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Does Title Increase Large Farm Productivity?

Institutional Determinants of Large Land-Based Investments' Performance in Zambia

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Abstract

The importance of well-functioning land markets for structural transformation via labor movements to the non-agricultural sector, growth in farm size, and the ability to use land as collateral for credit and has long motivated Government efforts at reducing the transaction costs of registering and transferring land and supporting large farm formation. Rigorous evidence on the effect of such measures has, however, been scant. This paper explores the impact of institutional arrangements on productivity for a representative sample of 3,000 large farms in Zambia, one of the earliest African adopters of such policies to close this gap. Instrumental-variable (IV) regressions suggest title has no effect on productivity, investment, or credit access and reduces rather than improves rental market participation. Measures to harness Zambia's potential include improving title quality through exclusive use of digital registries; imposition of a land tax on state land to incentivize productive rather than speculative land use and cancel outdated legacy documents; and greater involvement of traditional authorities in record maintenance and land management, possibly via land tax revenue sharing.

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Does title increase large farm productivity? Institutional determinants of large land-based investments' performance in Zambia

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1. Introduction

Land markets and the institutions supporting them are key drivers of structural change by allowing labor to move out of the agricultural sector and facilitating farm size growth; allowing better operation of financial markets through use of land as collateral; and supporting protection or better use of un- or underutilized land. These aspects are particularly relevant in Africa where the scope for improving land use is enormous and where a desire to foster economic transformation and respond to (foreign or local) investor demands for easier access to land led many countries to establish statutory tenure regimes to overcome the limitations of traditional customary systems, especially following the 2007/08 food crisis. Yet, rigorous evidence on the effect of such policies on productivity and local welfare remains limited. As a result, consensus on how to attract productive large farm investment and ensure its contribution to the economy remains debated. This is a serious constraint especially at a time when expected increases in global commodity prices could lead to quickly accelerating land demand.

To help fill this gap, this paper explores impacts of institutional arrangements on large farm performance in Zambia, a country that instituted policies to attract domestic and foreign investors to its agricultural sector and thus benefit from their capital and know-how long time ago. Two key elements of such policies are (i) a dualistic land tenure regime that allows rights to be formally recognized (and pledged as collateral) on 'state land' only; and (ii) establishment of 'farm blocks' where investors can access land, infrastructure, and complementary services on favorable conditions. Studies suggest that, possibly due to these policies, Zambia emerged as one of two African countries where more than half of the agriculturally suitable area is owned by large or medium farms (Jayne *et al.* 2014a).[1] The extent to which such policies improved productivity, local economic activity, and equity remains unclear, largely because there are no systematic data on large farms.

We piggy-backed on the 2020 census in Zambia's Eastern Province to obtain a list of all large farms that can serve as a sample frame, basic evidence on their activities and rights, and a map of cultivated fields. Overlaying this map with survey and sketch plans from the registry that were specifically digitized for this purpose,[2] allows distinguishing farms' *de facto* occupation from their *de jure* rights. An in-depth survey of a representative sample of 3,000 large farms was then conducted to obtain more detailed data for analysis. The census provides an estimate (at most 26%) of the province's agricultural area owned by large farms.[3] Discrepancies between official records and ground reality are large, consistent with the notion of weak

[1] Zambia's National Statistical Agency (Zamstats) defines large and medium farms as those larger than 5 ha and we refer to them as 'large farms' throughout the paper.
[2] Digitization of cadastral data was supported by the Zambia Integrated Landscape Management Project (ZIFLP).
[3] If applied nationally, even 26% of area owned by large farms would mean that 10 million ha was converted from customary tenure since 1995.

maintenance resulting from limited state capacity and local presence undermining the value of titles for third party transactions. We also find that the pace of land acquisition peaked in the 5-year period just after the entry into force of the new land law in 1995 rather than in response to the 2007/08 global commodity price boom; that large farms rarely engage in land transfers and own on average 20 ha of which they cultivate less than half; and that there is high unmet demand and willingness to pay for title.

Farm survey data allow examining the impact of title on land and financial market participation, investment, and productivity. Instrumental-variable (IV) regressions, with possession of title instrumented by parcels' tenure at acquisition and length of tenure suggest that, if anything, title reduces land market participation and has no significant impact on credit access, land-attached investment, and productivity of land use. While title seems associated with higher levels of perceived transferability and land values, this may point towards speculative land acquisition and rationing in title access, two factors that may, e.g., by impeding long-term rental of land acquired as an investment, hinder rather than help structural transformation.

In terms of policy, improving record quality and coverage while lowering cost of service delivery through elimination of rents are key to improve land markets (Arruñada 2012). By leveraging traditional authorities' informational advantages (Basurto *et al.* 2020) and trust (Baldwin 2018), decentralization can possibly help to achieve this objective. Increased use of urban land taxes in Africa (Deininger *et al.* 2020) with positive effects (Weigel 2020) also suggests that a land tax on state land[4] could increase incentives for efficient land use and -if tax payment provides evidence of use and non-payment to be used to cancel legacy titles which would otherwise threaten to undermine tenure security- also clarify records over time and, if all or part of revenues are shared, generate resources for local authorities in an incentive compatible way.

We contribute to three strands of literature. First, strong interest in large-scale land-based investment (LSLBI) following the 2007/08 commodity price boom triggered a wave of investigation that range from case studies of large often foreign ventures (Deininger & Byerlee 2011) to analyses of national land transfer inventories (Glover & Jones 2019) on nature and impact of this this phenomenon. We show that in Zambia -and most likely in any setting where the formal land administration system is characterized by limited outreach and high cost- informal land transfers constitute an important and quantitatively large segment of LSLBI that is not captured well by either of these sources. As this could give rise to yield biased accounts and misleading policy recommendations, generation of complete data on large land acquisitions that can be compared to spatial and textual data from the registry is an important area for future research. Beyond the approach of piggy-backing on census-related data collection efforts taken here, classification of land use

[4] A land tax on large farms operating on state land would have no negative equity impacts as owners who do not have the means to pay could rent out to generate the resources needed for tax payment.

based on remote sensing (Deininger & Xia 2018), an area where significant advances have recently been made through use of survey-based training data (Burke *et al.* 2020a) offers considerable promise.

Second, the impact of land title on small farms has been explored by numerous studies (Lawry *et al.* 2016). 'Stylized facts' from this literature are that titling helps to increase investment (Fenske 2011), transferability (Deininger & Jin 2006), and -if women's rights are documented- female empowerment (Deininger *et al.* 2008; Ali *et al.* 2014). However, credit effects are rare because (i) banks will accept land as collateral only if registries are kept up-to-date;[5] and (ii) even if titled properties could realistically be foreclosed,[6] fixed costs of loan origination may limit positive effects to large farms (Carter & Olinto 2003). The finding that, for Zambian large farms, title affects neither investment nor credit access is thus at variance with the literature. It has been attributed to limited demand, i.e., land in Zambia being viewed as a store of wealth rather than a productive asset (Sitko *et al.* 2014) or methodological differences.[7] We argue that supply side issues related to legal value of land documents, the quality of the information they contain, and the states' capacity for (and cost of) enforcement are equally important and that better measurement of these aspects and rigorous evaluation of the extent to which they affect title demand and tangible outcomes will be key to understand the land sector's institutional performance and identification of ways to improve it.

Finally, a large literature on structural transformation has shown that land (rental) market transaction cost may impede farm growth (Adamopoulos & Restuccia 2014) and occupational diversification (Chen 2017). In principle, eliminating such costs could have large effects on productivity (Chen *et al.* 2017), the structure of employment and GDP (Gottlieb & Grobovsek 2019), and equity (Restuccia 2021). We complement this by showing that limited or outdated registry coverage of large farms makes it difficult for owners to transfer land and for third parties to ascertain land ownership are key sources of such transaction costs. Moreover, beyond rental, registries to support active sales markets that allow liquidation of land pledged as collateral are needed for credit markets to provide resources for investment by productive farms. Beyond regulatory change to allow cost reductions through use of technology, digital service delivery, appropriate standards, and elimination of rents, reducing the cost of land market transfers may thus require more rather than less public sector involvement (Palsson 2021).

The rest of the paper is structured as follows. Section two provides a conceptual framework and institutional background on land tenure and LSLBI in Zambia to lay out the questions to be explored. Section three discusses descriptive evidence from the listing, a comparison of cultivated area with digitized cadastral

[5] Resources to keep land registries up to date can be considerable as shown for Jamaica (Barnes & Griffith-Charles 2007), the Philippines (Maurer & Iyer 2008), Argentina (Galiani & Schargrodsky 2016), Peru (Gutierrez & Molina 2020),and Rwanda (Ali *et al.* 2017; Ali *et al.* 2019b).
[6] Foreclosing on owner-occupied urban properties was difficult in Argentina (Galiani & Schargrodsky 2010) and Peru (Field & Torero 2006). This has not prevented policy-makers from articulating unrealistic expectations that ultimately failed to materialize (Stein *et al.* 2016),
[7] Huntington and Shenoy (2021) also find a significant zero effect of land documentation on investment in Zambia. As discussed below, the reason for this finding is not because they use a randomized approach but because the documents issued in their intervention have no legal value.

records, and the farm performance survey. Section four presents the results from regressions exploring the impacts of title on self-assessed land rights, land values, investment, and productivity. Section five concludes by discussing implications for policy and future research.

2. Background and conceptual framework

A large literature shows LSLBI can provide benefits for local populations if their land rights are respected while also highlighting that policies and the institutional arrangements to implement them affect volume and impact of such investment and that geo-referenced inventories are needed to assess quantity and impact of such investment. Low levels of agricultural productivity and large amounts of potentially suitable land have long led Zambia to adopt policies, including a dualistic land tenure regime, to encourage large farm growth. While this is estimated to have led to an agriculture sector dominated by (domestic) large farms, neither the extent and nature of large farms nor the effect of such policies on their productivity is known.

2.1 Lessons from large land-based investment

While early contributions highlighted the scope for "pioneer investors" to support discovery of agro-ecological suitability and establishment of technology and market linkages (Collier & Venables 2012), the extent to which large land acquisition by capital intensive large farms can support Africa's structural transformation has long been subject to debate (Deininger & Byerlee 2011; Collier & Dercon 2014; Cotula 2014).[8] A key motivation for providing title to large farms is the hope that doing so will provide them with the means to access credit to complement their better access to product markets and management thereby catalyzing structural transformation. However, with few exceptions (Muyanga & Jayne 2019), evidence on large farms' productivity or its determinants is lacking, making research on this issue a priority.

Several studies explore long-term effects of foreign cash crop plantations using discontinuity designs. They often find negative and persistent effects on human capital as in South America (Dell 2010) or Puerto Rico (Bobonis & Morrow 2014) due to labor coercion. In the Democratic Republic of Congo, individuals located inside the perimeter of a historical rubber concession exhibit significantly worse outcomes in terms of education, wealth, and health whereas their village chiefs are elected less competitively and provide fewer public goods (Lowes & Montero 2020). Positive impacts of a large banana plantation in Costa Rica on a range of welfare indicators highlight the importance of labor mobility; in the case studied, labor was highly mobile and had ample alternative sources of employment so it could be retained by the monopsonist only by offering amenities (Mendez-Chacon & van Patten 2021).

[8] Most of the land available for expansion in Africa is concentrated in a few countries (Deininger & Byerlee 2012), with poor access to infrastructure, low levels of profitability (Jayne *et al.* 2014b), and often weak governance (Arezki *et al.* 2015) that are outweighed by the advantages of resource access (Lay & Nolte 2018) and institutional proximity (Raimondi & Scoppola 2018).

The wave of LSLBI triggered by the 2007/08 commodity boom spawned many descriptive case studies. These studies generally support the notion that LSLBI can increase output and create positive external effects for small producers if (i) large and small farms do not compete for land or other resources but complement each other (e.g., by large farms providing ancillary infrastructure) and there are no negative externalities;[9] (ii) large farms increase productivity (Dubbert 2019) or labor demand (Nolte & Ostermeier 2017), e.g., through investment in irrigation (Schuenemann *et al.* 2017), high-value production (Negash & Swinnen 2013), or agro-processing; and (iii) institutional arrangements, such as contract farming (Hall *et al.* 2017) rather than increase skills and benefits beyond what is observed for wage labor -though better endowed individuals may still reap disproportional benefits (Boamah & Overa 2016). Case studies also suggest that public agencies may use LSLBI to pursue objectives other than that of increasing productivity[10] and that the type of rights large farms can access and the way to obtain them will affect potential benefits.

As case studies may be subject to selection bias, e.g., by focusing on foreign investors to the detriment of locals (Jayne *et al.* 2019) even if the latter comprise the vast majority of ventures and area (Hausermann *et al.* 2018), complete geo-referenced concession inventories, overlaid with existing household or farm surveys, provide a more representative way of exploring and testing welfare and productivity effects of LSLBI on neighboring households. Studies using this methodology have been conducted in Cambodia (Anti 2021), the Lao People's Democratic Republic (Nanhthavong *et al.* 2020), Mozambique (Deininger & Xia 2016; Glover & Jones 2019), and Ethiopia (Ali *et al.* 2019a). Notwithstanding an interesting approach, this leaves out farms not established through formal channels and, as it fails to provide evidence on productivity, cannot be used to ascertain determinants of large farm performance. Primary data collection is essential to provide evidence on these and below we focus on Zambia, one of Africa's most eager adopters of LSLBI, to explore how mechanisms for large farms to access and use land, and in particular their possession of title, affect productivity, credit access, and investment.

2.2 Land tenure and large farms in Zambia

With smallholders only cultivating a fraction of the country's area of 74 million ha (of which 58% is of high or medium agricultural suitability) at rather low productivity, a desire to support development of a large farm sector has long been a central element of Zambia's agricultural strategy. In fact, long before the 2007/08 commodity price boom, polices focusing on establishment of settlement schemes and 'farm blocks'

[9] Potential negative externalities in terms of environment (Baumgartner *et al.* 2015) and health (Xia & Deininger 2019) will have to be accounted for. Similarly, even if economic effects are positive, women may lose out (Tsikata & Yaro 2014) although programs to enhance their agency to address this have shown success in Malawi (Adams *et al.* 2019).

[10] Beyond aiming to improve productivity of land use, LSLBI has been used to support territorial control (Lavers 2016), provide political patronage (Bélair 2021), transfer resources to central or local government (Lanz *et al.* 2018) or support specific political actors (Widengard 2019). Moreover, if the prospect of LSLBI reduces security of existing rights but fails to put in place robust alternatives, net effects may well be negative, even if desired investments never materialize (Burnod *et al.* 2013).

as clusters for large farm development had been put in place.[11] The idea was that through such schemes, infrastructure and markets would be easily available (Middelberg *et al.* 2020) together with land to stimulate commercial agriculture and boost food security. The impact of this strategy is debated, partly because it mixed political and economic objectives (Roth 1995): some studies find blocks generated employment- and income- benefits (Matenga & Hichaambwa 2017) by providing market linkages (Burke *et al.* 2020b) and involving out-growers (Manda *et al.* 2020). Others suggest that settlement schemes were not associated with higher levels of productivity (Sitko *et al.* 2014), raising concerns that such schemes may, by tying up land, do more to forestall future development than to encourage it (Sitko & Jayne 2014).[12]

Assessing performance and prospects of Zambia's large farms is complicated by the lack of clarity on the amount of land they own or cultivate. Experts agree that 94% of the country's 74 million ha was under customary tenure in 1995 when conversion of customary to state land became legally possible (Roth 1995). Although based on a somewhat weak basis,[13] recent studies put the share of land owned by large farms above 50% (Jayne *et al.* 2014a), with estimates of up to 60% (Honig & Mulenga 2015). This would imply a transfer of more than 30 million ha of state land to large farms since 1995 -a more than six-fold increase with potentially far-reaching consequences if woodlands were affected (Wilson & Scholes 2020). The fact that according to FAO statistics (FAOStat) Zambia's agricultural output at most doubled over the same period suggests that either land thus transferred is not used productively or the amount of land transferred is lower.

Zambia's long-standing policy stance in favor of large farms is also evident from it having adopted one of Africa's most dualistic land policies. It is one of few countries that maintains a clear dichotomy between customary and statutory land rights based on an implicit assumption of a linear progression from customary to statutory tenure (Alden Wily 2018).[14] The only way to have land rights formally documented is to convert customary to 'state land'. Effecting such a conversion is complex (Adams 2003) and costly (Larson 2014). The fact that it involves high levels of administrative discretion (German *et al.* 2013b) and weak procedural

[11] The 2006 Zambia Development Agency (ZDA) Act as amended establishes ZDA to consolidate different agencies that had historically been involved in administering such schemes (see Roth (1995), p. 173-99 for a concise summary of the historical evolution).
[12] Before 2000, retired or retrenched civil servants accounted for a significant share of land acquisition while after 2000, speculative land acquisition by those who accumulated resources in non-agricultural ventures seem to predominate (Sitko & Jayne 2014). "Land titling may be implicated in process of elite capture of land at the possible expense of future small-scale farm growth and farm consolidation" (Sitko and Jayne 2014, p. 199).
[13] The estimate by Jayne *et al.* (2014a) is based on binned DHS data. Sitko *et al.* (2015) noted that "Data on state lands (which include farm blocks) are from a spatial boundary dataset in wide circulation within the Ministries of Agriculture, Finance, Planning, and other governmental and non-governmental entities, although the provenance of this dataset cannot be determined with certainty. To evaluate the validity of these datasets, we confirmed that mapped boundaries conformed to knowledge held by managerial and operational personnel within the relevant ministries" (p.13).
[14] Land relations in Zambia are governed by the 1995 Land Act. After long deliberations, a National Land Policy was adopted in May 2021. Studies have long pointed out that limited capacity and local presence of relevant state institutions makes implementing this 'replacement' paradigm (Bruce & Migot-Adholla 1994) difficult, implying that relevant laws may have little effect on local realities (Atwood 1990; Pinckney & Kimuyu 1994).

safeguards (Nolte 2014) is often viewed as one a reasons for potential adverse effects from why large land transfers on locals' welfare and access to natural resources (Merten & Haller 2008; German *et al.* 2013a).[15]

Implementing this policy must contend with two main challenges. One is that their potential advantages in terms of accessing information and providing public goods (Baldwin 2018) notwithstanding, traditional authorities have no formal role in administering state land or influencing its use (Honig 2017). As it would gradually deprive them of power and income without reducing locals' expectations for them to provide access to land and arbitrate land disputes,[16] transfer from customary to statutory tenure is resisted by chiefs (Ng'ombe *et al.* 2014). As documented more broadly for contexts of legal pluralism in Africa (Eck 2014), competition between customary and statutory authorities creates risk of decisions by one level of authority possibly being overturned by another for all land users (Jorgenson & Loudjeva 2005).

Rather than transfer land to the state, many chiefs or headmen have instead resorted to issuing informal documents (referred to as 'chief certificates' throughout the paper) to some or all of their subjects or enter into direct agreements with investors. As neither a legal basis nor a mechanism for recording/updating of such certificates exists and if they will be respected locally is at the discretion of the chief (or her successor), the security provided by such documents is limited. This has not prevented donors from supporting their issuance. Descriptive accounts suggest that in several cases this intervention led chiefs to cash in on land user's demand for secure title in favor of well-connected individuals, thus making land access more unequal and possibly even making people worse off by forcing them to pay for worthless pieces of paper (Green & Norberg 2018). This would be consistent with the results from a randomized control trial that found no impact of these documents on investment or other relevant outcomes except (short term) subjective tenure security (Huntington & Shenoy 2021).

A second challenge is the high cost of service delivery implied by the Ministry of Lands' centralization and limited adoption of modern information technology. Land registry offices exist in only two of the country's cities (Lusaka and Ndola) so that some land users are located more than 700 km from the next registry office. Unclear manual workflows that offer ample scope for discretion and informal payments to ensure processing, together with formal fees for title processing close to US$ 500 over and above the cost of a high precision survey that can add thousands of dollars led many landowners to abandon the titling process mid-stream after having taken the initial steps and received an 'offer letter' including a sketch plan from the Ministry. Rudimentary filing systems and widespread reliance on paper records that are easily tampered

[15] As documented among others in Deininger and Byerlee (2011), negative impacts of large scale land acquisition on locals even in cases where there is no direct competition for land by large farms that were initially established on marginal land either abandoning land after valuable natural resources have been destroyed or expanding to more fertile land already cultivated by smallholders to ensure economic viability.

[16] A key concern raised informally by many chiefs is that, unlike traditional leaders who are aware of local demand, the central state is unable to repossess or re-assign land if an external investment fails and that therefore irrevocably changing its designation to state land makes little sense.

with further increase the cost of service provision,[17] making it more difficult to ascertain absence of competing claims to titled land. Together with foreclosure costs of 48% of property value (World Bank 2008), this increases the cost of using land as collateral for any bank that would be interested in doing so.

3. Data and descriptive statistics

To gain a better understanding of the size of Zambia's medium and large farm sector and its temporal and spatial evolution, we combine a listing and mapping of large farms with digitized administrative records and a detailed large farm performance survey for the country's Eastern Province. We find that at most 26% of owned and 12% of cultivated land is accounted for by large farms; that formalized holdings are clustered in blocks with better soil quality and infrastructure access though neither yields nor profits are higher inside as compared to outside blocks. While titled land does not seem to enjoy a productivity advantage, there is considerable unsatisfied demand for title.

3.1 Emergent farmer census

To obtain a complete enumeration of all large farms in Eastern Province, a farm module was added to the mapping exercise for the 2020 population census conducted between January and March 2020. Computer assisted personal interviewing was used to list all structures, their purpose, and for those that were inhabited, administer a short questionnaire to residents. At the end of this questionnaire, a question was added asking respondents to indicate if they owned, operated, or guarded an agricultural holding greater than 5 ha.

For those answering in the affirmative, basic questions on the nature of the property were asked and boundaries of farms in the same district mapped using high resolution satellite imagery pre-loaded on enumerators' tablets as a base map.[18] The listing identified 8,301 farms in 1,729 enumeration areas (EAs) of which 6,782 were mapped (and 6,703 had a mapped area above 5 ha). To generate a sample frame for a more detailed farm performance survey, we dropped all wards[19] with fewer than 30 farms as these would have been too costly to visit, resulting in a frame of 5,620 farms in 1,066 EAs from 62 wards. To attain our target sample size of 3,000, we include all farms greater than 20 ha and a random sample of farms below 20 ha.[20] This provides the basis for studying the extent to which farms' productivity, level of land-related investment, and self-assessed land values are affected by access to formal documentation.

[17] In principle, the Zambia Integrated Land Information and Management System (ZILMIS) created in 2003 on an Oracle platform should allow fully digital document processing. However, the system is not operational, and the Ministry has neither access to source code nor capacity to even execute basic queries. The largely textual information in the system is of poor quality. While all spatial records for Eastern Province were digitized with World Bank support, the Ministry of Lands continues to run paper-based and digital systems in parallel so that absence of a competing claim in the electronic system cannot provide conclusive evidence of property ownership, failing the basic requirement of a titling system.
[18] Mapping was limited to farms located in the same district as loading imagery beyond the district would have exceeded tablets' storage capacity.
[19] After provinces, districts, and constituencies, wards are the fourth tier in Zambia's system of administrative divisions. They are used for census and election purposes.
[20] We include all 1,451 farms above 20 ha from the listing and randomly select 1,549 of the 4,169 farms in the 5-20 ha category. Enumerators managed to interview 2,903 (96.8%) of the original sampled farms and they ended up replacing 42 (from a randomly selected replacement list) of the 97 missing cases. The final sample size is thus 2,945 farms, resulting in roughly less than 2% attrition rate.

Table 1 presents summary statistics overall (col. 1) and by size class (col. 2-4). Almost 95% of interviews were conducted with the farm owner and 87% of farms are fully owner operated. With an average size of about 26 ha (with the largest farm in the sample having 6,670 ha), the size of Zambian large farms remains modest by international standards. More than 75% of large farms (with 29% of the area) own less than 20 ha while 18% (with 22 % of the area) own 20-50 ha; 5% (with 13% of the area) own 50-100 ha, and 2 % of farms (with 37% of area) own more than 100 ha.[21]

The data also show that traditional institutions remain the dominant source of land for large farms with 45% of farms having acquired land through chiefs or headmen; followed by government agencies, mostly Ministries of Lands, Agriculture, or Resettlement (20%); inheritance (19%); and purchase (13%).[22] Some 40% have formal documentation either in the form of title (25%) or offer letter (16%); 43% have a document or consent from traditional authorities; and 17% no document.

To appreciate land acquisition dynamics, we construct bins for all 5-year periods after the 1995 land law came into force. Using these suggests that, after responding to supposedly pent-up demand after 1995, the pace of land acquisition has slowed consistently: while 17% of current large farms acquired their land in 1996-2000, this share declined to 11% in 2001-2010 and 9% and 7% in 2011-15 and 2016-20, respectively. The lack of a visible response to the 2008-09 commodity price boom indicates that domestic institutions have an important role in translating exogenous shocks into effective demand by investors with the means and know how to improve agricultural performance. To probe if the nature of large farm establishment in Eastern Province differs significantly from that in the rest of the country, we aggregate data on the number of farms and the area they cultivate from the Zambia Integrated Land Management Information System (ZILMIS), the country's (as of yet incomplete) electronic registry by district and year of farm establishment for the period 2000-2017 inclusive and, in addition to an indicator variable for the post-2008 period, include an interaction term between Eastern Province and post-2008 dummies to test for significant differences in the post-2008 trend in either of these variables between Eastern Province and the rest of the country. Results, as reported in appendix table 1, point towards a positive trend post-2008 in both variables presumably due to greater use of the digital system, but they do not allow us to reject equality of trends in Eastern Province and the rest of the country based on existing registry data. We thus have no basis to assume that the time pattern of large farm establishment outside of Eastern Province is different from that found here. With only 3% of farms reporting to have acquired more land (through rental or sale) after

[21] While there are some discrepancies between own estimate and mapped area, the fact that the software used did not allow immediate cross-checking of polygons caution us against over-interpretating these.

[22] Central Government institutions administer land that had been converted to state land long time ago (e.g., under resettlement schemes) whereas land received from chief implies a recent conversion.

establishment, the dynamism of Zambia's large and medium farm sector and the extent of land market functioning are clearly limited.

While listing survey data provides information on the amount of land owned by farms greater than 5 ha, translating this into a share of the total requires an estimate of the area cultivated by small farmers. To get such an estimate, we use micro data from the 2014/15 post-harvest survey by the Zambia Statistical Agency which puts the total area cultivated by farmers below 5 ha in Eastern Province at 502,852 ha (with the 95% confidence interval between 481,529 and 524,174 ha). Based on table 1, the total area owned by large farms in the province amounts to 175,753.[23] Survey evidence suggests farmers below 5 ha cultivate virtually all the land they own (Ali *et al.* 2020) compared to between a third or about half of the area (measured by imagery or farmers' own estimate) for farms greater than 5 ha. This would imply that large farms account for at most 26% of the total area owned by farmers in Eastern Province, though only about 12% of cultivated area,[24] an estimate of owned area well below the more than 50% of land that recent studies suggest is held by farms in the 5-100 ha group nationally by (Jayne *et al.* 2014a). If these estimates are correct, large farms would need to hold well above 50% of agricultural land in other provinces.

3.2 Linking census data to administrative records

As official cadastral data include spatial information only for a subset of the properties located in Lusaka and neighboring provinces, comparing *de facto* property rights (i.e., area occupied) to *de jure* ones (sketch maps or survey plans attached to official deeds) requires digitization of survey plans and sketch maps. Doing so suggests a total area under digitized parcels for which *de jure* rights have been assigned of 275,625 ha of which 231,758 ha is clustered in farm blocks or resettlement schemes.[25] Of these, 107,700 ha overlap with area found as cultivated in our survey, implying that a significant share of the land to which formal rights have been awarded is not utilized in the way it was intended to.

Table 2 panel A reports results from overlaying digitized with listed parcels overall (col. 1) and by type of documentation (cols. 2-5). The extent of overlap between registered and cultivated parcels is, with about one-third, limited. It is higher (57%) for land with formal documentation, i.e., either title or offer letter. Yet, the fact that about 35% of the parcels or 11,061 ha of listed and mapped area located in a registered block has either no or only an informal document suggests state land may revert back to informality, possibly

[23] Note that the total area of listed parcels given in table 2 includes only mapped parcels at the time of the survey. Some parcels were not mapped due to distance from the place of interview and inability of respondent to identify the location on the high-resolution imagery used as a base map.
[24] Total area owned by large farms is 6,703*26.24 = 175,753 ha which is 25.7% of the estimated total area owned of 677,130 ha. The estimate of area owned by large farms would be lower if small farmers cultivated only part of their holding. Of course, the share of land cultivated by large farms would be much smaller, amounting to 11.96% (65,086/544,410) where 65,086 = 6703*9.71 as the average area cultivated by larger farms.
[25] Blocks consist of contiguous piece of recorded parcels ranging from 6 to 942 parcels with total area between 892 and 76,450 ha.

undermining the benefits that farm blocks were expected to provide. Conversely, it may imply expansion of cultivated area beyond farm blocks that may be environmentally less sustainable.

Summary statistics on mode of acquisition in panel B of table 2 separately for farms that overlap and do not overlap with digitized parcels illustrate formal and informal institutions' role in land administration and management. First, with 31% overall (57% of parcels without vs. 23% of parcels with overlap), a greater share of land was acquired from chiefs than from all government institutions together (30%), highlighting that traditional authorities continue to play a major role in land administration or management. Second, the difference is particularly pronounced for land that has title where 38% of parcels were inherited or purchased but 44% with vs. 17% without overlap with registered parcels, were acquired from a Government body. Third, formal institutions issued close to 80% of all offer letters (74% on overlapping and 83% on non-overlapping parcels) and the centralized nature of Zambia's formal land institutions is illustrated by the fact that only 3% of parcels with formal documents were received from local government.

Before discussing descriptive statistics at parcel level, we focus on changes in output and key inputs with distance to the nearest resettlement or farm block, noting that resettlement blocks were established earlier, mostly on land taken over from European settlers whereas farm blocks were established later to solve the land assembly problem for commercial farmers (Roth 1995). Table 3 panel A suggests, based on listing data, that digitized parcels are larger than area utilized by individual farms, possibly due to informal subdivision or encroachment. Compared to 630 ha for digitized parcels that overlap with cultivated ones, the average size of used parcels is only 19 ha (table 2 panel B.1). Moreover, titled land that overlaps with digitized parcels is, with an average of 27 ha, almost double the size of land to which no formal document exist. Although not all the land in blocks is utilized, the time profile of acquisition points towards expansion that gradually moves away from the blocks.[26]

Survey information in table 3 panel B suggests that cropping patterns, levels of output/ha, and profitability are not significantly higher inside farm blocks than outside. Moreover, crop output/ha, cost of purchased inputs and gross profit are higher by 30%, 10% and more than 60% on farms more than 20 km from the blocks than on farms inside them, possibly suggesting that more productive farmer (who acquired land more recently) find it difficult to acquire land in or next to farm blocks. While detailed analysis of profitability and the shadow price of labor is beyond the scope of this paper, family labor use increases monotonically with block distance up to the point where large farms more than 20 km from the blocks use some 60% more family labor/ha, possibly due to easier access to mechanized services on farm blocks.

[26] With 12% of the total (23% within blocks), purchase plays a limited role for getting land access. Chiefs are the main avenue for accessing land outside blocks where 56% of area is accessed through them, although 22% of total and more than one-third of land not obtained via inheritance or purchase inside blocks is from chiefs.

While 37% of listed properties inside blocks have title, 83% of those without a title inside blocks (and 81% overall) are interested in acquiring a title and 96% (95% overall) are willing to pay ZMK 300 per ha (ZMK 226/ha overall), an amount that would be sufficient to cover the costs of efficient provision. Although acquiring title should be much easier within blocks as no conversion to state land is required, demand and willingness to pay for such documents are, if anything, higher inside blocks than the immediate vicinity. This may suggest binding supply side constraints to accessing title beyond land conversion in line with studies suggesting that farm blocks often fail to offer higher levels of tenure security or marketability of land, thus not meeting the expectations placed on them (Middelberg *et al.* 2020).

3.3 Evidence from the farm performance survey

Table 4 provides descriptive evidence for the total of about 3,000 owned (panel A) and 2,700 owned and operated parcels (panel B) used in the regression analysis. Figures are reported for the entire sample (col. 1) and parcels with title (col. 2), chief certificate (col. 3), without a document (col. 4) and for medium scale (≤ 20 ha) and large (> 20 ha) farms (cols. 5 and 6) separately. Parcels with title are larger than those without (28 ha vs. 12 ha) and that more than two thirds of documents (69% of titles and 74% of chief certificates) are issued exclusively in the name of men with 8% joint and the remainder in the name of women only.

While perceived risk of conflict is, with 2% negligible, levels of perceived transferability are also very low; with 30%, the share of parcels that can be sold is comparable to the average (26%) from a nation-wide household survey (Ali *et al.* 2020), implying that land cultivated by large farms is no more transferable than that by smallholders despite much higher levels of formalization. Only about half of titled land is perceived to be transferable by sale, suggesting that rights supposedly associated with having title may be difficult or impossible to exercise, possibly because traditional authorities continue to exercise oversight over patterns of land use. Such limited transferability can reduce investment incentives and slow structural transformation by constraining productive farmers' ability to take over land from less productive ones and to access credit which banks may not be willing to provide if lack of an active land sales market (as indeed supported by our data) would increase the cost of foreclosure. Indeed, self-assessed ability to access credit is, with 20% for titled land, only slightly above the level for the entire sample (17%).

Quite surprisingly in light of the high demand and willingness to pay for formal documentation noted above, possession of title also does not seem to be related to either the self-assessed risk of land dispute or the level of soil conservation investment. For the subset of cultivated parcels, levels of crop output or profit per ha are not affected by title status. However, self-assessed land values for titled land are, with ZMK 14,300 per ha well above the sample mean of 10,600 per ha. This could indicate speculative land holding or imply that barriers to acquisition of title generate rents that are capitalized in land prices.

4. Econometric analysis

While descriptive analysis is suggestive, regression analysis suggests that title increases perceived ability to sell (45%) as well as land values but has no impact on investment or overall productivity, with little difference between titled parcels that were previously communal or state land. Demand and willingness to pay for title are high overall but highest on untitled state land, suggesting that starting policy reform from these areas may be appropriate.

4.1 Econometric approach

To assess the impact of title on perceived tenure security and transferability; self-assessed land values; land-related investment in soil and water conservation structures, tree planting, or fallowing; and productivity, we index parcels by *i* and use a linear regression of the form

$$Y_i = \alpha + \boldsymbol{T}_i\boldsymbol{\beta} + \boldsymbol{P}_i\boldsymbol{\gamma} + \boldsymbol{X}_i\boldsymbol{\delta} + \varepsilon_i, \quad (1)$$

where $\boldsymbol{T}_i$ is a vector of dummy variables indicating tenure status; $\boldsymbol{P}_i$ is a vector of parcel characteristics; $\boldsymbol{X}_i$ is a vector household characteristics; ε_i, is a random error term; and α, β, γ and δ are parameters to be estimated. Key right hand side variables are presence of a formal document (either title or offer letter), chief certificate, and a separate dummy for location on state land without title so that customary land with no document is the omitted category*;* log of parcel size, dummies for soil quality and slope in $\boldsymbol{P}$*;* and the head's age, gender, education, value of farm and household assets, farmer group membership and leadership in local organizations in $\boldsymbol{X}$. The coefficient vector of interest is $\boldsymbol{\beta}$ which denotes the estimated impact of tenure status on relevant outcomes. As we have information on whether titled land was previously state or customary land, we include these variables in a separate set of regressions.

To the extent that those with better access to connections and resources are likely to be better placed to gain access to title, OLS estimates will be biased. To deal with this, we follow Besley (1995) and instrument current tenure status with tenure status at acquisition on average some 26 years ago and length of tenure. Results from the first stage regression are in appendix table 2.[27] Test statistics for equality of coefficients on having had title or title being processed and state land without title are included in the bottom of the tables. With an R^2 of close to 0.50, they suggest that title status at acquisition, length of tenure, parcel size, and the owner's wealth and literacy are indeed highly significant predictors of current title status. In line with limited communication and mobility between the two systems, having chief certificate at acquisition is not significantly associated with the likelihood of having a title.

[27] Distance to digitized blocks could potentially be use as an additional instrument to account for potential information spillovers but doing so does not alter any of the substantive conclusions in tables 5-7, as estimated coefficients on this variable in the first-stage regression are insignificant but results in a loss of observations.

4.2 Transferability, land values and land-related investment

To probe if Zambian large farms' possession of title has the expected effect, table 5 reports IV estimates of title impact on objective outcomes such as land and credit market participation at holding level (col. 1 & 2); and perceptions regarding the risk of conflict (as the self-assessed risk of having any disagreement on the land parcel arising within the next 5 years), the right to sell, and self-assessed land values at plot level (cols. 3-5). Results in panel A are for overall effects of land title while panel B distinguishes between title on land that was previously under customary tenure or state land. The Sargan overidentification statistic does not reject the validity of the instruments except in the subjective land value regression. Panel C complements these estimates with a simple OLS regression to see if there is any difference in relevant outcome variables between state and customary land once parcel and household characteristics (coefficients for which are omitted in all tables) are controlled for.

Contrary to expectations of title facilitating land sales and credit access, only 15 farmers with title reported having engaged in subsequent land purchases. This makes estimation of a land sales regression impossible and forces us to rely on rental market participation instead. Results from relevant regression in table 5 col. 1 suggest that, instead of increasing participation, title triggers a significant and, with 20 percentage points, large *reduction* of land rental market participation. This effect is more pronounced for chief certificates and titled land on previously customary land (panel B). Panel C suggests land rental market participation is significantly lower by 12 percentage points on state than on customary land, suggesting that instead of expanding land market activity to foster structural transformation, the separation of state from customary land may actually constrain it.

While further investigation of the mechanisms underpinning this reduction in land rental market participation is desirable, these results clearly reject the notion that the state-customary land dichotomy helps to activate land or credit markets. Instead of helping to establish a dynamic large farm sector that uses markets to transfer land to its best use, title in Zambia seems to create barriers to competition in land markets in ways consistent with notions of rent seeking and speculative land acquisition. In such a context, expecting title to improve credit access would be unrealistic and we indeed find that title (or chief certificate) has no impact on credit access (col. 2). In the credit access regressions, only farm size is significant, a variable that has been found to serve as a signal of credit worthiness in other contexts where foreclosing on titled land was not a realistic option (Castaneda Dower & Potamites 2014).

Results regarding title impacts on perceptions suggest that, compared to customary land without document, formal rights reduce the perceived likelihood of future dispute (col. 3) and increase perceived ability to sell (col. 4) and self-assessed land values (col. 5), though for the latter the overidentification test rejects the validity of the instruments. Title does not affect conflict risk overall (panel A) and for land previously under

state or customary tenure (panel B) while having a chief certificate is estimated to increase it by 2 percentage points and perceived dispute risk is not significantly higher on customary than on state land (panel C).

Despite the very limited number of actual sales, having title increases *perceived* ability to sell land by 42 percentage points overall (col. 4 panel A), an effect that is more pronounced on previously customary land (panel B) the estimated coefficient for which (0.66) is different from that on titled state land (0.39) at 10%. The estimated coefficient on state land without title is not statistically significantly different from zero and that of chief certificate is only marginally significant, implying that perceived transferability of untitled state land is no different from that of customary land and that informal certificates' effect on perceived transferability is almost close to zero.

While failure to support the credibility of exclusion restrictions implies that estimated coefficients should be interpreted as correlations, regressions suggest title to be associated with large increases in self-assessed land values, by 124%, although lack of title on state land reduces perceived value by 66% compared to customary land without certificate. Land size is estimated to be negatively associated (a reduction of 39% for a doubling size) with subjective land values per unit of land. While study of non-agricultural land price dynamics is required to assess to what extent such price expectations are realistic, they raise the possibility of supply-side constraints exacerbating institutional rigidities that reduce the scope for land sales.

Regressions in table 6 suggest that, surprisingly given that individuals expend significant resources to acquire title and its effect on perceptions, there is no measurable effect of title on investment irrespectively of whether the dependent variable is fallowing as used by Goldstein and Udry (2008), soil and water conservation structures as by Bros *et al.* (2019); use of manure as by Gavian and Fafchamps (1996) and Dillon and Voena (2018); or tree planting as a type of investment that may be made to strengthen rights rather than improve soil fertility and future yields (Brasselle *et al.* 2002). In fact, except for tree planting, the Sargan test rejects exclusion restrictions for all investments and construction of structures for soil and water conservation seems lower on state land without title (col. 1 panels A & B). Title has no measurable effect irrespectively of whether it was issued on customary or state land (panel B) and a positive association (of 3.6 percentage points) between customary tenure and tree planting suggests that either such investment is used to demarcate land parcels or that the ability to enjoy the fruits of land-related investments is no different on land held under customary than under statutory tenure.

4.3 Agricultural productivity and demand for formalization

To test if the increment of perceived land values on land with formal documents may be due to higher levels of productivity on such lands, table 8 reports results for IV regressions to assess impact of title on value of output (col. 1), purchased inputs (col. 2) and gross profit (col. 3). As before, in addition to having one

variable for title (in panel A), results of distinguishing between title on previously customary or state land as well as simple state or customary tenure status are reported in panel B and C, respectively.

Results do not support a systematic relationship between title and productivity as measured by gross profit per ha. The positive relationship between formal documentation and value of output per ha is offset by a negative impact of roughly similar magnitude in purchased inputs. A chief certificate is, however, negatively associated with gross profit per unit of land (semi-elasticities of 31-37%).[28] The data also suggest a highly significant negative link between parcel size and the value of output and (with a larger magnitude) value of inputs, resulting in a positive and significant link between parcel size and profit/ha in line with Chen *et al.* (2021). While farm households whose head is literate have significantly higher levels of output, profits and input use, members of farmer groups (similar to those with title) obtain higher levels of output largely by using more inputs, resulting in a significantly negative impact on profits. Panel B reveals that land previously under state or customary tenure does not have any statistically significant impact on output, input levels and profits. Thus, notwithstanding the fact that exploring determinants of profits in more detail will be of interest in its own right, title does not seem to affect overall productivity.

Regressions regarding interest in acquiring and willingness to pay for title in table 8 suggest that demand for title and willingness to pay for it are significantly higher on untitled state than on customary land: point estimates of the increase in willingness to obtain title of 13 percentage points and an amount that is almost 50% higher than for customary land (mean willingness to pay of ZMK 263 vs. 149 per ha). Asset ownership is also positively associated with perceived demand and willingness to pay for title. While coefficients on other variables suggest higher demand for title by literate heads and those with chief certificate, willingness to pay is insignificant for (literacy), negative for chief certificate, and positive for undulating landform.

[28] Only the coefficient of chief certificate is significantly different from zero in the profit function (panels A & B). Semi-elasticates of having a chief certificate calculated using equation (10) of Bellemare and Wichman (2020) are -37% and -31%, respectively.

5. Conclusion and policy implications

Although the literature on this topic largely focused on foreign agricultural investment, in most countries, domestic players are quantitatively more important. Zambia allows us to study their productive performance in a policy environment aiming to actively promote such investment.

Results from doing so for Eastern Province suggest that, without well-functioning markets for land (and possibly labor), efforts to promote large farms will at best be ineffectual and lead to a return to informality as productive farms' will be unable to access credit and unlikely to invest. By preventing productive farmers from accessing land as evidenced by the fact that new farms are increasingly established outside of existing farm blocks, this increases cost of production, and may have adverse environmental impacts if conversion of sensitive areas is involved.

For Zambia -and, to the extent that our results generalize, other countries suitable for LSLBI- to benefit from large farm establishment or future commodity price booms, regulatory changes are needed in at least two areas. First, quality and efficiency of land service provision need to be improved -enhancing transparency and reducing scope for fraud- by fully moving workflows for issuance and maintenance of titles to a digital environment, establishing clear service standards, adjusting survey standards where needed, and passing resulting gains in efficiency to end users as fee reductions. This would allow significant expansion in coverage in response to demand. Second, to support improved service delivery and increase incentives for effective land use, a recurrent land tax should be introduced, and proceeds shared with local and traditional authorities in return for assuming greater responsibility for record maintenance and conflict resolution following clear norms and regulations. Given their agricultural potential and access to other infrastructure, farm blocks are key candidates for introducing such changes, possibly first on a pilot basis, and evaluating their economic, social, and environmental benefits in a way that would be of relevance well beyond Zambia.

Table 1: Descriptive statistics from farm census and digitization

	Total	5-20 ha	20-50 ha	50-100 ha	>100 ha
Type of respondent					
Farm owner	0.94	0.94	0.94	0.96	0.93
All operated by owner	0.87	0.88	0.85	0.82	0.74
Part operated by owner	0.12	0.11	0.14	0.18	0.26
If part or none: operated by a renter	0.08	0.09	0.05	0.04	0.11
Time of land acquisition[a]					
Before 1995	0.44	0.41	0.55	0.56	0.52
1996-2000	0.17	0.18	0.14	0.16	0.18
2001-2005	0.11	0.11	0.11	0.10	0.10
2006-2010	0.11	0.12	0.09	0.06	0.07
2011-2015	0.09	0.10	0.07	0.06	0.10
2016-2020	0.07	0.08	0.05	0.04	0.04
No. of years possessed	25.15	23.88	28.58	29.81	29.32
Modality of land acquisition					
From Chief	0.45	0.42	0.55	0.54	0.48
From Central Government	0.20	0.21	0.18	0.18	0.23
From Local Government	0.01	0.01	0.02	0.03	0.02
Inherited	0.19	0.21	0.14	0.16	0.16
Purchased	0.13	0.15	0.10	0.08	0.10
Type of documentation[a]					
Title	0.25	0.24	0.26	0.30	0.41
Male member only	0.37	0.37	0.31	0.40	0.59
Female member only	0.08	0.09	0.05	0.06	0.00
Jointly male & female	0.49	0.47	0.55	0.51	0.38
Non-household member	0.07	0.07	0.09	0.03	0.04
Offer letter	0.16	0.18	0.11	0.07	0.03
Document from chief	0.43	0.42	0.48	0.47	0.38
Other/no document	0.17	0.17	0.14	0.16	0.18
Size and land allocation (% of area)[b]					
Farmer own estimation (ha)	19.74	11.72	28.42	42.02	171.51
Mapped area (ha)	26.22	10.19	30.98	67.62	441.35
Cultivated area (ha)	9.71	7.08	13.19	18.06	51.47
Number of farms	6,703	5,010	1,221	325	147

Source: Own computation from 2020 Zambia Eastern Province Farm Survey

Note: [a] Information was collected only from owner respondents. Only 3% of farms expanded their farm size (via rental or sale) after establishment and at 1% of land acquired initially, the extent of such expansion remained limited.

Table 2: Overlap between cultivated and digitized parcels and mode of acquisition by type of document

	Total	Title	Offer letter	Chief document	No document
Panel A: Extent of overlap					
Total area of listed parcels in ha	107,699	31,751	13,443	46,830	15,675
Share located in registered block	0.34	0.60	0.50	0.19	0.25
if yes, total area of listed parcels in ha	41,015	21,696	8,259	8,218	2,843
if yes, total overlap area in ha	36,024	18,450	7,732	7,219	2,622
if yes, share of area overlapping	0.88	0.85	0.94	0.88	0.92
Panel B: Mode of acquisition					
1. Parcels overlapping with registered blocks					
Chiefs	0.23	0.17	0.03	0.58	0.09
Ministry of Lands	0.15	0.23	0.20	0.01	0.01
Dept. of Resettlement	0.07	0.05	0.19	0.01	0.04
Ministry of Agriculture	0.14	0.12	0.30	0.03	0.08
Local Government	0.03	0.04	0.04	0.01	0
Inherited	0.16	0.13	0.09	0.27	0.13
Purchased	0.21	0.25	0.12	0.08	0.6
Don't know	0.01	0.00	0.01	0.01	0.05
Area of digitized parcel	630.90	494.06	538.80	879.81	747.43
Area of cultivated (listed) parcel	19.33	27.19	14.88	15.39	12.10
Number of farms	2,122	798	555	534	235
2. Parcels without overlap					
Chiefs	0.57	0.45	0.06	0.79	0.39
Ministry of Lands	0.03	0.06	0.11	0.00	0.01
Dept. of Resettlement	0.10	0.06	0.65	0.00	0.01
Ministry of Agriculture	0.02	0.04	0.06	0.00	0
Local Government	0.01	0.01	0.01	0.00	0
Inherited	0.21	0.22	0.06	0.17	0.45
Purchased	0.06	0.16	0.03	0.03	0.12
Don't know	0.01	0.01	0.00	0.00	0.02
Number of farms	4,037	539	562	2,212	724

Source: Own computation from 2020 Zambia Eastern Province Farm Survey. Information from owner respondents only.
Note: There are 14 registered blocks with a total area of 231,758 ha sub-divided into 2,688 digitized parcels and 35 digitized isolated fragments with a total area of 43,866 ha.

Table 3: Time and mode of land acquisition as well as output by distance to farm/resettlement blocks

	Total	Distance to block				
		0	< 5 km	5-10 km	10-20 km	> 20 km
Panel A: Listing information						
Location						
Dist. to next block (km)	11.26	0.00	1.93	7.30	14.57	55.45
Size of next block	32,092	53,946	30,849	18,695	19,159	7,905
Avg. size of listed parcel (ha)	17.35	19.10	15.49	16.42	18.05	15.34
Time of land acquisition						
Before 1995	0.47	0.53	0.50	0.47	0.35	0.40
1996-2000	0.19	0.18	0.21	0.15	0.23	0.17
2001-2005	0.12	0.11	0.11	0.12	0.14	0.12
2006-2010	0.10	0.08	0.07	0.11	0.15	0.12
2011-2015	0.08	0.06	0.06	0.09	0.08	0.14
2016-2020	0.04	0.03	0.05	0.06	0.05	0.05
Mode of acquisition						
From chief	0.44	0.22	0.56	0.61	0.55	0.52
From Government	0.23	0.39	0.13	0.12	0.24	0.08
Inherited	0.19	0.15	0.18	0.21	0.15	0.35
Purchased	0.12	0.23	0.11	0.05	0.05	0.03
Title	0.22	0.38	0.16	0.16	0.14	0.07
Offer letter	0.18	0.26	0.12	0.11	0.22	0.09
No. of parcels	6,584	2,337	1,227	976	1,191	853
Panel B: Survey information						
Titled land	0.21	0.37	0.12	0.09	0.17	0.07
If no, would like a title?	0.81	0.83	0.83	0.86	0.81	0.63
If yes, would like to pay for it?	0.95	0.96	0.96	0.94	0.95	0.91
Willing to pay for title (ZMK/ha)	225.90	299.64	199.84	207.19	166.16	233.62
No. of parcels (owned)	2,645	921	535	423	509	257
Crop output (ZMW/ha)	3,264	3,326	2,933	3,112	3,115	4,284
Purch. inputs (ZMW/ha)	1,917	2,084	1,795	1,851	1,647	2,206
Family labor (d/ha)	85	68	80	96	101	109
Cultivated area (ha)	6.20	6.31	6.77	6.10	5.90	5.34
Maize	0.50	0.52	0.52	0.49	0.47	0.48
Sunflower	0.10	0.12	0.09	0.09	0.10	0.11
Groundnuts	0.13	0.12	0.14	0.14	0.11	0.15
Soybeans	0.19	0.16	0.16	0.21	0.24	0.19
Cotton	0.04	0.02	0.04	0.05	0.06	0.04
Tobacco	0.01	0.02	0.02	0.01	0.01	0.01
Beans, sweet potato & others	0.00	0.04	0.04	0.04	0.00	0.02
No. of parcels (cultivated)	2,314	821	453	379	444	217

Source: Own computation from 2020 Zambia Eastern Province Farm Survey

Table 4: Parcel-level descriptive statistics

	Total	Title	Chief Cert.	t-test	No doc.	t-test	5-20 ha	>20 ha	t-test
Panel A: Owned parcels									
Head's characteristics									
Male head	0.84	0.80	0.83		0.85	***	0.85	0.83	*
Age	54.12	56.57	54.01	***	53.35	***	52.71	55.62	***
Head is literate	0.75	0.82	0.79		0.72	***	0.73	0.78	***
Head is member of farmers group	0.41	0.50	0.31	***	0.42	***	0.39	0.44	**
Head leader in local organization	0.29	0.32	0.26	**	0.29		0.28	0.30	
Land endowment & characteristics									
Parcel area in ha	15.26	27.70	14.84	***	11.35	***	8.40	22.66	***
Cultivated land in ha	4.49	4.66	4.64		4.40		3.69	5.36	***
Titled land	0.20	1.00	-		-		0.20	0.20	
State land	0.17	0.85	-		-		0.17	0.17	
Previously customary land	0.03	0.15	-		-		0.03	0.03	
Document in name of male only	0.69	0.69					0.70	0.69	
Document in name of female only	0.23	0.23					0.21	0.25	
Document joint male/female	0.08	0.08					0.09	0.06	
Parcel with chief certificate	0.18	0.00	1.00		-		0.17	0.20	***
Document in name of male only	0.74		0.74				0.76	0.72	
Document in name of female only	0.18		0.18				0.17	0.20	
Document joint male/female	0.08		0.08				0.07	0.09	
State land w/o document	0.11	-	-		0.17		0.13	0.08	***
Customary land w/o document	0.51	-	-		0.83		0.51	0.51	
Perceived rights									
Has the right to sell land	0.33	0.51	0.26	***	0.29	***	0.36	0.29	***
Self-assessed land value (ZMK/ha)	10,632	14,317	11,320	*	9,214	***	10,394	10,888	
Likelihood of disagreement	0.02	0.02	0.02		0.03		0.02	0.03	
Would like to have a title?	0.81	-	0.84		0.80		0.82	0.79	
Would like to pay for a title?	0.94	-	0.94		0.95		0.95	0.94	
Amount willing to pay (ZMK/ha)	227	-	149		252		249	202	**
Land use									
Share of fallowed land	0.15	0.16	0.16		0.15		0.14	0.16	*
Left land fallow in past 5 years (y/n)	0.06	0.07	0.05		0.06		0.05	0.07	***
Has SWC measures (y/n)	0.17	0.19	0.14	**	0.17		0.16	0.18	
Has trees (y/n)	0.40	0.39	0.40		0.40		0.40	0.39	
Number of trees per ha	2.83	2.44	2.70		3.00		3.17	2.46	
Got access to credit (holding level)	0.17	0.20	0.20		0.15	***	0.15	0.19	**
Tenure status at acquisition									
Titled at acquisition	0.09	0.39	0.01	***	0.02	***	0.07	0.12	***
Title under process at acquisition	0.04	0.10	0.01	***	0.03	***	0.04	0.04	
Chief certificate at acquisition	0.21	0.04	0.82	***	0.08	***	0.18	0.24	***
State land w/o tile at acquisition	0.15	0.37	0.01	***	0.13	***	0.20	0.11	***
Customary w/o doc. at acquisition	0.49	0.08	0.15	***	0.73	***	0.50	0.49	
Number of parcels	3,072	614	566		1,892		1,592	1,480	
Panel B: Operated parcels									
Crop output (ZMW/ha)	3,378	3,570	3,237		3,406		3,296	3,471	
Purchased inputs (ZMW/ha)	2,114	2,113	1,972		2,224		2,102	2,128	
Gross profit (ZMW/ha)	1,264	1,457	1,264		1,183	*	1,194	1,343	
Cultivated area (ha)	6.12	6.33	6.25		6.00		5.64	6.64	***
Use manure?	0.13	0.20	0.11	***	0.12	***	0.14	0.12	
Years since acquisition	23.06	23.18	23.64		23.45		21.42	24.89	***
Titled land	0.18	1.00	-		-		0.19	0.18	
State land	0.16	0.85	-		-		0.16	0.15	
Previously customary land	0.03	0.15	-		-		0.03	0.03	
Parcel with chief certificate	0.17	-	1.00		-		0.15	0.19	***
State land with no document	0.09	-	-		0.17		0.11	0.07	***
Customary land with no document	0.46	-	-		0.83		0.45	0.47	
Number of parcels	2,737	503	456		1,512		1,444	1,293	

Source: Own computation from 2020 Zambia Eastern Province Farm Survey.

Note: Exchange rate is about ZMK 15 per USD at the time of the survey. Stars indicate significance of a t-test between title and chief certificate, title, and no document, and farms with less and more than 20 ha, respectively: * p<0.10, ** p<0.05, *** p<0.010.

Table 5: IV regressions for impact of title on self-assessed land rights and land values

	Rented-in land[a]	Got credit[a]	Risk of disagreement	Right to sell?	Log land value per ha
Panel A: All formal documents					
Parcel with formal document	-0.199***	-0.0372	-0.00662	0.417***	1.240***
	(0.0365)	(0.0450)	(0.0183)	(0.0601)	(0.163)
Parcel with chief certificate	-0.278***	0.0296	0.0245**	0.0691*	0.456***
	(0.0229)	(0.0300)	(0.0110)	(0.0361)	(0.0981)
State land with no title	-0.188***	0.0189	0.0174	-0.0289	-0.664***
	(0.0551)	(0.0686)	(0.0269)	(0.0883)	(0.233)
Log parcel/holding area in ha	-0.007***	0.0171**	0.00318	0.00331	-0.385***
	(132.9)	(0.00795)	(0.00272)	(0.00894)	(0.0290)
Sargan overidentification statistic	0.520	0.00606	0.240	0.121	7.375
Chi-sq(1) p-value	0.471	0.938	0.624	0.728	0.00661
Panel B: Formal documents by provenance					
State land with title (β_1)	-0.188***	-0.0391	0.00237	0.379***	1.255***
	(0.0370)	(0.0459)	(0.0185)	(0.0609)	(0.167)
Prev. cust. land with title (β_2)	-0.271***	-0.0231	-0.0667	0.664***	1.127***
	(0.0927)	(0.118)	(0.0460)	(0.151)	(0.388)
Parcel with chief certificate	-0.276***	0.0272	0.0253**	0.0660*	0.457***
	(0.0231)	(0.0303)	(0.0110)	(0.0363)	(0.0983)
State land with no title	-0.198***	0.0176	0.00830	0.00871	-0.680***
	(0.0554)	(0.0694)	(0.0272)	(0.0893)	(0.237)
Log parcel/holding area in ha	-0.008***	0.0186**	0.00331	0.00279	-0.385***
	(133.0)	(0.00811)	(0.00273)	(0.00899)	(0.0290)
Sargan overidentification statistic	0.584	0.0187	0.165	0.204	7.309
Chi-sq(1) p-value	0.445	0.891	0.685	0.652	0.00686
χ^2-test: $\beta_1 = \beta_2$	0.788	0.0104	2.279	3.576	0.108
p-value	0.375	0.919	0.131	0.0586	0.742
Panel C: State vs customary land (OLS regressions)					
State land	-0.123***	-0.0111	-0.000169	0.208***	0.339***
	(0.0132)	(0.0165)	(0.00611)	(0.0195)	(0.0512)
Log parcel/holding area in ha	-0.008***	0.0184**	0.00309	0.0160**	-0.313***
	(127.3)	(0.00773)	(0.00251)	(0.00803)	(0.0248)
Mean of dep. var.	0.11	0.17	0.03	0.32	8.46
No. of observations	2,744	2,485	2,649	2,649	2,435

Note: Field characteristics (subjective soil quality and slope measures) and owner characteristics (head's gender, age, literacy status, membership in farms group and having a leadership position in local organization as well value of household and farm assets) are included throughout but coefficients not reported. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.010

[a] Regressions are at holding level, and the inverse hyperbolic sine (IHS) transformation is applied to holding area as some of the farms are pure tenants cultivating only rented-in land. As estimated coefficients depend of the unit of measurement of the IHS-transformed variables (Aihounton & Henningsen 2020), we use the R^2 criterion to select the optimal scale factor holding size, i.e., in millions of ha. The reported coefficients for holding size are semi-elasticities calculated using equation (3) of Bellemare and Wichman (2020).

Table 6: IV regressions for impact of title on land-related investment

	Constr. SWC structures	Trees planted	Number of trees per ha	Practiced fallow	Use of manure[a]
Panel A: All formal documents					
Parcel with formal doc	0.0466	-0.00957	-0.794	0.0226	0.0477
	(0.0419)	(0.0507)	(2.589)	(0.0246)	(0.0424)
Parcel with chief certificate	-0.0450*	-0.0133	-0.822	-0.00723	0.00240
	(0.0253)	(0.0309)	(1.580)	(0.0149)	(0.0272)
State land with no title	-0.158**	-0.114	-1.561	-0.0510	0.0587
	(0.0616)	(0.0747)	(3.815)	(0.0362)	(0.0659)
Log parcel area in ha	0.0108*	0.00984	-0.324	0.000853	0.0112
	(0.00629)	(0.00769)	(0.393)	(0.00370)	(0.00798)
Sargan overidentification statistic	3.163	2.257	0.982	16.65	5.277
Chi-sq(1) p-value	0.0753	0.133	0.322	0.0000449	0.0216
Panel B: Formal documents by provenance					
State land with title (β_1)	0.0640	-0.0259	-1.506	0.0273	0.0608
	(0.0423)	(0.0510)	(2.611)	(0.0249)	(0.0434)
Prev. cust. land with title (β_2)	-0.0735	0.104	4.119	-0.0144	-0.0724
	(0.106)	(0.129)	(6.576)	(0.0621)	(0.136)
Parcel with chief certificate	-0.0435*	-0.0147	-0.885	-0.00668	0.00459
	(0.0254)	(0.0310)	(1.585)	(0.0149)	(0.0275)
State land with no title	-0.176***	-0.0976	-0.841	-0.0558	0.0457
	(0.0621)	(0.0751)	(3.842)	(0.0365)	(0.0671)
Log parcel area in ha	0.0110*	0.00956	-0.335	0.000967	0.0122
	(0.00631)	(0.00769)	(0.394)	(0.00371)	(0.00811)
Sargan overidentification statistic	2.911	2.098	0.889	16.38	4.929
Chi-sq(1) p-value	0.0880	0.147	0.346	0.0000519	0.0264
χ^2-test: $\beta_1 = \beta_2$	1.710	1.032	0.740	0.455	0.930
p-value	0.191	0.310	0.390	0.500	0.335
Panel C: State vs customary land (OLS regressions)					
State land	-0.00356	-0.0356**	-0.747	-0.00184	0.0625***
	(0.0140)	(0.0172)	(0.878)	(0.00827)	(0.0150)
Log parcel area in ha	0.0138**	0.0117	-0.326	0.00233	0.0110
	(0.00581)	(0.00714)	(0.365)	(0.00342)	(0.00800)
Mean of dep. var.	0.17	0.40	2.89	0.06	0.13
Number of observations	2,644	2,638	2,638	2,644	2,664

Note: Field characteristics (subjective soil quality and slope measures) and owner characteristics (head's gender, age, literacy status, membership in farms group and having a leadership position in local organization as well value of household and farm assets) are included throughout but coefficients not reported. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.010

[a] Sample includes cultivated parcels including rented-in land.

Table 7: IV regressions for impact of title on agricultural productivity

	Output value (ZMK/ha)	Purchased inputs (ZMK/ha)	Profit (ZMK/ha)
Panel A: All formal documents			
Parcel with formal document	-0.0235	0.00865	-0.00315
	(0.0925)	(0.111)	(0.00366)
Parcel with chief certificate	-0.0887	-0.0792	-0.00522**
	(0.0592)	(0.0708)	(0.00234)
State land with no title	0.0110	-0.0698	0.00309
	(0.144)	(0.172)	(0.00569)
Rented-in land	-0.0607	-0.186***	0.000515
	(0.0514)	(0.0615)	(0.00203)
ln parcel area in ha	-0.497***	-0.516***	-0.00814***
	(0.0174)	(0.0208)	(0.000689)
Log head's age	-0.143***	-0.111*	-0.00306
	(0.0504)	(0.0603)	(0.00200)
Male headed household	0.127***	-0.0850*	0.00595***
	(0.0396)	(0.0474)	(0.00157)
Head is literate?	0.0930***	0.0694*	0.00300**
	(0.0340)	(0.0407)	(0.00134)
Member of farmers group	0.0506*	0.146***	-0.00250**
	(0.0295)	(0.0353)	(0.00117)
Leader in local organization	0.0734**	0.0557	0.000915
	(0.0325)	(0.0389)	(0.00129)
Log value of assets in ZMK	0.245***	0.236***	0.00412***
	(0.0101)	(0.0120)	(0.000398)
R-squared	0.331	0.261	0.0799
Sargan statistic	0.0000614	2.755	0.00195
Chi-sq(1) p-value	0.994	0.0970	0.965
Panel B: Formal documents by provenance			
State land with title (β_1)	0.00114	0.00814	-0.00214
	(0.0938)	(0.112)	(0.00372)
Prev. cust. land with title (β_2)	-0.234	0.0283	-0.0118
	(0.294)	(0.352)	(0.0116)
Parcel with chief certificate	-0.0851	-0.0798	-0.00507**
	(0.0595)	(0.0712)	(0.00236)
State land with no title	-0.0131	-0.0688	0.00210
	(0.145)	(0.174)	(0.00576)
Rented-in land	-0.0651	-0.185***	0.000331
	(0.0518)	(0.0620)	(0.00205)
ln parcel area in ha	-0.495***	-0.516***	-0.00806***
	(0.0176)	(0.0210)	(0.000696)
Log head's age	-0.144***	-0.111*	-0.00311
	(0.0504)	(0.0603)	(0.00200)
Male headed household	0.129***	-0.0851*	0.00604***
	(0.0396)	(0.0475)	(0.00157)
Head is literate?	0.0916***	0.0695*	0.00294**
	(0.0340)	(0.0407)	(0.00135)
Member of farmers group	0.0510*	0.146***	-0.00249**
	(0.0295)	(0.0354)	(0.00117)
Leader in local organization	0.0726**	0.0557	0.000882
	(0.0325)	(0.0389)	(0.00129)
Log value of assets in ZMK	0.245***	0.236***	0.00413***
	(0.0101)	(0.0120)	(0.000399)
R-squared	0.332	0.260	0.0778
Sargan statistic	0.00225	2.754	0.000174
Chi-sq(1) p-value	0.962	0.0970	0.989
F-test: $\beta_1 = \beta_2$	0.620	0.00317	0.670
p-value	0.431	0.955	0.413
Panel C: State vs customary land (OLS regressions)			
State land	-0.00422	0.00850	0.000330
	(0.0320)	(0.0384)	(0.00126)

ln parcel area in ha	-0.497***	-0.515***	-0.00814***
	(0.0174)	(0.0209)	(0.000686)
Log value of assets in ZMK	0.244***	0.237***	0.00397***
	(0.00988)	(0.0119)	(0.000389)
R-squared	0.331	0.257	0.0873
Mean of dep. var.	7.72	7.14	0.013
Number of observations	2,664	2,664	2,664

Note: To prevent dropping negative observations, the inverse hyperbolic sine (IHS) transformation is applied to the profit function. As estimated coefficients depend of the unit of measurement of the IHS-transformed variables (Aihounton & Henningsen 2020), we use the R^2 criterion to select the optimal scale factor, i.e., in hundred thousand UAH. Field characteristics (subjective soil quality and slope measures) are controlled for throughout. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.010.

Table 8: Determinants of demand and willingness to pay for title

	Would like to obtain title	Willing to pay for title	Log amount willing to pay per ha
Parcel with chief certificate	0.108***	0.0104	-0.378***
	(0.0217)	(0.0133)	(0.0734)
State land with no title	0.133***	0.0475***	0.458***
	(0.0271)	(0.0165)	(0.0895)
Log parcel area in ha	0.0192**	-0.00866*	-0.822***
	(0.00765)	(0.00517)	(0.0330)
No. of years since acquisition	0.00177***	-0.0000694	0.000721
	(0.000667)	(0.000423)	(0.00233)
Good soil quality	-0.0411	0.0184	0.0499
	(0.0382)	(0.0240)	(0.134)
Fair soil quality	-0.0981**	0.0102	0.140
	(0.0382)	(0.0242)	(0.135)
Flat land	0.0404	0.0368	0.330**
	(0.0361)	(0.0236)	(0.133)
Gently slopped land	0.0604	0.0496**	0.486***
	(0.0372)	(0.0243)	(0.137)
Male headed household	0.0103	0.0180	-0.0236
	(0.0239)	(0.0153)	(0.0849)
Log head's age	0.0751**	-0.00494	0.164
	(0.0319)	(0.0208)	(0.114)
Head is literate?	0.0844***	0.0259**	0.000215
	(0.0193)	(0.0127)	(0.0701)
Member of farmers group	0.0147	0.0171	0.0216
	(0.0174)	(0.0111)	(0.0612)
Leader in local organization	0.00625	0.00785	-0.169**
	(0.0194)	(0.0122)	(0.0675)
Log value of assets in ZMK	0.0161***	0.0110***	0.202***
	(0.00559)	(0.00360)	(0.0201)
Constant	0.152	0.776***	3.141***
	(0.136)	(0.0895)	(0.492)
Number of observations	2,475	1,896	1,754
Mean of dep. var.	0.77	0.94	4.30
R-squared	0.0557	0.0223	0.304

Notes: Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.010

Appendix table 1: Number and area of registered large farms at district level (2000-2017)

	No. of farms > 20 ha	Area cultivated by these
Post-2008	0.191*	0.374*
	(0.101)	(0.193)
Eastern province	-0.451	0.521
	(0.284)	(0.545)
Post-2008*Eastern province	-0.0160	-0.768
	(0.369)	(0.706)
Constant	0.934***	6.390***
	(0.0836)	(0.160)
Number of observations	514	514
Mean of dep. var.	1.034	6.650
R-squared	0.0209	0.00800

Source: Raw data extracted from Zambia Integrated Land Management Information System (ZILMIS) in 2018.
Notes: Dependent variables are in logs. ZILMIS includes information on year of establishment for 2,858 farms (77 of which located in Eastern province) that were established in the 2000-2017 period. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.010.

Appendix table 2: First stage regression for determinants of having a formal document

Titled land at the time of acquisition (β_1)	0.776***	0.776***	0.777***	0.777***
	(0.0195)	(0.0197)	(0.0214)	(0.0217)
Title being processed at acquisition (β_2)	0.457***	0.456***	0.471***	0.470***
	(0.0275)	(0.0278)	(0.0287)	(0.0291)
State land without title at acquisition (β_3)	0.442***	0.444***	0.459***	0.461***
	(0.0155)	(0.0157)	(0.0164)	(0.0166)
Had chief certificate at the time of acquisition	-0.0103	-0.00902	-0.0120	-0.0104
	(0.0140)	(0.0143)	(0.0150)	(0.0153)
Log parcel area in ha	0.0173***	0.0174***	0.0190***	0.0192***
	(0.00465)	(0.00471)	(0.00521)	(0.00529)
No. of years since acquisition	-0.00108**	-0.00119***	-0.00121***	-0.00133***
	(0.000433)	(0.000438)	(0.000465)	(0.000471)
Male headed household	-0.00462	-0.00551	-0.00521	-0.00638
	(0.0151)	(0.0153)	(0.0160)	(0.0163)
Log head's age	0.00957	0.00844	0.0137	0.0129
	(0.0211)	(0.0215)	(0.0223)	(0.0227)
Head is literate?	0.0280**	0.0249*	0.0255*	0.0218
	(0.0129)	(0.0131)	(0.0136)	(0.0139)
Log value of assets in ZMK	0.0116***	0.0109***	0.00918**	0.00826**
	(0.00350)	(0.00359)	(0.00376)	(0.00386)
Member of farmers group		0.0174		0.0186
		(0.0113)		(0.0120)
Leadership position in local organization		0.00659		0.00920
		(0.0124)		(0.0132)
Good soil quality			-0.0358	-0.0354
			(0.0267)	(0.0271)
Fair soil quality			-0.0289	-0.0280
			(0.0268)	(0.0272)
Flat land			-0.000949	0.00174
			(0.0254)	(0.0258)
Gently slopped land			0.0168	0.0219
			(0.0261)	(0.0265)
Constant	-0.132	-0.125	-0.101	-0.0970
	(0.0857)	(0.0876)	(0.0953)	(0.0971)
Number of observations	2981	2918	2685	2625
Mean of dep. Var.	0.20	0.20	0.20	0.20
R-squared	0.471	0.472	0.467	0.469
$\beta_1 = \beta_2$	0.319***	0.320***	0.306***	0.307***
	(0.032)	(0.032)	(0.034)	(0.034)
$\beta_1 = \beta_3$	0.334***	0.332***	0.318***	0.317***
	(0.022)	(0.023)	(0.024)	(0.025)
$\beta_2 = \beta_3$	0.015	0.013	0.012	0.010
	(0.030)	(0.030)	(0.031)	(0.031)

Note: Dependent variable is an indicator of having a title. Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.010

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