

# Using Administrative Data to Assess the Impact and Sustainability of Rwanda's Land Tenure Regularization

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## Abstract

Rwanda's completion, in 2012/13, of a land tenure regularization program covering the entire country allows the use of administrative data to describe initial performance and combine the data with household surveys to quantify to what extent and why subsequent transfers remain informal, and how to address this. In 2014/15, annual volumes of registered sales ranged between 5.6 percent for residential land in Kigali and 0.1 percent for agricultural

land in the rest of the country; and US\$2.6 billion worth of mortgages were secured against land and property. Yet, informality of transfers in rural areas remains high. Decentralized service provision and information campaigns help reduce but not eliminate the extent of informality. A strategy to test the efficacy of different approaches to ensure full registration, scale up promising ones, and rigorously monitor the effect of doing so is described.

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# Using Administrative Data to Assess the Impact and Sustainability of Rwanda's Land Tenure Regularization<sup>¶</sup>

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## **1. Introduction**

Public registries that allow unambiguous and comprehensive low cost identification of property ownership have long been considered a key part of countries' infrastructure. To this end, considerable resources were spent in many developing countries to establish land administration systems, usually via adjudication and first-time registration of land. While studies show that establishing such systems can provide clear benefits, three developments have recently affected demand for land registration and the potential to respond to it, giving rise to what many consider a next generation of land registration initiatives that are more inclusive, less costly, and more participatory than the traditional type. New technology options in remote sensing, connectivity, and data processing drastically reduced the cost of acquiring and managing textual as well as spatial data. Economic growth and burgeoning land demand from sources including agricultural investors, urban expansion, and infrastructure increased the equity and investment benefits from secure property rights, including for women and communities who in traditional systems may have been disadvantaged. Finally, public goods such as planning and mobilization of own-source revenue depend on or can be more effectively performed if property rights are clearly defined.

Yet, like any piece of infrastructure, registries need to be maintained. A key difference to, say, roads, is that their sustainability depends not only on public investment but that private parties' decisions on whether or not to formally register any transactions are a key factor. Perceived benefits from such registration (which depend on legal knowledge) as well as the money and time needed for it (which are affected by regulatory frameworks) are key determinants of such decisions. The outcome matters: as a key benefit of registries is their ability to provide authoritative information on all parcels of interest, even low levels of informality may undermine trust in the system and the value of what has been established at high cost. In fact, studies show that, as they failed to carefully identify private and social benefits arising from their operation, compare them to low-cost models of service provision, and on this basis develop appropriate modalities for funding, formalization programs—including ones that had positive overall impact—in Africa (Atwood 1990), East Asia (Maurer and Iyer 2008), and Latin America (Galiani 2011) were eventually unsustainable and failed to deliver on their potential.

To assess if 'new generation' land projects will need to pay greater attention to the extent of subsequent transactions being registered, this paper focuses on the experience of Rwanda. The fact that this is the only African country that completed nation-wide, participatory, low-cost way land regularization makes it of great interest to document achievements made possible through this effort as well as remaining challenges. Beyond focusing on an oft-neglected, we rely on administrative data that provide reliable information on key aspects including number (and amounts) of registered mortgages, transfers (and land prices in case of sales), land owners' gender, and actual vs. potential tax receipts, at high levels of frequency and low cost.

These data are then combined with household surveys to precisely identify levels and determinants of informality.

We find that in 2014/15, i.e., after LTR completion, 5.6% and 1.54% of Kigali's residential and agricultural land parcels, respectively, were transferred through a registered sale each year (for the other provinces, figures are 0.27% and 0.07% for residential and agricultural land, respectively). A total of US\$2.6 billion of mortgage lending is secured by 49,694 mortgages—65%, 30%, and 5% by residential, agricultural, and commercial land/property. Quarterly data on numbers of registered land transactions show that posting of sector land managers (SLMs) had a very positive impact on the level of registered land transfers, showing that such data can be used not only to performance monitoring and change management but also the impact of interventions that are gradually introduced across administrative units.

Linking such data to household survey evidence at the parcel level produces reliable estimates of informality. Doing so shows that, Rwanda's success in first-time registration notwithstanding, in rural areas a substantial share of land transfers remain informal. Low awareness of relevant regulations, subdivision restrictions, high registration fees, and travel cost to reach relevant offices are some underlying factors. Given the high level of land market activity in the country, dealing with this issue will be important.

The paper is structured as follows. Section two reviews conceptual arguments and empirical evidence on costs and benefits of land registration and draws out implications for sustainability of land administration. It also describes Rwanda's legal and institutional structure, key elements of the country's program of land tenure regularization program, including efforts to integrate it into the country's decentralized system of governance, as well as data sources. Section three provides evidence on the level and incidence of informal transactions. Section four provides data on and the cost of registering transfers, compares them to households' stated willingness to pay, and draws out implications on its determinants. Section five concludes with recommendations for policy and research.

## **2. Literature and country background**

We discuss the conceptual framework for efforts at land regularization, challenges traditionally faced when trying to apply it in African contexts, and the advances made by Rwanda in implementing a national land tenure regularization program. While this has had positive impact and yielded large benefits, sustained enjoyment of these benefits will require that the registry provides up to date and authoritative information on land rights.

## 2.1 The debate on land regularization

A property rights system and registry that allows unambiguous identification of owners is an important part of countries' institutional infrastructure. If established transparently,<sup>1</sup> it can increase scope for investment and for more effective land use by reducing expropriation risk, including for women, and facilitating market transactions (Besley and Ghatak 2010). The literature on impacts of efforts to secure and maintain property rights to land and associated property globally (Lawry *et al.* 2016) and in Africa (Fenske 2011) suggest that benefits can increase in the level of insecurity and scope for transactions.

Reduced risk of land loss will increase investment incentives and obviate the need to spend private resources on protecting property, helping primarily the poor. Studies show that better property rights through land demarcation and certification lead to higher long-term investment (e.g., increase in fallowing) and free up labor for other productive uses rather than time spent guarding less secure plots, e.g., women shifting labor to less secure plots after participating in a certification program in Benin (Goldstein *et al.* 2015) and increased work away from home after urban land titling in Peru (Field 2007). Such effects will be most pronounced if land is scarce and traditional institutions are no longer able to guarantee broad-based access to and secure tenure of land or if conflict precluded efficiency-enhancing investments. Beyond traditional expropriation risk, e.g., in the context of land redistribution, reasons may include competition for land resources, e.g., from urban growth (Adam 2014), large scale land demand by outside investors (Deininger and Byerlee 2011), or speculative land acquisition by urban individuals (Sitko and Jayne 2014).<sup>2</sup>

With land a key asset, the way in which land rights are distributed across household members will affect not only the efficiency of land use but also autonomy by females. Female property rights to land and other assets can affect girls' survival rates (Qian 2008), their anthropometric status (Duflo 2003), level of schooling (Deininger *et al.* 2013; Luke and Munshi 2011), and the ability to take advantage of economic opportunities and cope with risks (Deere *et al.* 2013). Joint titling can empower women and benefit their offspring (Menon *et al.* 2014) with no negative productivity effect (Newman *et al.* 2015). As traditional systems often restrict inheritance rights by women (Colin 2008) or widows (Chapoto *et al.* 2011),<sup>3</sup> experience from India where inheritance reforms countered discrimination (Deininger *et al.* 2013) with benefits for the next generation (Deininger *et al.* 2014) is of interest.

Economic development normally involves specialization and a move of part of the labor force out of the agricultural sector, creating heterogeneity in skills and scope for efficiency-enhancing land transfers.

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<sup>1</sup> Key issues relate to dissemination to eliminate informational advantages by the rich and well-connected (Peters 2004) which otherwise could well result in such interventions disempowering the poor (Jansen and Roquas 1998) and entrenching inequality in land access (Easterly 2008).

<sup>2</sup> 'Land grabs' may coincide with program to secure property rights (Sitko *et al.* 2014), highlighting the importance of careful design and monitoring.

<sup>3</sup> In 15 Sub-Saharan African countries, less than half of widows inherited land (Peterman 2012) and their ability to hold on to their husband's land is highly unpredictable (Chapoto *et al.* 2011). Provisions to make their inheritance rights more secure are thus important (Cooper and Bird 2012).

Institutions to allow these at low cost and without creating a risk of land loss can thus increase productivity of land use and contribute to structural transformation. Land rental allows labor to move from agriculture to non-agriculture without forgoing the benefits of asset ownership, e.g., in terms of a social safety net. This is clearly evidenced by higher levels of out-migration from agriculture as consequence of property rights reform in Mexico, especially for households with weaker initial rights (de Janvry *et al.* 2015). While there is little need for formal documents if transfers remain short-term and involve only community members, longer-term transfers, including with outsiders, may offer greater opportunities for productivity increase. But lack of documentation may prompt landlords to restrict land transfers to close kin (Macours 2014), especially if migration is involved (de Janvry *et al.* 2015). Having rights and/or transfers recorded will reduce the cost of negotiating and enforcing contracts by making reliable information on land ownership publicly available (Arrunada 2009).

Increased scope for market transactions allows trade in assets and their use as collateral in financial markets. Full realization of gains from trade requires that reasonably complete, current, and authoritative information on the assignment of property rights—which is normally provided by public registries—be available at low cost to a set of agents with sufficiently diverse skills to allow efficiency-enhancing transactions. Credit impacts from land titling or registration can be expected only if registries are comprehensive, authoritative, and up to date, and if third parties such as mortgage lenders can access reliable registry information at low cost on a routine basis. While the limited number of studies finding credit impacts suggests these conditions may not always apply, in India, land record computerization—which reduced costs of registry access but did not alter the information it contains—increased the number of registered mortgages and volume of credit by in urban areas by 10.5 points (Deininger and Goyal 2012).

To make their establishment viable economically, formal systems must offer advantages, either in terms of higher tenure security or lower cost, over existing ones. In a traditional setting, customary settings often offer high levels of tenure security (Bruce and Migot-Adholla 1994) but they may come under pressure if land becomes more scarce, chiefs act as landlords rather than custodians of community assets (Berry 2009), demand from outsiders or investors increases (Chimhowu and Woodhouse 2010), or if land acquisition for public purpose neglects local occupancy rights. If demand for higher levels of tenure security by all or certain parts of the population warrants formalization, registration systems need to be designed and run in an efficient way for benefits from their existence and operation to exceed costs (Jacoby and Minten 2007) and avoid irrelevance (Atwood 1990; Pinckney and Kimuyu 1994).<sup>4</sup> In fact, even if benefits exceed costs (Galiani and Schargrotsky 2010), lack of awareness, incentives, or collective action to establish required

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<sup>4</sup> The technical literature on this topic has recently embraced the notion of a continuum of rights and the need to adopt an approach along this continuum that is 'fit for purpose' (Enemark *et al.* 2014).

institutional infrastructure and regulate its operation has undermined registry sustainability (Galiani 2011), leading to a loss of social welfare.

## **2.2 Rwanda's background and LTR accomplishments**

With land scarcity and insecure land tenure having been identified as one proximate cause of the 1994 Genocide (Andre and Platteau 1998), Rwandan policy makers after 1994 were clear that addressing land tenure was key for sustainable development. Recognition of the issue's gender dimensions led to adoption of the 1999 inheritance law to eliminate widespread bias against female land ownership (Daley *et al.* 2010). It was followed by the 2004 land policy, the 2005 organic land law (OLL), and the establishment of an institutional and administrative structure for land management and administration. At the district, town, and municipality levels, District Land Bureaus (DLBs), complemented by sector and cell level land committees, assumed responsibility for land administration and planning.

Given the near complete absence of registered land rights, and the lack of examples to be readily drawn on, in 2007-10 a pilot to register some 15,000 parcels was undertaken in four cells reflecting the diversity of the country. A process for systematic low cost demarcation and adjudication using aerial photography or high-resolution satellite imagery was designed and implemented through trained local para-surveyors. The latter recorded, in public with presence of neighbors and local authorities, agreed plot boundaries on the image, possibly after minor disputes had been resolved by local elders, issuing a demarcation slip that led to generation of a unique parcel ID, registration of a claim, and issuance of a claim receipt to the owner. Data was then computerized and results displayed publicly on office walls at the cell level for a period of at least one month in which objections could be raised and corrections made as needed. Once satisfactorily completed, titles and lease certificates were issued at the central level and distributed to land owners.<sup>5</sup>

An evaluation of the pilot exercise suggested clear impacts in three areas, namely (i) improved land access for legally married women and better recordation of inheritance rights, although women who were not legally married saw diminished property rights, an issue that was corrected before embarking on the national roll-out; (ii) significant investment impacts, e.g., a doubling of the change in investment in soil conservation, that were particularly pronounced for female-headed households in line with the notion that these had suffered from higher levels of insecurity before; and (iii) a marginal reduction in land market activity rather than a wave of distress sales (Ali *et al.* 2014).

Refinement of processes based on thorough review of the pilot experience allowed rapid scale-up and roll-out as a national program. In less than 3 years, the Rwanda Natural Resource Authority (RNRA) demarcated over 11.3 million out of an estimated 11.5 million land parcels in the country in a participatory way and at

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<sup>5</sup> Registration was free of charge during the pilot and exemptions for poor individuals were put in place during the national roll-out.

a unit cost of less than USD 6 per parcel (Nkurunziza 2015), setting a new standard for first time registration of land rights that many African countries endeavor to emulate. Survey data collected soon after program completion in 2012 point towards impacts in three areas. First, tenure security increased markedly for males and females equally, including those not legally married. This suggests modifications to implementation modalities to include women in informal marriages were effective (Santos *et al.* 2014). Second, the program led to distinct improvements in land rental market functioning and efficiency-enhancing land transfers (Ali *et al.* 2015). Finally, although investment did not increase in the short term, the program provided a basis for higher levels of agricultural investment in the medium run.

### **3. Evidence from administrative data**

Registry data document the size and gender-friendly nature of Rwanda's accomplishment but also point towards remaining challenges, in particular unclaimed parcels. They allow to document in real-time collateralized lending volumes, land prices for residential and agricultural land, and the extent to which LTR's gender equality is maintained. We review registration procedures and use data on roll-out of sector land managers to estimate the impact of this intervention on levels of formal land transfers at sector level.

#### **3.1 Level of registration and transaction frequency**

Official land administration information system (LAIS) data highlight Rwanda's accomplishments. In the context of LTR, information was collected on 11.42 million parcels; 0.39 million in Kigali city, 1.99 million in Eastern, 2.67 million in Northern and 3.2 million each in Southern and Western Province (table 1). Of these, 64.3% are in agricultural (50% in Kigali to 73% in Northern Province), 11.7% in residential, 8% in forest, 1.5% in commercial, and 0.3% in administrative use. The share of parcels in residential use is, with 34%, highest in Kigali, followed by the East (21%), West (13%), the South and North (7% and 6%, respectively). With an average of 0.18 ha; sizes vary between residential (900 m<sup>2</sup> in Kigali to 1,600 m<sup>2</sup> in the East) and agricultural parcels (0.11 and 0.42 ha in the North and East, respectively).

Administrative data support the gender sensitive nature of LTR as 86% of parcels owned by natural persons have a woman either as sole (25%) or co-owner (61%) and only 14% are registered exclusively to male claimants. It can help RNRA quantify and manage outstanding issues and monitor progress at high levels of disaggregation (cell or village level), e.g., the 16% of parcels for which claimants are not yet recorded.

Integration of land and the mortgage registries increases ease and security of using land as collateral.<sup>6</sup> Table 2 shows that by Dec. 31 2015, US\$ 2.6 billion of mortgage lending was secured by 49,694 mortgages, 65%, 30%, and 5% each secured against residential, agricultural, and commercial land, respectively. With the

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<sup>6</sup> Earlier, the mortgage registry was run by the Rwanda Development Board (RDB) in isolation from the land registry. In addition to increasing transaction costs, lack of a unique parcel identifier made it difficult for the lender to ensure absence of potentially competing claims.

exception of those against commercial land (US\$ 228,192/loan) mortgage values are US\$ 30,000 per loan and lending remains focused on Kigali (two thirds of total amounts) with Western and Eastern province accounting for 10% and South and North 6% each. Mapping amounts of overall (figure 1) and agricultural (figure 2) mortgage lending suggests relatively equal coverage with some concentration in Kigali.

Among many types of transactions recorded in the registry,<sup>7</sup> we focus on sales, gifts, and inheritances that result in ownership change. Table 3 provides, separately for residential and agricultural land, figures on all transactions registered in 2014/2015, mean numbers of transactions in each of the 2,148 cells, and the share of registered parcels for which transfers were registered. Registered transfer levels are higher for residential (0.8% for sales and 0.4% for other ownership changes per annum) than for agricultural (0.1% of sales and 0.06% other transfers per annum) land. Differences are even more pronounced between Kigali with 5.6% of residential and 1.5% of agricultural parcels having been transferred via registered sale each year (47 and 19 parcels per cell and quarter, respectively) and the rest of the country with corresponding figures of 0.3% and 0.06% (1.8 and 2.3 parcels per cell and quarter) for residential and agricultural land.

Table 3 also points towards differences in prices of land (with structures) between residential land with a mean price of US\$ 30 per m<sup>2</sup>, from US\$ 39.4/m<sup>2</sup> in Kigali, where more than 70 % of sales are concentrated, to US\$ 4.75/m<sup>2</sup> in the East which accounts for slightly more than 10% of registered sales. Agricultural land has a mean sales price of US\$ 4.45/m<sup>2</sup> (US\$ 6.65/m<sup>2</sup> in Kigali to US\$ 1.47/m<sup>2</sup> in the East). In principle, the registry can provide near-real time information on land prices at high levels of temporal disaggregation to inform private sector decision-making. To check if subsequent transactions maintain the levels of gender equality attained by LTR, panel C of table 3 disaggregates registered land transaction by gender. Comparing to table 1 points towards a decline of the number of parcels for which at least one claimant is female from 86% for first (see table 1) to 77% for subsequent registrations. Attention to this issue may thus be warranted.

Having the land registry seamlessly integrated with other parts of the public sector opens opportunities to add value in a number of related areas. For example, RNRA embarked on an effort to ensure that, for any civil dispute that may affect rights to a parcel of land, a caveat is placed on this parcel automatically and in real time, thus eliminating a source of potential fraud and insecurity. Access to LAIS data can allow the Rwanda Revenue Authority to simplify billing and payment of lease fees, thus not only saving costs but also ensuring greater transparency and equity and allowing greater revenue collection: in 2015 only a third of non-exempt residential properties in urban Kigali paid their lease fees, resulting in lost revenue of some US\$ 4.8 million. If, e.g. due to more efficient automatic billing, LAIS were to allow full collection of this amount without additional cost, the resulting benefits would be large enough to justify the entire investment

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<sup>7</sup> Migration from the Land Tenure Regularization Support System (LTRSS) to LAIS accounted for a large share of changes in the registry before 2014. As many of these were coded in a way that makes them indistinguishable from actual transfers, we limit our analysis to 2014 and 2015 data.

in LTR. Finally, LAIS is being integrated with data on land use and agro-ecological suitability maintained by the Ministry of Agriculture and Animal Resources to monitor land use and its changes and in doing so facilitate siting of investments higher up in the value chain, e.g., in agro-processing.

### **3.2 Measures undertaken to improve sustainability**

Registering a transfer of property in Rwanda requires submission of documentation to the district land office (DLO). Once authenticity and completeness of documents is verified, the responsible officer enters data and scanned documents into the computerized system, triggering notification of affected parties by SMS at this and subsequent steps in the process.<sup>8</sup> The registration request is then electronically forwarded to one of the five regional offices where, if satisfied, the Deputy Registrar approves the transaction. This will lead to titles being printed with one copy sealed and signed to be stored in the regional office and one transferred to the DLO for issuance to the applicant who can sign it in the presence of a notary. While the process is clear in principle, unaffordable fees, lack of awareness, and difficult access may create obstacles.

First, registering a transfer incurs a flat fee of RwF 27,000 or about USD 40.<sup>9</sup> As flat fees are regressive and may be unaffordable or difficult to justify for rural people with small plots, a review was conducted in 2015. It recommended to waive stamp duty and possibly reduce registration fees, for rural parcels below 5 ha and to set urban fees at levels that would allow the registration system to sustain itself. This is in line with evidence that, even in developed countries, transfer taxes raise little revenue compared to land taxes but encourage informality and threaten sustainability of land registries (Dachis *et al.* 2012). A revised fee structure is yet to be finalized and to be approved formally by the government.

Second, lack of awareness by concerned parties may be a key reason for high variability in the extent to which subsequent transactions are registered. Indeed, many buyers thought taking possession of the seller's title without name change would establish ownership or, unaware of the documents needed and process to be followed, had transfers authenticated by village officials.<sup>10</sup> To address this, the government conducted two national campaigns, referred to as 'land weeks', in May/June 2014 and February/April 2015.<sup>11</sup> These involved extensive coverage on television and radio, and face-to face events in some 150 sectors each.

Third, DLOs may be too distant from average citizens to act as the first point of contact for delivery of land services. To address this, sector land managers (SLMs) were recruited to provide information and be in

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<sup>8</sup> Until 2016 these documents, to be submitted by buyer(s) and seller(s) in person and witnessed included proof of identity and land ownership, marriage certificate and the transaction agreement with supporting documents (extract from the cadastral plan for sub-division, tax clearance, stamp duty and registration fee). Since 2016 witnesses and marriage certificate are no longer required.

<sup>9</sup> The stamp duty was reduced from 6% of property value in 2006. Partly to improve the country's ranking in the World Bank's 'Doing Business', a flat fee of RwF 20,000 plus a RwF 7,000 registration fee, was adopted.

<sup>10</sup> The fact that subdivision of land below a level of 1 hectare is formally prohibited may add another legislative aspect.

<sup>11</sup> The slogan for the first land week was 'any unregistered land you claim is not legally yours', whereas the second was under the motto 'register any land transaction and respect the land use plan'.

charge of all land-related issues, i.e., to receive, validate and notarize transactions, disseminate information, and help implement land use plans at sector local level. This was expected to help decentralize land services. All SLMs received some basic training and were sworn so they could also notarize transactions. By the end of 2015, 367 of the 416 sectors in Rwanda had a SLM in place. Deploying so many staff at very short notice raised logistical and managerial challenges but also prompted a range of innovations. For example, RNRA developed a web-based interface for SLMs to directly initiate transactions in LAIS instead of relying on paper records that have to be transported to the DLO and can be altered more easily. SLMs are also equipped with GPS-enabled tablets so they can conduct subdivision surveys although clarification of legal provisions on this subject may be needed to allow these to be effectively deployed.

Table 4 provides descriptive statistics on roll-out of SLMs and land week events at cell level: coverage with SLMs increased from 18% in batch one (in the third quarter of 2014) to 73% and 82% in subsequent batches (2<sup>nd</sup> and 3<sup>rd</sup> quarter of 2015). Local land week events were conducted in a total of 1,076 cells (614 in land week I and 462 in land week II). We also note that the mean distance to the DLO ranges from some 7 km in Kigali to some 15 km in the East and that the urban population share, which ranges between 9% in the East and 19% in the West and South, increases to more than 200% in Kigali city.

### 3.3 Assessing the impacts of decentralization and awareness campaigns

To see if measures to improve awareness and decentralize service delivery affected the volume of registered land transfers, we exploit quarterly data from 2014 and 2015 on the number of registered transactions for the country's 2,148 cells. Locally weighted regressions of the number of registered transactions per quarter by distance to the DLO and year or presence of SLMs point towards a clear increase in volumes of registered sales but not non-monetary transfers over time (figure 3) and with the presence of a SLM (figure 4).

Cell-level quarterly data for 2014 and 2015 also allow us to explore determinants of registered transfers of agricultural or residential land. We denote cells by  $c$ , quarters by  $q$  and year by  $t$  to estimate a regression of the form

$$T_{cqt} = \beta_0 + \beta_1 D_c + \beta_2 S_{cqt} + \beta_3 L_{cqt} + \beta_4 R_c + \beta_5 U_c + P_t + \varepsilon_{cqt}, \quad (1)$$

where  $T_{cqt}$  is number of registered residential or agricultural land transfers (total, monetary or non-monetary) for cell  $c$  in quarter  $q$  in year  $t$ ;  $D_c$  is the distance of cell  $c$  from the DLO in km,  $S_{cqt}$  is an indicator variable for whether or not cell  $c$  is located in a sector where a SLM had been appointed at  $q$  in  $t$ ;  $L_{cqt}$  is a dummy indicating past coverage of the sector where cell  $c$  is located by land week events at  $q$  in  $t$ ;  $R_c$  is the number of registered agricultural or residential land parcels in  $c$ ;  $U_c$  is the share of urban population at sector level from 2012 census estimates;  $P_t$  is a province-year dummy;  $\varepsilon_{cqt}$  is a random error term, and  $\beta$ s are coefficients to be estimated.

Cross-sectional estimates in cols. 1-3 of table 5 suggest that posting of SLMs led to significant increases in the number of registered sales but not non-monetary transfers of residential (panel A) or agricultural (panel B) land. There is no evidence of a separate effect of land week events in specific sectors, beyond that of the national campaigns. Higher urban population shares or numbers of residential or agricultural parcels are associated with higher levels of registered transfers especially for residential land. Distance to the DLO, a proxy for transport cost, is insignificant for sales but significant and large for non-monetary transfers where estimated coefficients suggest that beyond 10 km from the DLO, the likelihood of registration of non-monetary land transfers decreases by about half.

To support causal inference, we report results from fixed effects specifications (table 5, cols. 4-6). Presence of a SLM is estimated to raise numbers of registered sales per quarter and cell by 0.88 for residential and 1.23 for agricultural land, an annual increase of 71% or 146%. On the other hand, the estimated coefficient on non-monetary transactions of about—0.3 in both cases is marginally significant.

#### **4. Exploring informality and transactions in rural areas**

Administrative data, although suitable to provide information on formal transactions at low cost and high levels of temporal and spatial disaggregation, need to be combined with household survey data to obtain evidence on informality. Using a nationally representative rural household survey to do so suggests that, for a number of reasons, including lack of information, high fees, and difficulties in accessing officials, and although those who transferred their land are willing to spend resources on registration.

##### **4.1 Assessing levels of informality in rural Rwanda**

While the registry provides data on registered transactions, assessing levels and determinants of informality requires linking household to registry data at the parcel level. To do so in a way that is representative for rural areas in Rwanda, we use the 2015 round of a three-round panel of 3,600 households in 300 rural villages covering 23 districts that were interviewed in 2011, 2012, and early 2015.<sup>12</sup> This survey was administered using tablets and the questionnaire was pre-populated with a list of all parcels owned or cultivated by a household in 2012, requiring the enumerator to in each case check for changes in status (beyond asking for new acquisitions). The unique parcel identifier (UPI) was used to match with LAIS data, in particular the name of the registered owner, to ascertain that households who claimed to have completed the process of registering a transaction did actually do so.

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<sup>12</sup> The survey originally aimed to evaluate the impact of the LTR program's national roll-out. 100 sectors, 4 in each of the country's 25 districts, were randomly chosen. In each selected sector, three enumeration areas with 12 households to be interviewed in each were then selected randomly. In 2015, 3,348 of the original households could be re-interviewed.

Methodological weaknesses including use of a non-representative sample that cannot be traced back to a frame to allow sample weights to be calculated;<sup>13</sup> asking information on transactions and their formalization for one of the household's plots only without having first listed all of them; and failing to cross-check households' responses against official LAIS information to check that the respondents' subjective notion of 'registration' indeed refers to the official process are likely to introduce large errors. Studies that use such methods (Biraro *et al.* 2015) can provide case study evidence to understand underlying processes but not figures that can assist decision-makers.

Data from the household sample (table A1) suggest that about a third of households are female-headed, their asset endowments are limited, and mean assets (excluding land) are at US\$ 300. 94% of households own on average 0.68 ha of agricultural land (from 0.58 ha in the South to 0.91 ha in the East) with average parcel size of 0.18 ha (table A2) well below the 1 ha below which subdivision is legally prohibited. With 24% and 28% of the sample, respectively, reporting to have acquired or transferred out land (62% having purchased land, 46 % having inherited), land markets are active. This is consistent with some 1,800 parcels with an average size of 0.12 ha having been acquired—41% purchased, 29% inherited, and 16% rented—since early 2012.<sup>14</sup> Perceived levels of tenure security are high and awareness of legal restrictions on subdivision seems low. A test of legal knowledge suggests high levels of awareness of gender-issues but little knowledge of legal provisions and procedural aspects for property transfers (table A3). Moreover, while 65% of women know that land acquired by couples married under the common property regime needs to be registered jointly, this is the case for only 46% of men, providing one possible explanation of the fact that the gender benefits from LTR may be slowly eroding (see table 3, panel C).

The survey suggests that, between 2012 and 2015, 1,147 or 12% of parcels owned by households in our sample had been newly acquired. Of these, 51% were registered in the new owner's name under LTR, 47% had not started the registration process, and 2% went for subsequent registration. Appendix tables 3 and 4 illustrate the procedure employed by providing a side by side comparison of information from LAIS and the household survey regarding area and owners' names for a given UPI with table 4 including an additional column indicating that the name of the original owner in the 2012 round of our household survey matches

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<sup>13</sup> As is easily verified from table 1, of the 8.55 million parcels in either of these categories, 83% are agricultural, 15% residential, and 2% commercial. From the documentation provided, it seems that in the Biraro *et al.* (2015) sample proportions are 27%, 51%, and 22%, i.e., commercial and residential land are overrepresented by factors of 3.4 and 11.5 while agricultural land is underrepresented by a factor of 0.33. Even if there were no other issues with their methodology, any estimates arrived at without applying weights will provide a misleading picture of the national situation.

<sup>14</sup> Note that Rwandan law prevents the subdivision of agricultural land less than 1 ha. Although we do not have information on subdivision of agricultural land in our data, the fact that the majority of parcels transferred being small agricultural parcels (smaller than the average parcel size of the sampled villages) could likely imply illegal fragmentation and might, in turn, lead to non-registration of transactions. A deeper understanding of this issue requires detailed data on the parent parcels of transacted parcels.

the information recorded in LAIS.<sup>15</sup> Beyond highlighting differences across regions and transaction types that a regular performance monitoring system based on administrative data could help tracked and narrow, two observations are particularly pertinent.

With 42% (50% and 27% for purchases and non-monetary transfers, respectively) of households who failed to register transferred land in their name having taken action even at village level,<sup>16</sup> and a high share quoting lack of information as one reason for not taking any action, awareness of the need to register transactions to make them legally valid remains an issue. The challenge of maintaining the high level of gender-equality achieved in the first-time allocation of land holders (table 3) implies that campaigns to inform households of the need to register may also need to emphasize gender aspects.

The official valuation for parcels registered post-LTR is, with close to US\$700, well above the US\$365 for non-registered ones or the US\$290 for plots registered free of charge during LTR (table 7), in line with households' subjective valuation (US\$666 vs. US\$447 for registered/unregistered ones).<sup>17</sup> This suggests that, beyond information, registration fees may be an issue. To explore if high fees, relative to property value, make rural registration unaffordable, we combine data on sales values of transferred parcels from our survey with LAIS data on the value of transferred parcels for Kigali to compute the fee to be paid as a share of property value (table 8). Even if the 10% of rural parcels with values below the registration fee so that registration would not make economic sense are excluded, mean (median) rural parcel prices are US\$ 438 and US\$ 185. Thus, for the median rural property, registering a transaction would require a monetary outlay equivalent to 22.6% of property value, compared to urban properties in Kigali where the registration fee is only 0.64% of median property value. While it is not the only factor, making fee structures less biased against rural areas could possibly go a long way towards ensuring sustainability of Rwanda's land registry.

#### **4.2 Willingness to pay for registration and its determinants**

To explore willingness to pay for registering subsequent rural transfers, the survey asked those who had acquired but not registered land, to state the amount they would be willing to pay for registration. While 20% were not willing to pay at all, the mean for those with positive amounts is RwF 4,500; about 20% of the official fee and the median is RwF 1,000, equivalent to the fee charged for first-time registration of rural parcels.<sup>18</sup> We explore determinants of households' willingness to pay (WTP) by estimating a cross-section regression of the form:

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<sup>15</sup> Information had to be obtained from household surveys, as RNRA does not maintain records in ways that allows easy identification of parties to past transactions. While it is true that, contrary to a deeds system, registration of the current owner is sufficient to document ownership, having a historic record could still be very valuable help reach decisions in case of dispute and the current practice of discarding it may not be prudent.

<sup>16</sup> The lower level of informality for inheritance is due to a higher share of such transfers having been registered during LTR. \*\*

<sup>17</sup> Although responses to questions about reasons for non-registration may have to be taken with a grain of salt if households lack information, this is consistent with the fact that about 13% of those who have not yet registered their transactions cited high registration fees as a major reason.

<sup>18</sup> The average cost per parcel during the systematic exercise amounted to less than USD 6 (RWF 4,620).

$$\ln WTP = \beta X + \gamma Y + \delta Z + \varepsilon, \quad (2)$$

where  $WTP$  is stated willingness to pay to register a transaction for a parcel that was acquired but not yet registered and  $X$ ,  $Y$ , and  $Z$  are vectors of household, parcel, and community characteristics,  $\beta$ ,  $\gamma$ , and  $\delta$  are vectors of coefficients to be estimated, and  $\varepsilon$  is a random error term.

Although they will be only suggestive, results for specifications with province fixed effects for all parcels (column 1) and only those located in the cell of residence (column 2) in table 9 provide three insights. First,  $WTP$  increases with parcel size (elasticity of 0.11) but is lower for parcels allocated by government. Second, distance from the DLOs but not the share of certificates in the cell reduces  $WTP$ , either because of higher transport costs or lack of information. Finally, location in a sectors where a SLM had already been posted at the time of the survey significantly increases  $WTP$  for registering land in the cell of residence by some 60%, possibly as a result of greater awareness, or lower transport costs.

## **5. Conclusion and implications for future research**

Our analysis shows that Rwanda has made remarkable progress in a very short period of time and points towards a number of steps to make this accomplishment sustainable and fully realize the benefits from it.

Enormous differences in the rates with which subsequent transactions are registered point towards large differences in benefits or relative cost of land registration across the population. Building on a tradition of piloting in Rwanda's land sector, exploring impacts of targeted fee reductions, with or without campaigns to increase male and female land owners' or SLMs' awareness/knowledge could be a promising and low cost way to quickly identify options that could help bring the country closer to full registration of all transfers, helping to ensure the sustainability of the large investment made under LTR. Using LAIS, together with databases maintained by other institutions, to regularly and in real time monitor the indicators reported here, among others, could help RNRA to document the benefits already generated by LTR. Without maintenance it will be difficult to sustain these benefits, and manage the process of doing so.

Establishing a monitoring system that builds on planned real-time integration of the Land Administration and Information System (LAIS) with data on court cases or disputes by Ministry of Justice, land lease fees by the Revenue Authority, and land use by the Ministry of Agriculture promises to enhance these benefits. Regular monitoring and publication of key statistics at high levels of spatial disaggregation will allow the Rwanda National Resource Authority (RNRA) to measure progress in addressing remaining challenges, manage the process of doing so and, if data (at more aggregate levels to protect confidentiality of the underlying information) are made public, significantly improve the basis of information (e.g., on land prices) for private sector decision-making.

In line with RNRA's tradition of piloting, exploring impacts of targeted fee reductions, with or without efforts to increase male and female land owners' or SLMs' awareness/knowledge, appears a promising and low cost way to quickly identify options to help ensure registration of all transfers. In doing so, it could not only help ensure the sustainability of the large investment made under LTR but, more importantly, provide the basis for productive land use and conflict reduction potential in Rwanda.

Beyond Rwanda, our analysis points towards two important lessons. First, to ensure that expected benefits can be sustained, support to establishment or improvement of land registries should consider the set-up and operations phases jointly rather than in separation from each other, with a clear understanding of the private benefits that may accrue to different types of users, the social benefits, and the way in which these match up with available financing options. More in-depth analysis of the cost of service provision in Rwanda may provide useful inputs that could then be drawn into an economic analysis. Second, even if formal systems are far from providing universal coverage, analysis of administrative data routinely available from land registries has enormous potential to identify strengths, gaps, and risks for land governance in an objective and actionable way that can provide a basis for both output-based support to the land sector and in-depth analysis of the underlying issues.

**Table 1: Number and size of registered parcels by type**

	<b>Total</b>	<b>Kigali city</b>	<b>Southern</b>	<b>Western</b>	<b>Northern</b>	<b>Eastern</b>
<b>Total no. of parcels</b>						
Total no. of registered parcels	11,420,885	390,788	3,217,847	3,157,232	2,668,212	1,986,806
of which residential	1,341,467	134,203	227,046	419,683	147,693	412,842
of which commercial	169,709	4,369	16,671	117,303	17,272	14,094
of which agricultural	7,344,802	198,262	1,997,104	1,919,423	1,951,886	1,278,127
of which forest	916,359	13,875	262,232	322,117	267,162	50,973
of which admin./science/social	29,749	1,891	7,503	9,128	4,401	6,826
of which not categorized	1,618,799	38,188	707,291	369,578	279,798	223,944
Parcel size (ha)	0.18	0.18	0.17	0.13	0.11	0.38
.. for residential land	0.13	0.09	0.15	0.11	0.13	0.16
.. for agric. land	0.19	0.20	0.17	0.12	0.11	0.42
<b>Share of parcels by claimant type</b>						
Natural person	0.80	0.86	0.72	0.83	0.83	0.81
Non-natural person	0.05	0.02	0.09	0.03	0.03	0.03
Claimant not yet registered	0.16	0.12	0.19	0.14	0.14	0.16
<b>Share of parcels by claimant's gender</b>						
Female only	0.25	0.23	0.26	0.25	0.23	0.24
Male only	0.14	0.17	0.19	0.13	0.10	0.14
Male and female jointly	0.61	0.60	0.55	0.62	0.67	0.62

*Source:* Rwanda Natural Resource Authority (RNRA), Land Administration Information System (LAIS).

*Note:* Gender of owners is reported only for parcels registered in the name of natural persons.

**Table2: Cumulative number and loan amount of registered mortgages by end of 2015 by region**

	Total	Kigali city	Province			
			Southern	Western	Northern	Eastern
<b>All mortgages</b>						
Amount (US\$ bn)	2.604	1.66	0.173	0.307	0.164	0.3
No. of mortgages	49,694	19,285	7,371	6,682	6,888	9,468
Avg. amount	42,247	86,296	23,488	45,909	23,839	31,705
<b>Mortgages secured by residential land &amp; property</b>						
Amount (US\$ bn)	1.4026	1.06	0.0899	0.0839	0.0578	0.111
No. of mortgages	31,989	16,281	3,889	3,605	2,792	5,422
Avg. amount	30,520	65,089	23,107	23,272	20,685	20,448
<b>Mortgages secured by agric. land</b>						
Amount (US\$ bn)	0.4453	0.117	0.051	0.118	0.0533	0.106
No. of mortgages	14,843	2,231	3,210	2,363	3,585	3,454
Avg. amount	32,740	52,339	15,894	49,811	14,862	30,795
<b>Mortgages secured by commercial land</b>						
Amount (US\$ bn)	0.7613	0.488	0.0322	0.105	0.0532	0.0829
No. of mortgages	2,862	773	272	714	511	592
Avg. amount	228,194	630,984	118,542	147,291	104,046	140,108

Source: Rwanda Natural Resource Authority (RNRA), Land Administration Information System (LAIS)

**Table 3: No. of registered transactions leading to transfer of ownership in 2014/15 by region**

	Total	Kigali city	Province			
			Southern	Western	Northern	Eastern
<b>Panel A: Transactions involving residential land</b>						
<b>Totals</b>						
All	31,209	16,710	4,234	2,805	2,141	5,319
Sales	21,367	15,145	1,504	1,240	827	2,651
Sale value (\$/m <sup>2</sup> ) <sup>a</sup>	30.07	39.38	9.92	14.41	12.41	4.75
Others	10,038	1,665	2,762	1,606	1,319	2,686
<b>Mean no of transactions per cell and year</b>						
All	7.26	51.89	3.98	2.61	2.59	5.29
Sales	4.97	47.03	1.41	1.15	1.00	2.64
Others	2.34	5.17	2.60	1.49	1.59	2.67
<b>Share of registered parcels transferred per year</b>						
All	1.16	6.23	0.93	0.33	0.72	0.64
Sales	0.80	5.64	0.33	0.15	0.28	0.32
Others	0.37	0.62	0.61	0.19	0.45	0.33
<b>Panel B: Transactions involving agricultural land</b>						
<b>Total number of transactions</b>						
All	22,850	6,635	3,996	2,390	3,994	5,835
Sales	14,497	6,087	2,178	1,234	1,971	3,027
Others	8,510	609	1,855	1,180	2,033	2,833
Sale value (\$/m <sup>2</sup> ) <sup>a</sup>	4.45	6.65	3.70	3.57	3.91	1.47
<b>Mean no. parcels per annum</b>						
All	5.32	20.61	3.76	2.22	4.82	5.80
Sales	3.37	18.90	2.05	1.15	2.38	3.01
Others	1.98	1.89	1.74	1.10	2.46	2.82
<b>Percent of registered parcels per annum</b>						
All	0.16	1.67	0.10	0.06	0.10	0.23
Sales	0.10	1.54	0.05	0.03	0.05	0.12
Others	0.06	0.15	0.05	0.03	0.05	0.11
<b>Panel C: Gender of newly registered land's owners</b>						
<b>New registrations by gender</b>						
Female only	0.15	0.16	0.16	0.14	0.12	0.15
Male only	0.23	0.22	0.25	0.22	0.19	0.25
Joint	0.62	0.62	0.58	0.64	0.68	0.60
No. of cells	2148	161	532	538	414	503

Source: Rwanda Natural Resource Authority (RNRA), Land Administration Information System (LAIS).

Notes: <sup>a</sup> Two residential and two agricultural parcels from Kigali with values above 5,000 \$/m<sup>2</sup> have been dropped.

**Table 4: Expansion of registry infrastructure and information campaigns over time**

	Kigali city	Province			
		South	West	North	East
Covered with SLM Batch I (Q3, 2014)	0.18	0.40	0.07	0.03	0.05
Covered with SLM Batch II (Q2, 2015)	0.73	0.55	0.21	0.21	0.16
Covered with SLM Batch III (Q3, 2015)	0.82	0.81	0.59	0.57	0.57
Covered by land week I (Q3, 2014)	0.19	0.25	0.39	0.29	0.24
Covered by land week II (Q2, 2015)	0.33	0.18	0.23	0.19	0.22
Distance to DLO (km)	6.95	12.57	12.43	11.58	14.85
Ratio of urban to rural pop.	2.04	0.19	0.19	0.14	0.09
No. of obs. (cells)	161	532	538	414	503

*Source:* Rwanda Natural Resource Authority (RNRA) for sector land managers and land week coverage, National Institute of Statistics, Rwanda for population numbers.

**Table 5: Determinants of registered transactions at cell level**

	OLS			Cell level fixed effects		
	All	Sales	Non-mon.	All	Sales	Non-mon.
<b>Panel A: Residential land</b>						
Sector land manager appointed	1.113*** (0.363)	1.030*** (0.363)	0.077 (0.127)	0.575*** (0.204)	0.877*** (0.258)	-0.305* (0.165)
Sector covered by land week events	-0.064 (0.212)	-0.102 (0.188)	0.034 (0.095)	0.042 (0.113)	-0.075 (0.119)	0.109 (0.110)
Sector land manager * Land week	-0.078 (0.589)	-0.004 (0.570)	-0.073 (0.143)	-0.061 (0.271)	-0.081 (0.342)	0.029 (0.191)
Distance to DLO in km	-0.019 (0.020)	0.006 (0.015)	-0.025*** (0.008)			
No of residential parcels in the cell ('000)	3.485*** (0.701)	2.479*** (0.582)	1.014*** (0.220)			
Ratio of urban population in the sector	9.041*** (1.262)	7.110*** (1.167)	1.995*** (0.377)			
Constant	-1.575*** (0.510)	-1.811*** (0.446)	0.238* (0.122)			
Number of observations	17,184	17,184	17,184			
R <sup>2</sup>	0.362	0.334	0.111			
<b>Panel B: Agricultural land</b>						
Sector land manager appointed	0.973*** (0.226)	1.074*** (0.219)	-0.109 (0.094)	0.934*** (0.165)	1.225*** (0.232)	-0.296** (0.123)
Sector covered by land week events	-0.137 (0.134)	-0.120 (0.098)	-0.022 (0.075)	-0.012 (0.066)	-0.107 (0.079)	0.095 (0.061)
Sector land manager * Land week	0.346 (0.429)	0.305 (0.406)	0.054 (0.102)	0.080 (0.213)	0.032 (0.284)	0.063 (0.140)
Distance to DLO in km	-0.033*** (0.013)	-0.011 (0.009)	-0.023*** (0.006)			
No of agri. parcels in the cell ('000)	0.127*** (0.042)	0.079*** (0.029)	0.049** (0.020)			
Ratio of urban population in the sector	2.359*** (0.783)	1.547** (0.626)	0.832*** (0.274)			
Constant	0.547* (0.294)	-0.138 (0.240)	0.688*** (0.127)	0.822*** (0.040)	0.167*** (0.051)	0.660*** (0.026)
Number of observations	17,184	17,184	17,184	17,184	17,184	17,184
R <sup>2</sup>	0.136	0.168	0.033	0.095	0.136	0.024

*Note:* Dependent variable is the number of registered transactions resulting in a transfer of ownership for residential or agricultural land for Panels A and B, respectively.

All the specifications include province-year dummies throughout but coefficients are not reported. Robust standard errors clustered at the sector level in parenthesis: \*\*\* significant at 1%; significant at 5%; \* significant at 10%.

**Table 6: Incidence of informal land transactions in rural areas**

	<b>Total</b>	<b>Southern</b>	<b>Western</b>	<b>Northern</b>	<b>Eastern</b>
Share of newly acquired land since last visit (i.e., 2012) <sup>a</sup>	0.12	0.11	0.11	0.12	0.14
<b>All types of transactions<sup>b</sup></b>					
Registered during LTR	0.512	0.577	0.369	0.597	0.469
Subsequent registration	0.020	0.006	0.035	0.039	0.000
Not officially registered	0.468	0.417	0.596	0.365	0.531
Of which: register only at the village	0.423	0.659	0.145	0.363	0.547
RwF willing to pay for reg.	4442	2937	3794	4208	7188
Number of parcels	1,147	324	255	310	258
<b>Market transactions</b>					
Registered during LTR	0.352	0.354	0.218	0.418	0.395
Subsequent registration	0.026	0.007	0.056	0.050	0.000
Not officially registered	0.622	0.639	0.726	0.532	0.605
Of which: register only at the village	0.500	0.783	0.189	0.347	0.634
Number of parcels	576	144	124	141	167
<b>Inheritance transactions</b>					
Registered during LTR	0.673	0.756	0.511	0.746	0.604
Subsequent registration	0.014	0.006	0.015	0.030	0.000
Not officially registered	0.313	0.239	0.473	0.225	0.396
Of which: register only at the village	0.268	0.395	0.081	0.395	0.306
Number of parcels	571	180	131	169	91
<b>Reason for non-registration</b>					
Lack of information	0.21	0.34	0.09	0.18	0.31
Lack of interest	0.13	0.10	0.10	0.24	0.09
Fees too high	0.13	0.16	0.06	0.13	0.19
Will register later	0.12	0.10	0.03	0.22	0.18
Seller didn't have certificate	0.02	0.03	0.04	0.00	0.02
DLO is too far	0.01	0.01	0.01	0.01	0.01
Conflict on the parcel	0.01	0.01	0.01	0.01	0.01
Other reason	0.38	0.25	0.67	0.22	0.21
No. of owned parcels	12,798	3,574	3,501	3,234	2,489

Source: Own computation from 2015 round of Rwanda Land Tenure Regularization Survey

<sup>a</sup> Includes newly acquired parcels located outside the cell boundary or with missing detailed information on subsequent registration.

<sup>b</sup> Restricted only to parcels acquired within the cell of sampled villages.

**Table 7: Characteristics of newly acquired parcels land in rural areas**

	<b>Registered during LTR</b>	<b>Not officially registered</b>	<b>Subsequent registration</b>
Year acquired	2012	2013	2013
Land area in ha	0.13	0.11	0.09
Purchased	0.35	0.67	0.65
Registered land price in USD	290.12	365.01	698.98 <sup>a</sup>
Inherited	0.56	0.22	0.26
Government allocated	0.05	0.02	0.00
Subjective land value in USD	479.46	447.95	665.59
Registration fee paid (US \$)	2.14 <sup>b</sup>		30.06
Number of parcels	587	537	23

Source: World Bank 2015 third round follow up survey (**restricted to those within the cell boundary**).

<sup>a</sup>This is after dropping one outlier parcel, otherwise, the mean price would have been USD 1614.

<sup>b</sup>Note that 90% of the cases paid only the official rate of USD 1.42.

**Table 8: Average property price per parcel and effective registration rate**

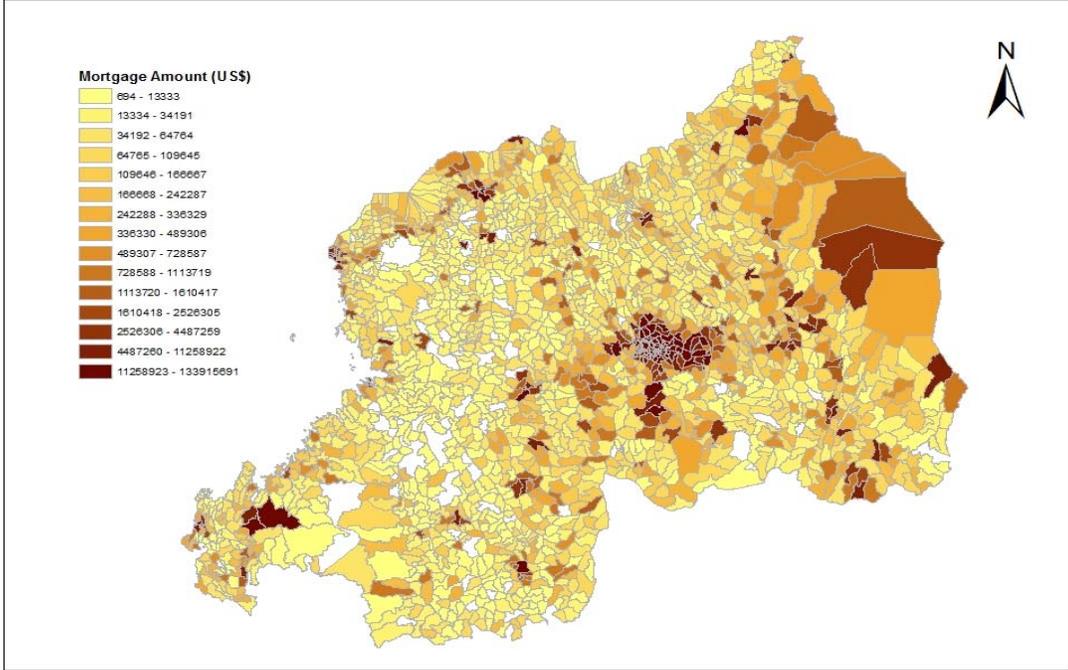
Decile	Mean land price		Effective reg. fee (%)	
	Rural (USD)	Kigali (USD)	Rural	Kigali
1	23	985	99.5	5.27
2	58	2,216	69.4	1.83
3	92	3,498	42.2	1.15
4	131	4,787	29.9	0.84
5	171	6,245	22.6	0.64
6	225	8,165	17.2	0.49
7	292	11,101	13.3	0.36
8	396	15,865	9.8	0.26
9	666	26,487	6.0	0.16
10	2,696	171,785	2.3	0.06

Note: The price of Kigali is from official registry for the period 2013-2015 on about 25,000 parcels. The exchange rate was 647, 682 and 720 Rwanda Franc per USD for 2013, 2014 and 2015, respectively. The data for the rural areas is from the 2015 World Bank survey of 3600 households. For this analysis, 10% of rural parcels with reported prices less than the official registration fee were dropped.

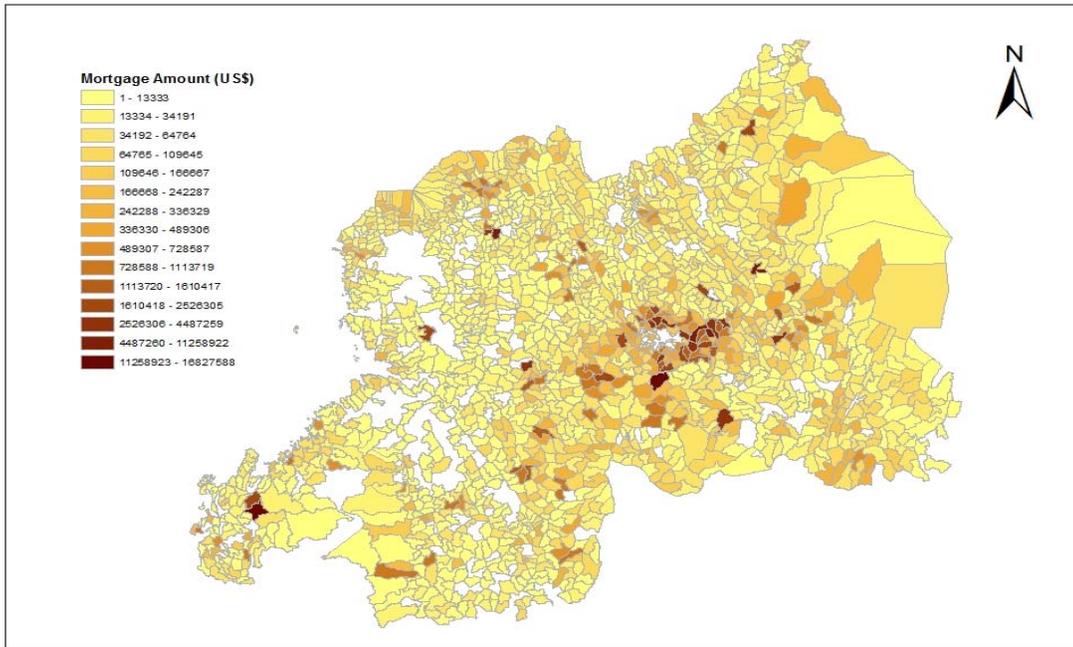
**Table 9: Determinants of self-reported willingness to pay to have land transactions registered**

	All parcels	Parcels in cell of residence
Ln age of head	-0.433 (0.267)	-0.495* (0.275)
Female headed household	0.057 (0.167)	0.091 (0.201)
Number of years of schooling, head	0.029 (0.024)	0.022 (0.025)
Household size	0.005 (0.032)	0.019 (0.035)
Ln sale value of assets, USD	0.151** (0.066)	0.134* (0.074)
Head/Spouse knows about registration process	0.377 (0.236)	0.425* (0.249)
Legal knowledge on registration, computed ind.	-0.047 (0.071)	-0.070 (0.068)
Parcel purchased	0.050 (0.138)	0.101 (0.154)
Parcel allocated by Gov.	-1.379*** (0.305)	-1.728*** (0.293)
Parcel jointly owned	0.154 (0.191)	0.150 (0.221)
Parcel main use : residential	0.113 (0.141)	0.130 (0.158)
Ln size of parcel, Ha.	0.114** (0.047)	0.110** (0.048)
Swamp/wetland	-0.001 (0.233)	0.049 (0.220)
Parcel irrigated	0.215 (0.195)	0.110 (0.167)
High quality soil	0.013 (0.113)	-0.013 (0.128)
No. months since acquisition	-0.007* (0.004)	-0.005 (0.005)
Share of parcels certified in Sector	0.364 (0.396)	0.320 (0.411)
Ln. dist. to DLO, km	-0.213** (0.095)	-0.357*** (0.082)
SLM in place at time of int.	0.385 (0.273)	0.584** (0.277)
Land Week event	0.170 (0.136)	0.086 (0.135)
West	0.107 (0.183)	0.167 (0.194)
North	0.323* (0.176)	0.369** (0.182)
East	0.274* (0.154)	0.401*** (0.155)
Constant	9.068*** (1.163)	9.677*** (1.190)
Number of observations	447	377
R2	0.177	0.209

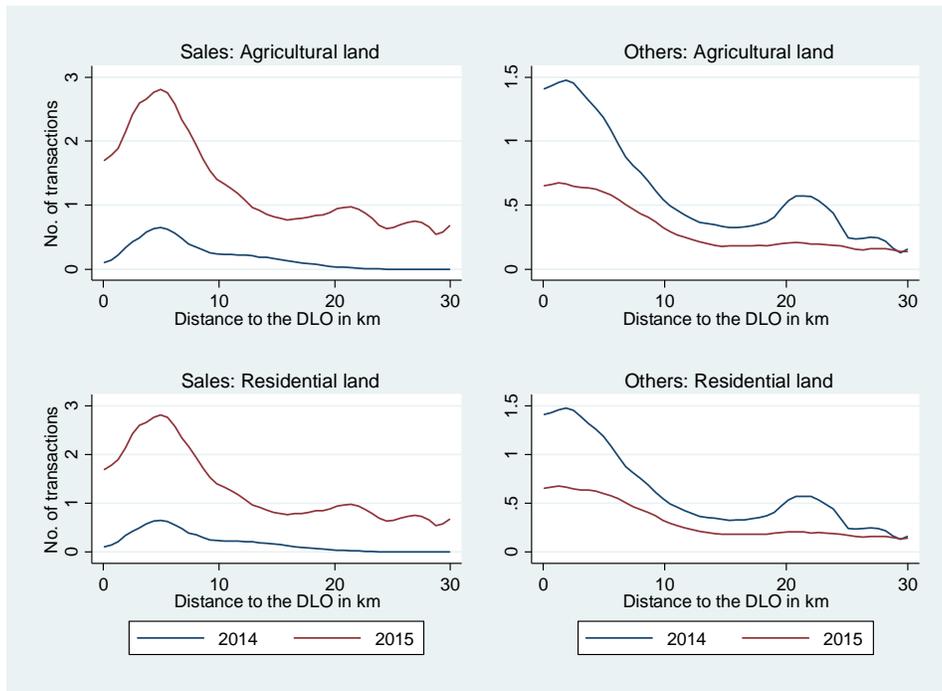
*Note:* As explained in more detail in the text, the sample comprises rural land users who had acquired land in the 2012-15 period. Dependent variable is the log of the self-reported willingness to pay (in RwF) for formal registration. . Robust standard errors clustered at the sector level in parenthesis: \*\*\* significant at 1%; significant at 5%; \* significant at 10%.



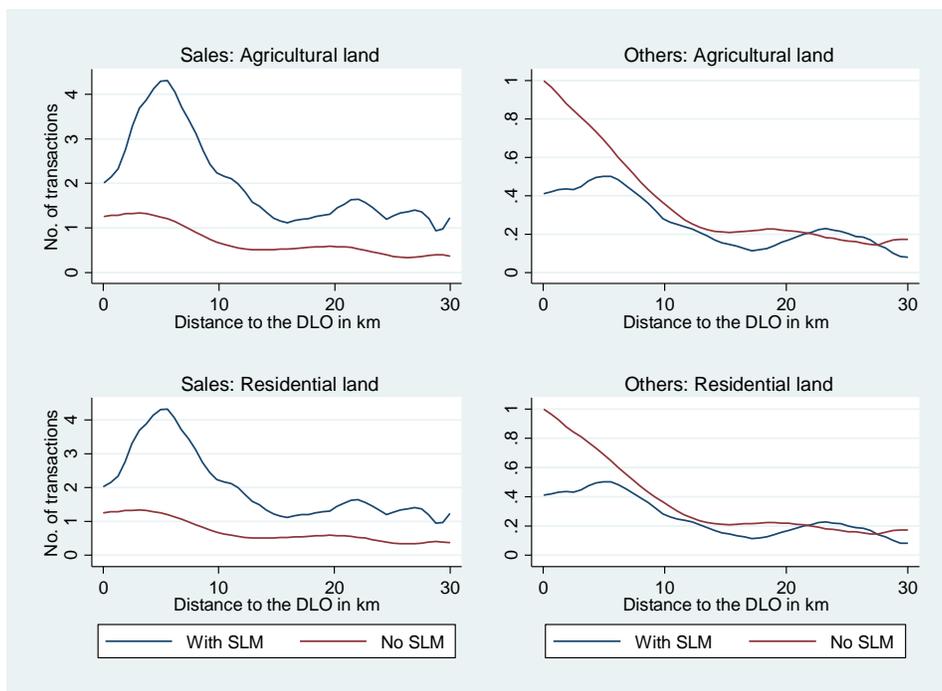
**Figure 1: Amount of total outstanding mortgages (US\$ equivalent) at cell level, December 31, 2015**



**Figure 2: Amount of outstanding agricultural mortgages (US\$ equivalent) at cell level, December 31, 2015**



**Figure 3: Number of quarterly registered transactions with transfer of ownership rights by distance of cell to the DLO and year**



**Figure 4: Number of quarterly registered transactions with transfer of ownership rights by distance of cell to the DLO and sector land manager in 2015**

**Table A1: Key household characteristics**

	Total	Quartile of the wealth distribution				Head's gender	
		1	2	3	4	Male	Female
<b>Head's characteristics &amp; size</b>							
Female head	0.32	0.52	0.36	0.24	0.17	0.00	1.00
Household size	4.68	3.79	4.51	4.94	5.48	5.20	3.58
Head's age	49.78	53.42	49.51	48.47	47.69	46.99	55.62
Head with primary	0.87	0.92	0.90	0.88	0.79	0.87	0.85
Head with secondary/voc'l	0.10	0.04	0.07	0.11	0.17	0.10	0.11
<b>Asset endowments</b>							
Value of non-land assets, USD	297	8	29	79	1072	401	81
Owens land	0.94	0.92	0.94	0.95	0.95	0.95	0.92
Total land owned (ha)	0.68	0.31	0.43	0.76	1.22	0.78	0.46
<b>Income &amp; its sources</b>							
Income from agric. (USD)	289	68	135	434	518	347	168
Head works in agriculture	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Works off farm	0.12	0.20	0.16	0.09	0.04	0.12	0.12
Has non-farm business	0.25	0.12	0.22	0.27	0.40	0.30	0.16
... if yes, annual profit, USD	270	11	41	115	581	288	201
<b>Land market participation</b>							
Transacted in land	0.24	0.15	0.25	0.25	0.32	0.27	0.17
if yes, purchased	0.62	0.39	0.56	0.60	0.80	0.69	0.40
... if yes, size (ha)	0.12	0.06	0.08	0.10	0.20	0.14	0.05
if yes, inherited	0.46	0.66	0.50	0.48	0.30	0.39	0.67
... if yes, size (ha)	0.07	0.08	0.08	0.07	0.05	0.05	0.11
Transacted out land	0.28	0.27	0.29	0.27	0.30	0.29	0.27
... if yes, subdivision	0.29	0.32	0.29	0.31	0.24	0.26	0.34
... if yes, size	0.18	0.13	0.15	0.19	0.25	0.19	0.15
No. of households	3348	839	831	835	834	2259	1078

Source: Own computation from 2015 round of Rwanda Land Tenure Regularization Survey

**Table A2: Key parcel characteristics**

	Total	Region			Head		
		South	West	North	East	Male	Fem
<b>Characteristics</b>							
Size, ha	0.18	0.17	0.14	0.14	0.29	0.19	0.15
Swamp/wetland	0.12	0.14	0.11	0.13	0.07	0.12	0.11
Irrigated	0.06	0.09	0.06	0.05	0.03	0.06	0.07
Main use residential	0.25	0.27	0.23	0.21	0.31	0.24	0.29
Main use annuals	0.56	0.55	0.53	0.62	0.53	0.56	0.55
Main use perennials	0.16	0.14	0.20	0.14	0.13	0.17	0.12
<b>Mode of acquisition</b>							
Purchased	0.34	0.25	0.36	0.39	0.40	0.38	0.22
Inherited	0.45	0.50	0.48	0.48	0.30	0.42	0.53
Allocated by gov't	0.03	0.03	0.02	0.01	0.10	0.03	0.05
Rented in	0.05	0.07	0.04	0.03	0.06	0.06	0.04
Other	0.10	0.13	0.07	0.08	0.11	0.10	0.13
<b>Perceived land rights</b>							
Can sell	0.90	0.89	0.89	0.93	0.88	0.92	0.84
Can give	0.92	0.90	0.93	0.94	0.90	0.94	0.87
Can use as collateral	0.90	0.89	0.90	0.93	0.89	0.92	0.85
Can rent out	0.91	0.90	0.90	0.94	0.89	0.92	0.87
Can divide	0.93	0.92	0.94	0.96	0.89	0.94	0.89
Any dispute	0.02	0.03	0.01	0.01	0.03	0.01	0.03
No future dispute	0.97	0.95	0.99	0.99	0.97	0.98	0.96
Won't lose if left fallow	0.91	0.91	0.88	0.95	0.92	0.91	0.91
No expropriation	0.67	0.64	0.68	0.72	0.62	0.67	0.67
No. of parcels	14,054	4,182	3,718	3,387	2,725	10,270	3,747

Source: Own computation from 2015 round of Rwanda Land Tenure Regularization Survey

**Table A3: Knowledge of Legal procedures for Registration of Land Transactions Post LTR**

	Region				
	Total	South	West	North	East
Land markets— Male	0.07	0.06	0.03	0.14	0.07
Land markets — Female	0.04	0.03	0.02	0.05	0.05
Inheritance: Register spouse if CPR male	0.68	0.69	0.62	0.75	0.69
Inheritance: Register spouse if CPR female	0.70	0.69	0.67	0.74	0.72
Purchase: Register spouse if CPR male	0.46	0.44	0.55	0.35	0.48
Purchase: Register spouse if CPR female	0.65	0.64	0.61	0.70	0.66
Number of observations	3351	1069	814	678	788

*Source:* Own computation from 2015 round of Rwanda Land Tenure Regularization Survey

*Note:* CPR refers to community of property marriage regime.

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