Land, Power, and Property Rights: The Political Economy of Land Titling in West Africa*

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Abstract

Rural households who obtain a formal title for their land benefit relative to households whose land remains informal. The uptake of such titles in the developing world remains slow and uneven, despite availability. This paper illustrates how the local politics of customary institutions combine with national land regimes to resolve this empirical puzzle. I combine 170,216 household-level observations of titling across 22 African countries with a novel geospatial measure of both land values and the returns to agricultural investment. Households in areas with high returns to potential agricultural investment are more likely to title. In countries with centralized land tenure regimes, strong customary institutions attenuate this relationship; in countries with decentralized land regimes, strong customary institutions reinforce it. I leverage an original survey of 801 households and 194 customary elites in the central cocoa belt of Côte d'Ivoire to illustrate how village chiefs capture devolved land titling institutions to discriminate against relative newcomers and reinforce their own authority. This research expands the study of property rights in the developing world by documenting granular variation in the uptake of land titles, by showing how local politics explain this variation, and by outlining the conditions under which customary elites impede or facilitate development.

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Insecure property rights pose barriers to economic activity and stifle growth across the developing world (Deininger and Goyal 2024). The agricultural sector in sub-Saharan Africa employs 52 percent of workers, but insecure land tenure constricts agricultural investments and reduces productivity.[1] To alleviate these concerns, governments and international donors devote sizable resources to land tenure formalization programs. Land titles are available on-demand to many African farmers as part of 'piecemeal' titling programs (Honig 2022*a*). However, the uptake of these programs, and rate of formal land titling, varies dramatically across countries. In Ethiopia, 79 percent of households possess such a title; in Burkina Faso, Burundi, and Malawi, only three percent possess a title.[2] Titling rates vary across regions and districts, even within countries with high and low levels of land titling. What explains the uneven uptake of formal property rights?

This paper argues that the confluence of local politics and national land regimes constrains household decisions to acquire a formal land title.[3] In addition to administrative fees, mapping complex patterns of land use onto individual titles creates risk for households. As a result, households formalize their landholdings only when the value of their property or the potential returns to agricultural investments enabled by titles increases to the point that the benefits justify the costs. In countries which devolve responsibilities for land tenure administration to local governments, customary elites facilitate land titling because they can capture the process and maintain their authority. In countries with centralized land tenure regimes, titling saps the authority of these intermediaries and so they impede formalization when they are able.[4]

I illustrate this theory using 170,216 household observations from the Demographic and Health Surveys (DHS) and Living Standards Measurement Surveys (LSMS) across 22 African countries. I introduce a geospatial measure of land values and the returns to agricultural investments which sidesteps measurement problems associated with informal and illegible property markets. These cross-national data document the expected but largely untested relationship between land values,

[1] This figure comes from the World Bank's 'Employment in Agriculture' statistics for sub-Saharan Africa in 2022. A wide-ranging body of evidence demonstrates that formal property rights provide greater security than informal property rights (Higgins et al. 2018; Lawry et al. 2017).

[2] These statistics are from the combined data I introduce below. Across the most recent survey waves, the median country has a titling rate of approximately 11 percent.

[3] I define 'land titles' here very broadly to mean some kind of state-issued written documentation of a claim over a parcel of land. May such documents lack some portion of the 'bundle of rights' associated with property deeds in a Western context (Deininger and Goyal 2024: 135–56). Some titles, such as a Sénégalese *déliberation foncière*, are long-term use rights which lack rights of alienability or transferability. My definition emphasizes defensibility: "the ability to defend property rights by calling on and retrieving clear property rights information, and by appealing to the state for rights enforcement" (Albertus 2020: 13). I use the terms land titling and land formalization interchangeably.

[4] I specifically considers agricultural land. Urban land tenure encounters different constraints (Balán et al. 2022) and so it is outside of my scope conditions. However, in appendix A.2 I use titles for dwellings as a placebo outcome to show that household wealth alone does not drive my results.

returns to agricultural investment, and the emergence of formal property rights. These data also provide both substantively and statistically significant evidence that the interaction between the local strength of customary institutions and national land regimes moderates this relationship. In centralized land regimes, strong customary authorities attenuate the relationship between land values and land tenure formalization: a 1,000 USD increase in the returns to long-term agricultural investment is associated with a 34 percent increase in the likelihood of possessing a land title where chiefs are strongest and a 63 percent increase where chiefs are weakest. In devolved land regimes, however, strong customary authorities strengthen the relationship between increased returns to agricultural investment and land tenure formalization. In such countries, the same increase in the returns to investment is associated with a 55 percent increase where chiefs are strongest, and no increase where they are weakest.[5]

To trace the role that customary authorities play in land titling, I use an in-depth case study of Côte d'Ivoire. The history of migration in Côte d'Ivoire combined with a village mapping procedure to create local variation in the strength of customary elites. I leverage this natural experiment through an original field survey of 801 household heads and 194 customary elites across the Ivoirian cocoa belt. I show evidence for a number of intermediate observable outcomes of my theory: villages with stronger chiefs have more land titles, stronger chiefs capture the land titling process, this capture is used to discriminate against relative outsiders (allochthones), and this discrimination buttresses the chief's authority.

These results add to a voluminous literature in political science and political economy which seeks to explain the presence or absence of strong property rights. Much of this research centers how states and elites manipulate property rights for political and economic advantages: it asks why and when states and elites supply property rights (Albertus 2020; Boone 2014; Nathan 2023). I nuance these theories by explicitly incorporating the household decision to seek a land title within my model and show that household demand for formal property rights varies significantly even within regions and districts. Local politics, in the form of strong or weak customary intermediaries, interact with national land regimes to attenuate or reinforce the relationships between economic circumstance and the decision to title. While much of the existing body of work treats property rights or institutions in abstract terms (Acemoglu and Robinson 2012; Libecap 1989; North and Weingast 1989), I open the "black box" of property rights by showing how households interact with concrete and tangible land titles.

Informal institutions structure statebuilding efforts and economic development across the de-

[5]These results are taken from column six of table 3.

veloping world (Acemoglu et al. 2020; Díaz-Cayeros, Magaloni, and Ruiz-Euler 2014). They often facilitate economic growth by serving as development intermediaries (Balán et al. 2022; Baldwin 2016). However, informal institutions do not always "add value" to development; they can serve as either compliments or substitutes to the state (Baldwin, Kao, and Lust 2023; Henn 2023). Through the lens of property rights, this paper advances the study of informal institutions by enumerating conditions under which informal elites support or impede statebuilding and economic development.

This paper proceeds in seven parts. The first section establishes an empirical puzzle: few African households title their land despite the benefits to so doing and the availability of titles. The second section delves into a demand-driven theory of land tenure formalization to explain this discrepancy. The third section outlines the data sources I marshal to test this theory, as well as the paper's methodology. The fourth section presents the quantitative results of these tests and documents how the interaction between strong customary institutions and land regimes moderates the uptake of land titling. The fifth section traces the intermediate steps of this theory by showing how powerful chiefs in Côte d'Ivoire capture the land tenure formalization process to maintain authority in a devolved land regime. The sixth section concludes the paper.

1 Formal and informal land tenure in sub-Saharan Africa

The majority of land in sub-Saharan Africa is held via informal, or customary, land tenure regimes. Across the most recent waves of the DHS and LSMS data collection, only 15.2 percent of landholding households possess a title for at least one of their agricultural parcels. The remainder hold their land through customary or informal rights, which are not registered and are rarely written. Customary land rights may be recognized by the state on a case-by-case basis, but are generally managed by customary authorities such as village chiefs.[6] In contrast, formal land rights are registered with state institutions, generally in the form of a written land title. Titles document a claim to the land (ownership, use rights, alienability, etc.) and carry legal weight.

Secure property rights incentivize investment because one is more likely to receive the returns to one's investment (North and Weingast 1989). Acemoglu, Johnson, and Robinson (2001) famously show that countries with better institutions—defined as those with a smaller risk of

[6]The word "customary" need not imply these institutions are rooted in longstanding tradition. Many contemporary institutions date to the colonial period, when colonial regimes installed local intermediaries. Where colonial interlocutors predated the precolonial period, they often leveraged their status to claim additional powers (Mamdani 1996; Nathan 2023).

property being expropriated—are richer than countries with worse institutions.[7] This mechanism also holds at the household level, where secure tenure incentivize investments.

Abundant empirical research illustrates the linkages between land tenure security and agricultural investment. In Ghana, officers of local customary institutions feel more secure in leaving their plots fallow, and have resultingly higher level of soil fertility and agricultural profits compared to non office-holders (Goldstein and Udry 2008). In a randomized control trial in Benin, even land demarcation sans additional titling procedures led households to shift cultivation to crops which required a longer-term investment (Goldstein et al. 2018). Dillon and Voena (2018) show that households in Zambian villages where widows are unable to inherit land invest less in land quality. Women are particularly vulnerable to land tenure insecurity, which means formalization has strong potential for empowering women in agriculture. For example, a land titling program in Rwanda improved land access for married women, who also saw the greatest impact on agricultural investment and soil quality (Ali, Deininger, and Goldstein 2014).[8] These effects are unique neither to Africa nor to developing countries. In India, households in areas with historically stronger landlords and weaker property rights have lower agricultural investments and productivity, even after independence (Banerjee and Iyer 2005). In the United States, uncertain title of railroads' land grants delayed the development or irrigation in frontier Montana and reduced land values by up to 21 percent (Alston and Smith 2022).

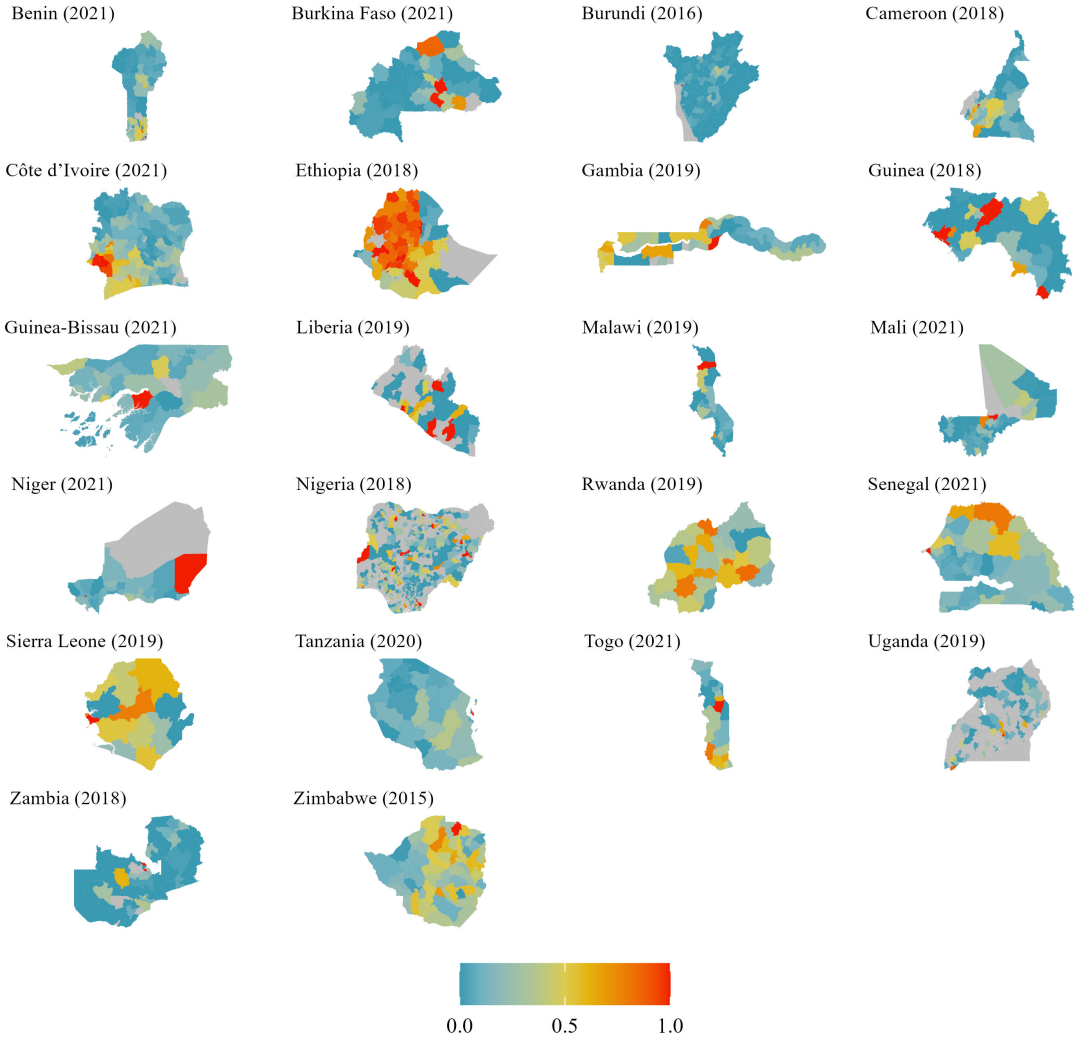
The policies of African governments reflect the importance of land tenure security. Since the 2000s, 41 African countries have established piecemeal, or on-demand land titling procedures (Honig 2022*a*: 2). In contrast to top-down land formalization programs, demand-driven programs allow households to opt-in to land tenure formalization. Land titles are available, but households are not obligated to seek them.[9]

[7] Alternatively, De Soto (2000) argued that secure property rights would lead to economic growth by allowing rural households to mortgage their land. Empirical evidence does not support this claim (Lawry et al. 2017): titles which lack alienability cannot be used as collateral for a mortgage, and the supply of credit is limited across much of rural Africa.

[8] Many climate adaptations, such as windbreaks or demi-lunes, are long term investments incentivized by secure property rights. Secure property rights have also been linked to investment in reduced deforestation (Deininger and Goyal 2024: 184–8).

[9] Rwanda and Ethiopia are important exceptions: both mandated top-down, comprehensive titling drives. According to the most recent round of DHS collection in 2019, 69.4 percent of Rwandan households possessed at least one formal land title; in 2018, 79.4 percent of Ethiopian households possess at least one formal land title.

Figure 1. Subnational variation in land titling across 22 African countries



This figure shows the fraction of landholding households with at least one formal title for an agricultural title at the district (2nd level administration division) level. Data are from the most recent round of the DHS and LSMS surveys. All calculations use the provided survey weights.

International donors also focus on land tenure security. The Land Portal Foundation, a consortium of international donor organizations, tracks 3,871 land governance projects around the world in its database. USAID alone has implemented land tenure projects in 23 separate

countries.[10] Land tenure appears or has appeared in 22 different compacts implemented by the Millennium Challenge Corporation. The World Bank also heavily focuses on land tenure issues.

Titling remains rare across sub-Saharan Africa despite these efforts. Figure 1 shows the spatial distribution of formal land titles, as of the most recent wave of DHS or LSMS data collection. This figure documents extensive variation in the fraction of landholding households who possess a title, within both countries and regions. Areas with high rates of titling are not universally clustered around national capitals, or in resource producing areas. For example, there is a large concentration of formal land titles in the Fouta Djallon region of Guinea, a bastion of strong customary authority among the Peulh (Fulani) ethnicity. Both Benin and Togo have clusters of land titling in the central forested belt, well outside the national capitals in the far south of the countries. Mali's highest rate of titling is in the fertile Mopti region, but several communes within the arid region around Gao also have high rates of titling. Even within the districts shown in figure 1, the uptake of land tenure formalization varies dramatically. For example, 14 percent of enumeration areas have less than one percent titling rates, even among the 11 countries whose national titling rate is above the median.

These facts pose a puzzle. Rural households benefit from land titles. Many African states have made land titles available, often with support from international donors. Nevertheless, land titles remain rare, although high levels of spatial variation exist even within regions. What explains this limited uptake of land tenure formalization?

2 A demand-driven theory of land titling

This section responds to the above puzzle by introducing a new theory of land tenure formalization in which household demand for land titles takes center stage. This theory has several components. Households decide whether to acquire a formal land title. Pursuing a land title is costly: households who title pay an administrative fee, but also incur a variety of risks when they title. As a result, they only title when the benefits outweigh the costs. These benefits are increasing in the value of land and the returns to potential agricultural investments. Chiefs have an incentive to impede titling, because titling displaces their role in customary land administration and removes a long-term reservoir of political authority. On the other hand, when land administration is devolved, chiefs continue to play a greater role in local land administration regardless of titling. In these contexts, chiefs facilitate land titling, to be seen as bringing development goods

[10] Land reform was a major component of US foreign aid policy during the Cold War. American policymakers believed it would reduce grievance-based political instability (Kapstein 2017).

to the village.

2.1 Household balance costs and benefits

Land titling is costly. The first set of costs are administrative. Generally households pay some kind of fee to title. In Sénégal, a land title costs around 5,000 CFA, or about 8 USD. In Côte d'Ivoire, Bassett (2020: 144) enumerates "over 20 steps to obtain a land certificate and another dozen to obtain a land title." Many of these administrative steps involve a fee, the largest of which comes from the requirement to hire an official surveyor to map the parcel. These steps involve multiple levels of government: the village land management committees (CVGFRs), the sous-prefectures, and the Agence Foncier Rurale (AFOR) in the capital, Abidjan. Côte d'Ivoire is an extreme case, but such processes are common across the continent.[11]

However, the costs to titling go beyond monetary fees or time spent in the sous-prefect's office. Land tenure formalization is not a one-to-one mapping of existing land use onto paper; it creates winners and losers. In much of sub-Saharan Africa, agricultural parcels are subject to overlapping ownerships, which exist in a state of strategic ambiguity (German 2022; Lund 2008). One person may have the right to farm in the dry season, another in the rainy season. A third person may have the right to graze their animals on the parcel. A fourth person may be the descendent of the original inhabitants of the area, who collects customary (but debatably ceremonial) rents. Which of these four owns the parcel? Land titling forces the issue of hierarchy between these partial owners. Formalization may carry a particular risk for "groups such as women, pastoralists, hunter-gatherers, casted people, former slaves and, and serfs, who have traditionally enjoyed subsidiary or derived (usufruct) rights to land" (Platteau 1996: 40). This risk forms an additional cost to titling.

If titling is expensive and risky, why do households pursue it? Land conflicts are an unfortunately common occurrence in much of Africa. In Côte d'Ivoire for example, settlement patterns by Burkinabé and Baoulé migrants led to large scale uprisings with as many as 4,000 casualties in the 1970s (Boone 2003: 220). In parts of Northern Ghana, the dispossession of historical elites led to conflicts between the village chiefs and the dispossessed earthpriests (Lund 2008). The fact that individuals who are more highly placed within customary institutions feel more secure in fallowing land likewise highlights the risk of expropriation (Goldstein and Udry 2008). Formal

[11] Similarly, though tribal certificates in Liberia are issued by local communities, they must be submitted to the Liberia Land Authority in Monrovia and published in both the official gazette and three other newspapers of national coverage.

property rights can help alleviate such concerns. Titling one's land reduces the risk of losing it.[12]

Households will be more willing to title their land when the value is higher. Losing a valuable piece of land to a conflict is worse than losing an unproductive piece of land. Where an asset is more expensive, households will go to greater lengths to protect it—including undertaking a costly titling process (Besley and Ghatak 2010). This relationship between land values and property rights is extensively asserted, but rarely tested in a systematic manner within studies of "endogenous" property rights.

These arguments echo those within political economy theories of endogenous institutions, which posit that property rights emerge when the individual benefits to organizing such a system become equal to the individual costs (North 1990). Shifts in relative prices can shock prevailing equilibria and drive institutional change (Libecap 1989). In the context of land formalization, a shift in the value of land or potential returns to investment could drive rural households to seek formal titles for their parcels.[13] Rosenthal (1992: 21) illustrates this dynamic clearly in Revolution-era France, where "it was not worthwhile to define property rights to unimproved land clearly, for enforcing such rights would have required monitoring unwarranted by the low value of the land." While the revolution created the possibility for new property rights institutions, these changes were only worth the expense in areas of high potential returns to that investment.

The other important benefit of land titling is that it permits households to invest in their land. Households with more secure land are able to invest with comparatively greater surety that they will receive the returns to these investments (Dillon and Voena 2018; Goldstein and Udry 2008). These investment can be short term—such as fallowing one's land, or investing in fertilizer—or long term, such as planting tree crops which can take four to five years to produce crops. The potential returns to investment in the parcel drive titling by incentivizing households to protect their future investments in the land. The returns to investment in a parcel are also likely to be "priced in" to the value of land (Ferree et al. 2023).

However, land tenure insecurity is not always the binding constraint to investing in one's agricultural parcels. Much land in sub-Saharan is arid, or infertile (Herbst 2014). Historically, this lack of fertility across much of Africa manifested in low population densities, complicating the task of projecting state power over arid and distant hinterlands. Many seemingly lush tropical areas also suffer from poor soil. In such cases, the benefits to households from seeking a formal

[12] I focus on the legal weight of titles, but the legibility of titles—regardless of their legal weight—could also drive an increase in perceived land tenure security. (Ferree et al. 2023; Honig 2022*b*: 54)

[13] As part of his survey of the British colonies, Lord Hailey (1938: 830) wrote that "we are beginning to see new varieties of custom created by the growth of more intensive systems of cultivation, and by the fact that, in some areas at least, land is beginning to acquire a commercial value."

land title will be lesser—more secure land title will not unlock investment where the potential returns to such investments fail to justify their costs.

Together, these dynamics suggest that households will formalize their land only when the value of the land or the returns to investment in agricultural parcels is high enough to justify the costs. As a result, I hypothesize that:

H.1 Households in areas where the value of land is higher will be more likely to possess a title.

H.2 Households in areas where the returns to agricultural investment are higher will be more likely to possess a title.

2.2 Chiefs and precolonial institutions

Households do not title in a vacuum. The vast majority of villages in sub-Saharan Africa have some manner of customary leader—most often a village chief (Baldwin 2016). These chiefs have an incentive to prevent households from seeking land titles. They have the ability to do so because of their position as a development intermediary within the land titling process. Chiefs in areas with strong precolonial institutions are more able to exert their will and prevent land titling.

Customary authorities, most often chiefs, are important political actors across sub-Saharan Africa (Baldwin 2016). Chiefs' control over land reinforces their authority in other dimensions. Where property rights are insecure, chiefs can use control over land to sanction households who go against the chiefs in other ways (Acemoglu, Reed, and Robinson 2014). Acting against the chief is difficult when the chief could reassign your land to another member of your community. Even without such threats, the role chiefs play in resolving land disputes enhances their perceived authority to regulate conflicts. Chiefs are often the first step to resolve land disputes. When households bring their disputes to the chief, they implicitly recognize the chiefs' right to arbitrate such disputes. Lund (2008: 10) summarizes this point, that "[r]ecognition of property rights by an institution simultaneously constitutes a process of recognizing the legitimacy of the institution." By keeping land rights in the customary regime, chiefs maintain a long-term reservoir of political legitimacy. Baldwin and Ricart-Huguet (2023) illustrate the result of this dynamic: households across sub-Saharan Africa perceive their chiefs to be more authoritative where land values are higher because of increased competition over land. If control over land held in the customary system enhances chiefs' political authority, then chiefs' authority will dwindle when households formalize their land.

Chiefs also act as crucial development intermediaries. Baldwin (2016) notes that much of chiefs' legitimacy as political actors comes from their performance on the job: constituents prefer

a chief that delivers development goods, such as roads or clinics. Land titles are another form of development good. However, the extent to which chiefs can claim credit for such development goods depends on where decisions are made. Where land tenure administration is centralized, this kind of credit-claiming becomes more difficult, creating a second rationale for chiefs to impede titling.

Chiefs are more authoritative in areas where precolonial institutions were stronger.[14] The strength of precolonial institutions is often measured in terms of the number of hierarchical layers of governance (Honig 2022*a*; Neupert-Wentz and Müller-Crepon 2024). Chiefs who are situated in hierarchical institutions are be better able to prevent the land titling process. First, customary elites who are situated within these hierarchical institutions are more empowered to enforce their decrees. Within weakly hierarchical society, customary elites may not have the political capital to enforce judgements (Boone 2003). Second, the nature of hierarchical institutions increases the accountability of customary elites. In villages with lower levels of hierarchy, an unfair ruling by the chief could go unchallenged; where there are customary elites above the village chief, there is a chance for appeal. This accountability may prevent chiefs from making decisions based on favoritism or their own interests (Honig 2022*a*). Nathan (2023) likewise shows that in the absence of precolonial hierarchies, chiefs are more likely to extract rents from their constituents, with the distribution of public goods suffering.

A variety of literature explores the legacies and persistence of precolonial institutions with regards to contemporary outcomes. Honig (2022*a*: 11), for example, notes that

> Customary institutions with hierarchical legacies trace their roots to powerful precolonial states with hierarchical authority structures that withstood the colonial conquest... the diverse origins of these institutions set them on different trajectories, producing variation in the contemporary strength of customary institutions within each country.

Similarly, Wilfahrt (2022) notes how the overlap of precolonial institutions and contemporary state organs affects local redistributive politics in Sénégal. Neupert-Wentz and Müller-Crepon (2024) show that areas with hierarchical precolonial institutions have greater levels of contemporary political complexity. Precolonial hierarchy is especially pertinent when it comes to chiefly control over land, because much of the chief's authority over village life is predicated upon their control over land (Acemoglu, Reed, and Robinson 2014; Honig 2022*a*). This political authority means that chiefs are better able to act on their incentives to prevent land titling.

[14] Appendix D explores the ties between precolonial institutions and the current strength of customary institutions more formally.

2.3 Devolved and Centralized Land Regimes

The above section describes a process of land titling that is divorced from the power of customary chiefs. However, chiefs often play an important and recognized role in land tenure formalizations. In areas where chiefs can capture the land tenure formalization process, titling can fortify, rather than diminish, the power of chiefs.

Land administration is a difficult task for African states: agricultural land often exists in hinterlands where state capacity is comparatively limited (Herbst 2014). In such conditions, chiefs are able to capture the land tenure formalization process. For example, municipal councils in Sénégal issue the rural land certificats (*déliberations foncières*). There is no formal role for the chief. In practice, chiefs guide the subcommitee of the municipal council which is deputized to investigate land claims, and often resolve land disputes. In a survey of 1,164 household heads across rural Sénégal, 92 percent of households said it would be necessary to inform the chief to acquire a *dèlibartion foncière*, 47 percent said it would be necessary for the chief to investigate your claim, and 18 percent said it would be necessary to pay the chief (Ribar 2023).

In Côte d'Ivoire, village land management committees (*comitès villageois de gestion foncière rurale*, or CVGFRs) investigate land claims, although titles (*certificats fonciers*) are formally distributed by the national land bureau. Village chiefs have no official position in CVGFRs, but they nevertheless almost always head the committee. Similarly, Firmin-Sellers (1995) shows that a land-rush in Ghana led to a rebirth of customary institutions to enforce private property rights.

Such decentralization contrasts with areas where land tenure formalization is centralized. In such contexts, decisions around land tenure formalization are made at the national level—which is more distant to customary elites. For example, the Liberian Land Authority presents itself as a "one-stop shop" for land tenure formalization. Land administration and titling occurs in Monrovia—far from customary institutions. Another strong example is Rwanda, where the country's comprehensive land tenure formalization drive was managed entirely by the state. Rwanda selected areas in which to title, household claims were mapped, and then the central land registry office published the information (Ali, Deininger, and Goldstein 2014).

Boone (2014: 24–5) distinguishes between *statist* and *neoclassical* land regimes. Chiefs can play a role in both neocustomary and statist land regimes. In statist regimes, "governments administer the allocation and holding of rural property directly;" in the latter, land is governed indirectly through customary institutions.[15] However, local land tenure arrangements are com-

[15] Boone (2014: 25 specifically refers to these institutions as *neocustomary* to emphasize their often limited resemblance to historical precolonial institutions.

plex, heterogenous, and often illegible to the state (Scott 1998). As a result, chiefs play a large role in adjudicating land claim even when land administration is officially in the hands of the state, such as in the Sénégalese case I describe above.

Why do some African states devolve land tenure? Centralized land tenure administration was the default condition across colonial Africa, particularly in polities under French control. Centralized administration was necessary to alienate productive land from African populations (Hailey 1938: 1649). Starting in the 1990s, the World Bank promoted a number of decentralization proposals across the developing world (Deininger 2003). A number of Millennium Challenge Corporation compacts, such as those in Benin and Niger, also promoted decentralization reforms. These reforms are largely donor-driven, rather than reflective of domestic politics. Decentralization programs are also a bad candidate for clientelist or targeted policies, because by nature they affect entire countries.[16] German (2022) further notes that many of the structural reforms and other projects are more reflective of a World Bank-driven 'knowledge-regime' than of local circumstance.

In summary, land kept in the customary system enhances the power of chiefs. When households title land, that land exits the customary system. Where the administration of land tenure is devolved, chiefs can retain some control over land tenure through their involvement in local land institutions, and so titling land does not eliminate the chiefs' authority. Chiefs also receive some credit for acting as a development broker within devolved regimes. Where land tenure administration is devolved, chiefs have an incentive to facilitate formalization. Where land tenure formalization is centralized, titling cuts chiefs off from this reservoir of political authority, and so they have an incentive to oppose it. However, the incentive to impede or facilitate titling does not confer the ability: stronger chiefs are better able to act on these incentives. More formally, this theory predicts that:

H.3 Strong customary institutions will attenuate the relationship between land values/returns to titling in countries where land tenure formalization is centralized.

H.4 Strong customary institutions will strengthen the relationship between land values/returns to titling in countries where land tenure formalization is devolved.

[16] This does not mean that access to land titles is equal across countries—some states may in fact create local land bureaus unevenly. This question is outside the scope of the present paper, but I address the consequences of uneven state capacity elsewhere in my dissertation project.

3 Data Sources and Methodology

This section overviews the four key sources of data I use in the remainder of the paper, along with my methodology. For the outcome variable, I combine 66 waves of DHS and LSMS data across 22 African countries to extract 170,216 household-level observations of land titling.[17] Next, I combine geospatial measures of agricultural suitability with historical commodity pricing to measure both the value of agricultural land and the returns to agricultural investment. Third, I introduce my measure of the strength of customary institutions, for which I use Murdock's ethnographic atlas. Finally, I introduce my original coding of country land regimes.

3.1 Outcome variable: household titling

The lack of accessible administrative data on land titling has hampered the ability of scholars to study the subject. Datasets are often private or difficult to access. Importantly, they are also not comparable across countries—what is included in one country may not be included in another country. The result is a literature which largely studies the emergence of formal property rights through case studies of individual countries. I sidestep this problem using survey data.

To sidestep this problem, I combine data from two large scale data collection efforts. The first is the DHS, a project of USAID. The DHS project collects comparable data on developing countries around the world. While the project is largely health focused, DHS also asks about households' participation in agriculture and their landholdings. Among other questions, the DHS asks "do you have a title deed or other government recognized document for any land you own?"

The second large scale data collection effort is the World Bank's LSMS program. Like the DHS, these surveys are a large scale effort to collect comparable data across the developing world. Unlike the DHS, the LSMS has a greater focus on agriculture and economic conditions than on health. The LSMS contains a parcel-level roster of agricultural land and asks "[d]oes your household currently have a title or ownership document for this parcel."[18]

The main outcome variable for this paper is a binary indicator for whether a household possesses a title for at least one parcel of agricultural land. Importantly, both sets of surveys include similar questions for whether a household possesses a title for their dwelling. This latter variable

[17] There are 425,663 observations across the merged survey data; the difference (251,466) are dropped because they are either urban, or they do not have access to land.

[18] While the DHS uses one standardized protocol across different countries, the LSMS protocols differ substantially across countries. Variable names, values of outcomes, etc. all differ across waves. These differences make merging LSMS waves a sizeable undertaking. The exception is the *Enquête Harmonisée sur le Conditions de Vie des Ménages* (EHCVM) implemented in the Economic Community of West Africa, which I explore further in the appendices.

serves as an important placebo, as the value of land and the returns to agricultural investment should not affect the demand for titling dwellings.[19]

3.2 Land values and returns to investment

Illegible and informal land markets in most of Africa prevent researchers from directly measuring realized values of land. Because this research focuses on agricultural land, I conceptualize the value of land as a function of the potential agricultural production of the parcel.[20] To overcome these issues, I implement a novel measurement of 'attainable value:' the value for which the maximum attainable yield (per hectare) could sell for on the international commodity market. I combine geospatial crop suitability data with global commodity prices to obtain these land values at a 10km-by-10km grid cell level. Adjusting the underlying parameters of the crop suitability models creates two measures of the returns to agricultural investment: the marginal increase in attainable value from using fertilizer, and the marginal increase in attainable value from planting tree crops as opposed to perennials.

I use version four of the Food and Agriculture Organization (FAO)'s Global Agro Ecological Zone (GAEZ) model to obtain the 'attainable yield' of different crop types. The model takes into account climate, soil and terrain data, as well as phenology and crop calendars. The attainable yield I use in these analyses are expressed in kilograms per hectare.[21] Attainable yield here differs from "agro-climactic suitability" because the latter do not consider soil suitability and terrain factors.[22] Potential total production is divided by total grid cell area. Prices come from the IMF's Primary Commodity Price System.[23] The majority of prices are listed as USD per metric ton; I apply an appropriate correction for other prices and set prices to constant 2011 USD. The commodities included in these data are: bananas, barley, chickpeas, canola oil, cocoa, coconuts, coffee, cotton, corn, groundnuts, oats, palm oil, rice, rubber, sunflower oil, soybeans, sorghum,

[19] An important note is that the outcome variables are not identical across the two surveys—while the LSMS protocol asks if any parcel owned by a household is titled, the DHS protocol asks if any man has a title for their land. While the overwhelming majority of parcels are owned by men, these answers could give slightly different numbers. This difference is absorbed by fixed effects in all models.

[20] Differences in future discounting which could also feed into latent land values, but these cannot be addressed with current data.

[21] Some crops use other measures (for example, "alfalfa, miscanthus, napier grass, reed canary grass, pasture legumes and grasses the yields are in 10kg dry weight per hectare"); I apply appropriate conversation factors where necessary (Fischer et al. 2021: 129).

[22] These data are based on the RCP4.5 climate projection.

[23] The FAO's producer price database provides more granular estimates of crop prices, but it has too many missing data points to be useful. For example, in our target period it is missing data for cocoa and coffee prices in Côte d'Ivoire—the country's two primary export commodities.

sugar, tea, and wheat.[24]

For each crop and grid cell, I multiply the maximum attainable yield (metric tons per hectare) by the commodity prices in a given year (USD per metric ton) to obtain the attainable price (USD per hectare). I then take the maximum of this vector. More formally, the maximum attainable value π of grid cell g in year y is defined as:

$$\pi_{g,y} = \max_{c}(p_{c,y} \cdot s_{c,y,g})$$

where p indicates crop price, s indicates the attainable yield, and observations are indexed by g for grid cell, y for year, and c for crop. These data measure the maximum attainable value in dollars per hectare for a given 10km-by-10km grid cell on a yearly basis.

This measure calculates the attainable value of agricultural production per hectare; in other words, in captures the value of agricultural land. However, testing H2 also requires a measure of the returns to potential agricultural investment. To that end, I calculate two additional variables: the returns to using fertilizer (a short-term investment) and the returns to planting tree crops (a long term investment). The primary land value measure assumes that households do not fertilize their parcels. By re-calculating the GAEZ attainable yield models assuming fertilizer use, I can take the difference to identify the returns to fertilization. Fertilizer is not a consistent or linear multiplier for yields. In some locations and for some crops, fertilizer greatly increases yields. Elsewhere, the returns are minimal.

I also calculate the returns to planting tree crops over perennial crops. Tree crops require a high up-front investment Households must purchase saplings or wait for trees to become productive. Coffee trees, for example, take five to seven years to become commercially viable. As a result, tree crops represent a longer-term investment than purchasing fertilizer for the remaining year. Of the 20 crops for which I have price data, I classify bananas, coconuts, cocoa, coffee, rubber, and tea as tree crops. I calculate the maximum attainable value for these crops, and subtract the maximum attainable value for other crops. Where this difference is negative, I reset it to zero, in recognition that farmers would not make an unprofitable decision.

Farmers do not receive the global commodity prices. However, the validity of this measurement requires only that the prices farmers receive are positively correlated with global commodity pricing. In appendix B.2, I probe this requirement using a subset of data for which households' planting decisions are available. I show that households respond to this measure of attainable

[24] I exclude tomatoes because the IMF commodity price is calculated as the consumer price per kilo in metropolitan France, rather than the price per kilo on the international commodity market.

value by changing their planting patterns. A one percent increase in the average attainable value per hectare of a crop is associated with a 0.13 to 0.16 percentage point increase in the amount of land that farmers dedicate to that crop. Similarly, an increase of one percent in the fraction of an administrative area in which a crop is the most profitable is associated with a 0.076-0.08 percentage point increase in the fraction of land that farmers dedicate to that crop. In other words, the elasticity of crop planting with regards to the crop's attainable value is positive, which supports this land value measure capturing the underlying phenomenon of agricultural production.

This metric superficially resembles a Bartik, or shift-share instrumental variables (SSIV), design. A plethora of literature in recent years has enumerated the assumptions through which shift-share instrumental variables identify effects and placed limits on their applicability (Borusyak, Hull, and Jaravel 2022; Goldsmith-Pinkham, Sorkin, and Swift 2020). However, the weighted exposure to common shocks approach I adopt differs from a SSIV in two key ways. First, my measure is not an instrument—attainable yield operationalizes the latent land values directly. Second, the SSIV designs use the weighted exposure to shocks across sectors; the canonical design weights sector-level exposure to Chinese import competition by industry concentration in a given area. In this paper, the land values metric takes the maximum of a vector of values (i.e. the highest multiplicative product of crop yield and commodity price vectors) rather than a weighted mean.

3.3 The strength of customary institutions

To measure the strength of customary institutions, I use geo-referenced data from Murdock's Ethnographic Atlas (Moscona, Nunn, and Robinson 2020; Murdock 1967). The Murdock Ethnographic Atlas is a common reference for differences among pre-colonial institutions. The Murdock dataset includes 89 variables on 802 different ethnic groups around the world, of which 239 are located in sub-Saharan Africa. The specific variable from the Murdock dataset through which I operationalize the strength of customary institutions is the precolonial institutions's level of hierarchy, or the:

> hich the first indicates the number of levels up to and including the local community and the second those transcending the local community. Thus 20 represents the theoretical minimum, e.g., independent nuclear or polygynous families and autonomous bands or villages, whereas 44 represents the theoretical maximum, e.g., nuclear families, extended families, clan-barrios, villages, parishes, districts, provinces, and a complex state(Murdock 1967: 160).

This paper uses ths first of these numbers: the number of administrative levels within villages. I specifically use local hierarchy because it is more likely to reflect local norms, rather than constellations of power which were sedimented by colonial regimes. Acephalous societies, such as the independent villages of northern Ghana, would rank at the lowest level (Nathan 2023). Highly structured societies, with multiple layers of hierarchical institutions, would score higher. In Sénégal, for example, the Imamate of Fouta Toto possessed a ruling council, regional chiefs, village chiefs, nighborhood chiefs, lineage heads, and household heads. Such a precolonial kingdom ranks at a four-four (the highest levels for both sets of hierarchy) on the Murdock scale.

There is undoubtably noise in the relationship between precolonial hierarchy and contemporary institutions.[25] However, a variety of literature suggests that, on average, contemporary political institutions are stronger in areas where precolonial institutions were more hierarchical (Honig 2022*a*; Neupert-Wentz and Müller-Crepon 2024). Moreover, I believe this source of error to be uncorrelated with the independent or dependent variables, so this source of error would attenuate my results towards zero. As a result, one can consider this paper's results as a lower bound on the relationship.

Ultimately, the hierarchy of precolonial institutions is an indirect measure of the strength of contemporary customary institutions. However, it has a crucial advantage over alternatives: it is comprehensive. This measures covers the universe of precolonial polities in Africa. These data are geospatial, so they produce variation at the levels where my other data sources vary. Appendix D provides additional evidence of the correlation between these Murdock data and the strength of current precolonial institutions.

3.4 Devolved and centralized land regimes

Finally, I code a variable for whether land regimes in a given country are centralized or devolved. I classify a land regime as devolved if decisions about whether a household can title a given parcel are made at the national level (centralized) or another level (devolved). I specifically code this variable based on where the decision is made, rather than the location at which land titles are certified or recorded. For example, in Sénégal, *déliberations foncières* are adjudicated, issued, and recorded by municipal councils, a third level administrative devision. Côte d'Ivoire is a more complicated case: village-level CVGFRs decide who can obtain a *certificat foncier*, the sous-prefect verifies that correct procedures were followed, and the national land agency ultimately

[25] An alternative approach would be to use Afrobarometer data. While these samples are randomly selected, and thus provide an unbiased average result, the overlap is just too small for statistical analysis—any correlations are as likely to be noise as they are to be signal. I discuss these relations further in appendix D.

certifies the title. While administrative procedures take place at all three levels, this is a devolved land regime because villages make the decisions. In contrast, the National Land Agency of Rwanda maps parcels, adjudicates titling, and issues certificates—a centralized land regime.

Benin, Burkina Faso, Burundi, Côte d'Ivoire, Ethiopia, Guinea, Guinea-Bissau, Kenya, Mali, Niger, Nigeria, Sénégal, and Zambia have decentralized land regimes according to this coding. Cameroon, Gambia, Lesotho, Liberia, Malawi, Rwanda, Sierra Leone, Tanzania, Togo, Uganda, and Zimbabwe have centralized land regimes. Appendix E gives more detailed narratives which explain these codings.

3.5 Methodology

I analyze these variables using a series of linear probability models. All regressions are estimated using ordinary least squares with fixed effects at the country-wave level (i.e. each survey wave has its own intercept). I also include a set of demographic controls, including the household head's education level, sex, age, marital status, and whether the household is urban or rural. My geographic controls are measured at the second-level administrative division, and include geographic area, population density of the district, an interaction of area and population density, average terrain ruggedness (Carter, Shaver, and Wright 2019), and caloric yield (Galor and Özak 2016).

I model the moderating effects of land regime and informal institutions on the relationship between land values and titling through a series of triple interaction models. The triple interactions are necessary to capture the dependencies between land values/returns to investment, hierarchy, and land regimes. These regressions take the form:

$$y_{idnw} = \beta_1 V_d + \beta_2 H_d + \beta_3 V_d \cdot H_d + \beta_4 H_d \cdot C_n + \beta_5 V_d \cdot H_d \cdot C_n + X_i + Z_d + \psi_{nw}$$

Where V indicates the land value variable (I estimate separate equations for each of three land value/agricultural investment variables), H represents the fraction of the district covered by hierarchical precolonial institutions, and C is a binary indicator for whether the country devolved its land administration. X and Z are vectors of household-level and district level controls (respectively), i indexes observations by individual, d by district, n by country, and w by survey wave.[26] Because triple interactions can be difficult to interpret, I also include marginal effects plots for all three land value variables. Tables 1, 2, and 3 all include these control variables; appendix tables

[26] I do not include the devolved indicator outside of interactions because it is otherwise absorbed by country-wave fixed effects

A1, A3, and A2 replicate these analyses without controls, with similar results.

3.6 Threats to inference

The primary variables of interest on the right hand side of my regressions relate to land values and the returns to investment. As I describe above, I measure land values by interacting the attainable yield per hectare for a variety of different agricultural products with their commodity prices on the global market and taking the maximum. We can think of this estimation strategy as a form of weighted exposure to external shocks: the crop prices are the shocks, and the total attainable yields per hectare are the weights. These shocks themselves are exogenous; no individual farmer is able to affect the commodity price of a crop on the global market. One potential threat to inference in this case is that observations' weights (i.e. their crop suitabilities) are likely not entirely exogenous to land titling. Soil quality may have other causal pathways to land titling rates; for example, Baldwin and Ricart-Huguet (2023) show that land quality affects the power of traditional leaders. In such cases, a non-random exposure to common shocks research design can lead to omitted variable bias (Borusyak and Hull 2020). When not otherwise controlled for by fixed effects, I include the average shock across all years for observation i to control for this bias.[27]

A second threat to inference is that a country's land tenure regime, centralized or decentralized, is endogenous to other variables. Albertus (2020: 169), for example, points out that farmers who are "fixed geographically and lack property rights while facing obstacles to acquiring necessary agricultural inputs and credits are the stuff of clientelist party fantasy." As a result, states may centralize land regimes in order to withhold titling. Many African leaders are also large-scale landowners, which gives them economic incentives to promote or withhold titling (Onoma 2010). However, the decision to devolve or centralize land tenure regimes takes place at the country level; this paper looks at within-country variation in titling. As such, all equations include country-wave fixed effects.

4 Results

In this section, I explore the results of a series of regressions using these variables. Previous theory suggests that both the value of land and the returns to agricultural investment should be

[27] Boryusak and Hull (2020) note that the distribution of shocks must be stationary over time for a time-invariant counterfactual shock to eliminate this source of omitted variable bias. After controlling for inflation, the distribution of maximum possible values per observation is indeed stationary.

Table 1. Strong customary institutions moderate the relationship between land value and the uptake of land titles

	(1)	(2)	(3)	(4)	(5)	(6)
Land value	0.031		0.030	0.034	0.040**	0.063*
	(0.024)		(0.024)	(0.023)	(0.015)	(0.026)
Hierarchy		−0.002	−0.001	−0.076*	−0.001	0.042
		(0.028)	(0.028)	(0.036)	(0.028)	(0.076)
Hierarchy * Devolved				0.108*		−0.059
				(0.044)		(0.087)
Land value * Hierarchy						−0.030
						(0.026)
Land value * Devolved					−0.012	−0.043
					(0.023)	(0.034)
Land value * Hierarchy * Devolved						0.050
						(0.029)
Country-Wave Fixed Effects	X	X	X	X	X	X
Demographic Controls	X	X	X	X	X	X
Geographic Controls	X	X	X	X	X	X
Num.Obs.	168 091	168 091	168 091	168 091	168 091	168 091
R2	0.250	0.250	0.250	0.252	0.250	0.253

Note: The dependent variable of this model is a binary indicator for whether a household possesses a land title. The independent variables are the maximum attainable value; the fraction of an administrative unit that is covered by a hierarchical pre-colonial institution; and a binary indicator for whether the country has devolved its land regime to local authorities. The unit of analysis is the household. Land value data vary at the second level administrative division, with the exception of Côte d'Ivoire (third level) and Malawi (first level). Demographic controls include the age, sex, and education of the household head; geographic controls include area, population density, an urban/rural indicator, and terrain ruggedness. Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

positively associated with titling rates (H1 and H2). In countries with centralized land tenure regimes, strong customary institutions—measured by the hierarchy of precolonial institutions—will attenuate this relationship (H3). In countries with devolved land tenure regimes, strong customary institutions will strengthen it (H4).

Table 1 shows the results of regressing the household titling indicator on the maximum attainable value per hectare (in the previous year), in various combinations with the percent of the administrative division covered by a hierarchical pre-colonial institution and an indicator for whether the country has devolved its land regime. This table shows relatively consistent results. The maximum attainable yield per hectare has a qualitatively similar magnitude across specifications, though it only reaches conventional statistical significance in columns 5 and 6. In these specifications, a one standard deviation increase in the maximum attainable value per hectare (0.370) is associated with 0.043 to 0.051 percentage point increase in the likelihood of a household possessing a formal land title, which translated to a 11 to 13 percent increase over the baseline

Table 2. Strong customary institutions moderate the relationship between returns to fertilizer and the uptake of land titles

	(1)	(2)	(3)	(4)	(5)	(6)
Difference (fertilizer)	0.781***		0.780***	0.843***	1.022***	1.591***
	(0.235)		(0.217)	(0.225)	(0.240)	(0.387)
Hierarchy		−0.002	−0.001	−0.077*	−0.001	0.064
		(0.028)	(0.027)	(0.031)	(0.027)	(0.053)
Hierarchy * Devolved				0.110**		−0.069
				(0.041)		(0.065)
Difference (fertilizer) * Hierarchy						−1.137*
						(0.503)
Difference (fertilizer) * Devolved					−0.435	−1.445
					(0.518)	(0.768)
Difference (fertilizer) * Hierarchy * Devolved						1.701*
						(0.679)
Country-Wave Fixed Effects	X	X	X	X	X	X
Demographic Controls	X	X	X	X	X	X
Geographic Controls	X	X	X	X	X	X
Num.Obs.	168 091	168 091	168 091	168 091	168 091	168 091
R2	0.251	0.250	0.251	0.253	0.251	0.254

Note: The dependent variable of this model is a binary indicator for whether a household possesses a land title. The independent variables are the increase in maximum attainable value from fertilizing a parcel; the fraction of an administrative unit that is covered by a hierarchical pre-colonial institution; and whether the country has devolved its land regime to local authorities. The unit of analysis is the household. Land value data vary at the second level administrative division, with the exception of Côte d'Ivoire (third level) and Malawi (first level). Demographic controls include the age, sex, and education of the household head; geographic controls include area, population density, an urban/rural indicator, and terrain ruggedness. Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

probability of possessing a land title of 0.168. This table shows support for H1, but does not support H3 or H4: households title in response to higher land values, but the effect of the interaction between land regime and strong customary institutions is unclear.

Table 2 repeats these analyses, but using the returns to fertilizing the parcel, which measures the potential for short-term investment in a parcel. The directionality of these results is identical, but they are consistently statistically significant. Across different specifications, a one standard deviation increase in the returns to using fertilizer (0.046) is associated with a 0.034 to 0.038 percentage point marginal increase to the likelihood of possessing a title, which translates to a 20.2 to 22.6 percent increase over the mean titling rate of 0.168. These effects are both substantively and statistically significant—households who could make more money by using fertilizer are more likely to have a land title. Table 2 shows strong support for hypotheses H2, H3, and H4.

Finally, table 3 repeats these analyses using the returns to long-term investment in a parcel.[28]

[28]The returns to fertilizer are comparatively smaller than the returns to planting tree crops. The means of these

Table 3. Strong customary institutions moderate the relationship between returns to planting tree crops and the uptake of land titles

	(1)	(2)	(3)	(4)	(5)	(6)
Difference (trees)	0.078***		0.079***	0.077***	0.093***	0.107***
	(0.011)		(0.012)	(0.015)	(0.022)	(0.029)
Hierarchy		−0.002	0.003	−0.067*	0.004	−0.051
		(0.028)	(0.028)	(0.033)	(0.027)	(0.034)
Hierarchy * Devolved				0.101*		0.072
				(0.040)		(0.042)
Difference (trees) * Hierarchy						−0.049**
						(0.018)
Difference (trees) * Devolved					−0.018	−0.083**
					(0.028)	(0.027)
Difference (trees) * Hierarchy * Devolved						0.118***
						(0.027)
Country-Wave Fixed Effects	X	X	X	X	X	X
Demographic Controls	X	X	X	X	X	X
Geographic Controls	X	X	X	X	X	X
Num.Obs.	168 091	168 091	168 091	168 091	168 091	168 091
R2	0.254	0.250	0.254	0.256	0.254	0.256

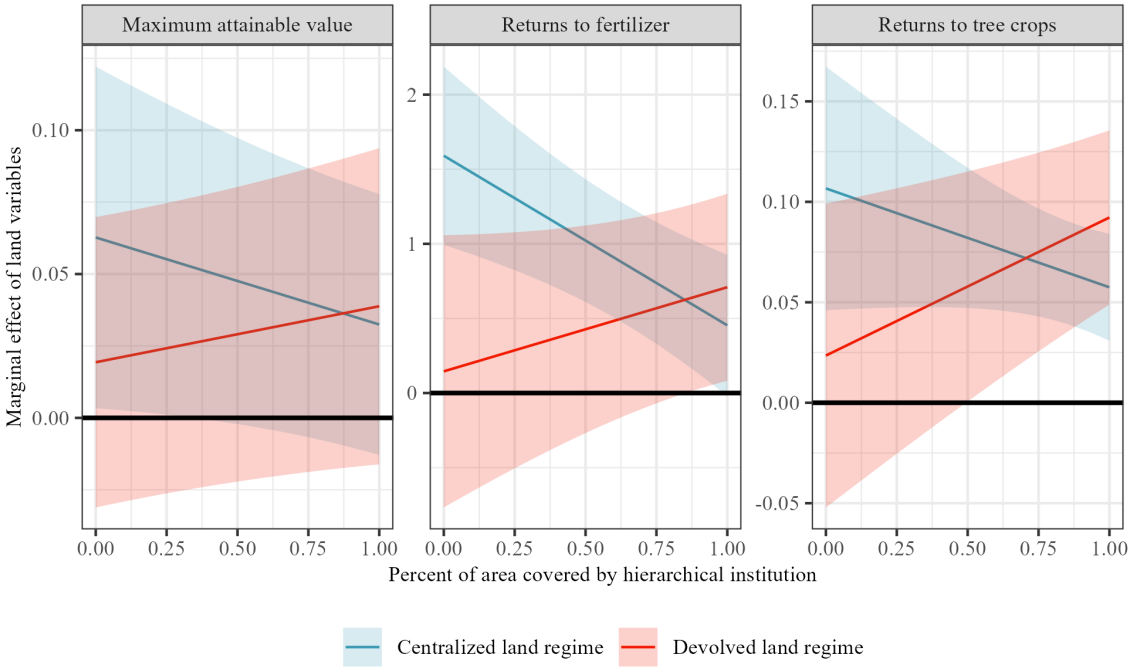
Note: The dependent variable of this model is a binary indicator for whether a household possesses a land title. The independent variables are the difference in maximum attainable value between planting tree crops and planting other crops; the fraction of an administrative unit that is covered by a hierarchical pre-colonial institution; and whether the country has devolved its land regime to local authorities. The unit of analysis is the household. Land value data vary at the second level administrative division, with the exception of Côte d'Ivoire (third level) and Malawi (first level). Demographic controls include the age, sex, and education of the household head; geographic controls include area, population density, an urban/rural indicator, and terrain ruggedness. Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

This measure captures the marginal increase in maximum attainable value from planting tree crops rather than non-tree crops (and is equal to zero if that difference is negative). These results are strongly significant and support H2, H3, and H4. Across models, a one standard deviation increase in the returns to planting tree crops is associated with a 0.038 to 0.039 percentage point increase in the likelihood of a household possessing a land title, an increase of 22.5 to 23.3 percent over the baseline likelihood of possessing a land title (0.168).

These tables suggest that the potential returns to agricultural investment are a stronger predictor of titling than land values. However, the directionality for the land value and agricultural investment variables is broadly consistent across these different models. Coverage by a hierarchical pre-colonial institution does not have strong associations with titling rates by itself. However, in a centralized land regime, moving from a district which is zero percent covered by a hierarchical pre-colonial institution to one that is entirely covered by a hierarchical pre-colonial insti-

variables are 0.076 and 0.177 respectively, both in 2011 USD.

Figure 2. The marginal effect of land variables by the presence of precolonial institutions depends on the prevailing land regime



This figure shows the marginal effects of three land variables on the probability a household has a title, broken out by the percent of the administrative division covered by a title and whether the country has a devolved or centralized land regime. All equations are estimated separately using OLS, with country-wave fixed effects.

tution diminishes the relationship between returns to investment and land titling. However, the triple-interaction coefficient reveals a crucial point: devolved land regimes invert the relationship between strong pre-colonial institutions and land values.

To make sense of these triple interaction models, figure 2 shows the marginal effect of the different measurement strategies for land value on titling rates by the strength of precolonial institutions, across both types of land regime. The vertical axes show the marginal effect of land value/returns to investment; the horizontal axes show the percentage of the district covered by hierarchical pre-colonial institutions. In other words, the vertical axis shows the magnitude of the relationship between land values/returns to investment and land titling rates, once all other variables have been taken into account. For example, a value of 0.10 on the vertical axis for a given level of pre-colonial strength and a given land regime implies that within this subgroup, a one unit

increase in the land value variable is associated with a 0.10 point increase in the probability of land titling.

Figure 2 shows that the effects of both the maximum attainable value of land and the returns to agricultural investment on titling is consistent in direction. Across all specifications, the marginal effect of land values on land titling is weakly positive. Regardless of the country's land regime or the presence of hierarchical institutions, the relationship between land values and land titling is never negative—only statistically indistinguishable from zero or positive. However, the magnitude of the relationship between land values and titling varies dramatically.

In countries with devolved land regimes, the relationship between land values and titling is weakly increasing in a district's coverage by hierarchical precolonial institutions. Within devolved regimes, a one unit increase in the returns to tree crops is associated with a (statistically insignificant) 0.023 percentage point increase in titling rates at the lowest rates of hierarchy, and a statistically significant increase of 0.092 percentage points at the highest levels of hierarchy. The slope of the marginal effects is similar for the maximum attainable value and the returns to fertilization, but at no point do they cross the threshold for statistical significance. In summary, within devolved land regimes, the presence of hierarchical customary institutions *increases* the strength of the relationship between land values and land titles.

Centralized land regimes tell a different story. Within these countries, the relationship between land values and titling is positive and significant at all but the highest levels of pre-colonial hierarchy. However, a one unit increase in the marginal returns to planting tree crops within centralized land regimes is associated with a 0.107 point increase in the likelihood of having a title among households at the lowest levels of hierarchy. Among households at the highest level of hierarchy, a one unit increase in the returns to tree crops is associated with only a 0.058 increase int he likelihood of having a land title. The magnitude and significance of these results is similar for the maximum attainable value of a parcel and the marginal returns to fertilization. Strong pre-colonial institutions *weaken* the relationship between land values and titling and centralized land regimes.

These results paint a nuanced portrait of the relationship between the value of land, returns to agricultural investment, and the uptake of formal land titles. Across the board, households with more valuable land—as well as those with higher returns to agricultural investment—are more likely to have a formal title for at least one of their parcels. However, local politics, in the form of strong customary institutions interact with a country's land regime to moderate these relationships. In countries where land administration is centralized, households title less when chiefs are strong, meaning that chiefs impede titling. Households in countries where land regimes

are devolved title more when their chief is strong, because chiefs have an incentive to facilitate titling.

One alternative mechanism that could explain these results is that households in areas with higher land values—or higher returns to agricultural investment—are simply wealthier. Higher levels of household wealth could alleviate monetary barriers to the uptake of titling, and therefore increase uptake. To test this mechanism, I conduct a series of placebo regressions using the same sets of explanatory variables, but with a binary indicator for whether the household has a formal title for their dwelling. Titles for dwellings would be equally facilitated by increased wealth, but not by incentives to invest on agricultural land. These regressions (detailed in table A5) show null effects across the board, suggesting that higher household wealth is not a mechanism through which land values drives titling. Population density also does not predict land titling rates, suggesting it does not capture the underlying value of the land. Results are similar across British and non-British colonial powers.[29]. Appendix A.3 shows that these results are robust to a variety of model specifications, including excluding Ethiopia and Rwanda, log-transforming the land value and the returns to agricultural investment, and subsetting to only the most recent survey wave.

These results show that broad, cross-national trends in land titling are consistent with the overarching theory. Households make a cost-benefit trade-off to decide whether to title, but sufficiently powerful customary chiefs can capture this program. In the following section, I use an original field survey in Côte d'Ivoire to better elucidate these mechanisms.

5 Côte d'Ivoire: customary elites in action

Côte d'Ivoire is a useful case because two factors provide empirical leverage through which to trace the role of customary elites in land tenure formalization. First, Côte d'Ivoire moved from a centralized to devolved land tenure system in the wake of its 1998 land law, which benefitted some groups while harming others (Boone 2018; Boone et al. 2021). Second, the history of migration and land use in the Côte d'Ivoire led to very high levels of variation in the perceived authority of chiefs.[30] It is roughly average in terms of both overall titling rates and the perceived authority of

[29] These results are in appendix A.2

[30] Village chiefs are the relevant customary authority in Côte d'Ivoire. Many villages have both a village chief—selected by the village elders as the strongest representative of the village—and a customary authority, such as a land chief (*chef de terre*) or earthpriest. Such authorities may play a role within the villages, but village chiefs serve as interlocutors to the state and who manage the village land committees.

chiefs in titling.[31] These factors make it an "on-the-line" case, which is ideal as a nested case for testing the broader theory of land titling outlined above (Lieberman 2005).

The Ivoirian case illustrates several key intermediate steps in the broader theory. I adopt a process-tracing framework, in which I identify the observable implications of my theory at work, and illustrate how these mechanisms explain the case (Bennett and Checkel 2015). Specifically, I demonstrate four intermediate steps. First, when land administration was centralized before a 1998 reform, chiefs opposed the state's interference. Second, chiefs effectively took control of the land titling process to exclude allochthones, or relative newcomers, and make them feel their titles would be less useful.[32] Third, titling rates are higher in villages with stronger chiefs—though not for the out-group. Fourth, autochthones who believe their chiefs could prevent them from titling see chiefs as less authoritative, a finding in opposition to the broader theory. This nested, within-country case study approach compliments the broader cross-national work: the cross-national research reveals broad patterns, but the Ivoirian case specifically traces the intermediate steps of my theory.

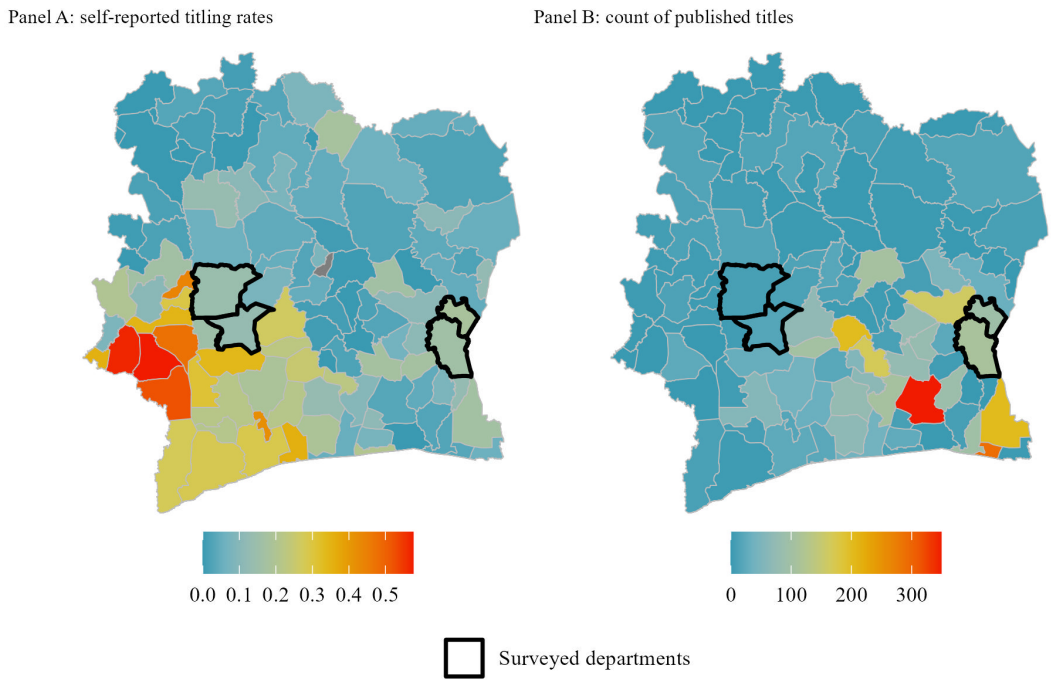
The Ivoirian case also permits me to unpack different dimensions of chiefly authority. I specifically distinguish between two dimensions: the overall average of chiefs' authority, and the extent to which chiefs' authority is perceived to be secular, rather than traditional. By secular, I mean relevant to contemporary state behavior rather than activities such as traditional dances, customary ceremonies, or religious leadership. The latter measurement better aligns with my theoretical rationales for why chiefs matter. Secular power means political power.[33] Across contexts, chiefs use their control over land to advance other political priorities (Acemoglu, Reed, and Robinson 2014; Lund 2008). While chief's control over customary functions likely enhances their ability to sanction households, the chief's control over resources and access to the state is the heart of chief's power. As such, the extent to which the chief is secular is the variable that best aligns with my theoretical expectations. Chiefs' legitimacy as development intermediaries also does not depend on their ability to compel participation in traditional ceremonies, but rather their ability to marshal support for development projects. As such, I operationalize chiefly authority as the extent to which chiefs are perceived as secular, rather than traditional. However, I report effects for overall chiefly authority, for completeness and contrast.

[31] Figure C1 shows these figures in comparative perspective and further discusses the case selection.

[32] Land tenure in Côte d'Ivoire pits autochthones, or sons of the soil, against allochthones, or relative newcomers. Throughout this section, I will use the term *certificat foncier* and title interchangeable. Côte d'Ivoire also has *titres fonciers* but these are almost exclusively concentrated in cities.

[33] I use the term secular to avoid confusion with other variables, but this dimension could also be called chief's political authority.

Figure 3. Spatial distribution of land titles across Côte d'Ivoire



The left panel shows the average self reported titling rates by department from the 2021 *Enquête Harmonisée sur les Conditions de Vie des Ménages*, which follows the LSMS template. All averages use household weights. The right panel shows the count of land published in the Ivoirian national gazette (*Journal Officiel de la République de Côte d'Ivoire*) as of November 7, 2022.

I unpack this case study through an original field survey of 801 household heads and 194 customary elites in the cocoa belt rgions of Haut-Sassandra and Indénié-Djuablin in Côte d'Ivoire. [34] Figure 3 shows these areas. It also shows the distribution of *certificats fonciers* in Côte d'Ivoire through two measures. The righthand panel shows the independent variable from my main analysis, in this case measured through a 2021 LSMS wave. The lefthand panel shows the count of publish *certificats fonciers* logged in the Ivoirian national gazette. The publication process takes several years, which makes these administrative data a lagging indicator. Nevertheless, they both show a concentration of titles in the country's forested belt, where cocoa and coffee can be grown, which is consistent with the expected relationship between returns to agricultural investment and

[34] Both regions are in the country's central forest belt, where coffee, cocoa, rubber, and oil palms are commonly grown as cash crops. With both land values and the prevailing land regime as constants, this context isolates the relationship between chiefly authority and the uptake of formal property rights.

land titling.

The survey took place in the spring of 2024, and covered 80 administrative villages in these regions. Within each village, I surveyed five households within the village itself, and another five in a randomly elected hamlet or campement. In fifty percent of villages, I surveyed an additional randomly selected hamlet or campement. Within each location, I also surveyed the village chief/headman or their representative.

5.1 Context: Natives and strangers in the Ivoirian cocoa belt

Migration in Côte d'Ivoire created a dense patchwork of different ethnicities. Most areas have an autochthonous group, who are the descendants of the first inhabitants to 'clear the bush.' Later arrivals are called 'allochthones,' or simply 'strangers.' These relative newcomers often give symbolic gifts to acknowledge the precedence of the autochthones, though in many cases the allochthones have lived in the village for decades. Burkinabè families are particularly prominent among the allochthones, because the long-serving first president Félix Houphouët-Boigny recruited wealthy planters from Burkina Faso to increase Ivoirian cocoa and coffee production (Zolberg 1964). Autochthony is orthogonal to ethnicity; any ethnicity would be autochthonous in their homeland and allochthonous elsewhere. Arriving families often established their fields and households at some distance from the original village. Over time, these settlements grew into hamlets and campements. These hamlets often rival the original village in population and economic prominence; near Daloa for example, allochthones now outnumber autochthones and hold most of the area's land (Boone et al. 2021).

Faced with these disparate constituencies, land policy in Côte d'Ivoire has alternated between use-based conceptions of land rights, which benefit the allochthones currently using the land, and customary land rights, which favor the autochthones (Boone 2018; Colin, Le Meur, and Leonard 2009). Use-based rights are exemplified by the long-serving Ivoirian president Houphouët-Boigny's famous statement: "the land belongs to whoever develops it."[35] After a lengthy power-struggle in the 1990s following Houphouët-Boigny's death, Côte d'Ivoire passed the 1998 land law (Law 98-750), signaling a new, land regime which favored customary rights. The law "contained an array of potentially or inherently conflicting provisions for assigning land ownership rights on the basis of autochthony" (Boone 2018: 191). Laurent Gbagbo, the opposition leader, was the major proponent of this policy as it benefited his largely autochthonous

[35] Allochthones often have more capital than allochthones—many cocoa and coffee plantations are maintained by Burkinabè and Baoulé migrants.

political supporters. After Alassane Ouattara took power in 2011, the administration used land administration instead as a tool of state-building (Boone 2018; Chauveau 2009).[36]

These quilt-like settlement patterns make autochthone versus allochthone the important cleavage for land disputes in Côte d'Ivoire, not ethnicity. Village chiefs are almost always autochthones. Previous land tenure regimes favored allochthones, and grievances remain. As a result, village chiefs discriminate against allochthones when they can because chiefs perceive the allochthone's land to be merely borrowed. For example, the headman of an allochthonous hamlet near Abengourou to whom I spoke expressed concern that the village chief would displace the hamlet in a few years when his cocoa trees became unproductive. Another farmer to whom I spoke in the same region mentioned that he only permitted allochthones to farm land once he knew them personally, "to avoid them trying to claim the land." AFOR, in contrast, is agnostic as to customary versus use-based claims to land. As a result, chiefly capture of the land tenure formalization process in Côte d'Ivoire manifests as discrimination against allochthones.

Village land management committees (CVGFRs) are central to chiefs' capture of land titling in in Côte d'Ivoire. CVGFRs investigate land claims (Bassett 2020) and issue dossiers for potential *certificats fonciers* (CFs). The national land bureau (*Agence Foncier Rurale*—AFOR) ultimately records and issues CFs, but important decisions are made locally. Chiefs often control the CVGFRs, which means they are gatekeepers to, and facilitators of, land titling. Therefore, in line with the broader theory, we would expect titling rates to be higher in villages with stronger chiefs.

5.2 Chiefly opposition before 1998

Before the 1998 land law, land administration in Côte d'Ivoire was centralized, and so my theory predicts that chiefs would oppose it. In the colonial period, the African population of Côte d'Ivoire was "effectively reduced to the status of tenants at will" (Zolberg 1964: 57). After independence, Houphuët-Boigny prioritized an expansion of cocoa and coffee production. Chiefs represented the autochthone groups, into whose land the incoming planter bourgeoisie expanded. As a result, the Houphuët-Boigny administration sidelined them (Boone 2003). Chaveau (2009: 138) notes that much of this internal colonization was not documented in formal laws, but in certificates of occupation given to migrants by sous-prefects over the heads of village chiefs.

The power of these chiefs was almost entirely destroyed in what Boone (2003: 213) calls "a

[36] Land-based grievances metastasized into violence during the 2010-2011 civil war and prevented broader implementation of land titling at the start of Alassane Ouattara's administration.

near-perfect model of direct rule." As a result, village chiefs did not exert a meaningful effect on rural politics before the 1998 land law. Analyses of this period in Ivoirian history rarely mention overt chiefly resistance to land titling or land administration, but the sense of chiefly resentment pervades the period. Chiefs and their autochthone constituents opposed Houphuët-Boigny's development initiatives, so he sidelined them. Chiefly resistance to these efforts can be read between the lines—chiefs did not support what they saw as the theft of their land.[37] This resistance contrasts with chief's later role in land administration, which I demonstrate below.

5.3 Strong chiefs lead to more titles

Under Côte d'Ivoire's prevailing and devolved land regime, my theory predicts that land titles would be more common when chiefs are more authoritative. I measure chiefly authority using an index of seven survey questions: "[f]or each of these activities [that chiefs in Côte d'Ivoire sometimes mandate], I would like you to tell me how much of the village you think would do what the chief asked them to do." The seven activities were: (1) Participate in village cleanup day; (2) Give up a piece of land for a school; (3) Give up a piece of land for a mosque; (4) Spend a day repairing a road; (5) Spend a day planting trees; (6) Come to participate in a traditional dance; and (7) Give money to support a traditional ceremony. For each of these activities, respondents answered: nobody, very few people, some people, most people, or everybody.

I then use principal component analysis to create two indices. The first principal component is evenly weighted across the seven questions; I think of this principal component as the overall authority of the chief. The coefficient of correlation between a simple sum of these questions and the first principal component is 0.99. The second principal component has strong negative weights on giving up land for a mosque, participating in a traditional dance, and giving money to a traditional ceremony, but strong positive weights on other items. As a result, I think of the second principal component as measuring the extent to which a chief's power is secular, rather than purely customary. As I discuss above, this 'chief is secular' index best aligns with my theoretical mechanism. Table C2 further breaks down this index and table C5 shows that these results are consistent when using participation in the individual activities as independent variables.

Overall, approximately 38 percent of households possess at least one formal land title. Table 4

[37] One exception to the latent character of chiefly opposition is chief's outward push against a 1962 reform of the country's land law, facilitating land claims by allochthones. Chiefly opposition sufficed to prevent the law from being promulgated (Chauveau 2009: 117).

Table 4. Autochthones but not allochthones have more titles when their chief is authoritative

	(1)	(2)	(3)	(4)	(5)	(6)
Overall authority	0.008	0.015	0.015	0.026+	0.031+	0.030
	(0.010)	(0.011)	(0.012)	(0.014)	(0.018)	(0.018)
Chief is secular	0.072*	0.069**	0.068**	0.145***	0.133***	0.133***
	(0.034)	(0.026)	(0.026)	(0.030)	(0.025)	(0.025)
Allochthone	0.188**	0.189+	0.185+	0.209**	0.241*	0.237*
	(0.071)	(0.109)	(0.106)	(0.071)	(0.107)	(0.104)
Overall authority * Allochthone				−0.045+	−0.034	−0.032
				(0.026)	(0.025)	(0.025)
Chief is secular * Allochthone				−0.186***	−0.172***	−0.174***
				(0.042)	(0.038)	(0.039)
Hamlet/camp	−0.105	−0.076	−0.078	−0.089	−0.075	−0.074
	(0.085)	(0.077)	(0.075)	(0.073)	(0.071)	(0.070)
Department FEs	X	X	X	X	X	X
Demographic controls		X	X		X	X
Geographic controls			X			X
Num.Obs.	787	785	785	787	785	785
R2	0.101	0.263	0.270	0.155	0.301	0.308

Note: The dependent variable is whether a respondent has a formal land title for at least one agricultural parcel. The independent variables are indices of responses to: [f]or each of these activities [that chiefs in Côte d'Ivoire sometimes mandate], I would like you to tell me how much of the village you think would do what the chief asked them to do. Demographic controls include education, sex, age, ethnicity, the respondent's relationship to the household head, and wealth. Geographic controls include an indicator for PAMOFOR, distance to department capital, cocoa suitability, coffee suitability, and terrain ruggedness. All regressions use OLS with inverse sampling probability weights. Standard errors are clustered at the administrative village level.

shows the relationship between the chiefly authority indices and household titling.[38] The outcome variable is a binary indicator for whether a household possesses a formal land title for at least one of their parcels. The independent variables are the two indices of chiefly authority: their overall authority, and the extent to which the chief is secular. Columns 1 to 3 reinforce the principal conclusion: in Côte d'Ivoire, which has a devolved land regime, stronger chiefs lead to more titles. More specifically, a one standard deviation increase in the extent to which households perceive their chief as secular (as opposed to customary) is associated with a 0.083 percentage point increase in the likelihood of a household having a title, an increase of 19.6 percent over the baseline mean of 0.42.

[38]These regressions also control for the presence of PAMOFOR (Land Policy Improvement and Implementation Project for Côte d'Ivoire), a World Bank project which subsidizes land titling. PAMOFOR was in an early stage as of fieldwork for this project; assignment to PAMOFOR was also randomized at the commune level. Of the 80 administrative villages in which this research took place, 12 took part in PAMOFOR.

Table 5. Allochthones and autochthones have different opinions about land titling

	CVGFR Composition			
Village	Entirely autochthonous	Mostly autochthonous.	Equally split	Mostly allochthonous
Mostly autochthonous	11	20	1	3
Equally split	6	16	15	1
Mostly allochthonous	2	2	0	1

Note:
Data from a 2024 customary elites survey in the Haut-Sassandra and Indénié-Djuablin regions of Côte d'Ivoire.

Columns 4-6 show that these results are highly heterogenous by whether the respondent is an allochthone. Across the 801 observations, 443 were allochthones and 355 were autochthones.[39] Allochthones are overall more likely to have a title—likely reflecting the state's influence in the earliest periods of titling, when CVGFRs were directly overseen by AFOR. Among autochthones, stronger chiefs have a dramatic influence on titling. A one standard deviation increase in the extent to which the chief is perceived as secular among autochthones is associated with a marginal increase of 0.15 percentage points in the likelihood of possessing a land title—an increase of 40.4 percent over the baseline titling rate of 0.38 among autochthones. However, the interaction effect between allochthony and the 'chief is secular' index nullifies these effects. Among allochthones, a one standard deviation increase in the perception of the chief as secular is associated with a statistically insignificant decrease of 0.05 points, a decrease of 9.7 percent over the baseline titling rate of 0.48. The effects and interactions for the overall chiefly authority are similar in direction, but is not statistically significant.

These results paint a clear picture. In this devolved land regime, where land values are relatively high due to the cocoa and coffee plantations, strong chiefs lead to more titles. However, this effect only holds for autochthones—the in-group for Ivoirian chiefs. The Ivoirian state and AFOR are agnostic to allochthony, but chiefs are able to capture land titling and selectively distribute titles.

5.4 Chiefs capture land management and exclude allochthones

In the specific Ivoirian context, chiefs' capture of land management means the exclusion of allochthones. This is most visible in the case of the village land management committees, or CVGFRs I asked the chiefs of each village (1) whether the village was mostly autochthones, evenly split, or mostly allochthonous, and (2) whether the CVGFR was mostly autochthones or

[39]The remaining three refused to answer the question.

Table 6. Chiefs in allochthonous villages think titles are less useful

	More likely to keep		Are better off	
	(1)	(2)	(3)	(4)
Allochthone village	−0.357*	−0.362*	−0.385**	−0.368**
	(0.154)	(0.162)	(0.131)	(0.132)
Autochthone village	0.056	0.057	0.011	0.055
	(0.149)	(0.147)	(0.139)	(0.146)
Department FEs	X	X	X	X
Geographic controls		X		X
Num.Obs.	192	192	192	192
R2	0.052	0.055	0.075	0.096

Note: Dependent variables of these models are responses to "[t]o what extent do you agree or disagree with the following statements? (1) Households who formalize their landholdings are less likely to lose access to their land than other households; (2) Households who formalize their landholdings are better off than when before they formalize their land?" Respondents are village chiefs and headmen. Each question is asked by a five point likert. Regressions use OLS with inverse sampling probability survey weights. Standard errors are clustered at the village level. Geographic controls include an indicator for PAMOFOR, distance to department capital, cocoa suitability, coffee suitability, and terrain ruggedness.

allochthones. Table 5 shows this breakdown: allochthone and split villages have greater levels of allochthone representation, but table 5 nevertheless illustrates that chiefs exclude allochthones from the local land management body.

How do chiefs exclude allochthones? Chiefs may selectively enforce *certificats fonciers*, leading to lower uptake among allochthones. Table 6 shows that chiefs/headman of allochthone settlements[40] perceive titles to be less useful. The reference category is chiefs/headmen of settlements which are evenly split between autochthones and allochthones. Columns 1 and 2 show that chiefs/headmen of locations which are mostly allochthonous are less likely to agree that "[h]ouseholds who formalize their landholdings are less likely to lose access to their land than other households." Columns 3 and 4 show that chiefs/headmen of locations which are mostly allochthonous are less likely to agree that "households who formalize their landholdings are better off than before they formalize their land."[41]

[40] I use the word settlement to mean villages, hamlets, and camps; I use the word village only to refer to administrative villages.

[41] I present results using OLS for consistency, but results are qualitatively identical for tables 6 and 7 using an ordered logit, because of the likert response scale.

Table 7. Autochthones, but not allochthones, think strong chiefs make titles more useful

	Keep land		Be compensated		Win dispute	
	(1)	(2)	(3)	(4)	(5)	(6)
Overall authority	0.004	0.007	0.081	0.087**	0.004	0.003
	(0.014)	(0.017)	(0.043)	(0.029)	(0.019)	(0.016)
Chief is secular	0.109***	0.107***	0.064	0.105	0.150***	0.165***
	(0.028)	(0.030)	(0.076)	(0.074)	(0.044)	(0.036)
Allochthone	−0.319**	−0.323*	−0.264**	−0.183	−0.350**	−0.311
	(0.108)	(0.144)	(0.090)	(0.195)	(0.105)	(0.159)
Overall authority * Allochthone	−0.120***	−0.131***	−0.159***	−0.168***	−0.121**	−0.128**
	(0.035)	(0.037)	(0.045)	(0.038)	(0.044)	(0.040)
Chief is secular * Allochthone	0.087*	0.108	−0.023	−0.047	0.048	0.040
	(0.043)	(0.063)	(0.083)	(0.090)	(0.054)	(0.078)
Hamlet/camp	0.095	0.007	0.114	0.144	0.108	0.053
	(0.081)	(0.118)	(0.069)	(0.125)	(0.069)	(0.095)
Department FEs	X	X	X	X	X	X
Demographic controls		X		X		X
Geographic controls		X		X		X
Num.Obs.	798	796	798	796	798	796
R2	0.236	0.307	0.176	0.305	0.243	0.329

Note: Dependent variables are answers to '[d]o you think somebody with a certificat foncier would be (1-2) more likely to keep their land if the government attempted to take it; (3-4) compensated fairly for the land, were it taken' and (5-6) more likely to succeed in a land dispute? All answers use a five-point likert scale. Demographic controls include education, sex, age, ethnicity, the respondent's relationship to the household head, and wealth. Geographic controls include an indicator for PAMOFOR, distance to department capital, cocoa suitability, coffee suitability, and terrain ruggedness. All regressions use OLS with inverse sampling probability weights. Standard errors are clustered at the administrative village level.

Table 7 shows similar results, but at the household level. Specifically, it shows whether respondents agree that: (1) having a title helps you **keep your land** if the government wants to take it; (2) having a title helps you **be compensated** if the government does take your land, and (3) having a title is useful in case of a **dispute** against your peers. Across all three categories, autochthones think titles are less helpful. These results are strongest the perception that titles are effective for keeping land if the government wants to take it: allochthones have approximately half a standard deviation less confidence that titles will be useful to help them keep their land in the face of government expropriation. Responses to the other categories are similar in magnitude, but inconsistently significant.

When the chief is more secular, both autochthones and allochthones are more likely to think that effective to keep land that the state wants to expropriate, as well as that titles more useful to keep land and to win disputes against neighbors. A one standard deviation increase in the 'chief is secular' index is associated with a 0.18 standard deviation in the belief that titles are helpful against the state among autochthones and a 0.32 standard deviation increase among al-

lochthones. A one standard deviation increase in the 'chief is secular index' is associated with an approximately 0.20 standard deviation increase in the belief that titles are effective in disputes with one's peers for both groups. In contrast, allochthones perceive titles to be less useful when the overall authority of the chief goes up. A one standard deviation increase in perceived overall authority is associated with an approximately one third of a standard deviation decrease in the perceived utility of titles across all categories. Together, these results suggest that one mechanism by which chiefs discriminate against allochthones is the uneven enforcement of *certificats fonciers*. In areas where chiefs are stronger, autochthones perceive their titles to be stronger, but allochthones perceive their titles to be weaker.

5.5 Capturing the process buttresses chiefs' authority

The final moving part of this theory is that the chiefs' role in the titling process maintains their political authority. Qualitative interviews with chiefs and headmen likewise reinforce the positive relationship between titling and chief's authority. In Daloa for example, one chief told me that "villagers [with title] continue to respect the chief and bring their disputes before him." Many chiefs said titling would be beneficial because it would help them resolve conflicts. In the survey of 194 customary elites, chiefs and headmen who perceived themselves to be more secular were more likely to say that titling helped chiefs to do their job, when asked "what effect does land titling have on village chiefs in Cote d'Ivoire?"

Chiefs continued to emphasize their own role. Few chiefs said that less conflicts would take place, but many chiefs said that it would be easier for *them* to resolve conflicts. The headman of a hamlet in Agnébilekrou made this point explicitly: "formalization gives authority to the village chief, he can resolve conflicts." The chief of an administrative village in Abengourou gave a similar sentiment, that "[land formalization] restores the chief's dignity." In the survey, 36 percent of village chiefs said titling reduces conflict, but only 22 percent of village headmen said the same thing.[42] These results suggest that more authoritative chiefs perceive titles to be more helpful in carrying out their roles—and in so doing, maintaining their authority.

Chiefs are also able to extract rents from their control over titling. While chiefs have no official role in titling, 70 percent of the 801 respondents in my survey expected to have to pay chiefs in order to formalize a land title. Only 57 percent thought they would have to pay their CVGFR, which is actually empowered to title land. These statistics indicate that chiefs have a monetary incentive to capture land titling, beyond its role in buttressing their authority.

[42] Table C4 presents these results more formally

Table 8. Chiefs who can oppose titling are less secular, but only for autochthones

	Overall authority			Chief is secular		
	(1)	(2)	(3)	(4)	(5)	(6)
Chief could oppose	−0.145	−0.113	−0.118	−0.211***	−0.194***	−0.189**
	(0.149)	(0.109)	(0.116)	(0.057)	(0.054)	(0.058)
Allochthone	0.205	−0.179	−0.212	−0.638**	−0.845***	−0.750***
	(0.633)	(0.579)	(0.571)	(0.230)	(0.188)	(0.202)
Chief could oppose * Allochthone	−0.107	−0.125	−0.117	0.156*	0.144*	0.124*
	(0.164)	(0.146)	(0.143)	(0.066)	(0.059)	(0.059)
Department FEs	X	X	X	X	X	X
Demographic controls		X	X		X	X
Geographic controls			X			X
Num.Obs.	798	796	796	798	796	796
R2	0.046	0.223	0.228	0.134	0.248	0.271

Note: The dependent variables are the first two principal components of a series of questions which ask "[f]or each of these activities, I would like you to tell me how much of the village you think would do what the chief asked them to do." The independent variable is the response to 'If a village chief opposed a household's attempt to formalize their landholding, how likely is it that the village chief would be able to prevent it?' Demographic controls include education, sex, age, ethnicity, the respondent's relationship to the household head, and wealth. Geographic controls include an indicator for PAMOFOR, distance to department capital, cocoa suitability, coffee suitability, and terrain ruggedness. All regressions use OLS with inverse sampling probability weights. Standard errors are clustered at the administrative village level.

Within the household survey, I measure the chief's capture of the process by asking "[i]f a village chief opposed a household's attempt to formalize their landholding, how likely is it that the village chief would be able to prevent it?" Table 8 shows no relationship between the perception that a chief could stop you from titling and the overall authority of the chief. However, it shows a strong relationship between the perception that chiefs can oppose titling and the 'chief is secular' index. Among autochthones, a one standard deviation increase in the belief that the chief could oppose land titling is associated with a 0.25 standard deviation *decrease* in the 'chief is secular' index. Allochthones think that the chief is less secular regardless, but the interaction term between perceiving that the chief could oppose titling and the respondent being an allochthone negates the relationship. In other words, allochthones always think chiefs are less secular, but belief the chief could oppose a land title makes no difference. These results are surprising in the context of the broader theory—if chiefs intervene in the titling process, it ought to enhance their legitimacy rather than reduce it.

Together, this nested case study of Côte d'Ivoire sheds light into the mechanisms at play in the above theory of land titling. Using a series of intermediate and observable implications

of this theory, I show a chain of events linking the strength of chiefs to land tenure outcomes (Bennett and Checkel 2015). Before land tenure was devolved by the 1998 land law, chiefs were largely opposed to titling. To investigate contemporary outcomes, I use an original survey of 801 household heads and 194 customary elites in two regions of Côte d'Ivoire's cocoa belt. I show that strong chiefs facilitate titling within their village. However, strong chiefs discriminate: they only facilitate titling among autochthones, the chiefs' in-group. Strong chiefs have no effect on titling for allochthones. Moreover, allochthones perceive titles to be less effective, suggesting that enforcement of land titles may be unequal. Surprisingly however, households who think their chief could intervene in the titling process think their chiefs are less authoritative, as measured by the extent to which they perceive their chief as secular rather than purely customary. This case illustrates that the mechanisms on which the broader theory is predicated do, in fact, play out in Côte d'Ivoire. This case study compliments the cross-national analyses by showing the individual components of the theory in action.

6 Conclusion

Strong and secure property rights are a necessary condition for economic development. Across sub-Saharan Africa, secure tenure over agricultural land is the form of property rights most relevant to the high percentage of households which the agricultural sector employs. Land titles benefit households: they reduce the risk of households losing their land, and they make households feel more secure making profitable investments. These land titles are available on-demand in many African countries. So why are African farmers leaving these economic gains on the table?

Across 170,216 survey observations, the average titling rates across countries is 16.8 percent[43]. Households whose land has higher attainable agricultural value and higher returns to agricultural investment are more likely to possess a title. However, the confluence of the strength of customary institutions and the country's land regime moderate this relationship. Where land tenure administration is devolved, an increase of 1,000 USD in the returns to long-term agricultural investment is associated with a (statistically insignificant) 14 percent increase in titling rates where customary institutions are weakest, and a statistically significant increase of 55 percent where customary institutions are strongest. Where land tenure administration remains centralized at the national level, the same increase in the returns to long-term investment is associated with a 63 percent increase in the likelihood of having a title among households with the weakest customary

[43]This number is 15.2 percent using only the most recent waves

institutions, and an increase of only 34 percent among households with the strongest customary institutions.

These results make two broad contributions to the existing literature. Much of the existing literature uses states and elites to explain the supply of property rights (Albertus 2020; Boone 2014). I document variation in the titling rates within states and within regions, suggesting that household demand plays an important role in the uptake of land titles. In establishing broad patterns in land tenure formalization across sub-Saharan Africa, I hope to open avenues for future research to test theories of property rights formalization against these empirical patterns. I also show that the interaction between national land regimes and customary institutions constrains household uptake of land titles. However, land tenure policy is one of many items in states' toolkits: export boards, tariff policies, and agricultural extension programs all play a role in rural politics (Bates 1981). This research creates space for scholars to examine how other institutions which dominate rural life in Africa affect—and are affected by—household decisions to title their land.

Second, by showing how their cooperation with the state depends on their ability to maintain control over local processes, this paper advances the literature on informal institutions and elites in developing countries. This finding helps explain existing contradictory results on when the informal elites compliment or substitute for the state (Henn 2023; Lust 2022). By unpacking the chiefs' incentives, this paper creates an opportunity for future research to examine how these incentives play out in alternative policy spaces.

These findings have important implications for African governments and donor organizations. Local politics affect how land tenure formalizations progress, which suggests a one-size fits all approach is unlikely to find consistent success. If chiefs facilitate land titling where they can capture the process, it also implies that chiefs ought to be taken into account when designing land tenure formalization program. The Ivoirian case specifically suggests that interventions designed to reduce any bias through which chiefs and other village land institutions assign land titles could have strong effects on both equity and uptake.

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Appendices

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A Details for cross-country regressions

A.1 Controls and weights

The cross-national regressions in this paper use household-level sampling weights provided in the original DHS or LSMS data files. Both DHS and LSMS data use a complex, multi-level sampling strategy rather than a pure random sample. As a result, these surveys include sampling weights to account for both idiosyncrasies of sampling strategy and differential non-response. I make two modifications to these survey weights.

First, I winsorize all survey weights on a country-by-country basis. Weights above the 95th percentile for country i are set to the 95th percentile value; weights below the 5th percentile for country i are set to the 5th percentile value. This procedure is renders the estimates less sensitive to extreme outliers and reduces the variance of estimates.

Second, I rescale all survey weights so that the country i's fraction of total survey weight is equal to the fraction of total observations which belong to country i. For example, of the 425,663 total observations in the combined DHS/LSMS dataset, 28,991 observations come from Mali, or about 6.8 percent. After rescaling, the fraction of total survey weight which comes from observations in Mali is also 6.8 percent. This procedure ensures that results are not dominated by a single country due to different weighting procedures or base weights at the country level.

I include two sets of control variables for all regressions. The demographic set of controls include variables calculated from the LSMS/DHS surveys themselves. These data are necessarily constrained by the availability of data within the underlying survey. These controls include the education of the household head (don't know, no education, preschool, primary education, or secondary education/higher), the sex of the household head, and the household head's age. Ethnicity questions were not included in approximately half of all DHS/LSMS surveys, so I do not include it as a control. Household wealth questions were also administered inconsistently across countries, which limits their utility.

The second set of controls are geographic. They include the area of the 2nd level administrative division (in square kilometers), population density (CIESIN 2017), the interaction between district area and population density, average terrain density (Carter, Shaver, and Wright 2019), the distance between the district centroid and the country's capital, and caloric suitability (Galor and Özak 2016). With the exception of population density, these data are stationary over time. As alluded earlier, all regressions also include the average land value "shock" across all periods (Borusyak and Hull 2020).

Table A1. Strong customary institutions moderate the relationship between land value and land titles (no controls)

	(1)	(2)	(3)	(4)	(5)	(6)
Land value	0.041		0.041	0.044	0.064*	0.087*
	(0.040)		(0.040)	(0.039)	(0.032)	(0.035)
Hierarchy		−0.002	−0.002	−0.082	0.000	0.065
		(0.033)	(0.033)	(0.044)	(0.031)	(0.063)
Hierarchy * Devolved				0.117*		−0.085
				(0.054)		(0.082)
Land value * Hierarchy						−0.037
						(0.023)
Land value * Devolved					−0.030	−0.064*
					(0.018)	(0.029)
Land value * Hierarchy * Devolved						0.059*
						(0.029)
Country-Wave Fixed Effects	X	X	X	X	X	X
Demographic Controls						
Geographic Controls						
Num.Obs.	170 216	170 216	170 216	170 216	170 216	170 216
R2	0.240	0.239	0.240	0.242	0.241	0.244

Note: The dependent variable of this model is a binary indicator for whether a household possesses a land title. The independent variables are the maximum attainable value; the fraction of an administrative unit that is covered by a hierarchical pre-colonial institution; and whether the country has devolved its land regime to local authorities. The unit of analysis is the household. Land value data vary at the second level administrative division, with the exception of Côte d'Ivoire (third level) and Malawi (first level). Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

Tables A1, A2, and A3 repeat the regressions from section 4 without these control variables. All estimates are similar in magnitude.

Table A4 shows the coefficients for demographic and geographic predictors of land titling. These controls are included in all tables in 4. While most levels of education are not highly predictive of land titling, household heads with no education are less likely to possess a title. Female headed households are less likely to possess a title, as are households with younger heads. For geographic variables, the distance of the administrative unit's centroid to the national capital is negatively associated with titling—more remote areas have fewer titles. However, caloric suitability—a measure of how much food can be produced by an area—is also negatively associated with titling. This last result also suggests that my measures of land values and the returns to agricultural investment are capturing value, rather than pure productivity.

Table A2. Strong customary institutions moderate the relationship between returns to planting tree crops and the uptake of land titles (without controls)

	(1)	(2)	(3)	(4)	(5)	(6)
Difference (trees)	0.093***		0.094***	0.092***	0.120***	0.134***
	(0.006)		(0.008)	(0.011)	(0.016)	(0.027)
Hierarchy		−0.002	0.009	−0.067	0.010	−0.051
		(0.033)	(0.033)	(0.040)	(0.032)	(0.041)
Hierarchy * Devolved				0.110*		0.079
				(0.048)		(0.053)
Difference (trees) * Hierarchy						−0.051*
						(0.021)
Difference (trees) * Devolved					−0.033	−0.097***
					(0.021)	(0.024)
Difference (trees) * Hierarchy * Devolved						0.120**
						(0.045)
Country-Wave Fixed Effects	X	X	X	X	X	X
Demographic Controls						
Geographic Controls						
Num.Obs.	170 216	170 216	170 216	170 216	170 216	170 216
R2	0.247	0.239	0.247	0.249	0.247	0.250

Note: The dependent variable of this model is a binary indicator for whether a household possesses a land title. The independent variables are the difference in maximum attainable value between planting tree crops and planting other crops; the fraction of an administrative unit that is covered by a hierarchical pre-colonial institution; and whether the country has devolved its land regime to local authorities. The unit of analysis is the household. Land value data vary at the second level administrative division, with the exception of Côte d'Ivoire (third level) and Malawi (first level). Demographic controls include the age, sex, and education of the household head; geographic controls include area, population density, an urban/rural indicator, and terrain ruggedness. Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

Table A3. Strong customary institutions moderate the relationship between returns to fertilizer and land titles (without controls)

	(1)	(2)	(3)	(4)	(5)	(6)
Difference (fertilizer)	0.716		0.715	0.806*	1.172***	1.776***
	(0.384)		(0.380)	(0.347)	(0.326)	(0.454)
Hierarchy		−0.002	−0.001	−0.084*	−0.001	0.067
		(0.033)	(0.033)	(0.040)	(0.031)	(0.049)
Hierarchy * Devolved				0.120*		−0.078
				(0.050)		(0.063)
Difference (fertilizer) * Hierarchy						−1.217*
						(0.505)
Difference (fertilizer) * Devolved					−0.781	−1.877**
					(0.488)	(0.727)
Difference (fertilizer) * Hierarchy * Devolved						1.890**
						(0.702)
Country-Wave Fixed Effects	X	X	X	X	X	X
Demographic Controls						
Geographic Controls						
Num.Obs.	170 216	170 216	170 216	170 216	170 216	170 216
R_2	0.240	0.239	0.240	0.243	0.241	0.245

Note: The dependent variable of this model is a binary indicator for whether a household possesses a land title. The independent variables are the increase in maximum attainable value from fertilizing a parcel; the fraction of an administrative unit that is covered by a hierarchical pre-colonial institution; and whether the country has devolved its land regime to local authorities. The unit of analysis is the household. Land value data vary at the second level administrative division, with the exception of Côte d'Ivoire (third level) and Malawi (first level). Demographic controls include the age, sex, and education of the household head; geographic controls include area, population density, an urban/rural indicator, and terrain ruggedness. Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

Table A4. Demographic and geographic predictors of land titling

	(1)	(2)	(3)
HH head education: preschool	−0.006		−0.001
	(0.019)		(0.018)
HH head education: primary	0.015		0.013
	(0.010)		(0.009)
HH head education: secondary	0.032		0.027*
	(0.018)		(0.013)
HH head education: higher than secondary	0.041		0.033
	(0.038)		(0.024)
HH head is female	−0.017		−0.019
	(0.025)		(0.024)
HH head age	0.010***		0.009***
	(0.001)		(0.001)
Area		0.000	0.000
		(0.000)	(0.000)
Population density		0.005	0.005
		(0.003)	(0.004)
HH is urban		0.019	0.016
		(0.019)	(0.017)
Terrain ruggedness		0.000*	0.000*
		(0.000)	(0.000)
Centerpoint distance to capital		0.000***	0.000***
		(0.000)	(0.000)
Caloric suitability		0.000***	0.000***
		(0.000)	(0.000)
Area * population density		0.000	0.000
		(0.000)	(0.000)
Country-Wave Fixed Effects	X	X	X
Num.Obs.	170 784	168 094	168 091
R^2	0.244	0.244	0.249

Note: The dependent variable of this model is a binary indicator for whether a household possesses a land title. This model includes the demographic and geographic controls used in the rest of this paper's tables. The lefthand panel shows binary control variables; the righthand panel shows continuous control variables, all of which are standardized to a one standard deviation increase. The unit of analysis is the household. Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

A.2 Robustness Checks and Placebo Regressions

This section shows additional robustness checks for the regressions in section4. First, table A5 shows results obtained by regressing a binary indicator for whether a household possesses a title for their dwelling on the explanatory variables. If households title their lands because of shifts to agricultural values, then the results of this regression should be null across the board. However, if households simply title because households with higher land values or in areas with profitable tree crops are richer, then we would also expect households to also title their dwellings more when these variables increase. As such, table A5 is a valuable placebo test for my main specifications. This table shows null results, which supports my interpretation of the main results.

Another concern may be different colonial experiences may be driving my results. The archetype of British approach to empire emphasized indirect rule through native interlocutors (Hailey 1938). In contrast, other powers (mostly the French) were more likely to disrupt pre-existing institutions to rule indirectly. In reality, policy towards native authority often differed as much within empires as between them (Boone 2003: 16). Nevertheless, table A6 shows that results of my primary specifications are relatively consistent in both former British colonies and other African states. The statistical significance switches on and off, but magnitudes are relatively similar.

Finally, table A7 replaces my measures of land values with population density. If land titling was bring driven by urban pressure, then population density should predict higher levels of titling. Table A7 shows that it does not.

Table A5. Land values do not affect titling for dwellings

	(1)	(2)	(3)	(4)	(5)	(6)
Max value	0.010	−0.007				
	(0.015)	(0.015)				
Difference (fertilizer)			0.064	−0.198		
			(0.404)	(0.373)		
Difference (trees)					0.025	−0.001
					(0.032)	(0.029)
Hierarchy	−0.052	−0.095	−0.067	−0.087	−0.031	−0.021
	(0.075)	(0.074)	(0.062)	(0.057)	(0.027)	(0.025)
Hierarchy * Devolved	0.056	0.048	0.067	0.053	0.032	0.009
	(0.084)	(0.080)	(0.069)	(0.063)	(0.033)	(0.029)
Max value * Hierarchy	0.006	0.021				
	(0.021)	(0.021)				
Difference (fertilizer) * Hierarchy			0.323	0.615		
			(0.552)	(0.541)		
Difference (trees) * Hierarchy					0.011	0.007
					(0.034)	(0.033)
Max value * Devolved	−0.005	−0.004				
	(0.018)	(0.019)				
Difference (fertilizer) * Devolved			0.005	−0.166		
			(0.501)	(0.533)		
Difference (trees) * Devolved					−0.004	−0.047
					(0.037)	(0.040)
Max value * Hierarchy * Devolved	−0.008	−0.002				
	(0.025)	(0.024)				
Difference (fertilizer) * Hierarchy * Devolved			−0.344	−0.108		
			(0.652)	(0.641)		
Difference (trees) * Hierarchy * Devolved					−0.007	0.064
					(0.037)	(0.042)
Country-Wave Fixed Effects	X	X	X	X	X	X
Demographic Controls		X		X		X
Geographic Controls		X		X		X
Num.Obs.	254 772	251 233	254 772	251 233	254 772	251 233
R2	0.070	0.104	0.069	0.104	0.070	0.104

Note: The dependent variable of these models is a binary indicator for whether a household possesses a title for their dwelling. The independent variables are three metrics of land value (maximum attainable value, the returns to using fertilizer, and the returns to planting tree crops); the fraction of an administrative unit that is covered by a hierarchical pre-colonial institution; and whether the country has devolved its land regime to local authorities. The unit of analysis is the household. Land value data vary at the second level administrative division, with the exception of Côte d'Ivoire (third level) and Malawi (first level). Demographic controls include the age, sex, and education of the household head; geographic controls include area, population density, an urban/rural indicator, and terrain ruggedness. Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

Table A6. Estimates are similar in British former colonies and other countries

	Former British colonies			All other countries		
	(1)	(2)	(3)	(4)	(5)	(6)
Max value	0.054*			0.013		
	(0.024)			(0.049)		
Difference (fertilizer)		1.708***			0.273	
		(0.184)			(0.964)	
Difference (trees)			0.097**			0.125***
			(0.034)			(0.030)
Hierarchy	0.098	0.113*	−0.052	−0.129	−0.071	0.081***
	(0.058)	(0.047)	(0.033)	(0.104)	(0.063)	(0.020)
Hierarchy * Devolved	−0.107	−0.155**	−0.031	0.104	0.061	−0.054
	(0.054)	(0.043)	(0.037)	(0.106)	(0.066)	(0.028)
Max value * Hierarchy	−0.046*			0.053		
	(0.017)			(0.039)		
Difference (fertilizer) * Hierarchy		−1.526***			1.176	
		(0.338)			(0.870)	
Difference (trees) * Hierarchy			−0.058			−0.081***
			(0.042)			(0.022)
Max value * Devolved	−0.025			0.007		
	(0.015)			(0.040)		
Difference (fertilizer) * Devolved		−0.998**			−0.202	
		(0.322)			(0.968)	
Difference (trees) * Devolved			−0.218***			−0.082
			(0.038)			(0.050)
Max value * Hierarchy * Devolved	0.024			−0.031		
	(0.014)			(0.040)		
Difference (fertilizer) * Hierarchy * Devolved		1.104**			−0.572	
		(0.295)			(0.935)	
Difference (trees) * Hierarchy * Devolved			0.183***			0.145***
			(0.040)			(0.030)
Country-Wave Fixed Effects	X	X	X	X	X	X
Demographic Controls	X	X	X	X	X	X
Geographic Controls	X	X	X	X	X	X
Num.Obs.	49 366	49 366	49 366	118 725	118 725	118 725
R_2	0.068	0.072	0.067	0.333	0.333	0.337

Note: The dependent variable of these models is a binary indicator for whether a household possesses a title for at least one agricultural parcel. The independent variables are three metrics of land value (maximum attainable value, the returns to using fertilizer, and the returns to planting tree crops); the fraction of an administrative unit that is covered by a hierarchical pre-colonial institution; and whether the country has devolved its land regime to local authorities. The unit of analysis is the household. Land value data vary at the second level administrative division, with the exception of Côte d'Ivoire (third level) and Malawi (first level). Demographic controls include the age, sex, and education of the household head; geographic controls include area, population density, an urban/rural indicator, and terrain ruggedness. Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

Table A7. Population density does not predict the uptake of land titles

	(1)	(2)	(3)	(4)	(5)
Population density	0.005	0.005	0.005	0.027	0.004
	(0.004)	(0.004)	(0.004)	(0.019)	(0.028)
Hierarchy		−0.002	−0.075**	−0.001	−0.086***
		(0.016)	(0.023)	(0.016)	(0.019)
Hierarchy * Devolved			0.106***		0.111***
			(0.028)		(0.026)
Population density * Hierarchy					0.043
					(0.027)
Population density * Devolved				−0.023	−0.010
				(0.019)	(0.028)
Population density * Hierarchy * Devolved					−0.032
					(0.028)
Country-Wave Fixed Effects	X	X	X	X	X
Demographic Controls	X	X	X	X	X
Geographic Controls	X	X	X	X	X
Num.Obs.	168 091	168 091	168 091	168 091	168 091
R_2	0.250	0.250	0.252	0.250	0.253

Note: The dependent variable of this model is a binary indicator for whether a household possesses a land title. The independent variables are the population density of the second level administrative division; the fraction of an administrative unit that is covered by a hierarchical pre-colonial institution; and a binary indicator for whether the country has devolved its land regime to local authorities. The unit of analysis is the household. Demographic controls include the age, sex, and education of the household head; geographic controls include area, population density, an urban/rural indicator, and terrain ruggedness. Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

A.3 Alternative specifications

This section shows that my results are robust to a variety of alternative specifications. Ethiopia and Rwanda are the two countries in sub-Saharan Africa with the highest titling rates, due to their top-down land titling drives. As a result, one might worry that any results are being driven by these two outliers, or that the underlying theory operates differently in these two countries. Table A8 shows that my results are identical—or even stronger—when excluding Ethiopia and Rwanda.

Alternatively, one might wish to log transform the different measurements of land values and the returns to agricultural investment, due to their non-normal (right skewed) distribution. Table A9 shows that my results are largely invariant to such a transformation.

Finally, we might be concerned that results are being driven by the fact that the underlying panel data is unbalanced. Certain countries (Tanzania and Uganda) have multiple waves; others have only one. Table A10 shows that coefficients are largely similar when restricting the data to only the most recent waves. However, the standard errors are inflated by the smaller sample size, so the statistical significance is inconsistent.

Table A8. Results are robust to excluding Ethiopia and Rwanda

	(1)	(2)	(3)	(4)	(5)	(6)
Max value	0.049*	0.066*				
	(0.024)	(0.027)				
Difference (fertilizer)			0.885***	1.463***		
			(0.202)	(0.266)		
Difference (trees)					0.087***	0.109***
					(0.018)	(0.028)
Hierarchy		0.059		0.080		−0.050
		(0.061)		(0.045)		(0.027)
Hierarchy * Devolved		−0.106		−0.097		0.050
		(0.066)		(0.050)		(0.032)
Max value * Hierarchy		−0.034				
		(0.018)				
Difference (fertilizer) * Hierarchy				−1.240***		
				(0.348)		
Difference (trees) * Hierarchy						−0.040
						(0.029)
Max value * Devolved		−0.027				
		(0.024)				
Difference (fertilizer) * Devolved				−1.004		
				(0.609)		
Difference (trees) * Devolved						−0.086
						(0.051)
Max value * Hierarchy * Devolved		0.056*				
		(0.022)				
Difference (fertilizer) * Hierarchy * Devolved				1.701**		
				(0.532)		
Difference (trees) * Hierarchy * Devolved						0.115**
						(0.038)
Country-Wave Fixed Effects	X	X	X	X	X	X
Demographic Controls	X	X	X	X	X	X
Geographic Controls	X	X	X	X	X	X
Num.Obs.	150 756	150 756	150 756	150 756	150 756	150 756
R^2	0.074	0.077	0.075	0.079	0.080	0.083

Note: Data are from the DHS and LSMS programs; these regressions exclude Ethiopia and Rwanda, which have top-down land titling programs. The dependent variable of this model is a binary indicator for whether a household possesses a land title. The independent variables are three metrics of land value (maximum attainable value, the returns to using fertilizer, and the returns to planting tree crops); the fraction of an administrative unit that is covered by a hierarchical pre-colonial institution; and whether the country has devolved its land regime to local authorities. The unit of analysis is the household. Land value data vary at the second level administrative division, with the exception of Côte d'Ivoire (third level) and Malawi (first level). Demographic controls include the age, sex, and education of the household head; geographic controls include area, population density, an urban/rural indicator, and terrain ruggedness. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

Table A9. Results are invariant to log-transforming the land value variables

	(1)	(2)	(3)	(4)	(5)	(6)
Max value	−0.039*	0.004				
	(0.018)	(0.066)				
Difference (fertilizer)			−0.005	0.122**		
			(0.029)	(0.041)		
Difference (trees)					0.022**	0.025**
					(0.006)	(0.007)
Hierarchy		0.012		−0.344**		−0.112***
		(0.063)		(0.100)		(0.028)
Hierarchy * Devolved		0.005		0.479***		0.228***
		(0.066)		(0.116)		(0.043)
Max value * Hierarchy		−0.067				
		(0.058)				
Difference (fertilizer) * Hierarchy				−0.128**		
				(0.046)		
Difference (trees) * Hierarchy						−0.017*
						(0.008)
Max value * Devolved		−0.056				
		(0.067)				
Difference (fertilizer) * Devolved				−0.150**		
				(0.051)		
Difference (trees) * Devolved						−0.018
						(0.014)
Max value * Hierarchy * Devolved		0.088				
		(0.059)				
Difference (fertilizer) * Hierarchy * Devolved				0.166**		
				(0.049)		
Difference (trees) * Hierarchy * Devolved						0.038***
						(0.010)
Country-Wave Fixed Effects	X	X	X	X	X	X
Demographic Controls	X	X	X	X	X	X
Geographic Controls	X	X	X	X	X	X
Num.Obs.	168 091	168 091	168 091	168 091	168 091	168 091
R2	0.251	0.253	0.250	0.253	0.253	0.256

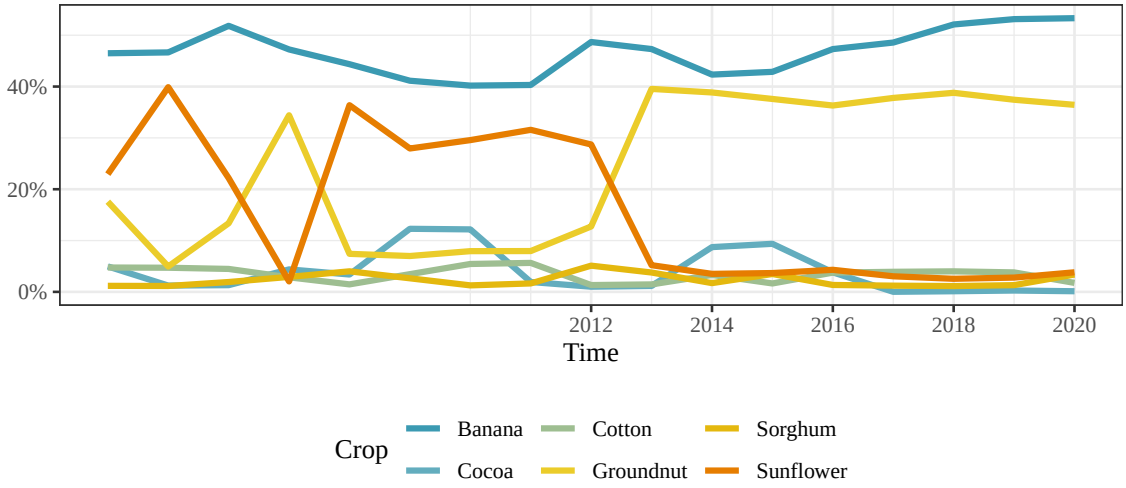
Note: The dependent variable of these models is a binary indicator for whether a household possesses a title for their dwelling. The independent variables are three metrics of land value (maximum attainable value, the returns to using fertilizer, and the returns to planting tree crops); the fraction of an administrative unit that is covered by a hierarchical precolonial institution; and whether the country has devolved its land regime to local authorities. All three land value variables are logged (plus 0.01). The unit of analysis is the household. Land value data vary at the second level administrative division, with the exception of Côte d'Ivoire (third level) and Malawi (first level). Demographic controls include the age, sex, and education of the household head; geographic controls include area, population density, an urban/rural indicator, and terrain ruggedness. Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

Table A10. Results are consistent when subsetting to only the most recent survey waves

	(1)	(2)	(3)	(4)	(5)	(6)
Max value	0.016	0.020				
	(0.051)	(0.047)				
Difference (fertilizer)			0.489	0.710		
			(0.463)	(0.423)		
Difference (trees)					0.057***	0.072
					(0.014)	(0.046)
Hierarchy		−0.028		−0.030		−0.005
		(0.074)		(0.083)		(0.050)
Hierarchy * Devolved		−0.058		−0.023		0.003
		(0.081)		(0.084)		(0.050)
Max value * Hierarchy		0.002				
		(0.014)				
Difference (fertilizer) * Hierarchy				0.061		
				(0.533)		
Difference (trees) * Hierarchy						−0.013
						(0.045)
Max value * Devolved		−0.028**				
		(0.009)				
Difference (fertilizer) * Devolved				−1.076***		
				(0.262)		
Difference (trees) * Devolved						−0.075
						(0.046)
Max value * Hierarchy * Devolved		0.035				
		(0.019)				
Difference (fertilizer) * Hierarchy * Devolved				0.898		
				(0.620)		
Difference (trees) * Hierarchy * Devolved						0.086
						(0.048)
Country-Wave Fixed Effects	X	X	X	X	X	X
Demographic Controls	X	X	X	X	X	X
Geographic Controls	X	X	X	X	X	X
Num.Obs.	60 857	60 857	60 857	60 857	60 857	60 857
R2	0.326	0.328	0.326	0.328	0.329	0.331

Note: The dependent variable of these models is a binary indicator for whether a household possesses a title for their dwelling. The independent variables are three metrics of land value (maximum attainable value, the returns to using fertilizer, and the returns to planting tree crops); the fraction of an administrative unit that is covered by a hierarchical pre-colonial institution; and whether the country has devolved its land regime to local authorities. All three land value variables are logged (plus 0.01). The unit of analysis is the household. Land value data vary at the second level administrative division, with the exception of Côte d'Ivoire (third level) and Malawi (first level). Demographic controls include the age, sex, and education of the household head; geographic controls include area, population density, an urban/rural indicator, and terrain ruggedness. Data are from the DHS and LSMS projects. All regressions use OLS with survey weights and country-wave fixed effects. Standard errors are clustered at the country-wave level.

Figure B1. Percentage of grid cells where each crop is most valuable



Note: This figure excludes crops which are the most valuable in less than one percent of grid cells. Data are from the FAO's Global Agro Ecological Zone model and the IMF's Primary Commodity Price System.

B Measurement strategy for crop prices

This appendix section provides additional details on the geospatial strategy for measuring land values and the returns to agricultural investment.

B.1 Measurement details

Figure B1 shows the percentage of grid cells for which a given crop has the highest attainable value. The figure excludes crops which are the most potentially valuable in less than one percent of grid cells. This excludes a number of important cash crops; coffee, for example, often has high attainable values but only within small areas.

These data are an important first check for whether this land value metric appears accurate. All seven listed crops are common across different parts of Africa. Bananas are consistently the most profitable potential crop. Cotton is a notable cash crop in the Sahel. Sorghum is notable for growing where other crops would falter. It is important to note that crops can be consistently profitable without appearing in these time series. These figures suggest that this measure has some face validity for measuring change in agricultural attainable value.

Table B1 shows the descriptive statistics for the land value measure in each year (in constant

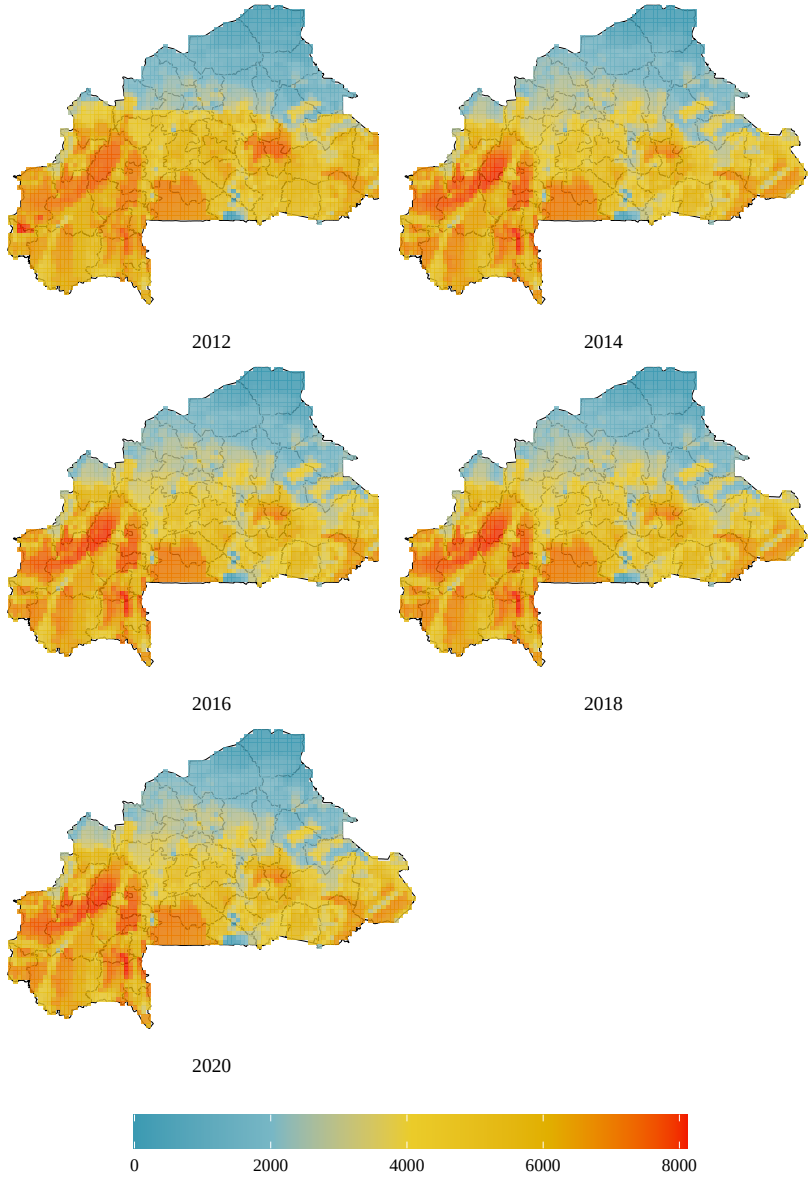
Table B1. Attainable yield summary statistics by year

Year	Mean	StdDev	Min	25th percentile	Median	75th percentile	Max
2011	2562.7	2070.1	0	446.8	2663.5	4270.3	8526.8
2012	2277.9	1842.6	0	344.5	2397.4	3823.1	7778.0
2013	2476.2	1985.1	0	336.8	2645.6	4167.6	8236.8
2014	2271.8	1849.9	0	275.1	2384.7	3821.1	7511.8
2015	2105.9	1729.6	0	254.3	2199.8	3516.6	7447.4
2016	1963.1	1621.7	0	237.9	2047.8	3261.0	7577.5
2017	2054.5	1702.8	0	257.1	2119.7	3413.1	7950.7
2018	2078.5	1727.4	0	267.1	2130.2	3467.9	8292.6
2019	1886.7	1588.3	0	231.1	1929.6	3110.2	8107.5
2020	1975.7	1660.5	0	235.7	2037.0	3255.9	8531.1

Note:
Values are in 1000s of constant 2011 U.S. dollars. Data are from the FAO's Global Agro Ecological Zone model and the IMF's Primary Commodity Price System. These data only cover the countries included in the combined DHS/LSMS dataset.

2011 USD). These values are roughly similar per year, but we can see some key trends. Values decrease over time. While the maximum value increases most years, the 25th percentile, median, and 75th percentile decrease over time. These data illustrate how additional political variables are necessary to contextualize the relationship between the value of land and the uptake of land titles. Land tenure formalization is increasing over time; attainable land values are not. These data are too detailed for visual detail across the continent, but Figure B2 shows this change over time in an example country: Burkina Faso. Overall the trends are the same. Different regions of Burkina Faso see different fluctuations; for example, the Hauts-Bassin regions sees an increase in values around 2012 and 2014. Attainable yields are much lower in the arid far north of the country.

Figure B2. Attainable agricultural value per hectare in Burkina Faso, 2012-2020



Note: Values are in 1000s of constant 2011 U.S. dollars. Data are from the FAO's Global Agro Ecological Zone model and the IMF's Primary Commodity Price System.

B.2 Crop planting elasticity

The primary contributions of this paper are twofold: it documents extensive variation in the uptake of formal land titles, and it shows how neither land values nor the returns to potential agricultural investment predict land titling in a vacuum. For these measures to be valid, they need to affect other economic behaviors that one would suppose to be associated with land values. In this section, I specifically examine whether farmers in areas where crop c has a higher attainable value actually plant more of crop c. In other words, I calculate the elasticity of crop plantings with regards to the attainable value of the crop. For this strategy to measure land values to be reasonable, I would exect a positive association: farmers plant more of crop c where crop c is more profitable.

I calculate these numbers using a subset of the LSMS. This set of surveys, called the *Enquêtes Harmonisé sur les Conditions de Vie es Ménages*, was sponsored by ECOWAS, the Economic Community of West African States. These surveys took place in Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Sénégal, and Togo in both 2019 and 2021. It is useful because the harmonized surveys use identical variable coding, which allows cross-national analysis beyond the level of simple variables such as whether a household possesses a title.[44] These data cover a variety of state capacities, land regimes, and climactic zones.

For each household in this sample, I first calculate the household's overall landholdings. I then calculate the fraction of those landholdings dedicated to a crop. The resulting data uses the household-crop as its unit of observation. For example, one observation would be the fraction of household i's land on which cocoa is grown, another observation would be the fraction of household i's land on which sorghum is grown, and so on. To avoid inflating my sample size without meaningful variation, I only include crops which are grown in the given country. For instance, I do not include sorghum in Côte d'Ivoire, where it is rarely grown, but do include it in Mali and Niger, where it is a major crop.

Table B2 shows the relationship between the attainable value per hectare of a given crop (calculated across the 2nd level administrative division) and the fraction of households' landholdings planted with that crop. Columns 1 and 2 are untransformed; because this relationship can be thought of as an elasticity, I also include columns 3 and 4, which log-transform both the explanatory and outcome variables. The results are strong and statistically significant. For the

[44] More specifically, because LSMS surveys (apart from the EHCVM) are collected by national statistics agencies, variable definitions change. There is no equivalent to the DHS recode files, in which large amounts of variables can be easily combined across countries. Using the EHCVM data removes this challanges and renders data analysis more feasible.

Table B2. Households grow more of a crop when its attainable value per hectare is higher

	(1)	(2)	(3)	(4)
Total value of crop	0.044***	0.047***		
	(0.006)	(0.006)		
log(Total value of crop)			0.130***	0.159***
			(0.017)	(0.020)
Country/Crop Fixed Effects	X	X	X	X
Demographic Controls		X		X
Num.Obs.	392 786	368 394	392 786	368 394
R2	0.348	0.346	0.365	0.369

Note: The dependent variable in these models is the fraction of a household's agricultural land where a crop is the principal planting. The independent variable measures the total attainable value for this crop. Observations are at the household-crop level; the data include all crops which are grown in the respondent's country at least once. All regressions include country-crop fixed effects; standard errors are clustered at the second-level administrative division.

elasticity regressions in particular, a one percent increase in the attainable value of a crop leads to a 0.130-0.159 percent increase in the fraction of land farmers dedicate to that crop.

Table B3 shows similar results, but with a different explanatory value. Using my land value measure, I back out the percentage of grid cells in a given administrative area where crop i is the most potentially valuable. This strategy provides an alternative measure: if crop i increases in value, it may still not be the most profitable crop, and so changes to the price of crop i may not be picked up in this paper's primary regressions. In contrast, the percentage of an area where crop i is most profitable is invariant to shifts in prices of other crops, unless that price moves above the threshold to where it has a higher attainable value than crop i.

In Table B3, the results are similar to those of Table B2. For a one percent increase in the fraction of an administrative region where crop c has the highest attainable value, the fraction of households' land on which they grow crop c increases by 0.076-0.080 percent. The crop-level elasticity of planting with regards to the land value for that crop is positive and statistically significant.

Taken together, these results suggest that my measure of land values is indeed capturing the underlying agricultural conditions which could drive land titling. Farmers make planting decisions in ways consistent with the measure of land values. Where the attainable value of that crop is higher, farmers are more likely to plant it.

Table B3. Households grow more of a crop in areas where it is the most valuable potential crop

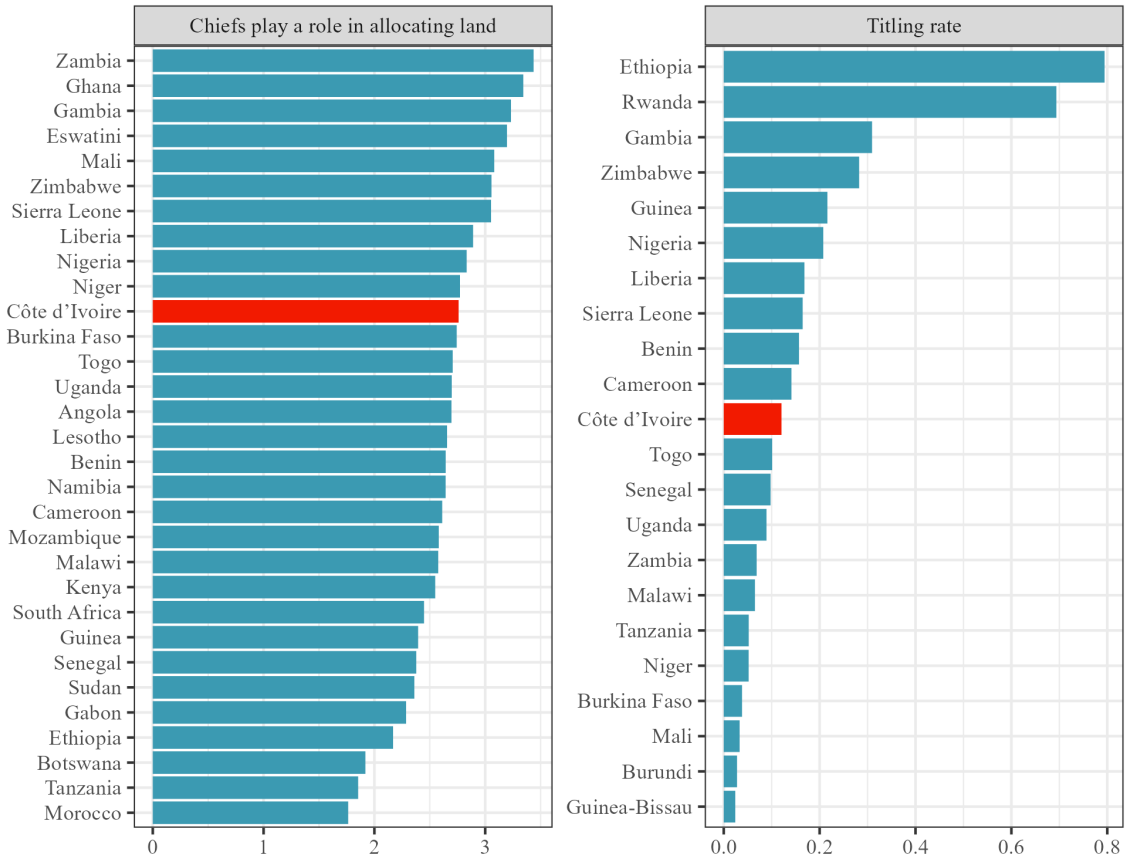
	(1)	(2)	(3)	(4)
Total value of crop	0.030*	0.033*		
	(0.013)	(0.014)		
log(Total value of crop)			0.080***	0.076***
			(0.021)	(0.020)
Country/Crop Fixed Effects	X	X	X	X
Demographic Controls		X		X
Num.Obs.	392 786	368 394	392 786	368 394
R2	0.339	0.336	0.358	0.361

Note: The dependent variable in these models is the fraction of a household's agricultural land where a crop is the principal planting. The independent variable measures the fraction of grid cells within the second level administrative division where a given crop is most profitable. Observations are at the household-crop level; the data include all crops which are grown in the respondent's country at least once. All regressions include country-crop fixed effects; standard errors are clustered at the second-level administrative division.

C Côte d'Ivoire survey details

C.1 Case selection

Figure C1. Côte d'Ivoire is roughly average in terms of land titling and chief's influence on land allocation



The lefthand panel shows answers on a four point likert scale (1=None, 2=A small amount, 3=Some, 4=A lot) to the question "How much influence do traditional leaders currently have in each of the following areas: allocating land?" Data are from round 8 of Afrobarometer and use within-country survey weights. The righthand panel shows country averages of titling rate from the most recent round of DHS or LSMS data collection.

This figure shows Côte d'Ivoire's relative position on two key dimensions of the broader theory of this paper. The lefthand panel shows results from round 8 of Afrobarometer for the question "How much influence do traditional leaders currently have in each of the following areas:

allocating land?" Côte d'Ivoire is ranked 11th out of 31 countries in which the question was asked. The righthand panel shows country-level averages from the DHS and LSMS data that I use for the main analyses. Côte d'Ivoire is ranked 11th out of 22. These data support the choice of Côte d'Ivoire as a case study—it is roughly typical on both of these important dimensions.

C.2 Sampling strategy

My sampling strategy for this survey was meant to maximize variation on my key explanatory outcome: chiefs' political authority.[45] To do this, I leverage a process called village delimitation, which unfurled differently depending on the period of time in which a village was delimited.

Arriving families often established their fields and households at some distance from the original village. Over time, these settlements grew into hamlets and 'campements.' These hamlets often rival the original village in population and economic prominence. The high number of ethnicities and these quilt-like settlement patterns mean that the important cleavage for land disputes in Côte d'Ivoire is autochthone versus allochthone, not ethnicity per se. This also means that before delimitation, any given area in Côte d'Ivoire will have a diverse set of autochthonous villages, allochthonous villages, camps, hamlets, and other populated clusters. Delimitation forces the issue of the hierarchy between these settlements.

Delimitation also forces the issue of hierarchy between customary elites. Each village, hamlet, etc., has its own customary headman or chief. When villages are delimited, some villages and chiefs will see their status merely confirmed; others will see their relative position increased or decreased. For example, the headman of a campements could suddenly find himself an independent chief of an administrative village. A formerly independent chief could find himself chief of an 'attached' village. This process creates the potential for village delimitation to create a sudden shock to a chief's perceived authority or legitimacy.

The political value of this process has not gone unrecognized by Ivoirian elites. The Ivoirian land regime has alternated between two conceptions of land rights: use-based and customary (Boone 2018). Use-based land regimes favor allochthones who currently farm parcels of land. Often these allochthones are better capitalized than the autochthones—many of the cocoa and coffee plantations in the central forested regions of the country are maintained by Burkinabè and Baoulé migrants.[46] Use-based rights are exemplified by the long-serving Ivoirian president

[45]The text for this section is largely taken from the registered pre-analysis plan, available at the Open Science Foundation Registry.

[46]The Burkinabé element means there is also an element of nationalism (*Ivoirité*) in Ivoirian debates over land policy, which is not strictly relevant to this natural experiment. Between 2014 and November 2022, 95 percent of

Houphouët-Boigny's famous statement: "the land belongs to whoever develops it." Importantly, the wealthy autochthonous planters were important supporters of Houphuët-Boigny, so a use-based land regime was a political necessity (Zolberg 1964).

After a length political power-struggle in the 1990s following Houphuët Boigny's death, the country passed the 1998 land law (Law 98-750), signalling a new, customary land regime. The law "contained an array of potentially or inherently conflicting provisions for assigning land ownership rights on the basis of autochthony" (Boone 2018: 191). In other words, this law recognized the rights of those who inherited a customary claim to the land from their ancestors, generally those who first settled the area. Laurent Gbagbo, the opposition leader, was the major proponent of this policy as it benefitted his largely autochthonous political supporters. His support for customary land rights continued after he gained power in 2000. This land agenda was the centerpiece of a broader effort towards decentralization and the elevation of customary elites, such as village chiefs. In 2010, Alassane Ouattara was elected president; Laurent Gbagbo refused to accept these results. By 2011, pro-Ouattara forces (and their French allies) arrested Gbagbo, and Ouattara was firmly ensconced in power. Importantly, the use of village delimitation as a crutch for autochthonous land rights was also abandoned. Rather, village delimitation was used as a tool of state-building (Boone 2018).

To summarize, there are three periods of village delimitation in Côte d'Ivoire. The first period, until 1998, emphasized use-based land rights and favored allochthones. From 1998 to 2010, the 1998 land law promoted use-based rights and favored autochthones. Finally, after Ouattara took power in 2011 village delimitation has been neuteral with regards to autochthony. These shifts are independent of local circumstances—the actual timing of village delimitation has largely been determined by donor considerations. I conducted the survey in three sets of villages: villages which did not see a change in status (control villages), villages where the village was downgraded (chiefs received a negative shock to their legitimacy) and villages where the status was upgraded (chiefs received a positive shock to their legitimacy. Table C1 summarizes these different villages.

Delimitation has primarily taken place through a series of externally funded programs. These programs are:

- The Plan Foncier Rurale (PFR) (1989-1997), sponsored by the World Bank. This program took place across five pilot zones in Abengourou, Béoumi, Daloa, Korhogo, and Soubré.
- The Rural Land Management and Community Infrastructure Project (1997–2010), also known as the Projet National de Gestion des Terroirs et d'Équipement Rural (PNGTER).

certificats fonciers gazetted in the *Journal Officiel de la République de Côte d'Ivoire* belong to Ivoirien nationals.

Table C1. The history of delimitation in Côte d'Ivoire creates three treatment groups

		After delimitation	
		Attached	Independent
Before delimitation	Attached	No change (control)	Upwards shock (treatment)
	Independent	Downwards shock (treatment)	No change (control)

This program was primarily funded primarily by the World Bank, with contributions from the Ivoirian government and the Agence Française de Développement (AFD). It was meant to expand the PFR across Côte d'Ivoire, but only formalied 171 villages (Bassett 2020: 152).

- The Village Lands Delimitation Pilot Operation, between 2000 and 2001, was funded by the AFD, which failed to delimit additional villages.
- The National Land Tenure Security Program from 2007 to 2012 (Programme National de Sécurisation du Foncier Rural [PNSFR]) also made extremely limited advances in village delimitation.
- The Support Project for the Revival of the Agricultural Sector (Projet d'Appui à la Relance des Filières Agricoles de Côte d'Ivoire [PARFACI]) from 2012 to 2020 built on PNSFR, and delimited 639 villages (AFOR, n.d.).
- The World Bank is currently supporting the Project for the Improvement and Implementation of the Rural Land Policy of Côte d'Ivoire (Projet d'Amélioration et de Mise en Oeuvre de la Politique Foncière Rurale [PAMOFOR]), which started in 2018. The project targets 665 villages across 19 departements; as of 2023, it delivered 41,032 land certificats, making PAMOFOR a dramatic step-up in the pace of land titling and village delimitation. 12 of the 80 villages in which I conducted my survey were selected for PAMOFOR, and I include a binary control for PAMOFOR participation at the village level.

Between these programs and independent efforts, approximately two thirds of Côte d'Ivoire's 8,533 have been delimited.[47] Both Ivoirian and World Bank officials have noted that the pace of both land titling and village delimitation has massively scaled up since the establishment of

[47]The two thirds figure comes from a series of conversations with Ivoirian officials. The 8,533 figure comes from the 2014 repetoire des localités.

AFOR in 2016. This trend is also visible in the publication of *certificats fonciers* in the Ivoirian national gazette (*Journal Officiel de la République de Côte d'Ivoire*).

The survey took place in the rural Indénié-Djuablin and Haut-Sassandra regions. I selected these regions for two reasons. First, they both experienced limited delimitation efforts as part of the World Bank's PNGTER project. Second, these areas are both squarely located in the country's middle forested region, where cocoa and coffee are commonly grown. These areas were the loci of Burkinabè and Baoulé migration during the Houphouët-Boigny regime. As a result, these areas have the patchwork of autochthonous and allochthonous settlements on which this experiment is predicated. Within these two regions, I sampled within the Daloa and Vavoua departments in Indénié-Djuablin region, and the Abengourou and Agnebilekrou departments in Haut-Sassandra region. As with the region-level selection, this choice is driven by the program areas of the PNGTER intervention.

My sampling frame was the list of villages from the 2014 census of locations (*répertoire des localités*). I randomly sampled villages across three strata, each strata corresponding to a period in which villages were delimited. One strata comprised villages delimited before 1998 (as part of the original PFR program); another strata comprised villages delimited between 1998 and 2010; and the third strata comprised the remainder of villages.

I used a variety of secondary literature to identify which villages were delimited in each period. First, the impact evaluation of the PFR program has extensive appendices; I sorted all villages which were mentioned at least once in this report into the first strata (Côte d'Ivoire 1996). The second strata comprised villages delimited as part of the PNGTER program, thanks to records generously shared by Catherine Boone. All remaining villages in the census of locations comprise the third strata. This strategy assumes that villages which were not formalized as part of the PNGTER or PFR program were not delimited through another program, but a review of existing evidence suggests that this is the case (Bassett 2020). Regardless, the purpose of stratifying is not to ensure that sampled villages were delimited on a precise time frame, but to ensure that there is variation over the period of time in which villages were delimited.

Within villages, I sampled both the administrative village and either one or two outlying hamlets/settlements. In each settlement/village, I will first administer a brief survey to the village's chief or headman.[48] This survey confirms the village's history and experience with delimitation. From this survey, I hope to glean the treatment category to which the village belongs.

Finally, in each village/settlement, I administered a survey to heads of households. House-

[48] If the chief was unavailable, I spoke with a member of the village land management committee, the CVGFR.

holds were chosen via a random walk. I will aim to administer the survey to 10-15 households per administrative village: five in the administrative village, and five in at most two hamlets/ campements/attached villages. We randomly decided the village in which we would sample one versus two outlying hamlets; the choice to sample on average 1.5 hamlets was made for budgetary reasons. I surveyed 80 administrative villages, giving a total sample of 192 chiefs/headmen (one per administrative village, plus one or two per hamlet, depending on the number of existing outlying settlements) and 801 household heads.

C.3 Survey methodology

This section outlines additional details surrounding the field survey in Côte d'Ivoire. Specifically, table C2 shows how the two indices of chiefly authority on which I rely—overall authority and the extent to which the chief is secular—are constructed from the underlying questions.

The original questions are : "Now I am going to read you a list of activities that chiefs in Côte d'Ivoire sometimes mandate. For each of these activities, I would like you to tell me how much of the village you think would do what the chief asked them to do." The seven activities were: (1) Participate in village cleanup day; (2) Give up a piece of land for a school; (3) Give up a piece of land for a mosque; (4) Spend a day repairing a road; (5) Spend a day planting trees; (6) Come to participate in a traditional dance; and (7) Give money to support a traditional ceremony. For each of these activities, respondents answered: 1 = nobody, 2 = very few people, 3 = some people, 4 = most people, or 5 = everybody.

I then used principal component analysis (PCA) to isolate the axes on which these responses vary. The principal component for observation i would be the dot product of the vector of weights and the vector of responses for observation i. The first principal component (overall chief's authority) explains approximately 29 percent of total variation. Table C2 shows that it is relatively evenly weighted across the different questions. As a result, I refer to the first principal component as the chief's overall authority. The first principal component also has a correlation coefficient of 0.99 with the simple sum of these responses.

The second index captures the extent to which a chief is perceived as secular. I divide these activities into ones more reflective of a chief's administrative roles, and ones that are more reflective of their role as a traditional leader—such as participating in a traditional dance or giving money to a traditional ceremony. This index is positively weighted on the secular activities (except for giving a piece of land for a school) and negatively weighted on the customary activities. For example, a respondent who thinks their chief has a very strong ceremonial role but wouldn't

Table C2. Principal component loadings on individual chiefly authority items

	Principal components			
Activity	1st	2nd	3rd	4th
Secular				
Participate in village cleanup day	0.30	0.15	0.01	0.45
Spend a day repairing a road	0.39	0.45	0.06	0.14
Spend a day planting trees	0.44	0.56	0.10	-0.45
Give up a piece of land for a school	0.37	-0.11	-0.24	0.64
Customary				
Give up a piece of land for a mosque	0.39	-0.32	-0.76	-0.36
Participate in a traditional dance	0.39	-0.33	0.36	-0.15
Give money for a traditional ceremony	0.36	-0.49	0.48	-0.07

Note: Data from a 2024 household survey in the Haut-Sassandra and Indénié-Djuablin regions of Côte d'Ivoire. This table shows the first four of seven principal components, ranked in order of the fraction of explained variance.

listen to the chief on more practical matters such as repairing a road would rank negatively on this index.

C.4 Additional analyses

I also display a variety of alternative analyses of these survey data. First, table C3 shows a balance table of several variables broken out by whether the respondent is an autochthone or an allochthone. This table illustrates several key factors. First, autochthones trust chiefs more. While the distinction is not quite significant for the 'chief is secular', autochthones are much more likely to report that they trust their chiefs and their land committees (CVGFRs). This table also shows that autochthones perceive titles to be dramatically more useful across all measures. Finally, autochthones are less likely to believe that the chief could prevent you from titling and that there is enough land in the village, but are more confident that they could hold on to their land.

Next, table C4 elaborates on results presented in section 5.5. Specifically, it shows results from a dictionary method to code chief's and headmen's responses to "what effect does land titling have on village chiefs in Côte d'Ivoire?" Specifically, I code two responses: (1) that land titling reduces conflict, and (2) that land titling helps chiefs to execute their responsibilities. The explanatory variables are the village type and the village averages of the chief's authority indices. This table shows that headmen of attached villages are less likely to say that titling reduces conflict. Outlying

Table C3. Allochthones and autochthones have different opinions about land titling

	Autochthones		Allochthones		Difference
	Mean	Std.Err.	Mean	Std.Err.	T-score
Chief's authority					
Overall chief's authority	-0.25	2.19	-0.09	2.03	-1.07
Chief is secular	0.27	1.21	0.12	1.11	1.88
Trust in chiefs	0.43	0.77	0.12	0.78	5.56
Trust in land committee	0.46	0.63	0.15	0.85	5.71
Cost of titling					
N. actors you pay to formalize	2.60	1.60	2.92	1.79	-2.67
N. customary actors you pay to formalize	3.82	2.15	3.81	2.04	0.05
N. steps to title	9.77	6.27	9.45	6.05	0.72
Titles are helpful to:					
Succede in a land dispute	4.80	0.56	4.50	0.83	5.95
Keep their land if govt. tries to take it	4.56	0.91	4.37	0.76	3.23
Be compensated fairly for taken land	4.82	0.52	4.56	0.77	5.72
Other titling opinions					
Chief could prevent you from titling	2.41	1.51	2.85	1.44	-4.21
Likely to lose land while titling	0.50	0.83	0.51	0.77	-0.18
There is enough land in the village	0.78	0.86	0.99	0.84	-3.62
Likely to still have access to land in a year	4.21	1.18	3.98	1.17	2.78

Note: Data from a 2024 household survey in the Haut-Sassandra and Indénié-Djuablin regions of Côte d'Ivoire. 355 respondents are autochthones; 443 respondents are allochthones. All calculations use inverse sampling-probability survey weights.

hamlets and campements are subordinate to administrative villages and are largely allochthonous, so this result suggests that the titling process allows centrally located autochthones to settle scores against their neighbors. This table also shows that chiefs with higher secular indices are more likely to say that titling helps them perform their jobs, which is entirely consistent with more powerful chiefs being better able to capture the titling process.

Finally, table C5 replicates table 4, but using the individual components of the chief's authority questions rather than the indices. These tables are consistent. In table 4, the 'chief is secular' index is associated with higher land titling, but only for autochthones. Table C5 shows that the individual questions which comprise this index have similar results when deployed individually.

Table C4. Chief's authority and village status affect whether they think titles are helpful for chiefs

	Titling reduces conflicts			Titling helps chiefs		
	(1)	(2)	(3)	(4)	(5)	(6)
Overall authority	0.017		0.016	0.024		0.024
	(0.017)		(0.017)	(0.023)		(0.023)
Chief is secular	0.028		0.033	0.072*		0.071*
	(0.023)		(0.021)	(0.034)		(0.034)
Attached village		−0.133*	−0.138*		0.035	0.022
		(0.061)	(0.060)		(0.068)	(0.068)
Department FEs	X	X	X	X	X	X
Geographic Controls	X	X	X	X	X	X
Num.Obs.	194	194	194	194	194	194
R2	0.154	0.167	0.178	0.132	0.097	0.132

Note: These data are from the survey of chiefs and headmen. The outcome variable for columns 3 to 4 is whether the respondent mentioned that land titling makes conflict less frequent in response to: what effect does land titling have on village chiefs in Cote d'Ivoire? The outcome variable for columns 5 to 6 measures whether the respondent mentioned that titles would help chiefs in their duties in response to the same question. Results are coded using a dictionary method from free response answers. Geographic controls include an indicator for PAMOFOR, distance to department capital, cocoa suitability, coffee suitability, and terrain ruggedness. All regressions use OLS with inverse sampling probability weights. Standard errors are clustered at the administrative village level.

Table C5. Chief's authority and titling by participation in individual activities

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Clean village	0.031						
	(0.046)						
Land for school		−0.074*					
		(0.033)					
Land for mosque			0.025				
			(0.040)				
Repair road				0.083*			
				(0.035)			
Plant trees					0.141***		
					(0.034)		
Participate in dance						−0.049	
						(0.043)	
Money for ceremony							−0.055
							(0.047)
Clean village* Allochthone	−0.121+						
	(0.068)						
Land for school* Allochthone		−0.021					
		(0.049)					
Land for mosque* Allochthone			−0.008				
			(0.051)				
Repair road* Allochthone				−0.163**			
				(0.059)			
Plant trees* Allochthone					−0.179**		
					(0.054)		
Participate in dance* Allochthone						0.064	
						(0.061)	
Money for ceremony* Allochthone							0.050
							(0.059)
Hamlet/camp	−0.037	−0.030	−0.066	−0.051	−0.093	−0.083	−0.073
	(0.079)	(0.073)	(0.088)	(0.082)	(0.081)	(0.081)	(0.081)
Department FEs	X	X	X	X	X	X	X
Demographic controls	X	X	X	X	X	X	X
Geographic controls	X	X	X	X	X	X	X
Num.Obs.	776	771	772	770	764	773	773
R_2	0.086	0.101	0.071	0.095	0.133	0.076	0.078

Note: The dependent variable is whether a respondent has a formal land title. The independent variables are responses to: [f]or each of these activities [that chiefs in Côte d'Ivoire sometimes mandate], I would like you to tell me how much of the village you think would do what the chief asked them to do. Demographic controls include education, sex, age, ethnicity, the respondent's relationship to the household head, and wealth. Geographic controls include an indicator for PAMOFOR, distance to department capital, cocoa suitability, coffee suitability, and terrain ruggedness. All regressions use OLS with inverse sampling probability weights. Standard errors are clustered at the administrative village level.

D Precolonial hierarchy and contemporary customary institutions

My theory of land titling is predicated on the relationship between local hierarchy of precolonial institutions and the strength of contemporary political authorities. In this appendix, I probe that relationship using two sources of data: village-level information on chiefs' involvement in the village from the *Enquête Harmonisé sur les Conditions de Vie des Ménages*, and multiple waves of Afrobarometer.

Importantly, a wide body of literature supports linkages between precolonial hierarchical institutions and contemporary outcomes. Neupert-Wentz and Müller-Crepon (2024) show that groups with higher levels of precolonial institutions have higher levels of political centralization and functional differentiation today. Bahrami-Rad, Becker, and Henrich (2021) also show that the Murdock data correlate with contemporary social practices across a number of outcomes. Wilfahrt (2022) also shows that precolonial institutions condition the distribution of public goods in Sénégal.

Afrobarometer includes a variety of measures of confidence and reliance on customary institutions. Two reasons preclude me from using Afrobarometer for the main analysis. First, the Afrobarometer data are not available at a sufficiently granular level: the available data include only the respondent's first administrative division. In contrast, my outcome data on uptake of formal property rights are available at the second level administrative division, and my primary measure of land values is available at a 10km-by-10km grid across Africa. More importantly, even within the first level administrative regions, the sample size is relatively small. For example, the Saint-Louis region of Sénégal encompasses both the old colonial capital of French West Africa and much of the fertile rice-growing Sénégal River Valley. According to Sénégal's 2023 census, its population is 1.2 million. Afrobarometer sampled 80 respondents from this area for its eight wave; the 2019 round of DHS data collected 336 responses.

Both Afrobarometer and the DHS are accurate *on average*—estimates using these data are unbiased because the samples are random. Combining both sources of survey data will produce a lot of noise because of the moderate sample sizes. The probability of one respondent answering both surveys is minuscule. However, I can still compare Afrobarometer directly with the measure of hierarchy, because this geospatial data is universal in coverage.

Table D1 shows the relationship between two measures from wave 7 of Afrobarometer. The outcome variable measures the respondents' perceptions of how well their chief has done their job over the past twelve months. The independent variables are (1) a binary indicator for whether a precolonial hierarchical institutions existed within a 25 kilometer radius of the enumeration area

Table D1. Households approve the performance of chiefs in hierarchical areas, but only if households trust the chiefs

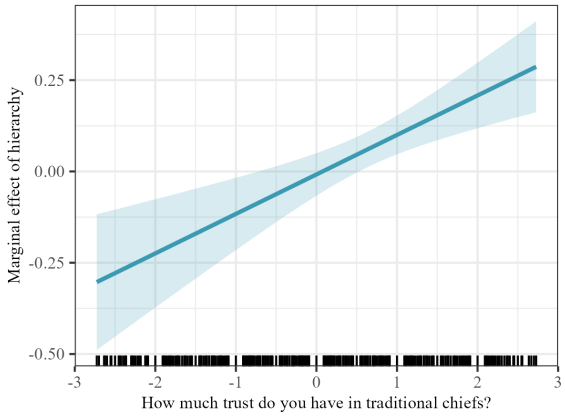
	(1)	(2)	(3)	(4)	(5)	(6)
Hierarchy	−0.026	−0.005	0.024	0.044	−0.008	0.012
	(0.027)	(0.027)	(0.026)	(0.026)	(0.030)	(0.030)
Trust in chiefs			0.094***	0.095***	0.020	0.022
			(0.011)	(0.010)	(0.024)	(0.023)
Hierarchy * trust in chiefs					0.108***	0.108***
					(0.027)	(0.027)
Country Fixed Effects	X	X	X	X	X	X
Demographic Controls		X		X		X
Num.Obs.	34 947	34 896	31 559	31 515	31 559	31 515
R2	0.070	0.076	0.047	0.052	0.048	0.053

Note: The dependent variable in this model is household responses to Do you approve or disapprove of the way the following people have performed their jobs over the past twelve months, or haven't you heard enough about them to say: Your Traditional Leader? The independent variables are: (1) a binary indicator for whether an enumeration area is within a hierarchical institution's boundaries, and (2) demeaned responses to How much do you trust each of the following, or haven't you heard enough about them to say: traditional leader. Data are from Murdock's ethnographic atlas and round seven of Afrobarometer. All regressions use OLS with survey weights and country fixed effects. Standard errors are clustered at the enumeration area.

centerpoint and (2) the respondents' reported trust in their village chief. For the latter, I subtract the respondents' average level of trust across all other surveyed institutions to obtain the chief-specific elements of trust. Hierarchy itself does not affect whether the respondent approves of the chief's performance. Unsurprisingly households who trust their chiefs more approve more of the chief's performance: a one standard deviation increase in trust in chiefs is associated with a 0.05 standard deviation increase in perception the chief is doing a good job—a statistically significant but modest increase.

However, columns 5 and 6 show that this increase is concentreated entirely among areas which contain a hierarchical precolonial institution. Figure D1 shows the marginal effect of hierarchy by trust in chiefs. In other words, people in areas with hierarchical precolonial institutions approve their chief's performance more when they trust their chief. In contrast, trust in chief does not affect approval of the chief's performance absent hierarchical precolonial institutions. These results show that hierarchy is a key element of how citizens perceive the performance of chiefs.

Figure D1. The marginal effect of hierarchy on chief's performance depends on household confidence in customary leaders



The lefthand panel shows answers on a four point likert scale (1=None, 2=A small amount, 3=Some, 4=A lot) to the question "How much influence do traditional leaders currently have in each of the following areas: allocating land?" Data are from round 8 of Afrobarometer and use within-country survey weights. The righthand panel shows country averages of titling rate from the most recent round of DHS or LSMS data collection.

E Additional information on land regime coding

This section provides narrative details to justify the coding of different countries having devolved or centralized land tenure regimes. The crux of this coding is the location of decisions about which households can formalize a title. In many contexts, titles are approved at various stages in the process, but these approvals are often just a confirmation that the appropriate forms were observed. Similarly, I do not code local offices of a national land bureau as indicative of devolved tenure.

Land tenure formalization procedures in Côte d'Ivoire exemplify these distinctions. The first legal step to obtaining a *certificat foncier* (CF) in the country is to gain the approval of the village land committee (CVGFR). The CVGFR approves the dossier and sends it over to the sous-prefect, who signs it to "control the process." Then the dossier goes to the local office of the national land bureau (AFOR) to record it and to verify that the correct procedure was followed. The CF is then entered into the country's national gazette. So, technically three seperate institutions are involved in the titling process (the CVGFR, the sous-prefects, and AFOR), but the decision about whether to approve the title is made only by the CVGFRs. The other agencies are only involved in verifying that the process was correct, so I code Côte d'Ivoire as devolved.

Table E1. Narratives for coding devolved and centralized land regimes

Country	Devolved	Narrative	Sources
Angola	No	Land tenure is on-demand as per the 2004 land law. There is no national land agency, and most land administration is non-functioning throughout Angola. The 2004 land law said that farmers had to register land by 2010 or risk losing it, but then the government failed to follow up and most land remains un-registered.	Safarik, Navarra, and Rodrigues 2022
Benin	Yes	Land in Benin is governed by the 2009 Code Foncier et Domanial. A national land agency exists, which has implemented a quasi-national cadaster. Benin was also one of the pilot countries for the World Bank's Plan Foncier Rurale (PFR) program. There is a national rural land agency, but rural land management is devolved to the level of the commune, through the Bureaux Communals du Domaine et du Foncier, who approve titles.	Deininger and Goyal 2024; Delville 2019

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Table E1. Narratives for coding devolved and centralized land regimes *(continued)*

Country	Devolved	Narrative	Sources
Burkina Faso	Yes	Land tenure was heavily altered by the 2009 land law, and a subsequent MCC compact. This created land institutions at the municipality and commune levels which adjudicate titles. This means that land was heavily devolved from the Sankara-era legislation, which vested all land with the state. Land tenure remains 'on demand' from these various offices, and a few thousand certificats were distributed, which confirms that certificats are indeed available.	Hughes 2014
Burundi	Yes	Land tenure in Burundi was theoretically devolved by a 2011 land law; land titles are now administered and adjudicated by local Services Fonciers Communaux. Land titles are available but uptake is low. The binding constraint on issuing land titles in Burundi appears to be state capacity, rather than a policy framework.	Tchatchoua-Djomo, Leeuwen, and Haar 2020
Cameroon	No	Applications for land titles in Cameroon are submitted directly to the Divisional Service of Lands. I find no evidence of recent land reform, despite ongoing dialogue within Cameroonian civil society. Very few land certificates here.	Njoh 2013
Cote d'Ivoire	Yes	While the Agence Foncier Rurale formally issues titles, they are adjudicated by Comités Villageois de Gestion Foncier Rurale. Sous-prefects and AFOR officials approve titles, but only to ensure that due process was followed.	Author's own field work
Ethiopia	Yes	In 2003-5, the country underwent a top-down land titling process which demarcated more than six million plots. Land-use committees were elected at the village level, who demarcated parcels and issued certificates. Disputed parcels were appealed to local courts, but the process remained devolved.	Deininger and Goyal 2024: 64–5

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Table E1. Narratives for coding devolved and centralized land regimes *(continued)*

Country	Devolved	Narrative	Sources
Gambia	No	The Ministry of Lands and Regional Government administers freehold and leashold land, although most land in the country remains help in customary tenure. I found no evidence of intermediate institutions which govern land titling, with the exception of customary authorities (alkalos) who govern customary land administration at the village level.	Larson et al. 2021
Guinea	Yes	There are no intermediate land organizations in Guinea to which land institutions are devolved. A new land law took effect in 2024, the effects of which are still unclear, but this took place after these data were collected.	USAID 2016
Guinea-Bissau	Yes	Land has been devolved to local 'land commissions' at the level of the sector. Property rights are technically available—especially in the area around Banjul—but remain rare. Most property is controlled by traditional authorities.	Bank 2006
Kenya	Yes	National Land Commission exists, but practical power is largely devolved to the County Land Management Boards.	Boone et al. 2019; Dyzenhaus 2021
Lesotho	No	All land tenure formalization in Lesotho goes through the national level Land Adminsitration Authority.	Deininger and Goyal 2024: 62–3
Liberia	No	The Liberian Land Authority in Monrovia is a 'one-stop shop' for land titling in the country	The Liberia Land Authority's website.
Malawi	No	Land in Malawi is largely divided between large-scale plantations and small holder farms. The small holder farms hold land almost exclusively through customary tenure, but there is no intermediate formal organization which manages land, it's administered through the Malawi ministry of lands.	Deininger and Xia 2017
Mali	Yes	The 2000 Land tenure code governs land tenure formalization in Mali. Land planning is devolved to the commune level.	Hughes 2014
Niger	Yes	Land tenure in Niger is governed by the 1993 rural code, and most land is still in customary hands. Land tenure certificates are issued at the department level.	Hughes 2014

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Table E1. Narratives for coding devolved and centralized land regimes *(continued)*

Country	Devolved	Narrative	Sources
Nigeria	Yes	Administration of property and property taxes are the responsibilities of Nigerian states	Deininger and Goyal 2024: 119
Rwanda	No	Rwanda is one of the few examples of comprehensive titling in sub-Saharan Africa. All titling goes through the National Land Authority in Kigali.	Deininger and Goyal 2024: 62–3
Senegal	Yes	Land titles (deliberations foncieres) in Senegal are arbitrated and awarded by the 'commissions domaniales' of local municipal councils.	Honig 2022, author's own experiences
Sierra Leone	No	The land tenure system in Sierra Leone was largely inherited from the British colonial period, whereby the state ruled indirectly through customary chiefs. As a result, there are no intermediate institutions administering land tenure formalization between the state and the chief. However, similar to Liberia, different land tenure systems prevail across the country: formal tenure is more common in the Western Peninsula (around Freetown), and customary tenure is dominant in the four rural provinces.	Dieterle 2023
Tanzania	No	The Tanzanian Ministry of Lands Awards titling. While village land committees exist, they deal exclusivly with land usage, not with land titling. Land tenure administration in Tanzania also contends with the legacies of the country's previous experiences with 'African socialism.'	Deininger and Goyal 2024: 69–70
Togo	No	A 2018 land reform put into place a national land agency (Agence nationale du domaine et du foncier), but the implementation is unclear. Nevertheless, the bill does not mention any intermediate agencies or devolved powers, so I classify this as a centralized system. In fact, Togo is the only centralized system among francophone African countries.	Gagné 2023

(Continued on Next Page...)

Table E1. Narratives for coding devolved and centralized land regimes *(continued)*

Country	Devolved	Narrative	Sources
Uganda	No	Different areas of Uganda have historically different forms of tenure, most notably a 'mailo' system wherein many landlords are absentees. While a legal framework has been developed for local government to handle certificates of occupancy, these local institutions do not appear to have been stood up. Moreover, the Department of Land Registration at the Ministry of Land, Housing, and Urban Developments is responsible for titling.	Nakanwagi and Morokong 2021
Zambia	Yes	Land tenure policy in Zambia largely descends from British colonial legislation. Land tenure adminstration has largely been devolved explictly to customary chiefs , who are recognized by the state. According to Honig (2022: 154), "any new title on customary land must have the written permission of an official chief."	Honig 2022
Zimbabwe	No	Land tenure in Zimbabwe is largely subject to political pressure; as a result, there is no intermediary between households, the Deeds Registry which records transactions, and the Ministry of Lands, Rural Resettlement which oversees land tenure formalization. Previous land redistribution continues to shape land tenure policy in Zimbabwe.	Nyoni 2016

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