. 2007. "Property rights and the political organization of agriculture." *Journal of Development Economics 82* (2): 416-47.

Dabrundashvili, T. 2006. "Rights Registration System Reform in Georgia." Paper presented at the Expert Meeting on Good Governance in Land Tenure and Administration. Rome: FAO.

Datta, N. 2006. "Joint Titling--A Win-Win Policy? Gender and Property Rights in Urban Informal Settlements in Chandigarh, India." *Feminist Economics* 271-98.

De Meza, D. and J. Gould. 1992. "The Social Efficiency of Private Decisions to Enforce Property Rights." *Journal of Political Economy 100* (3): 561-80.

de Soto, H. 2000. *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere else* New York: Basic Books.

Deininger, K. 2003. *Land Policies for Growth and Poverty Reduction. A World Bank Policy Research Report*. Oxford and New York: World Bank and Oxford University Press.

Deininger, K. and D. A. Ali. 2008. "Do overlapping property rights reduce agricultural investment? Evidence from Uganda." *American Journal of Agricultural Economics 90* (4): 869-84.

Deininger, K., D. A. Ali and T. Yamano. 2008a. "Legal Knowledge and Economic Development: The Case of Land Rights in Uganda." *Land Economics 84* (4): 593-619.

Deininger, K., D. Ayalew and T. Alemu. 2008b. "Assessing the Functioning of Land Rental Markets in Ethiopia." *Economic Development and Cultural Change 57* (1): 67-101.

Deininger, K., D. Ayalew, S. Holden and J. Zevenbergen. 2008c. "Rural land certification in Ethiopia: Process, initial impact, and implications for other African countries." *World Development 36* (10): 1786-812.

Deininger, K. and R. Castagnini. 2006. "Incidence and Impact of Land Conflict in Uganda." *Journal of Economic Behavior & Organization 60* (3): 321-45.

Deininger, K. and J. S. Chamorro. 2004. "Investment and Income Effects of Land Regularization: The Case of Nicaragua." *Agricultural Economics 30* (2): 101-16.

Deininger, K. and S. Jin. 2006. "Tenure Security and Land-Related Investment: Evidence from Ethiopia." *European Economic Review 50* (5): 1245-77.

Deininger, K. and S. Jin. 2008a. "Land Sales and Rental Markets in Transition: Evidence from Rural Vietnam." *Oxford Bulletin of Economics and Statistics 70* (1): 67-101.

Deininger, K. and S. Jin. 2008b. "Securing property rights in transition: Lessons from implementation of China's rural land contracting law." *Journal of Economic Behavior & Organization forthcoming*.

Deininger, K., S. Jin, and H. K. Nagarajan. 2006. "Gender discrimination and the returns to self employment: Evidence from rural India." World Bank Policy Research Working Paper. Washington, DC: World Bank.

Deininger, K., E. Zegarra and I. Lavadenz. 2003. "Determinants and Impacts of Rural Land Market Activity: Evidence from Nicaragua." *World Development 31* (8): 1385-404.

Di Tella, R., S. Galiani and E. Schargrodsky. 2007. "The Formation of Beliefs: Evidence from the Allocation of Land Titles to Squatters." *Quarterly Journal of Economics 122* (1): 209-41.

Do, Q. T. and L. Iyer. 2008. "Land Titling and Rural Transition in Vietnam." *Economic Development and Cultural Change 56* (3): 531-79.

Dowell, D. E.and M. Leaf. 1992. "The Price of Land for Housing in Jakarta." In Kim, K. A., eds., *Spatial Development in Indonesia, Review and Prospects*. Avebury: Aldershot.

Dower, P. and E. Potamites. 2005. "Signaling Credit-Worthiness: Land Titles, Banking Practices and Access to Formal Credit in Indonesia."

Durand-Lasserve, A. and L. Royston. 2002. *Holding their ground: Secure Land Tenure for the Urban Poor in Developing Countries*. London: Earthscan Publications.

Easterly, W. 2007. "Inequality does cause underdevelopment: Insights from a new instrument." *Journal of Development Economics 84* (2): 755-76.

Easterly, W. 2008. "Institutions: Top down or bottom up?" *American Economic Review, Papers and Proceedings 98* (2): 95-9.

Ege, S. 1997. "The Promised Land: The Amhara Land Redistribution of 1997." SMU-rapport 5/97. Dragvoll, Norway: Norwegian University of Science and Technology, Centre for Environment and Development.

Ellickson, R. C. 1993. "Property in Land." *Yale Law Journal 102* (6): 1315-400.

Feder, G. and A. Nishio. 1999. "The Benefits of Land Registration and Titling: Economic and Social Perspectives." *Land Use Policy 15* (1): 143-69.

Feder, G., Y. Chalamwong, T. Onchan and C. Hongladarom. 1988. *Land Policies and Farm Productivity in Thailand*. Baltimore and London: Johns Hopkins University Press.

Feder, G. and D. Feeny. 1991. "Land Tenure and Property Rights: Theory and Implications for Development Policy." *World Bank Economic Review 5* (1): 135-53.

Field, A. J., E. Field, and M. Torero. 2006. "Property rights and crop choice in rural Peru, 1994-2004." MTID Discussion Paper 100. Washington, DC: International Food Policy Research Institute.

Field, E. 2005. "Property Rights and Investment in Urban Slums." *Journal of the European Economic Association 3* (2-3): 279-90.

Field, E. 2007. "Entitled to Work: Urban Property Rights and Labor Supply in Peru." *Quarterly Journal of Economics 122* (4): 1561-602.

Field, E. and M. Torero. 2006. "Do Property Titles Increase Credit Access Among the Urban Poor? Evidence from a Nationwide Titling Program."

Field, E. M. 2003. "Fertility responses to land titling: The roles of ownership security and the distribution of household assets." . Cambridge MA: Harvard University.

Firmin-Sellers, K. 2000. "Custom, Capitalism, and the State: The Origins of Insecure Land Tenure in West Africa." *Journal of Institutional and Theoretical Economics 156* (3): 513-30.

Fitzpatrick, D. 2005. "'Best practice' options for the recognition of customary tenure." *Development and Change 36* (3): 449-75.

Fort, R. 2007. *Property rights after market liberalization reforms: land titling and investments in rural Peru*. Wageningen, NL: University of Wageningen.

Fred-Mensah, B. K. 1999. "Capturing Ambiguities: Communal Conflict Management Alternative in Ghana." *World Development 27* (6): 951-65.

Friedman, J., E. Jimenez and S. K. Mayo. 1988. "The Demand for Tenure Security in Developing Countries." *Journal of Development Economics 29* (2): 185-98.

Galiani, S., D. Heymann, C. Dabus and F. Tohme. 2008. "On the emergence of public education in land-rich economies." *Journal of Development Economics 86* (2): 434-46.

Galiani, S. and E. Schargrodsky. 2004. "Effects of Land Titling on Child Health." *Economics and Human Biology 2* (3): 353-72.

Galiani, S. and E. Schargrodsky. 2005. "Property Rights for the Poor: Effects of Land Titling." Documento de Trabajo 06/2005. Buenos Aires: Universidad Torcuato Di Tella, Centro de Investigacion en Finanzas.

Goldstein, M. and C. Udry. 2006. "The profits of power: Land rights and agricultural investment in Ghana." Economic Growth Center Working Paper 929. New Haven, CT: Yale University.

Gordillo, G., A. de Janvry and E. Sadoulet. 1998. "Between Political Control and Efficiency Gains: The Evolution of Agrarian Property Rights in Mexico." *CEPAL Review 0* (66): 151-69.

Gould, K. 2006. "Land regularizatoin on agricultural frontiers: The case of Northwestern Peten, Guatemala." *Land Use Policy 23* (2): 395-407.

Government of Kenya. 2004. "Report of the Commission of Inquiry into the Illegal/Irregular Allocation of Public Land." . Nairobi: Government Printer.

Government of Mexico. 2000. "Marco legal agrario." Edicion commemorativa - reforma agraria 1915-2000. Mexico, D.F.: Procuraduria Agraria.

Griffith-Charles, C. 2004. "The impact of land titling on land transaction activity and registration system sustainability: A case study of St. Lucia." PhD Dissertation. Gainesville, FL: University of Florida.

Gulyani, S. and D. Talukdar. 2008. "Slum real estate: The low-quality high price puzzle in Nairobi's slum rental market and its implications for theory and practice." *World Development forthcoming*.

Henrysson, E. and S. F. Joireman. 2007. "On the edge of the law: The cost of informal property rights adjudication in Kisii, Kenya." Working Paper. Wheaton, IL: Wheaton College.

Holden, S., K. Deininger, and H. Ghebru. 2008a. "Land certification, land related investment, and productivity in Tigray, Ethiopia." Working Paper. Aas, Norway: Norwegian University of LIfe Sciences.

Holden, S., K. Deininger, and H. Ghebru. 2008b. "Low-cost land certification and land rental market participation in Tigray, Ethiopia." Working Paper. Aas, Norway: Norwegian University of Life Sciences.

Holden, S. and H. Yohannes. 2002. "Land Redistribution, Tenure Insecurity, and Intensity of Production: A Study of Farm Households in Southern Ethiopia." *Land Economics 78* (4): 573-90.

Hunt, D. 2004. "Unintended Consequences of Land Rights Reform: The Case of the 1998 Uganda Land Act." *Development Policy Review 22* (2): 173-91.

Jacoby, H. and B. Minten. 2007. "Is land titling in Sub-Saharan Africa cost effective? Evidence from Madagascar." *World Bank Economic Review 21* (3): 461-85.

Jacoby, H. G., G. Li and S. Rozelle. 2002. "Hazards of Expropriation: Tenure Insecurity and Investment in Rural China." *American Economic Review 92* (5): 1420-47.

Jansen, K. and E. Roquas. 1998. "Modernizing Insecurity: The Land Titling Project in Honduras." *Development and Change 29* (1): 81-106.

Johnson, S., J. McMillan and C. Woodruff. 2002. "Property Rights and Finance." *American Economic Review 92* (5): 1335-56.

Joireman, S. F. 2008. "The mystery of capital formation in Sub-Saharan Africa: Women, property rights and customary law." *World Development 36* (7): 1233-46.

Kaganova, O. and J. McKelar. 2006. *Managing Government Property Assets: International Experiences*. Washington, DC: Urban Institute Press.

Kato, E. 1998. "We have rights, they have power. A case study of land expropriation in Northwest Cambodia." . Phnom Penh: Oxfam Land Study Project.

Kazianga, H. and W. A. Masters. 2006. "Property Rights, Production Technology, and Deforestation: Cocoa in Cameroon." *Agricultural Economics 35* (1): 19-26.

Kung, J. K.-S. 2002. "Off-Farm Labor Markets and the Emergence of Land Rental Markets in Rural China." *Journal of Comparative Economics 30* (2): 395-414.

Lanjouw, J. O. and P. I. Levy. 2002. "Untitled: A Study of Formal and Informal Property Rights in Urban Ecuador." *Economic Journal 112* (482): 986-1019.

Lavigne-Delville, P. 2000. "Harmonising Formal Law and Customary Land Rights in French-Speaking West Africa." In Toulmin, C. and J. Quan, eds., *Evolving land rights, policy and tenure in Africa*. London: DFID/IIED/NRI.

Lavigne-Delville, P., C. Toulmin, J.-P. Colin and J.-P. Chauveau. 2002. *Negotiating Acces to Land in West Africa: A Synthesis of Findings from Research on Derived Rights to Land*. London: IIED/GRET.

Leuprecht, P. 2004. "Land concessions for economic purposes in Cambodia: A human rights perspective." Report by the Special Representative of the Secretary General for human rights in Cambodia. Phnom Penh: United Nations, Cambodia Office of the High Comissioner for Human Rights.

Lobo, A. and S. Balakrishnan. 2002. "Report card on service of bhoomi kiosks: An assessment of benefits by users of the computerized land records system in Karnataka." Working Paper. Bangalore: Public Affairs Centre.

Lueck, D. and T. Miceli. 2006. "Property Law." Arizona Legal Studies, Discussion Paper 06-19. Tuscon, AZ: Universrity of Arizona.

Mabogunje, A. L. 1992. "Perspective on Urban Land and Urban Management Policies in Sub-Saharan Africa." *World Bank Technical Paper No.196, Africa Technical Department Series, Washington, D.C.*

Macours, K., A. de Janvry, and E. Sadoulet. 2004. "Insecurity of Property Rights and Matching in the Tenancy Market." Working Paper 992. Berkeley: Department of Agricultural & Resource Economics, UC Berkeley.

Malik, A. and R. M. Schwab. 1991. "Optimal Investments to Establish Property Rights in Land." *Journal of Urban Economics 29* (295): 309.

Maurer, N. and L. Iyer. 2008. "The cost of property rights: Establishing Institutions on the Philippine Frontier under American Rule, 1898-1918." Working Paper 14298. Cambridge, MA: National Bureau of Economic Research.

McKenny, B. and P. Tola. 2002. "Natural Resources and Rural Livelihoods in Cambodia: A baseline assessment." Working Paper 23. Phnom Penh: Cambodia Development Resource Insititute.

Meinzen-Dick, R. and E. Mwangi. 2008. "Cutting the web of interests: Pitfalls of formalizing property rights." *Land Use Policy forthcoming*.

Mushinski, D. W. 1999. "An Analysis of Offer Functions of Banks and Credit Unions in Guatemala." *Journal of Development Studies 36* (2): 88-112.

Nettle, K. 2006. "Titles vs. deeds: International experience and implications for India." . New Delhi: Paper presented at the MoRD/World Bank workshop on "Land Policies for Accelerated Growth and Poverty Reduction in India", Jan. 5 and 6, 2006.

Nugent, J. B. and J. A. Robinson. 2002. "Are Endowments Fate?" CEPR Working Paper 3206. London.

Panda, P. and B. Agarwal. 2005. "Marital violence, human development and women's property status in India." *World Development 33* (5): 823-50.

Pande, R. and C. Udry. 2005. "Institutions and Development:A View from Below." Working Papers 928. New Haven, CT: Yale University, Economic Growth Center.

Payne, G., A. Durand-Lasserve, and C. Rakodi. 2008. "Social and economic impacts of land titling programmes in urban and peri-urban areas: International experience and case studies of Senegal and South Africa." . Oslo and Stockholm: SIDA and Norwegian Mnistry of Foreign Affairs.

Peters, P. 2004. "Inequality and social conflict over land in Africa." *Journal of Agrarian Change 4* (3): 269-314.

Powelson, J. P. 1988. "The Story of Land: a World History of Land Tenure and Agrarian Reform." Lincoln Institute of Land Cambridge, MA.

Quisumbing, A. R. and J. A. Maluccio. 2003. "Resources at Marriage and Intrahousehold Allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa." *Oxford Bulletin of Economics and Statistics 65* (3): 283-327.

Rajan, R. and R. Ramcharan. 2008. "Landed interests and financial underdevelopment in the United States." NBER Working Paper 14347. Cambridge, MA: National Bureau of Economic Research.

Rozelle, S. and J. F. M. Swinnen. 2004. "Success and Failure of Reform: Insights from the Transition of Agriculture." *Journal of Economic Literature 42* (2): 404-56.

Schweigert, T. E. 2007. "Land Title, Tenure Security, Investment and Farm Output: Evidence from Guatemala." *Journal of Developing Areas 40* (1): 115-26.

Shavell, S. 2003. "Economic Analysis of Property Law." National Bureau of Economic Research, Inc, NBER Working Papers: 9695.

Siamwalla, A. 1990. "The Thai Rural Credit System: Public Subsidies, Private Information, and Segmented Markets." *World Bank Economic Review* (4): 271-95.

Sjaastad, E. and D. Bromley. 2000. "The Prejudices of Property Rights: On Individualism, Specificity. and Security in Property Regimes." *Development Policy Review 18* (4): 365-89.

Sjaastad, E. and D. W. Bromley. 1997. "Indigenous Land Rights in Sub-Saharan Africa: Appropriation, Security and Investment Demand." *World Development 25* (4): 549-62.

Stiglitz, J. E. and A. Weiss. 1981. "Credit Rationing in Markets with Imperfect Information." *American Economic Review 71* (3): 393-410.

Transparency International India. 2005. "India corruption study 2005." . New Delhi: Transparency International.

Udry, C. 1996. "Gender, Agricultural Production, and the Theory of the Household." *Journal of Political Economy 104* (5): 1010-46.

UNECE. 1996. "Land Administration Guidelines, With Special References to Countries in Transition." *United Nations Economic Commission for Europe, ECE/HBP/96, New York and Geneva.*

van den Brink, R., D. W. Bromley and J. P. Chavas. 1995. "The Economics of Cain and Abel: Agro-pastoral Property Rights in the Sahel." *Journal of Development Studies 31* (3): 373-99.

Vogl, T. S. 2007. "Urban Land Rights and Child Nutritional Status in Peru, 2004." *Economics and Human Biology 5* (2): 302-21.

Wooldridge, J. M. 2001. *Econometric analysis of cross section and panel data*. Cambridge, MA: MIT Press.

Wooldridge, J. M. 2005. "Simple Solutions to the Initial Conditions Problem in Dynamic, Nonlinear Panel Data Models with Unobserved Heterogeneity." *Journal of Applied Econometrics 20* (1): 39-54.

World Bank. 2002. "Mexico- Land Policy: A Decade after the Ejido Reforms." . Washington, DC: The World Bank, Rural Development and Natural Resources Sector Unit.

World Bank. 2003. "Nicaragua Land Policy and Administration: Towards a more secure property rights regime." Report 26683-NI. Washington, DC: World Bank.

World Bank. 2007. *Doing business 2008*. Washington DC: World Bank, International Finance Corporation, and Oxford University Press.

Yang, D. T. 1997. "China's Land Arrangements and Rural Labor Mobility." *China Economic Review 8* (2): 101-15.

Zepeda, G. 2000. "Transformación Agraria. Los Derechos de Propriedad en el Campo Mexicano bajo el Nuevo Marco Institucional." *CIOAC, Mexico*.