STATES, LAW, AND PROPERTY RIGHTS IN WEST AFRICA

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ABSTRACT. This paper investigates the factors that have shaped the institutions governing property in land in West Africa. Using a regression discontinuity design, I estimate the effects of the divergent *de jure* property law of Ghana and Côte d'Ivoire on *de facto* property rights institutions. I find that households just on either side of the border between the two states report similar prevalence of rights to transfer their land. My findings provide evidence that formal law has played a limited role in property rights institutions and that instead non-state sources of norms shape the *de facto* rules governing real property. Furthermore, I show that part of the substantial within-country variation in property rights institutions is explained by economic factors, as hypothesized by Demsetz (1967). In particular, areas that are more suitable for growing cocoa have a greater prevalence of transfer rights, providing evidence that the commercialization of agriculture has led to more individualized property rights institutions.

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1. INTRODUCTION

Where do property rights come from? That is, what forces and actors determine and enforce the bundles of rights that ownership confers? Some accounts of the development of property rights accord the state a central role. For example, Douglass North argues that "[t]he essence of property rights is the right to exclude, and an organization which has a comparative advantage in violence is in the position to specify and enforce property rights" (North, 1981, p. 21). North offers a "neoclassical theory of the state" that defines the state as such an organization. However, there are many sources of normative orderings other than the state, and a growing literature documents the importance of informal social norms (e.g., Ellickson, 1991; Posner, 2000).

This paper investigates the factors that have shaped the institutions governing property in land in West Africa. I first examine the impact of states and formal law on the actual *de facto* institutions experienced by rural households. I use data from Ghana and Côte d'Ivoire, two neighboring states that have had very different state institutions and *de jure* property law. In particular, beginning with British rule in the colonial period, the Ghanaian state has incorporated customary law on land, which limits the rights of households to alienate their land, into its common law regime. In contrast, the French rulers of Côte d'Ivoire largely ignored customary insitutions, declaring all unused land property of the state, and the postcolonial Ivorian state continued the policy of marginalizing customary institutions in the *de jure* legal regime.

National-level measures of property rights institutions in the two countries are consistent with the view that these differences in *de jure* legal institutions had large effects on *de facto* institutions: a much larger fraction of households in Côte d'Ivoire report the right to alienate their land than in Ghana. However, the two countries are different in ways other than state institutions and policies, such as in geography, pre-colonial population density, and ethnic group composition. Comparisons at the national level cannot disentangle the causal effect of state institutions and policies from the effects of these other differences.

My empirical approach is to instead use household-level data in a regression discontinuity design that exploits the discontinuous change in *de jure* law at the international border. While areas

of Ghana and Côte d'Ivoire far from the border are quite different, as you approach the border between the two countries the geography and pre-colonial ethnic groups and institutions on either side converge. As long as other determinants of institutions vary continuously at the border, any differences in property rights institutions in the areas just on either side of the border must result from the cumulative effects of state policies and *de jure* law from the time the border was drawn to the present rather than from preexisting differences.

I find that, despite very different *de jure* legal regimes, measures of *de facto* property rights in land are remarkably continuous at the border. Households just on either side of the border report similar prevalence of rights to rent out their land and to sell their land. These results provide evidence that formal law has had little effect on property rights institutions, and that instead non-state sources of norms shape the *de facto* rules governing property in land.

In contrast, the data show that service provision by states and agricultural policy play important roles in economic outcomes. Measures of human capital investment jump discontinuously at the border, implying that Ghana's greater expenditure on schooling has raised human capital in rural areas relative to that in Côte d'Ivoire. Furthermore, each state's agricultural policies have had a profound effect on crop choices: coffee production jumps from a low level in Ghana to a high level in Côte d'Ivoire, likely as a result of the long involvement of the Ivorian state in regulating exports. Thus it appears that states are not completely ineffectual in this context, but rather that they are ineffectual at influencing certain types of economic institutions. Their impotence with respect to property rights in land may reflect the strength of local elites, such as chiefs and lineage heads, who benefit from the customary property rights institutions.

While states play little role in property rights institutions in this context, there is substantial variation in property rights institutions *within* Ghana and Côte d'Ivoire. I show that part of this within-country institutional variation is explained by economic factors, as hypothesized by Demsetz (1967). In particular, areas that are more suitable for growing cocoa, an important export crop in the region, have a greater prevalence of transfer rights, providing evidence that the commercialization of agriculture has led to more individualized property rights institutions. My results

thus provide support for the view of Easterly (2008) that bottom-up institutional evolution is more important than state-led reforms in determining property rights institutions in West Africa.

My work contributes to a growing literature that investigates the origins of property rights institutions. Non-state sources of norms appear to be crucial determinants of the institutions governing property in land in West Africa. Moreover, these norms appear to have evolved in response to the introduction of cocoa toward the arguably efficient set of norms, providing support for what Ellickson (1989) terms the "hypothesis of wealth-maximizing norms." In a seminal paper, Demsetz (1967) posited that property rights institutions tend to evolve efficiently. In this vein, North and Thomas (1973) argued that increasing population density explains the move towards individual ownership of land in Europe between 1000 and 1300. Other accounts of the evolution of property rights in land that focus on population density include Lewis (1955), Boserup (1965), Hopkins (1973), and Ault and Rutman (1979).

The related hypothesis that commercialization of agriculture has led to increased individualization of land rights, particularly in sub-Saharan Africa, is also widely believed (Bruce, 1988). However, while there are many suggestive case studies linking commercialization of agriculture to individualization of land rights in Africa (e.g., Hill, 1963), existing quantitative evidence is weak. In the leading study, Migot-Adholla et al. (1991) compare three regions of Rwanda and find that transfer rights in land are most prevalent in the region with the greatest degree of commercialization of agricultural production. In addition to a small sample size, Migot-Adholla et al. (1991) is plagued by an endogeneity problem: having more individualized land rights may encourage cash crop adoption. My use of geographic suitability for cocoa avoids this reverse causality problem.

My findings provide a new perspective on the application to sub-Saharan Africa of the literature that examines the role of institutions in explaining long-run development outcomes. Much of the existing empirical work linking institutions with long-run development has focused on institutional variation mediated by *states* and used cross-country comparisons (e.g., La Porta et al., 1999; Acemoglu et al., 2001). The low capacity of African states may well explain part of the continent's abysmal growth record (Easterly and Levine, 1997). But my results suggest that *within*

sub-Saharan Africa, where states have short histories and limited capacity, variation in *de facto* economic institutions may have little to do with states and *de jure* law.

2. Background

2.1. **Indigenous property rights institutions in West Africa.** The indigenous institutions governing property in land in West Africa have a long history. While there is considerable variation, both over time and across space, the indigenous property rights institutions in West Africa typically have a communal element in the sense that individual households have rights to use land that are derivative of the rights of some broader social group, and a representative of the social group (e.g., a chief or lineage head) regulates access to and transfers of land.

Here I describe the indigenous institutions of the Ashanti people of Ghana, which are particularly well documented.[1] The Ashanti are part of the larger Akan group, which is the major ethnic group that spans the border between Ghana and Côte d'Ivoire, making their institutions of particular relevance given my empirical strategy. It is important to note, however, that the Ashanti had a relatively centralized state, and the property rights institutions of less centralized pre-colonial polities likely provided somewhat stronger rights over particular parcels of land to individual households (Asante, 1964).

Among the Ashanti, land had a spiritual significance — it was regarded as belonging to the ancestors of a community, from whom the living inherited the right to use the land.[2] Individual Ashanti households thus did not own their land in the sense of an estate in fee simple under modern common law. Rather, the land was vested in the community, with the chief acting as a custodian. The community was symbolized by a ceremonial stool, on which the chief sat. Hence,

> In any Ashanti village the inquirer was informed, 'The land belongs to the stool,' or 'The land belongs to the chief.' Further investigation revealed that both expressions meant the same thing: 'The land belongs to the ancestors.' Busia (1951, p. 44).

Subjects of a stool claimed use rights to land though their matrilineage (*abusua*), which was an extended family group. Members of such a lineage could acquire use rights for the lineage simply

[1] My exposition draws on Rattray (1923, 1929), Busia (1951), Asante (1964), Wilks (1993) and Austin (2004).
[2] Busia (1951, p. 42)

by investing their labor in clearing and cultivating unclaimed land within the stool boundaries. The head of each lineage was in turn responsible for allocating use rights among its members.

Households individually owned the crops that they grew on the land they cultivated, but their rights over the land itself did not include the full bundle of rights we typically call ownership. Hence the Ashanti maxim, *afuo mu yɜ me deɜ, asase yɜ ɔhene deɜ*, "the farm is my property, the land is the chief's."[3] Individual households generally could not alienate their use rights to land to an outsider, at least not without obtaining permission from their lineage and chief.[4] Moreover, when a household stopped cultivating land, the land would generally revert back to the community and use rights to it could be acquired by another household. A subject's use rights could be passed on to his heirs upon his death. Importantly, however, heirs were traced matrilineally so that a man could not pass on property to his children but rather passed it to his brothers or nephews.[5]

The chief's role as custodian of the land included settling disputes between lineages, reallocating land among lineages, and superintending transfers of land within the community. With appropriate consent from elders of the community, the chief could sell the community's land to outsiders. Furthermore, "strangers" who migrated outside their home communities had to bargain with the chief of their host community and typically pay some form of regular tribute in exchange for the right to use land. The community retained a reversionary interest in the land in the case that a stranger settler died without heirs.[6] Any treasure-trove found on the community's land had to be turned over to the chief (the finder was typically allowed to keep a small share).

This system of property rights in land may result in certain inefficiencies. For example, investments in land may be lower because individual households are unlikely to reap the full benefits of their investment (Besley, 1995; Goldstein and Udry, 2008). Moreover, restraints on alienation may prevent the highest value user from acquiring the land, and in the presence of other factor market imperfections, result in an inefficient allocation of labor to land.

[3]Rattray (1929, p. 347); Wilks (1993, p. 99).
[4]Rattray (1929, p. 363).
[5]A man's sons were members of their mother's *abusua*, not their father's.
[6]Rattray (1923, p. 232).

2.2. ***De jure* property law in Ghana and Côte d'Ivoire.** The African states that correspond to present day borders are relatively recent creations. Many areas of pre-colonial Africa lacked any centralized political institutions like the modern state, and the pre-colonial states that did exist were largely based on different borders and institutional structures than were those that emerged under colonialism. The colonial period itself was brief. The colonial powers began demarcating and claiming territory in Africa in the "scramble" following the Berlin Conference of 1885. During this period the modern borders of Ghana and Côte d'Ivoire were established. Beginning in 1957 with Ghana, African colonies became independent states with few changes in boundaries. Herbst (2000) argues that both colonial and postcolonial states in Africa faced a challenging geographic environment of low population density and limited external threats such that the costs of effectively controlling their hinterland areas exceeded the benefits, leading to low capacity states.

Nonetheless, it has long been argued that differences in the ruling strategies of the French and British had persistent effects on African states in the post-independence period (Crowder, 1964). Furthermore, the broader literature on institutions and development focuses on state-mediated variation in institutions. Most notably, perhaps, La Porta et al. (2008) and Acemoglu et al. (2001) argue that the state institutions set up during the colonial period had long lasting economic consequences. The former focus on the identity of the colonizer, contrasting the legal systems transplanted by the French and British to their colonial possessions. The latter argue that the conditions facing settlers shaped the nature of institutions set up up by the colonial powers. Both argue that these colonial shocks to state institutions had persistent economic effects.

During the colonial period, Ghana and Côte d'Ivoire adopted quite different *de jure* property law, and these differences persisted post-independence. I describe each in turn.

2.2.1. *Ghana.* Ghana was colonized by the British, who imported their common law legal institutions. The British recognized indigenous customary law in their courts in Ghana — respect

for custom is a hallmark of the common law approach[7] — beginning with the Supreme Courts Ordinance of 1876.[8]

Furthermore, the British delegated substantial authority to indigenous elites under their "indirect rule" policy. The putative goal of the British colonial rulers was, as one colonial administrator put it, to "grant to Africa the benefits of Western civilization without disrupting the social institutions of the African people" (Hailey, 1957, p. 201). Notably, under the Native Jurisdiction Ordinance of 1883, chiefs were authorized to create "native tribunals" with jurisdiction over, *inter alia*, "all disputes relating to the ownership or possession of lands held under native tenure."[9] Firmin-Sellers (1996) and Berry (2000) argue that the incorporation of chiefs as agents of the colonial state served to increase the power of chiefs with respect to the allocation of land.

British courts, when hearing appeals from native tribunals, applied the idea that individual ownership was foreign to West Africa. In an opinion issued in 1921, the Privy Council endorsed the view expressed by Chief Justice Rayner:

> The next fact which it is important to bear in mind in order to understand the native land law is that the notion of individual ownership is quite foreign to native ideas. Land belongs to the community, the village or the family, never to the individual. All the members of the community, village, or family have an equal right to the land, but in every case the Chief or Headman of the community or village, or head of the family, has charge of the land, and in loose mode of speech is sometimes called the owner.[10]

This principle was subsequently applied in courts throughout British West Africa.[11]

Post-independence, the Ghanaian state continued to consider customary law part of the *de jure* law of Ghana. Article 40 of the 1960 Constitution of the Republic of Ghana included customary

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[7]Blackstone, in his Commentaries on the Laws of England, defined the common law as composed of general customs, particular customs (which affect only particular communities), and particular laws that apply in certain specialized courts. 1 WILLIAM BLACKSTONE, COMMENTARIES *67.

[8]The ordinance provided that

> Nothing in this Ordinance shall deprive the Supreme Court of the right to observe ... any law or custom existing in the Colony... Such laws and customs shall be deemed applicable in causes and matters where the parties thereto are natives of the Colony, and particularly ... in causes and matters relating ... to the tenure and transfer of real and personal property...

Supreme Courts Ordinance, 1876, § 19, in 1 Ordinances of the Gold Coast Colony in Force June, 1898, 16.

[9]Native Jurisdiction Ordinance, 1883, § 11, in 1 Ordinances of the Gold Coast Colony in Force June, 1898, 392-393.

[10]Tijani v. Secretary, Southern Nigeria, [1921] 2 A.C. 399, 404.

[11]Asante (1964, p. 857).

law, defined in section 18 of the Interpretation Act 1960 as consisting of "rules of law which, by custom, are applicable to particular communities in Ghana," as part of the law of Ghana. Crook et al. (2007) argue that the formal incorporation of customary law into the law of Ghana has resulted in a highly legalised form of customary law, developed by formal judicial rulings with *stare decisis* effect, which then feeds back into the norms applied by (especially well-educated) non-state customary actors.

2.2.2. *Côte d'Ivoire.* The *de jure* property law of Côte d'Ivoire followed a markedly different path than that of Ghana. Côte d'Ivoire was colonized by the French, who took a decidedly more dismissive approach to customary law.[12] At the outset of the colonial period, the French administration claimed state ownership of all land then unoccupied and uncultivated, which at that point was the vast majority of land in Côte d'Ivoire, extinguishing any customary claims.[13] In 1932, the French administration defined the legal procedure for obtaining freehold land title, which required only evidence of active land use, further moving the *de jure* regime away from customary norms.[14] The French approach to property in land in Côte d'Ivoire was consistent with their general "direct rule" approach to colonial governance, which relied on putting French administrators in the hinterlands and suppressing indigenous elites (Suret-Canale, 1971, pp. 71-83).

Near the end of the colonial period, in 1955, the French reversed their policy by renouncing state claims to uncultivated land, recognizing customary rights to land, and requiring concessionaires to seek waiver of rights by any customary claimants.[15] However, this reversal was short-lived, as post independence in 1967 Côte d'Ivoire's first President, Felix Houphouet-Boigny, declared that "land belongs to the person who brings it into production, providing that exploitation rights have been formally registered."[16] The registration proviso of the decree, however, was unobserved, and the decree was used as justification for land claims based on simply clearing the land (Heath, 1993, p.

[12]The account that follows draws on Heath (1993).
[13]Decree of 20 July 1900.
[14]Decree of 26 July 1932, "portant Réorganisation du Régime de la Propriété Foncière en Afrique Occidentale Francaise."
[15]Decree of 20 May 1955, "portant Réorganisation Foncière et Domaniale en Afrique-Occidentale Franciase et en Afrique Équatoriale Francaise."
[16]Decree of March 20, 1967.

32). The reversion to the French policy was completed in an Interior Ministry circular dated Dec. 17, 1968, that asserted that "the state is the owner of all unregistered land," and that "customary rights to land are abolished."[17]

2.2.3. *The implications of the differences in de jure law between Ghana and Côte d'Ivoire.* In sum, the formal legal system of Ghana has historically supported customary law on land, while that of Côte d'Ivoire has undercut it. If formal law matters in this context, we would expect property rights to be more individualized in Côte d'Ivoire than in Ghana. And indeed, scholars have argued that these differences in *de jure* law in Ghana and Côte d'Ivoire led to changes in the *de facto* property rights institutions, that is, the rules that in practice actually apply and constrain households in their use of and transactions in land. For example, Firmin-Sellers (2000, p. 256) argues that

> French and British colonizers designed very different institutions to regulate their interaction with indigenous chiefs [in Côte d'Ivoire and Ghana]. ... Consequently, *these institutions yielded very different property rights systems and landholding patterns* (emphasis added).

Firmin-Sellers (2000) goes on to argue that in Côte d'Ivoire, lineage heads became outright owners of land, unconstrained by chiefs, due to the undermining of chiefs by the French. In contrast, both commoners and the paramount chiefs whose authority over land extended over a large area in Ghana were empowered by the British, while local chiefs were marginalized. Crook et al. (2007) similarly argue that intervention by the two states has led to more individualized property rights in Côte d'Ivoire than in Ghana.

However, there is little quantitative evidence on the role of states and formal *de jure* law in affecting the *de facto* property rights institutions in West Africa. And the fact that states in West Africa are generally young and weak casts doubt on the views of Firmin-Sellers (2000) and Crook et al. (2007) that these state-level institutional differences have had a large impact on the *de facto* norms that actually shape decision making.

[17]Heath (1993, p. 32).

3. The effect of de jure property law on de facto institutions

3.1. **Data and descriptive statistics.** To investigate whether these differences in state-level institutions and *de jure* property law had a causal effect on *de facto* property rights institutions, I use data from the first two Living Standards Measurement Surveys (LSMS) run by the World Bank in Africa: the Côte d'Ivoire Living Standards Survey (CILSS) and the Ghana Living Standards Survey (GLSS). The CILSS, which ran from 1985-88, was the first LSMS survey ever administered. The GLSS 1 and 2 were collected in 1987-88 and 1988-89, respectively, using a survey instrument nearly identical to the CILSS questionnaire. Each survey's questionnaire contains detailed questions on household composition, education, consumption, production, assets, and borrowing, as well as questions on households' perceptions of their rights to sell and rent out their land.

Both surveys used a two-stage sampling design in which enumeration areas (EAs) were first randomly selected from a stratified list of populated places from the most recent national census, and then a sample of households was randomly selected from each selected EA. I determined the locations of the EAs using maps and data from the GEOnet Names Server. Figure 1 provides a map of the GLSS 1 and 2 and CILSS EAs. More details on the sampling process are provided in the Data Appendix.

3.1.1. *Measures of de facto property rights institutions.* As measures of *de facto* property rights institutions, I use households' perceptions of their right to rent out and to sell their land. This approach is commonly used in the literature on African property rights institutions. For example, Besley (1995) uses self-reported transfer rights in his study of the effect of property rights on investment incentives. He finds that an index of self-reported rights to sell, rent, gift, mortgage, pledge, and bequeath a field is associated with increased investments in the field. The rationale for using transfer rights as a measure of property rights is three-fold. First, the right to transfer use rights in land is itself an important right. It enables owners to realize the full value of their investments in land and, when other factor markets are imperfect, helps to efficiently allocate other factors, most importantly labor, to land. Second, as discussed above, restrictions on transferring land are a feature of the customary property rights institutions in much of West Africa. Hence, the

prevalence of transfer rights is a good measure of the degree to which institutions have evolved toward more individualized property rights. Third, transfer rights are likely correlated with other aspects of property rights, for example the right to continued exclusive use of the land even after fallowing it.

Both the GLSS and CILSS asked about households' transfer rights. For example, the GLSS asks, "Have the members of your household the right to lease, rent out or sharecrop out all or part of the land they are using?" and "Do the members of your household have the right to sell all or part of their land to someone else if they wish?" I use responses to these questions to create binary indicators of whether each household has the right to rent out or to sell any of its land. Details of the variable construction, including discussion of differences in the wording of the two questionnaires, are provided in Table 1.

3.1.2. *Sample selection and descriptive statistics.* I restrict the sample to households who own agricultural land in the GLSS and CILSS. I exclude households that rent in or sharecrop in all of the agricultural land they use. The reason is that I want to measure the transfer rights of the owner of the land. Households generally cannot sell or sublease land that they rent in. Were I to include tenant farmers in the sample, then it would appear that transfer rights were less prevalent in areas where there are *more* transfers through leasing. As discussed in Section 2, "ownership" of land is a somewhat different concept in this context than it is in, for example, the United States. To determine whether a household owns land, I use questions from the surveys about land available for use by the household, and exclude from the measure any land that is rented or sharecropped in.[18]

Table 2 provides descriptive statistics for the resulting sample from the two surveys. Transfer rights are relatively rare, with only 51% of households reporting the right to rent out their land, and 31% reporting the right to sell their land.

[18]To be more precise, to construct a measure of the amount of land households own from the GLSS, I sum the answers to the following questions: "Questions 3 to 9 do not include land rented in or sharecropped in by the household. 3. How many acres of land belonging to your household have been farmed during the past 12 months, including the land rented or sharecropped out to others? 4. How many acres of fallow land are available for use by the members of your household?" I use analogous questions from the CILSS.

3.2. **Empirical framework.** The discussion above makes clear that the Ghanaian and Ivorian states diverged in their *de jure* law on property in land. A naive way to estimate the effects of that divergence would be to compare mean outcomes in the two countries. Table 3 presents the country means, which under a naive interpretation are consistent with the view that differences in *de jure* law had a big impact on the *de facto* institutional environment: 67% and 44% of Ivorian households report the rights to rent out and to sell their land, respectively, compared to only 38% and 21% of Ghanaian households.

However, the problem with this approach is that the two countries differ in ways unrelated to state policy and law that might affect property rights institutions. For example, the ethnic groups that predominate in western Côte d'Ivoire are quite different from those in eastern Ghana. A comparison of means at the country level would confound differences due to state policy with these differences that are not due to state policy.

3.2.1. *Regression discontinuity.* Instead, I exploit the discontinuous change in state that occurs at the border between the countries to estimate the cumulative effect of state policy and *de jure* law at the border. Formally, I estimate the size of the discontinuous jump in the conditional expectation of measures of property rights institutions at the border. The intuition behind this approach is straightforward. While areas of Ghana and Côte d'Ivoire located far from the border are quite different, as you approach the border between the two countries the geography and pre-colonial ethnic groups and institutions on either side converge. Any differences now between the households just on either side of the border are due to differences in the state policy in the two countries, not to pre-existing differences.

The fact that the border was drawn arbitrarily and did not follow pre-colonial divisions between ethnic groups is key to the validity of this approach. This ensures that determinants of property rights institutions unrelated to state policy vary continuously at the border. The border between the Gold Coast (as colonial Ghana was called) and Côte d'Ivoire was determined through a series of Anglo-French agreements between 1893 and 1905 (Brownlie, 1979). The border was demarcated by concrete beacons, with about half of the boundary based on a river or stream and half based

on straight lines between landmarks. The resulting border did not follow ethnic lines and instead split a series of ethnic groups in two, including the Assini, Anyi, Brong, Dagari, and Ligbi Degha (Barbour, 1962, pp. 306-307, 312-313).

Another important assumption underpinning this strategy is that the CILSS and GLSS are comparable surveys so that the survey design does not itself induce a jump in measures of property rights at the border. The CILSS and GLSS were both coordinated by the LSMS Study Office at the World Bank. The CILSS was started first, and the GLSS questionnaire was based on the CILSS questionnaire. Some differences were introduced in the GLSS questionnaire, but they are minor and seem unlikely to cause signficant differences in survey responses. Table 1 details the differences between the survey questions used in the analysis.

This sharp regression discontinuity (RD) approach can be formalized in a potential outcomes framework as follows.[19] Let $Y_i(0)$ and $Y_i(1)$ denote potential outcomes for household i for some outcome variable Y such as whether the household has the right to sell its land. $Y_i(0)$ is the outcome if household i is "treated" by the policies in Côte d'Ivoire, and $Y_i(1)$ is its outcome if it is in Ghana. The unit-level causal effect of state policy is defined as $Y_i(1) - Y_i(0)$. The fundamental problem, of course, is that for any household i we observe only one potential outcome, namely $Y_i(0)$ for households in Côte d'Ivoire and $Y_i(1)$ for households in Ghana. The RD design solves this problem by imputing the missing potential outcomes using households just on either side of the border, allowing us to estimate an average causal effect for the subpopulation of households at the border.

To see this, let $S_i \in \{0, 1\}$ denote the state that household i resides in, with $S_i = 1$ (0) denoting Ghana (Côte d'Ivoire). Furthermore, let D_i be the distance from household i to the border between Ghana and Côte d'Ivoire, with positive (negative) values indicating households that live east (west) of the border. S_i is a deterministic function of D_i:

$$S_i = 1(D_i \geq 0) \tag{1}$$

[19] See Imbens and Lemieux (2008) for a detailed treatment of RD designs, on which the discussion that follows draws.

This discontinuity in the assignment of households to states allows us to consistently estimate the average causal effect of the states' differences in policy for households that live at the border, defined as $\tau_{SRD} = E[Y_i(1) - Y_i(0)|D_i = 0]$. To estimate τ_{SRD} we must assume that $E[Y(0)|D = d]$ and $E[Y(1)|D = d]$ are both continuous in d at $d = 0$. With this smoothness assumption, we have that $\tau_{SRD} = \lim_{d\downarrow 0} E[Y|D = d] - \lim_{d\uparrow 0} E[Y|D = d]$. These two limits can be estimated using standard regression function estimation techniques.

3.2.2. *Estimation.* To estimate the jump in the conditional expectation of each outcome variable at the border, I estimate equations of the form:

$$Y_i = \beta_0 + \beta_1 S_i + f(D_i) + S_i * g(D_i) + \epsilon_i \tag{2}$$

where $f(D_i)$ and $g(D_i)$ are polynomials in distance to the border. I use two basic specifications: a global 4th-order polynomial regression, using all of the data, and a local linear regression using only data near the border. To determine the bandwidth for the local linear regression, I follow the cross-validation procedure recommended by Imbens and Lemieux (2008) with one modification: I allow for different bandwidths on either side of the border, since there is no reason to expect the different sample sizes of the GLSS and CILSS to result in the same optimal bandwidth on either side. In calculating the cross-validation criterion function, I sum over data points within the 0.5 quantile of the empirical distribution of D_i on either side of the border. I report local linear regression estimates using these optimal bandwidths, as well as twice and half the optimal bandwidths, for each outcome variable.

As shown in Figure 1, Ghana extends further north than does Côte d'Ivoire. Because there are no comparison units in Côte d'Ivoire for the EAs in Ghana that are north of the northernmost point on their border, I discard them.

3.2.3. *A check on validity.* As a simple check on the identifying assumption that other determinants of property rights institutions vary continuously at the border, Figure 2 plots local averages of the latitude of households in 15 km bins of their distance to the border. While latitude is not, strictly speaking, predetermined since households can migrate, it is comforting that there is no

discontinuous jump in the latitude of households at the border. Table 4 presents point estimates of the jump in latitude at the border. The global 4th-order polynomial estimate is in column (1), and the local linear regression esimates with the optimal bandwidth, twice the optimal bandwidth, and half the optimal bandwidth are in columns (2), (3), and (4), respectively. All are indistinguishable from zero (albeit with large standard errors).

3.3. **Results.**

3.3.1. *Property rights institutions.* I turn now to regression discontinuity estimates that measure the change in property rights institutions at the border. Figure 3 shows the regression discontinuity plot for the right to rent out land. The scatter plot of local averages suggests no discontinuity in land rights at the border and shows a striking linear relationship between longitude and the right to rent out land, decreasing from west to east. A 4th order polynomial fit on either side of the border is also drawn, which shows very little gap in the regression functions at the border. The point estimates are provided in Table 5. Confirming the visual evidence, the point estimates are close to zero, and none are statistically significant.

Figure 4 and Table 6 show the RD results for the right to sell land. The basic pattern is the same: despite substantial differences in country means, the regression functions meet at the border and there is no evidence of a discontinuity in the right to sell land.

A related outcome variable is actual land market activity. The prevalence of land rentals is not solely a function of property rights institutions — other state policies, such as migration policy and export crop policy, may shift demand for land transfers. But it is natural to expect the supposed liberalization of land transfers in Côte d'Ivoire to have resulted in more land transfers. In fact, Figure 5 again shows the same basic pattern in prevalence of land rentals — the estimated regression functions come together at the border. The point estimates are presented in Table 7. While the 4th-order polynomial estimate is indeed insignificant, a local linear regression using the optimal bandwidth results in a significant discontinuity of 22 percentage points. However, this discontinuity is not robust to using a larger bandwidth — it drops to an insignificant 3 percentage points at twice the bandwidth.

The data thus show that, despite being subject to very different *de jure* legal regimes, households just on either side of the border are subject to similar *de facto* norms governing property rights in land. This suggests that states play little role in property rights institutions, and instead non-legal sources of norms are the crucial determinants of *de facto* institutions.

3.3.2. *Other economic outcomes.* One interpretation of the lack of a discontinuity in property rights institutions at the border is that the border and the state simply do not matter. I turn now to other economic outcomes that may be affected by state policy to investigate whether states are completely ineffectual in this context.

States likely have an impact on human capital accumulation through education policy, and Ghana and Côte d'Ivoire's education policies diverged beginning in the colonial period. The British placed more emphasis on primary education in their African colonies, including in the indigenous languages, whereas the French adopted an "assimilationist" approach, focusing on secondary education to create "French citizens" out of a narrower segment of the population. In consequence, primary enrollment rates were much higher in British than in French colonies (Benavot and Riddle, 1988). Moreover, these colonial patterns persisted in the post-colonial period, as the newly independent governments were slow to change the education systems they inherited (Bolt and Bezemer, 2009).

My regression discontinuity approach confirms that state policies had a big impact on schooling outcomes in Ghana and Côte d'Ivoire. Figure 6 shows that there is a dramatic discontinuity at the border in whether the household head ever attended school. The 4th order polynomial point estimate in Table 8 is a 36 percentage point effect of state policy on school attendance at the border. Moreover, these differences in schooling have real effects on human capital. Figure 7 and Table 9 show RD estimates of the effect of the state on literacy of the household head. The 4th-order polynomial estimate is a 12 percentage point increase in literacy, but is not statistically significant. All of the local linear regression-based estimates are larger and significant. Similarly, Figure 8 shows a dramatic jump at the border in the ability of household heads to do written calculations, which is confirmed in the point estimates in Table 10.

Another major activity of African states is regulation of export crop markets (Bates, 1984). Both states established marketing boards to regulate the price farmers receive for export crops, ostensibly to insure farmers against fluctuations in the world price but in practice imposing a substantial tax on farmers' production. While cocoa is a major export crop in both countries, coffee is grown mainly in Côte d'Ivoire with little Ghanaian production. The French have historically purchased most of Côte d'Ivoire's coffee output, paying a 50% premium over the world price (Due, 1969). Figure 9 and Table 11 show the RD results for whether the household grows coffee and confirm that the state had a large impact on production. At the border, where the geographic suitability for coffee cultivation is the same in the two countries, Côte d'Ivoire produces dramatically more coffee.

3.3.3. *Discussion.* My finding that *de jure* law has little effect on *de facto* property rights institutions echoes Ellickson (1991)'s findings on norms in a very different context. He found that norms about who is responsible for damage caused by trespassing cattle in Shasta County, California, are independent of the legal rule — the norm is uniformly that the owner of the cattle is responsible, even in areas where the formal legal rule makes the owner of the land responsible for fencing cattle out. Similarly, in West Africa social norms that are largely independent of formal law govern property rights.

Importantly, though, the data show that West African states are not completely ineffectual. In particular, it appears that states can provide public goods (e.g., education) and regulate export crop production. A potential explanation for this pattern is that certain economic institutions, including property rights in land, are part of a set of local, non-state institutions that are resistant to state policy. Local elites play important roles in West African customary property rights institutions and changes to them will reduce their status and wealth. The interests of national elites and local elites in education policy, on the other hand, are likely to be well-aligned — nobody minds when the government builds a school. And while national elites' and local elites' interests over agricultural policy are in conflict, controlling export markets is relatively easy for states to do as it does not require a substantial administrative apparatus in the hinterlands of their territory.

While my empirical strategy identifies only the local effect of states at the border — a relatively remote rural area — most of West Africa is rural and far from the national capital, making this an estimand of broad external validity in West Africa. An important caveat, though, is that neither the Ghanaian or Ivorian states engaged in the type of large-scale land titling programs established in Kenya in the late 1950s. Moreover, West Africa had relatively few European settlers during the colonial period. My results may not generalize to areas of Africa in which the state attempted more ambitious land reforms or in which settlers played a larger role in agriculture.

4. Explaining within-country variation: The commercialization of agriculture

While states evidently play little role in property rights institutions in West Africa, Figures 3 and 4 show that there is substantial variation in property rights institutions *within* Ghana and Côte d'Ivoire. Acemoglu and Dell (2009) argue that such within-country differences in institutions are important determinants of within-country variation in productive efficiency. However, one of the oldest and most parsimonious theories of the origins of property rights focuses on productive efficiency as a *cause* of institutions. In a classic contribution, Demsetz (1967) argued that "the emergence of new property rights takes place in response to the desires of the interacting persons for adjustment to new benefit-cost possibilities. ... [P]roperty rights develop to internalize externalities when the gains of internalization become larger than the cost of internalization." Platteau (1996, 2000) labels this theory the "evolutionary theory of land rights" — institutions evolve in response to demand for new institutions as economic conditions change.

As an application of this theory, many argue that the commercialization of agriculture leads to stronger private property rights in land (Bruce, 1988). As farmers move from subsistence production into producing for the market, the size of the distortion caused by communal property rights gets larger. If there is some fixed cost to changing institutions, as in Mulligan and Shleifer (2005), then the introduction of export crops could induce institutional change by causing the benefits of such change to exceed the costs.

Cocoa is by far the most important cash crop in Ghana. It was adopted in the early 20th century, and Ghana quickly became the world's largest producer of cocoa. Qualitative case studies suggest that the introduciton of cocoa led to an individualization of property rights in land in Ghana (see, e.g., Hill, 1963). However, existing quantitative evidence on the effect of commercialization of agriculture on property rights is weak. I now use the GLSS data to investigate whether cocoa had the effect on property rights many attribute to it and hence explains part of the variation in property rights institutions within Ghana.

4.1. **Empirical framework.** As a simple structural model, consider the following equation,

$$PropRights_{hv} = \beta_0 + \beta_1 Cocoa_v + \beta_2 X_v + \mu_v + \epsilon_{hv} \tag{3}$$

where $PropRights_{hv}$ is some measure of the strength of the property rights of household h in village v to its land, $Cocoa_v$ is a measure of the extent of cocoa production in village v, and X_v is a vector of exogenous controls. A basic problem with estimating such a model is reverse causality: households with more individualized property rights may be quicker to adopt cash crop cultivation.

To deal with this identification problem, I use a geographic measure of the suitability of the land in an area for cocoa as an instrument for the adoption of cocoa. The reduced form equation is,

$$PropRights_{hv} = \alpha_0 + \alpha_1 CocoaSuit_v + \alpha_2 X_v + \xi_v + \nu_{hv} \tag{4}$$

where $CocoaSuit_v$ is a measure of the suitability of the land around village v for cultivation of cocoa. Equation (4) is not subject to any reverse causality, and estimating α_1 provides a test of whether demand-side factors — that is, demand for individualized property rights institutions — have influenced the evolution of property rights. Adding an exclusion restriction assumption — that $CocoaSuit_v$ affects property rights institutions only through its effect on cash crop production — I can further estimate the effect of cocoa production on property rights institutions, β_1 in (3), using an instrumental variables estimator.

4.2. **Data.** I use data from the GLSS 1 and 2 to measure property rights institutions and employ the same measures used in Section 3 above. As a measure of the suitability of land for cocoa

cultivation, I use a cocoa suitability index generated by the Soil Research Institute (SRI) in Accra, Ghana. SRI used the FAO's Agro-ecological Zones (AEZ) methodology to produce a cocoa suitability index that takes into account precipitation, temperature, elevation, slope, and soil type to measure how suitable the land is for cocoa cultivation. The index runs from 0 to 1.

Figure 10 provides a map with the cocoa suitability index and the EAs in the GLSS 1 and 2. The darker areas of the map are more suitable for cocoa. The boundaries are regional boundaries. Cocoa cannot be grown in the northern part of the country, so I include region dummies in all regressions so that I am using only within-region variation rather than comparing the north to the south (which are very different on many dimensions).

4.3. **Results.** Column (1) of Table 12 shows the first stage regression of the fraction of land in an EA planted in cocoa on the cocoa suitability index. The cocoa suitability index is strongly positively associated with cocoa production, even controlling for region.

Column (2) presents estimates of a simple OLS regression of households' right to rent out their land on the fraction of land in the household's EA planted in cocoa. The correlation is strong: a 1 percentage point increase in the fraction of land planted in cocoa is associated with a 0.5 percentage point increase in the prevalence of rights to rent out land. However, this estimate is plagued by reverse causality and omitted variables bias, as well as potentially attenuation bias due to measurement error.

I turn now to instrumental variables estimates that address these endogeneity problems. In column (3) I present the reduced form regression of the right to rent out land on the cocoa suitability index. The coefficient is 0.11 and is statistically significant. This implies that moving from an area completely unsuitable for cocoa production ($CocoaSuit = 0$) to one very suitable ($CocoaSuit = 1$) results in an 11 percentage point increase in prevalence of rights to rent out land.

In column (4), I present the IV estimate of the effect of cocoa cultivation on the right to rent out land, instrumenting for cocoa cultivation using cocoa suitability, which at 0.670 is similar to the OLS estimate presented in column (2) and is statistically significant.

Columns (5) - (7) present the OLS, reduced form, and IV estimates using right to sell land as the dependent variable. The results are similar to the results on the right to rent out land.

These data thus provide support for the commercialization of agriculture hypothesis. Areas that are suitable for cocoa were subject to a demand-side shock in the 20th century as cocoa quickly became an important cash crop in those areas. Cocoa increased the size of the distortion caused by customary property rights institutions, generating demand for more individualized property rights institutions. That demand induced changes in property rights institutions, which are reflected in the greater prevalence of transfer rights in cocoa growing areas.

5. Conclusion

Ghana and Côte d'Ivoire's very different *de jure* laws on property in land have had little effect on *de facto* property rights institutions. In contrast, the economic needs of communities, as proxied for by cocoa cultivation, have had an impact on the degree of individualization of property rights in land. My work contributes to a growing literature that points to non-state sources of norms as important constraints on behavior and suggests that these norms do, to some extent, evolve to accommodate the changing needs of society.

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DATA APPENDIX

Côte d'Ivoire Living Standards Survey. The CILSS was run for four years from 1985 - 1988 as a rotating panel. In each year, half of the households from the previous year's survey were replaced with new households. The sampling was done in two stages: first EAs were selected from a census list with probability proportional to population, and then households were sampled within each EA. I use just the first observation for each household, discarding any data on the household from subsequent years. The resulting survey dataset has a total of 200 EAs and 4,351 households.

While the sampling design was intended to produce a self-weighted sample, analysis of the sample revealed several biases in the sampling process, including an oversampling of wealthier households.[20] Corrective weights are provided with the dataset, and I use these weights ($allweightn$) in my analysis.

Ghana Living Standards Survey 1 and 2. The GLSS 1 and 2 were run in 1987-88 and 1988-89 respectively as a rotating panel using a two-stage sampling design. I retain only data from the first visit for each household, discarding revisits in subsequent years. The resulting survey sample has 261 EAs and 4,826 households.

[20]For example, for 1985 and 1986, a full enumeration of households within each selected EA was not done; instead a sampling frame was generated by selecting the n-th door in each EA, beginning from some central location. This leads to an oversampling of households with multiple doors. The weights I use incorporate the weights constructed by Demery and Grootaert (1993) to correct for the resulting sampling bias.

APPENDIX

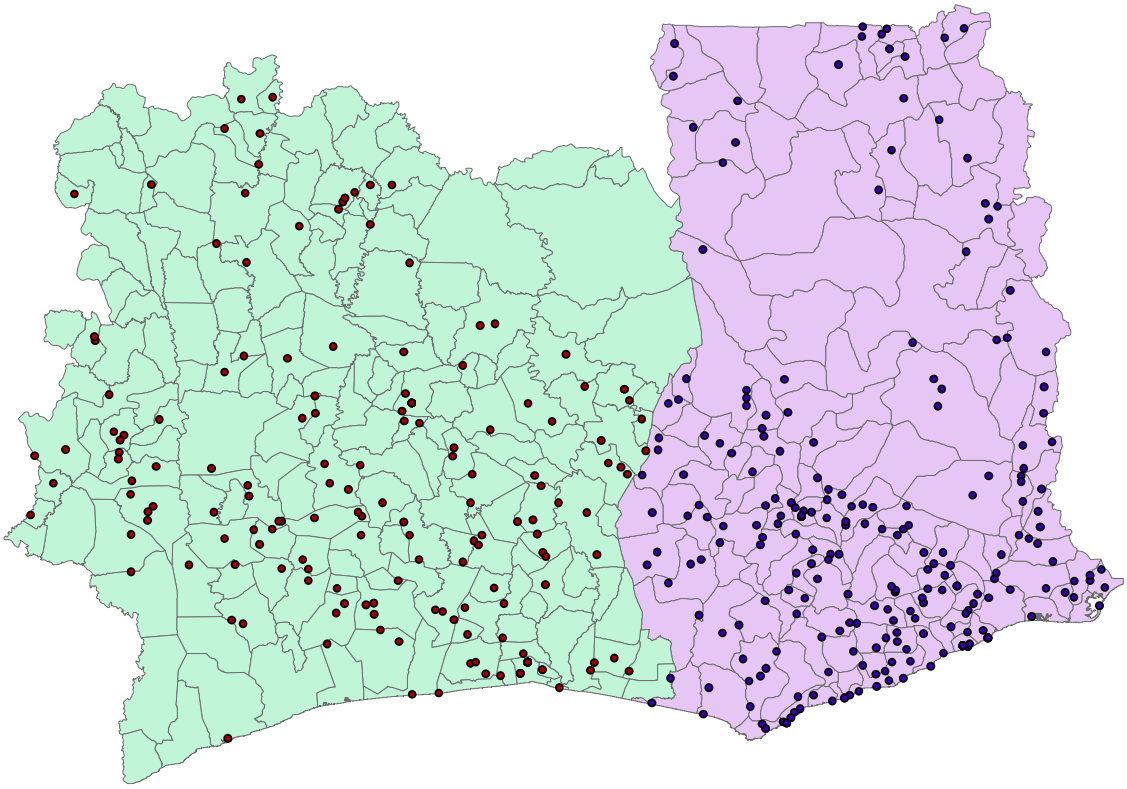

FIGURE 1. GLSS 1 and 2 and CILSS enumeration areas.

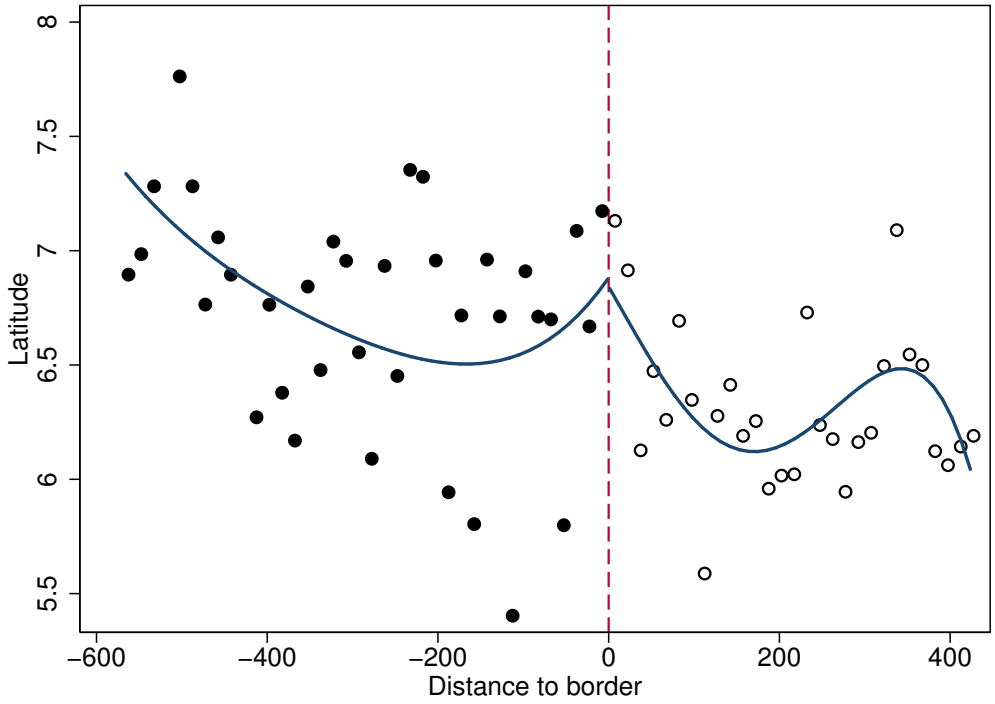

FIGURE 2. Latitude by distance to the border.

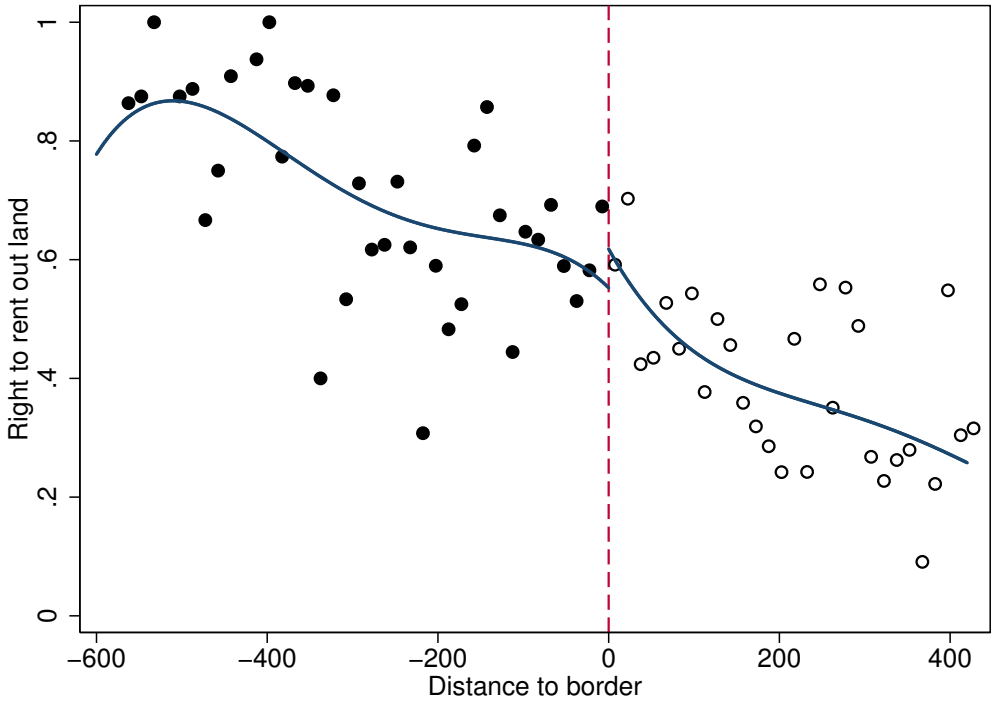

FIGURE 3. Right to rent out land by distance to the border.

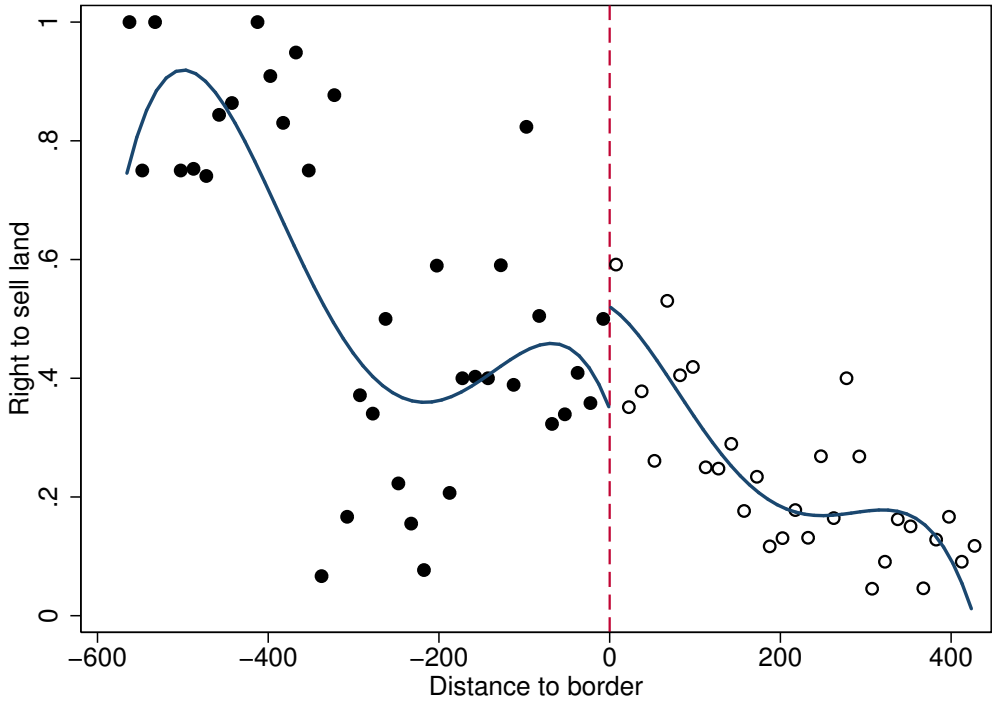

FIGURE 4. Right to sell land by distance to the border.

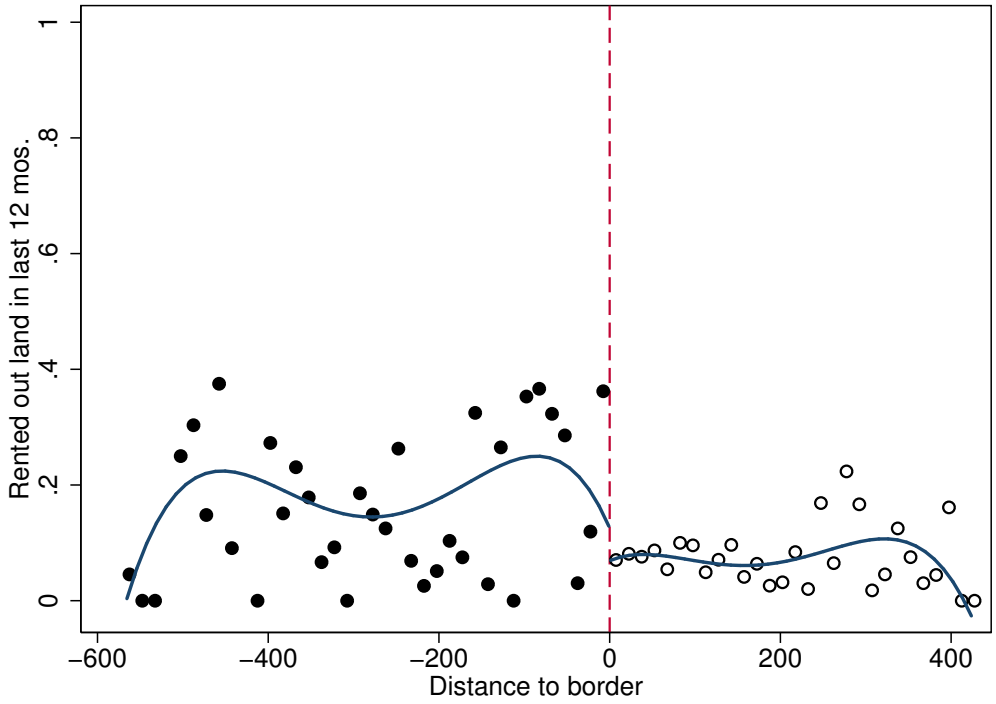

FIGURE 5. Rented out land in last 12 mos. by distance to the border.

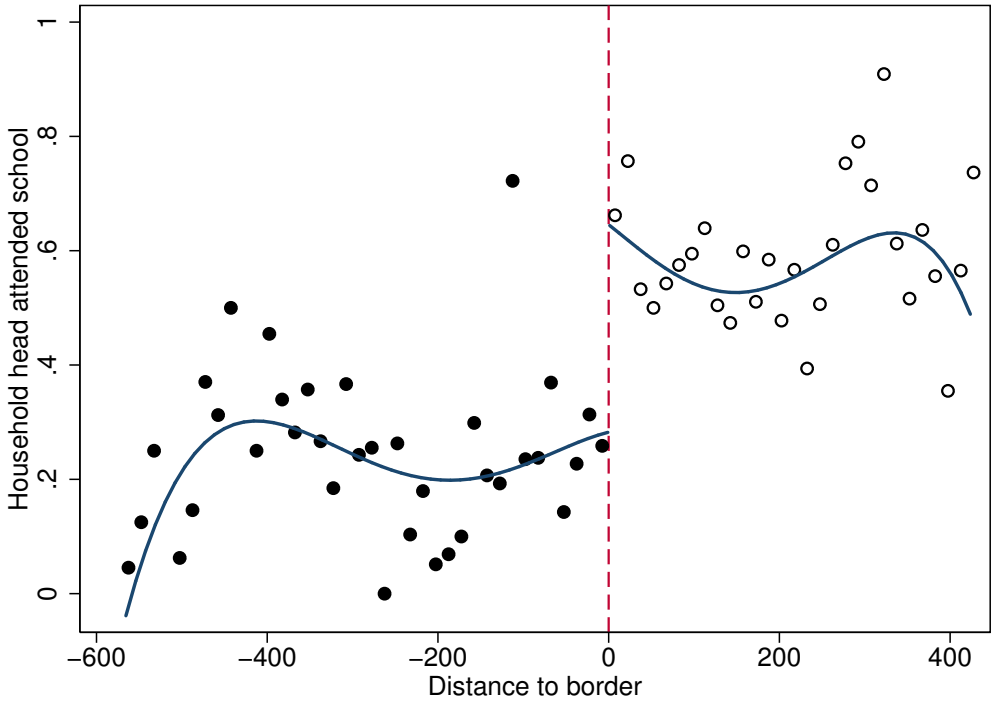

FIGURE 6. Household head attended school by distance to the border.

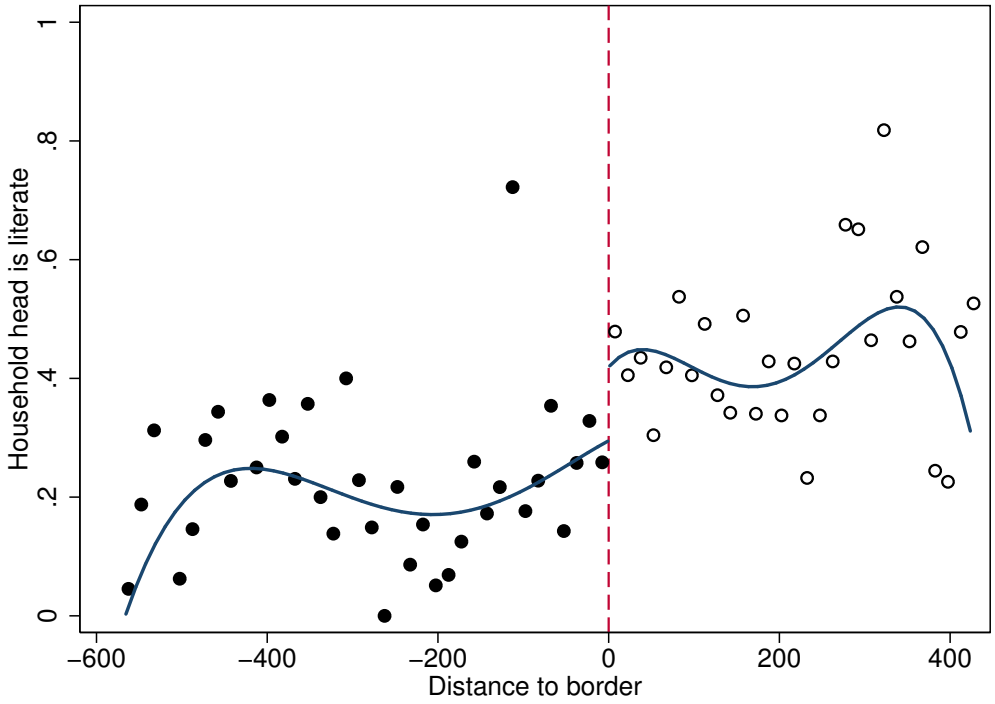

FIGURE 7. Household head is literate by distance to the border.

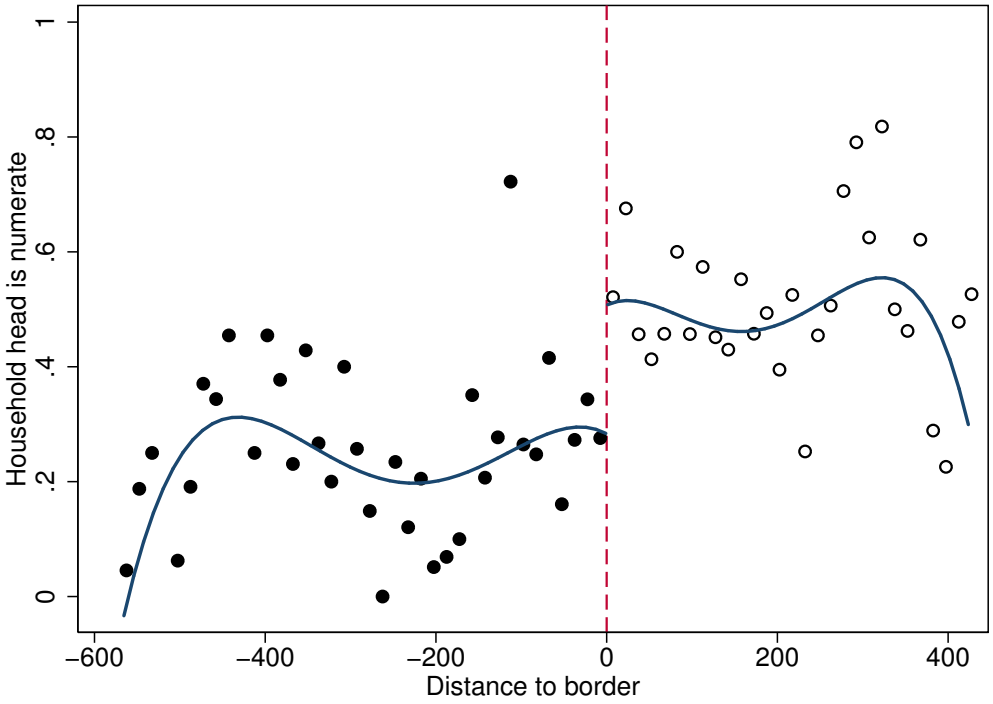

FIGURE 8. Household head is numerate by distance to the border.

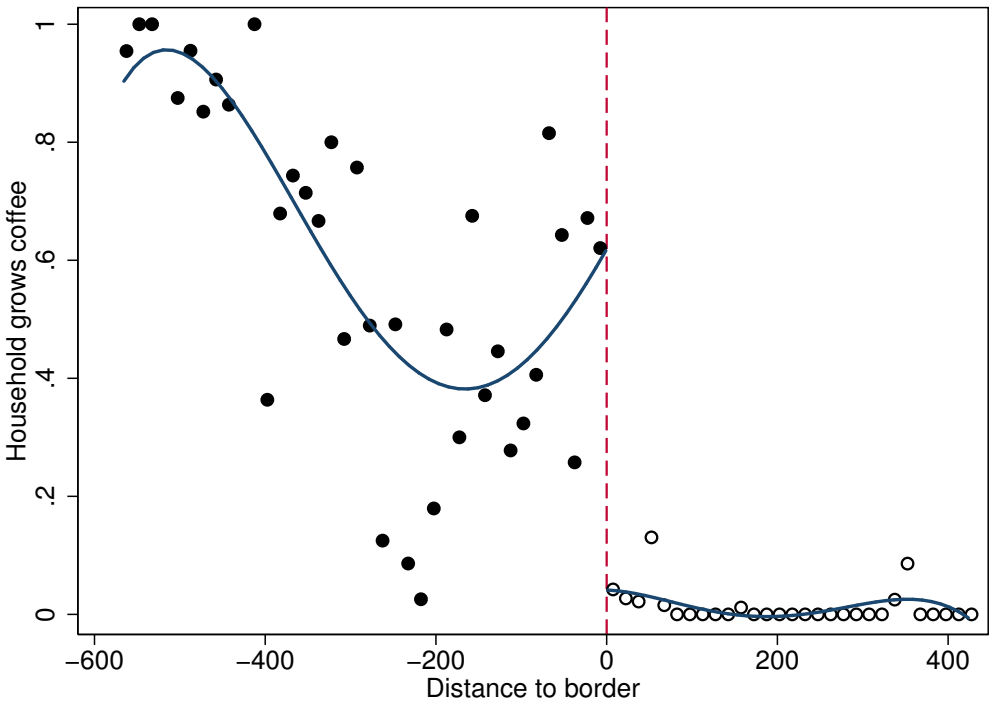

FIGURE 9. Household grows coffee by distance to the border.

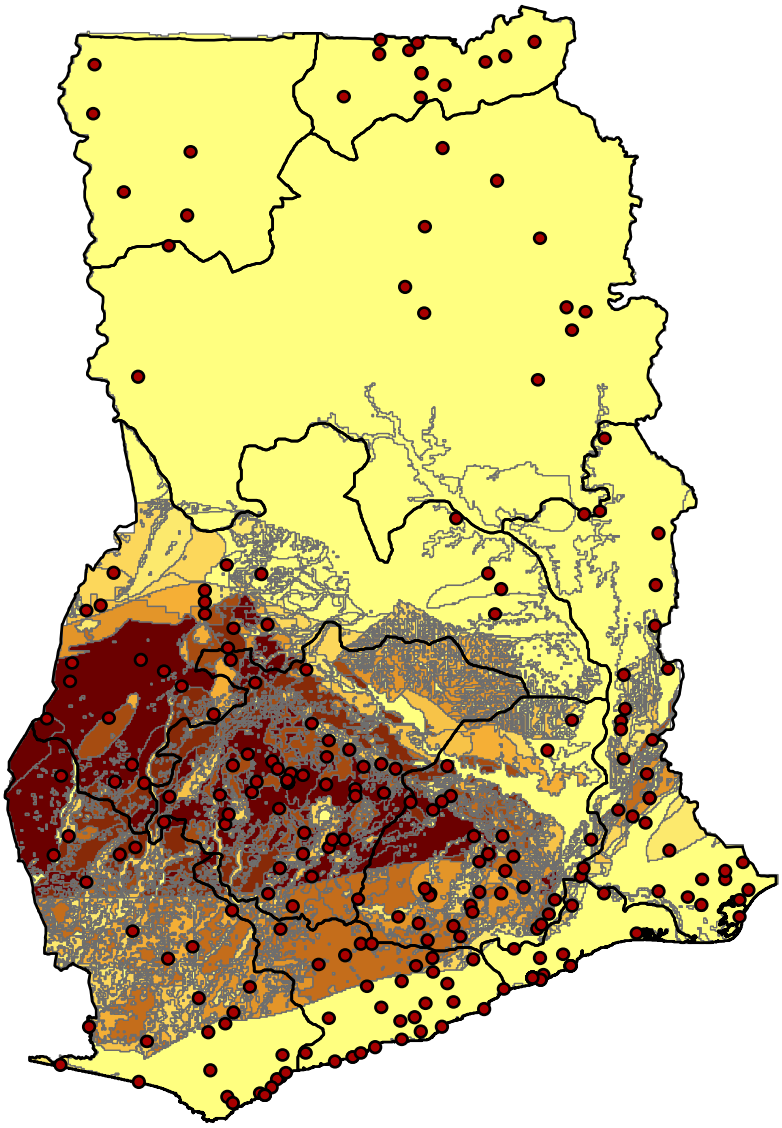

FIGURE 10. Cocoa suitability index and GLSS 1 and 2 EAs with regional boundaries. Darker areas are more suitable for growing cocoa.

Table 1: Differences in CILSS and GLSS Questions

Variable	Differences in CILSS and GLSS
Right to rent: $= 1$ if the household has the right to rent out its land; $= 0$ if not.	*CILSS*: "Have the members of your household the right to cede or transfer all or part of the land they are using? For example: Can they rent out part of the land they use? Can they lend a part to someone? Can they lend or give part for sharecopping?" *GLSS*: "Have the members of your household the right to lease, rent out or sharecrop out all or part of the land they are using?"
Right to sell: $= 1$ if the household has the right to sell its land; $= 0$ if not.	*CILSS*: "Do the members of your household have the right to sell all or part of this land if they wish?" "Yes" and "No" are the only possible answers. *GLSS*: "Do you or the members of your household have the right to sell all or part of their land to someone else if they wish?" There are four possible answers: "Yes," "No," "Only after consulting family members who are not household members," and "Only after consulting the chief or village elders." In the GLSS, only 8% of the sample said they needed permission from their extended family, and only 1% of the sample said they needed permission from the chief. I code those responses as "No" to make the survey questions comparable, since if you need permission then the answer in the CILSS is presumably "No." A subtle difference between the two questionnaires is that the GLSS excludes land that the household rents in in this question, while the CILSS includes it. Because the sample is restricted to households that own some land, this is only relevant for households that also rent in land. However, because households generally do not have the right to sell the land that they rent in, this difference should have little effect.

Continued on next page

Variable	Differences in CILSS and GLSS
Rented out land in last 12 mos: $= 1$ if the household rented or sharecropped out any of its land in the last 12 months; $= 0$ if not.	*CILSS*: "Have the members of your household ceded or transferred land to someone who is not a member of the household in the past 12 months? For example: A member of the household who rents out land to someone? A member of the household gave land to sharecroppers?" *GLSS*: "Have any members of your household leased, rented out or sharecropped out land to someone who is not a household member in the last 12 months?" One concern about the slight difference in wording is that the CILSS would include land that is lent to another household for no payment, while the GLSS only includes renters who pay for land. Because of this, I define renting as including only *paid* use of land, including both sharecropping and fixed rent leases. I determine whether the land was paid for by using the subsequent question in both surveys asking for the amount paid.

Notes: For the CILSS, survey questions quoted include the clarifying language added to the survey questionnaire in 1987.

TABLE 2. Sample Descriptive Statistics

Variable	Mean	Std. Dev.	N
Ghana	0.570	0.495	4,925
Right to rent out land	0.509	0.5	4,922
Right to sell land	0.311	0.463	4,824
Rented out land in last 12 mos.	0.103	0.304	4,920
Sold land in last 12 mos.	0.007	0.083	3,738
Migrant	0.373	0.484	4,915
Grows coffee	0.204	0.403	4,925
Household head attended school	0.376	0.484	4,916
Household head literate	0.298	0.457	4,916
Household head numerate	0.341	0.474	4,916
Distance to border (km)	225	129	4,925

Notes: The sample is all households who own agricultural land in the Ghana Living Standards Surveys 1 and 2, 1987-1989, and Côte d'Ivoire Living Standards Survey, 1985-1988. The statistics are unweighted and describe the sample, not the population.

TABLE 3. Comparison of Ghana and Côte d'Ivoire

	Ghana	Côte d'Ivoire	Difference
Right to rent out land	0.381	0.669	-0.288***
	(0.0193)	(.0163)	(.0253)
Right to sell land	0.211	0.443	-0.232***
	(0.014)	(0.031)	(0.034)
Rented out land in last 12 mos.	0.062	0.150	-0.088***
	(0.007)	(0.015)	(0.017)
Sold land in last 12 mos.	0.008	0.004	.004
	(0.002)	(0.002)	(0.003)
Migrant	0.455	0.270	0.185***
	(0.020)	(0.023)	(0.031)
Grows coffee	0.010	0.445	-0.435***
	(0.003)	(0.003)	(0..027)
Household head attended school	0.505	0.198	0.307***
	(0.015)	(0.013)	(0.020)
Household head literate	0.382	0.175	0.207***
	(0.012)	(0.014)	(0.018)
Household head numerate	0.435	0.207	0.228***
	(0.015)	(0.013)	(0.020)
Distance to border	199.8	262.4	-62.61***
	(7.29)	(10.85)	(13.07)

Notes: The sample is all households who own agricultural land in the Ghana Living Standards Surveys 1 and 2, 1987-1989, and Côte d'Ivoire Living Standards Survey, 1985-1988. Population means for Côte d'Ivoire are estimated using survey sample weights provided by LSMS Study Office. Standard errors in parentheses are corrected for heteroskedasticity, account for the stratified sampling design, and are clustered at the EA level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 4. RD Estimates of Effect on Latitude

	Dependent variable: Latitude			
	(1)	(2)	(3)	(4)
Ghana	-0.039	0.001	0.040	0.308
	(0.451)	(0.398)	(0.285)	(0.530)
Polynomial order	4	1	1	1
Left bandwidth (km)	∞	165	330	82.5
Right bandwidth (km)	∞	84	168	44
Observations	3,967	1,062	2,300	599
R^2	0.12	0.06	0.04	0.08

Notes: Regressions are weighted using sample weights provided by LSMS Study Office for Côte d'Ivoire. Standard errors in parentheses are clustered at the EA level. Column (2) uses optimal bandwidths that minimize the cross-validation criterion function on either side of the border; columns (3) and (4) use twice and half the optimal bandwidths, respectively. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 5. RD Estimates of Effect on Right to Rent Out Land

	Dependent variable: Right to rent out land			
	(1)	(2)	(3)	(4)
Ghana	0.065	0.050	-0.022	0.159
	(0.116)	(0.098)	(0.075)	(0.131)
Polynomial order	4	1	1	1
Left bandwidth (km)	∞	170	340	85
Right bandwidth (km)	∞	70	140	35
Observations	3,964	1,029	2,015	574
R^2	0.11	0.02	0.02	0.02

Notes: Regressions are weighted using sample weights provided by LSMS Study Office for Côte d'Ivoire. Standard errors in parentheses are clustered at the EA level. Column (2) uses optimal bandwidths that minimize the cross-validation criterion function on either side of the border; columns (3) and (4) use twice and half the optimal bandwidths, respectively. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 6. RD Estimates of Effect on Right to Sell Land

	Dependent variable: Right to sell land			
	(1)	(2)	(3)	(4)
Ghana	0.172	0.056	0.139	-0.071
	(0.131)	(0.133)	(0.098)	(0.156)
Polynomial order	4	1	1	1
Left bandwidth (km)	∞	64	128	34
Right bandwidth (km)	∞	130	260	65
Observations	3,866	919	2,112	407
R^2	0.16	0.01	0.06	0.02

Notes: Regressions are weighted using sample weights provided by LSMS Study Office for Côte d'Ivoire. Standard errors in parentheses are clustered at the EA level. Column (2) uses optimal bandwidths that minimize the cross-validation criterion function on either side of the border; columns (3) and (4) use twice and half the optimal bandwidths, respectively. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 7. RD Estimates of Effect on Renting Out Land

	Dependent variable: Rent out land			
	(1)	(2)	(3)	(4)
Ghana	-0.056	-0.216**	-0.032	-0.299***
	(0.100)	(0.089)	(0.095)	(0.112)
Polynomial order	4	1	1	1
Left bandwidth (km)	∞	50	100	25
Right bandwidth (km)	∞	292	584	146
Observations	3,962	2,059	2,737	893
R^2	0.04	0.01	0.05	0.03

Notes: Dependent variable is an indicator of whether the household rented out any land in the last 12 mos. Regressions are weighted using sample weights provided by LSMS Study Office for Côte d'Ivoire. Standard errors in parentheses are clustered at the EA level. Column (2) uses optimal bandwidths that minimize the cross-validation criterion function on either side of the border; columns (3) and (4) use twice and half the optimal bandwidths, respectively. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 8. RD Estimates of Effect on Schooling

	Dependent variable: Schooling			
	(1)	(2)	(3)	(4)
Ghana	0.363***	0.347***	0.364***	0.432***
	(0.099)	(0.066)	(0.046)	(0.099)
Polynomial order	4	1	1	1
Left bandwidth (km)	∞	287	574	148.5
Right bandwidth (km)	∞	104	208	52
Observations	3,967	1,675	3,031	792
R^2	0.12	0.13	0.11	0.11

Notes: Dependent variable is an indicator of whether the household head ever attended school. Regressions are weighted using sample weights provided by LSMS Study Office for Côte d'Ivoire. Standard errors in parentheses are clustered at the EA level. Column (2) uses optimal bandwidths that minimize the cross-validation criterion function on either side of the border; columns (3) and (4) use twice and half the optimal bandwidths, respectively. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 9. RD Estimates of Effect on Literacy

	Dependent variable: Literacy			
	(1)	(2)	(3)	(4)
Ghana	0.124	0.155***	0.218***	0.254***
	(0.093)	(0.058)	(0.044)	(0.091)
Polynomial order	4	1	1	1
Left bandwidth (km)	∞	287	574	148.5
Right bandwidth (km)	∞	104	208	52
Observations	3,967	1,605	2,977	739
R^2	0.06	0.06	0.05	0.03

Notes: Dependent variable is an indicator of whether the household head is literate. Regressions are weighted using sample weights provided by LSMS Study Office for Côte d'Ivoire. Standard errors in parentheses are clustered at the EA level. Column (2) uses optimal bandwidths that minimize the cross-validation criterion function on either side of the border; columns (3) and (4) use twice and half the optimal bandwidths, respectively. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 10. RD Estimates of Effect on Numeracy

	Dependent variable: Numeracy			
	(1)	(2)	(3)	(4)
Ghana	0.224***	0.236***	0.252***	0.310***
	(0.098)	(0.072)	(0.051)	(0.103)
Polynomial order	4	1	1	1
Left bandwidth (km)	∞	259	518	129.5
Right bandwidth (km)	∞	79	158	39.5
Observations	3,967	1,422	2,508	724
R^2	0.07	0.06	0.06	0.05

Notes: Dependent variable is an indicator of whether the household head can perform written calculations. Regressions are weighted using sample weights provided by LSMS Study Office for Côte d'Ivoire. Standard errors in parentheses are clustered at the EA level. Column (2) uses optimal bandwidths that minimize the cross-validation criterion function on either side of the border; columns (3) and (4) use twice and half the optimal bandwidths, respectively. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 11. RD Estimates of Effect on Coffee Production

	Dependent variable: Grows coffee			
	(1)	(2)	(3)	(4)
Ghana	-0.577***	-0.490***	-0.314***	-0.545***
	(0.086)	(0.059)	(0.052)	(0.074)
Polynomial order	4	1	1	1
Left bandwidth (km)	∞	287	574	138.5
Right bandwidth (km)	∞	143	286	71.5
Observations	3,967	1,891	3,492	927
R^2	0.48	0.23	0.43	0.02

Notes: Dependent variable is an indicator for whether the household grows coffee. Regressions are weighted using sample weights provided by LSMS Study Office for Côte d'Ivoire. Standard errors in parentheses are clustered at the EA level. Column (2) uses optimal bandwidths that minimize the cross-validation criterion function on either side of the border; columns (3) and (4) use twice and half the optimal bandwidths, respectively. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

TABLE 12. Effect of Cocoa Cultivation on Property Rights Institutions

Dep. Var.:	(1) $FracCocoa_v$ OLS	(2) Right Rent OLS	(3) Right Rent OLS	(4) Right Rent IV	(5) Right Sell OLS	(6) Right Sell OLS	(7) Right Sell IV
$CocoaSuit_v$	0.166***		0.113***			0.124**	
	(0.027)		(0.042)			(0.049)	
$FracCocoa_v$		0.537***		0.670***	0.359***		0.768**
		(0.12)		(0.25)	(0.12)		(0.32)
Constant	0.0297	0.261***	0.272***	0.239***	0.221***	0.189***	0.158***
	(0.024)	(0.031)	(0.039)	(0.052)	(0.032)	(0.044)	(0.057)
Observations	4714	3485	3486	3485	2744	2745	2744
R^2	0.33	0.05	0.04	0.04	0.11	0.10	0.10

Notes: $CocoaSuit_v$ is cocoa suitability index $\in [0, 1]$. $FracCocoa_v$ is the fraction of cultivated land in the EA on which cocoa is planted. In (5), $FracCocoa_v$ is instrumented by $SuitIndex_v$. In (4) and (7) $FracCocoa_v$ is instrumented by $CocoaSuit_v$. Standard errors in parentheses are clustered at the EA level. All regressions include region indicators as controls. Sample: Ghana Living Standards Surveys 1 and 2, households who own agricultural land. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.