Legible Institutions and Land Demand: The Effect of Property Rights Systems on Investment in Liberia

Darin Christensen [*] and Alexandra Hartman [†] and Cyrus Samii [‡]

This Draft: February 22, 2017
Preliminary, please do not circulate or cite.

Abstract

We address a major debate in the development literature over the effects of private versus customary property rights systems on investment and welfare. This debate has been reinvigorated by a dramatic increase in the demand for land in developing countries: despite political economists' claims that investors favor private property rights, observers argue that customary systems have enabled large-scale "land grabs." We develop a model of investment under different property rights systems and then use use a natural experiment in Liberia — a major target of new investment — to evaluate the effects of these regimes on investment. Laws dating back to the 19th Century established two parallel property rights systems. We combine geographical discontinuity and difference-in-difference methods to assess differential changes in investment in title-based and customary property rights systems in the aftermath of the Global Food Crisis of 2007-8. We find that investment increased more rapidly where private property rights prevailed; moreover, this divergence is caused by larger and more active agribusiness concessions.

[*] Assistant Professor of Public Policy, UCLA. e: darinc@luskin.ucla.edu.
[†] Assistant Professor of Political Science and Public Policy, UCL. e: alexhartman@gmail.com.
[‡] Assistant Professor of Politics, NYU. e: cds2083@nyu.edu

The Global Food Crisis of 2007-8 led to a dramatic spike in the demand for land. In response to higher food prices, investors began acquiring large tracts for new agribusiness operations. Much of this land was in developing countries: according to estimates from the Land Matrix, agricultural land acquisitions total over 40 million hectares (roughly the size of California and larger than Germany), and another 20 million hectares are covered by intended deals (Nolte, Chamberlain and Giger 2016, vi). Moreover, African countries remain the largest target, accounting for just under half of all recorded deals; the Government of Liberia has, by some estimates, already committed up to 75 percent of the country, much of it to commercial companies (De Wit 2012, 1).

These trends are puzzling in light of the political economy literature (North 1981; Acemoglu, Johnson and Robinson 2005). We expect investors to favor stable democratic countries with strong protections for property rights (La Porta et al. 1998; Jensen 2008). The appeal of institutions that protect private property is baked into international indexes that rank the relative "ease of doing business" (World Bank) or "business freedom" (Heritage Foundation) afforded by different states. At the micro-level, a large literature within development economics stresses how secure property rights encourage forward-looking investments in property (e.g., Besley 1995; Field 2005; Goldstein and Udry 2008).

Deininger and Byerlee (2011), echoing the concerns of many NGOs, claim that the recent spate of land deals — often termed "land grabs" — follows a different logic. Investors have focused attention on countries like Liberia, because these states allow investors to simply displace prior land users and, thus, acquire large tracts of land at low prices. In this account, weak property rights actually attract land investments, which get bogged down by regulations that require, for example, free, prior, and informed consent before leases can be concluded that oust existing land users.

This debate among political economists echoes a disagreement among anthropologists and political scientists about whether customary property rights systems — regimes in which local authorities manage land on behalf of a descent-based communities — deter investment.[1] This is a debate that extends well-beyond West Africa; customary property rights systems govern up to six billion hectares of land used by over two billion rural poor Wily (2011). On the one hand, customary institutions can be more flexible: local authorities are not constrained by national law and can tailor local solutions to local needs (Boone 2014). In Liberia, for example, some argue that customary authorities quickly reallocated land following the country's civil war, enabling the speedier resumption of agricultural activity. On the other hand, customary systems can be difficult for outsiders to understand; per Scott (1999) these property rights systems are less externally "legible." Where the rules for allocating land are difficult to discern, outside investors must pay to learn local rules, incurring high transactions costs.

[1] Boone (2014) uses the term "neocustomary" to describe these tenure systems in which Chiefs or other indigenous authorities manage land on behalf of a descent-based community. While we do not attach the "neo-" prefix, we certainly agree with her claim that land rules and practices have changed dramatically since the pre-colonial period and that the term customary can obscure these changes.

We develop a formal model to incorporate the claims raised by these literatures about why different property rights systems promote investment: private property protects owners and is legible to outsiders; customary systems, on the other hand, permit the displacement of existing users but can be difficult to discern. Depending on the relative magnitudes of these forces, our model can rationalize the conflicting predictions from prior research. If illegible customary systems imply prohibitive transaction costs, we expect greater investment under the formal system (per, for example, Besley 1995); alternatively, if local authorities depress land prices by displacing farmers who cannot threaten to resist, this could attract investors seeking cheap tracts of land (a la Deininger and Byerlee 2011).

We develop a formal model to incorporate the claims raised by these literatures about why different property rights systems promote investment: private property protects owners and is legible to outsiders; customary systems, on the other hand, permit the low-cost displacement of existing users but can be difficult to discern. Depending on the relative magnitudes of these forces, our model can rationalize the conflicting predictions from prior research. If illegible customary systems imply prohibitive transaction costs, we expect greater investment under the formal system (per, for example, Besley 1995); alternatively, if local authorities depress land prices by displacing farmers, this could attract investors seeking cheap tracts of land (a la Deininger and Byerlee 2011).

We take these competing predictions to data, evaluating how property rights systems affect investment by exploiting a natural experiment in the West African state of Liberia — a case that is frequently used to illustrate both the promise and peril of outside investments in primary commodities. Liberia provides an excellent case to evaluate the effects of institutions on investments, because of a unique institutional feature: two parallel property rights regimes existed in different geographic zones of the country throughout much of its history. In the coastal zone (also dubbed the Littoral or County Area), colonial settlers established a formal system of private property. By contrast, Liberian law (until very recently) stipulates that customary property rights govern land further than forty miles inland from the coast.

We exploit this geographic discontinuity in property rights systems and look at whether, as global demand for land increases, we see differential *changes* in land clearing (our primary measure of investment) on either side of this institutional boundary. Our empirical design combines the strengths of a difference-in-differences and regression discontinuity: looking only at land that falls in a narrow band around the discontinuity and, thus, has similar growing conditions allows us to more credibly estimate the counterfactual trend in investment. This quasi-experimental design contributes to an empirical literature that has tended to rely more heavily on cross-sectional comparisons of countries or regions governed by customary versus formal property rights systems (see Lawry et al. 2014, for a recent review).

In the aftermath of the the Global Food Crisis of 2007-8, we find a larger increase in land clearing in the County Area, where formal private property rights enable market-based land transactions. The effect is both robust and substantial, amounting to roughly half of the mean of the dependent variable. Our empirical

design, which includes fixed effects for every 1 km^2 cell and year, rules out time-invariant geographic features or country-wide shocks. Furthermore, restricting attention to a band just around the institutional boundary bolsters our identifying, parallel-trends assumption.

In addition to our main result, we look into mechanisms, homing in on the large increase in concession agreements concluded (largely) by international investors. Agricultural concessions, for which we see the most intense forest clearing activities, are concentrated in the County Area. And restricting attention to concession areas, we see more land clearing in agricultural concessions held on the formal side of the boundary. For agribusinesses, property rights systems appear to affect both the extensive and intensive margins: private property rights lead to more land being leased and more of that land is subsequently cleared.

Combining our formal model and empirical results, we compare farmers' predicted income under the different property rights systems. The consequences of foreign investments in land differ depending on whether farmers contract directly with investors under a system of private property or, instead, rely on chiefs under a customary system. Perhaps unsurprisingly, farmers benefit more from investment where local authorities cannot serve as middlemen and siphon off rents.[2]

1. Background: Land Acquisition and Investment in Liberia

1.1 Dual Land Tenure Systems in Liberia

Prior to land reforms implemented after the Liberian Civil War (1989-2003), Liberian law divided the country into two zones:

> "The territory of the Republic shall be divided for the purpose of administration into the County Area and Hinterland. **The County Area shall include all territory extending from the seaboard forty miles inland and from the Mano to the Cavalla Rivers.' The Hinterland shall commence at the eastern boundary of the County Area; i.e., forty miles inland and extend eastward as far as the recognized limit of the Republic**" (Government of Liberia 1956, emphasis added)

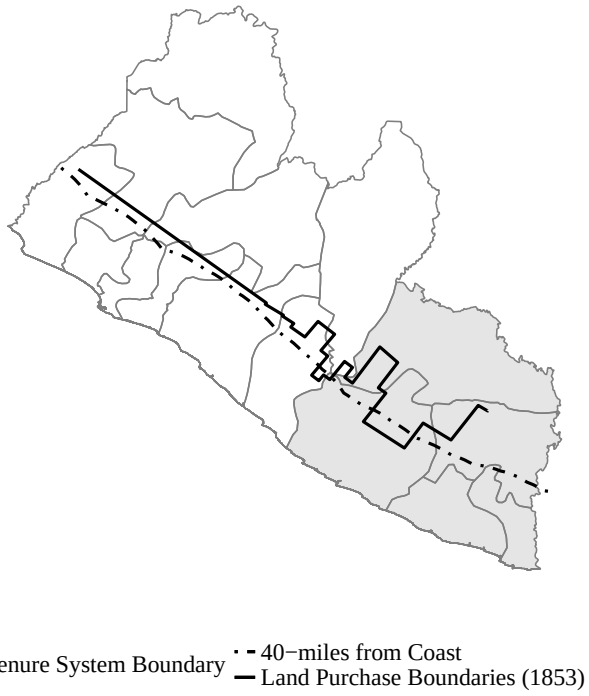
These zones demarcated two distinct systems of property rights: in what Liberian law referred to as the County area, Americo-Liberian settlers and their descendants instituted a "Western statutory system of land ownership based on individual fee simple titles" (USAID 2016). Fee simple titles are the highest possible ownership interest under common law; holders can alienate, divide, or hand down their property. By contrast, in what the law referred to as the Hinterland (roughly 60 percent of Liberia's territory), customary systems govern collectively owned land; individuals or families living in these areas enjoy access rights that stop substantively short of full ownership with some variation across the Hinterland districts.

[2] Our analysis does not incorporate the positive (e.g,. infrastructure) or negative (e.g., pollution) externalities associated with commercial investments (Wily 2011). A comprehensive welfare analysis of concessions, which we do not attempt here, would look beyond surface rents.

Figure 1 displays a boundary (dashed) forty miles from the coast, as well as the purchase boundaries (solid line) of early settlers as of 1853. As is apparent from the map, these boundaries track each other closely, particularly north west of Sinoe County. This close correspondence reflects what Unruh (2008, 20) calls "discriminatory pluralism," the early practice of granting private, fee simple titles to settlers while denying those same rights to the so-called "indigenous" populations unless they became "civilized."

Following the end of the Liberian Civil War in 2003, the central government passed several legal reforms aimed at reshaping the property rights system throughout the country. These include a 2008 moratorium on transactions involving Public Land, the Community Rights Law of 2009 with Respect to Forest Lands, and the 2016 Land Rights Act. However, given the halting reform process, de facto property rights continue to reflect the pre-war division of the country into two parallel zones, each with several key characteristics.

Figure 1: Discontinuity in Liberia's Land Tenure Regimes



The 40-mile buffer and purchase boundaries diverge in the shaded counties. We designate these — Grand Gedeh, Grand Kru, Maryland, Sinoe, and River Gee — the "southern counties" and exclude them from selected analysis below.

The Hinterland zone exhibits a set of features that created flexible, community-based property rights that were not very legible to outsiders. First, little or no formal documentation of land rights exists (Stevens 2014). The Government of Liberia has never conducted a general survey of land in the Hinterland. Instead, community members rely on natural landmarks and oral histories to identify the boundaries of their landholdings

(Alden-Wiley 2007). Over time, development and population growth overburdened this system leading to overlapping claims (World Bank et al. 2015).

Second, the legal status of land was not defined until the 2016 reform (Bruce 2008). For most of the 20th Century, Liberian law suggested that all land in the Hinterland should be considered public land, with allocative authority resting with the central government. Although some property rights legislation[3] suggested that local authorities retain decision-making power over community land, it did not practically define the distinction between community and public land.

Third, in practice the customary system limits individual rights over land in Hinterland communities. Liberian law and local authorities agree that community lands could not be alienated or used as collateral without permission from community authorities. Any proposed sale of community lands necessitates a complicated process of acquiring a tribal certificate. This costly process is rarely (if ever) followed according to the letter of the law; as a result, many transactions involving community land would not stand if subjected to legal scrutiny (Bruce 2008). Even family plots (outside of community lands) could not be freely disposed of by their owners. Decisions about land transfers pass through community leadership and a "landlord," an insider that claims first-comer status (Alden-Wiley 2007).

Finally, community members question the permanence and legality of transfers to outsiders. Historically, membership in the community determined who did and did not enjoy access to land; this norm has been invoked to reverse land deals in the Hinterland.[4] This creates a flexible system that allows communities to evolve property rights that suited their own interpersonal dynamics and material resources. While the 2016 Land Rights Act seeks to reform this system, the law has not yet been implemented and most features persist.

In contrast, land administration in the County zone has always been much clearer. First, land deeds and maps exist that identify the owners of specific plots. Second, the status of land is defined, with a large proportion of land held by private individuals. Owners have the right to develop and transfer land without seeking approval from local authorities. Finally, a legal land market exists, with a government administration that support the process of transferring title. (Bruce 2008)

To preview the argument that we make below, these two property rights systems present potential investors with different challenges. Land deals under the customary system require negotiating with local authorities under vague laws. This can raise transactions costs — due, for example, to the complexity of the tribal certificate process — but also permits land deals that could not be concluded under a system of private property. Absent a functioning land market, prices can be set by (artificially low) local authorities; without title or even clear legal status, tenants or previous land holders can be displaced from their plots without warning or consent. While the customary system permits discretion, the absence of a clear legal basis and resentment against outsiders can lead to (sometimes violent) local efforts to renegotiate these agreements.

[3] ADD LEGISLATION HERE FROM STEVENS 2014

[4] see Konneh (1996) for a description of challenges faced by ethnic groups without indigenous status.

1.2 The Demand for Land & the 2007-8 Global Food Crisis

A recent increase the demand for arable land has increased the salience of property rights systems in countries like Liberia. Following two decades of decline, food prices started to tick up in the early 2000s and spiked in 2008: between 2003 and 2008 the world prices for maize and wheat doubled (Cotula 2012, 662). While demand wavered during the financial crisis and resulting global economic downturn, prices returned to their 2008 levels in 2011. And the medium- to long-run projections suggest that food prices will remain high or even increase: a larger and increasingly urbanized and wealthy population puts upward pressure on demand; rising input (e.g., fuel) costs and declining production in other regions constrain supply (Deininger 2011, 219).

This real and projected rise in food prices and an increase in the demand for biofuels prompted a global search for affordable, arable land. Deininger (2011, 217) observes

> "Land demand, which was propelled to extraordinarily high levels in the wake of the 2007/08 commodity price spike…Expressed demand also focused disproportionately on Africa, where two-thirds of such demand is concentrated and where demand in 2009 alone was equivalent to more than 20 years of previous land expansion."

Liberia, like other countries in West Africa, became a target for new investments. Between 2004 and 2009, Deininger and Byerlee (2011, xxxii) report that investors acquired or renegotiated concession agreements covering 1.6 million hectares in Liberia — roughly 17 percent of the country's land area.[5]

Investor interest in Liberia, these authors argue, is not simply driven by land availability. Rather, they claim that international investors increasingly favor states like Liberia, because they have weak land governance (49). Prompted by the 2007-8 food crisis, investors have targeted countries with weak property rights, where they can acquire land "essentially for free and in neglect of local rights" (Deininger and Byerlee 2011, 55).

2. Theory: Property Rights Systems and (Foreign) Investment

As interest in Liberia increases, we consider how the parallel property rights systems in Liberia's County and Hinterland areas affect investors' decisions about how much land to acquire and at what price. We construct a model to illustrate how the legibility and (the absence of) land markets change the costs that investors pay to lease acreage. To preview the model's predictions, investors appreciate legibility and the lower implied

[5] A 2012 report offers a more startling assessment:

> "Inventory work at the national level indicates that the [Government of Liberia] has already allocated 50.95% of the total Liberian land mass as different long term land use rights (25 years and more) to various categories of land users, especially to commercial companies. Planned extensions of these areas take up another 25%, thus 75% of Liberian land is already committed, at least theoretically" (De Wit 2012, 1).

transactions costs in the County area. Yet, they also prefer lower prices. If, as Deininger argues, local authorities can neglect local rights and, thus, depress prices, this could attract investment. The balance of these counter-acting forces then determines whether more or less land acquisition occurs in the legible County area or the flexible Hinterland area, where customary authorities, rather than pure market forces, determine land prices.

2.1 Investment under Private Property

A 2015 report from the World Bank outlines the process through which investors acquire land in Liberia. "The most straightforward case," they observe, "is where there is clear evidence of private rights to the land in the concession area. In such cases the concessionaire generally negotiates directly with the owner to lease the land and provide annual lease payments" (28). This suggests a very simple model of land acquisition (see left side of figure 2): an investor (I) approaches a land-owner or farmer (F) and proposes to lease some amount of land ($\ell \geq 0$) and names a unit price ($p \geq 0$). Investors maximize profits given by $\pi(\ell, p) = (k/\alpha)\ell^{\alpha} - \ell(p + t_{pp})$, which incorporates transactions costs ($t_{pp} \geq 0$) and diminishing marginal returns ($k > 0, \alpha = 1/2$).[6] The farmer can reject this offer, end the game, and earn the prevailing rental rate ($r > 0$); in that case, the investor pays and earns nothing. Alternatively, the farmer can accept the investor's terms, though this comes with some risk: perhaps the investor will make productivity enhancing investments in the farmer's land or community, a positive shock ($\gamma > 0$); however, it is also possible that the investor will fold and fail to pay, a negative shock ($-\gamma$). These shocks are scaled by the size of the investment.

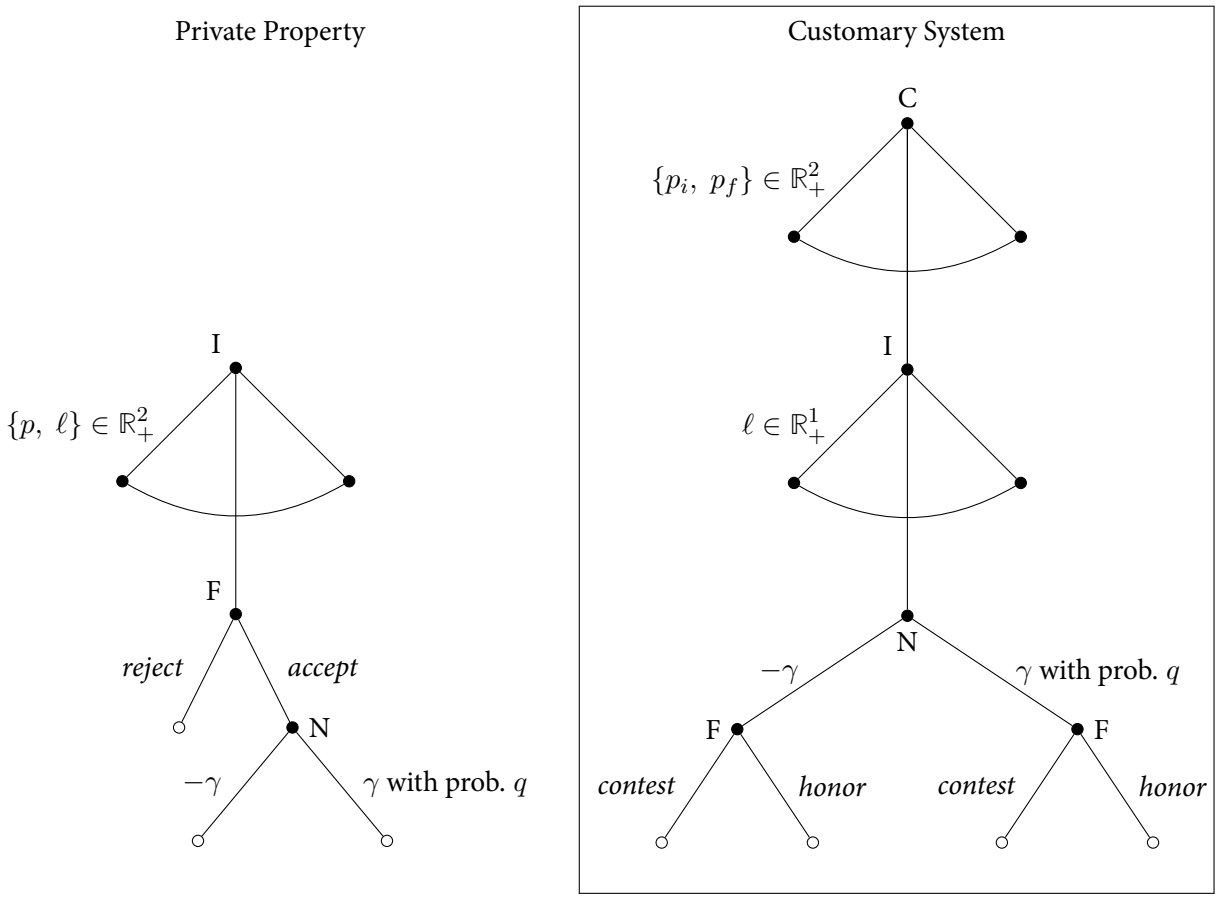
In equilibrium, the investor offers the lowest price that leaves the farmer indifferent between accepting and rejecting: $p^* = r - \gamma(2q - 1)$. Given that price, the investor maximizes profits by choosing $\ell^* = \left(\frac{k}{p^* + t_{pp}}\right)^{1/(1-\alpha)}$. Unsurprisingly, land acquisition falls as price increases, either due to higher transactions costs, increases in the rental rate, or when the downside risk to the farmer rises.

2.2 Investment under Customary System

In a customary system, a representative of the community leadership, who we refer to as the chief (C), assumes a decisive role in negotiations with outside investors, both setting the price the investor pays and deciding what share of surface rents to disburse to the farmer whose land is being acquired. We amend our model accordingly to incorporate the chief as a third actor. In this new game (right side of figure 2), the chief first sets both the price that the investor pays ($p_i \geq 0$), as well as the price paid to the farmer ($p_f \geq 0$). The investor then chooses how much land to acquire at the chief's price ($\ell(p_i) \geq 0$). As before, with some probability (q) the investment delivers a positive shock to the farmer (e.g., a new job); conversely, the investment detract from the farmer's welfare (e.g., polluting a local stream). After this shock is realized,

[6] We subscript t_{pp} to indicate that these are the unit transactions costs under a system of private property, which could differ from transactions costs under the customary system described below.

Figure 2: Land Investment under Private Property vs. Customary Systems



the farmer decides whether to honor the agreement struck by the chief or to contest the deal at a cost ($c > 0$) and earn the rental rate ($r \geq c + \gamma$). If the farmer contests, both the chief and investor receive nothing.

The farmer's and investor's decisions are simple. Let $s \in \{-\gamma, \gamma\}$ be the realized shock. The farmer honors the agreement only if $p_f + s \geq r - c$. The investor maximizes profits given the chief's price offer: $\ell^*(p_i) = \left(\frac{k}{p_i + t_c}\right)^{1/(1-\alpha)}$.[7]

The chief sets prices for the investor (p_i) and farmer (p_f) to maximize the following objective function: $\mathbb{1}(\text{F } \textit{honors})(p_i - p_f)\ell^*(p_i)$. The chief never wants to overpay the farmer. He either sets $p_f = \underline{p_f} = r - c - \gamma$, squeezing the farmer, and facing contestation with positive probability ($1 - q$); alternatively, he sets $p_f = \overline{p_f} = r - c + \gamma$ and ensures that the farmer honors the agreement even following a negative shock. The chief

[7] As our empirical strategy accounts for differences in the productivity of land on either side of the discontinuity, we assume that k and α are the same under both private property and the customary system.

pays the farmer the lower price if

$$\max_{p_i}\{q(p_i - \underline{p_f})\ell^*(p_i)\} \geq \max_{p_i}\{(p_i - \overline{p_f})\ell^*(p_i)\}$$
$$\text{Assuming } \alpha = 1/2\,, \quad q \geq \frac{\underline{p_f} + t_c}{\overline{p_f} + t_c} = \frac{r - c - \gamma + t_c}{r - c + \gamma + t_c} \tag{1}$$

If equation (1) is satisfied, then the chief pays the lower price to the farmer ($\underline{p_f}$) and charges the investor the revenue-maximizing price: $p_i^* = 2\underline{p_f} + t_c$. Otherwise, the chief pays the farmer the higher price ($\overline{p_f}$) and leases to the investor at a higher unit price: $p_i^* = 2\overline{p_f} + t_c$.

2.3 Investment Levels under Different Tenure Regimes

We can now compare investment levels under the two different tenure regimes at different parameter values. In particular, we ask: under what conditions is investment higher under the system of private property?

First, suppose that equation (1) does not hold, and the chief offers the higher price to the farmer ($\overline{p_f}$). Then the level of land investment under private property is greater if

$$2t_c - t_{pp} \geq 2c - r - \gamma(2q + 1) \tag{2}$$
$$\text{as } q \to 0, \quad 2t_c - t_{pp} \geq 2c - r - \gamma$$

This condition holds when transactions costs are relatively high on the customary side and when the farmer's costs to resisting the agreement between the chief and investor are not too high relative to the rental rate (i.e., the farmer's outside option). Where resistance is extremely costly to the farmer, the chief can drive down land prices and, thus, encourage greater investment.

Second, if equation (1) is satisfied, then the chief offers the lower price to the farmer ($\underline{p_f}$), and the level of land investment under private property is greater if

$$2t_c - t_{pp} \geq 2c - r - \gamma(2q - 3) \tag{3}$$
$$\text{as } q \to 1, \quad 2t_c - t_{pp} \geq 2c - r + \gamma$$

The right side of equation (3) is larger than equation (2), making this condition more difficult to satisfy. When the probability of a positive shock (q) is high, then the chief can pay the farmer less and pass some of that savings onto the investor. Whether this results in greater investment than under private property again depends on the difference in transactions costs, as well as the farmer's costs to resisting the deal.

This model helps rationalize conflicting predictions regarding the relationship between tenure systems and investment levels. Deininger and Byerlee (2011) claim that investors target areas with weak property

rights, where they can acquire land at next to nothing by neglecting local rights. One could argue that these are places where the costs of contesting concession agreements are prohibitive (c is large). In the absence of functioning, impartial courts or facing the threat of repression, farmers may be effectively coerced into accepting surface rents well below the rate at which they value their land. This allows chiefs to profit while still advertising relatively low lease rates to investors, generating increased investment. More formally, as c increases, equations (2) and (3) become more difficult to satisfy, making it more likely that land investment is higher on the customary side.

Second, as we note above, transaction costs are often much higher where land owners do not hold private titles to their land. While transacting directly with private owners in Liberia is "straightforward," the same World Bank report notes that "communities and individuals in concession areas [often] lack formal ownership rights under the current law, despite the fact that they have long inhabited or productively used the land…Often, people's claims to the land arise from historical use and/or *customary systems*…Concessionaires have generally been left to develop their own policies with regard to these claims" (29, emphasis added). In short, customary systems are less legible: investors must sort out vague, overlapping claims to land, and "local systems for managing these claims — generally a standard hierarchy of customary authorities — are not equipped to manage these conflicts in concession areas…" (29). In terms of our model, transaction costs in customary areas exceed those costs given private ownership: $t_c \gg t_{pp}$. This increases the left sides of equations (2) and (3), making it more likely that we observe heightened investment given private property.

3. Empirical Strategy: Exploiting a Discontinuity with Panel Data

Identifying the causal effects of economic institutions, such as private property rights, is a challenge given concerns about reverse causality and omitted variables (Acemoglu, Johnson and Robinson 2005, 403). As Besley and Persson (2011) argue, higher levels of investment and income encourage governments to make complementary investments in fiscal and legal capacity, including the protection of private property rights. In their framework, past income helps determine future legal capacity and tenure security — a clear instance of reverse causality. Equally vexing, in a cross-sectional design it is difficult to enumerate and measure all the variables that could jointly determine both investment and property rights (e.g., Glaeser et al. 2004).

Recent work has attempted to overcome these issues with experimental or quasi- experimental designs. Previous scholars have tended to focus on identifying the impact of increasing individual property rights security. Field (2005; 2007) shows how formalizing individual property rights shapes both household economic outcomes and decision-making within the household. In Ghana, individual titles increased the use of land as collateral, and in Buenos Aires titling initiatives increased investment and improved health outcomes (Besley 1995; Galiani and Schargrodsky 2004). We build on these studies to study the long term impacts of different property rights systems on investments in land.

We compare changes in land investment (proxied by forest loss) before and after the 2007-8 Global Food Crisis across the two property rights regimes. Specifically, we estimate:

$$y_{it} = \alpha_i + \gamma_t + \beta D_{it} + \eta X_{it} + \varepsilon_{it} \tag{4}$$

where i indexes cells; t, year; and D_{it} is an indicator variable that takes a one in the County Area after 2007. X_{it} is a matrix of covariates, such as county or concession type.

This difference-in-differences design rests on the parallel-trends assumption — namely, that investment would have followed the same trend had there been no difference in land tenure. While this is an untestable assumption, we bolster its credibility by first showing that investment in the Customary and County Areas follows parallel trends prior to the Global Food Crisis.

Nonetheless, readers may be concerned that different agro-climatic conditions (e.g., elevation, precipitation, temperature) exist on either side of this geographic discontinuity. Time-invariant differences in, for example, growing conditions will be absorbed by our unit fixed effects (the α_is) and not confound our analysis. Yet, as international demand spikes, investors might be attracted to the County Area if, for example, it provides superior growing conditions. To address these concerns about time-varying selection and increase the credibility of our parallel trends assumption, we restrict attention to areas close to the 40-mile boundary (the dashed boundary in figure 1).

In summary, we combine features of a difference-in-differences and regression discontinuity to strengthen our empirical strategy. Looking at a narrow band around the discontinuity, growing conditions are quite similar in treatment and control areas. As such, we expect that trends in the Hinterland area provide a credible estimate of counterfactual land clearing activity on the County side.

4. Data

4.1 Forest Loss

Our outcome data comes from Hansen et al. (2013), who provide information on annual forest cover loss from 2000-2014 at an extremely fine spatial resolution (30 m at the equator). Over 50 million cells are contained in our 40-kilometer bandwidth around the discontinuity. For largely computational reasons, we aggregate these 30-m cells to a roughly 1-km resolution by creating blocks of the original cells that measure 36×36. Forest loss represents the complete removal of the tree cover canopy according to Landsat satellite imagery. Given that our interest is in land conversion, and that forest gain cannot be allocated to a specific year (as it occurs over a longer time span), our dependent variable (y_{it}) measures the proportion of 1-km cell i that experienced forest loss in or before year t.

The Global Forest Change data has been used extensively; Hansen et al. (2013) has been cited over 1500 times according to Google Scholar. The authors suggest that the data can be used to better understand "the

economic drivers of natural forest conversion to more intensive land uses" (853), and yet the data has received less attention in economics and political science (Burgess et al. 2012, being the most notable exception). A number of studies from other fields use forest loss data to study land use changes associated with industrial activities similar to recent concessions in Liberia. Abood et al. (2015), for example, find that logging, fiber, oil palm, and mining concessions account for over 40 percent of forest loss between 2000 and 2010 across several islands in Indonesia. Gaveau et al. (2016) find that plantation industries — principally, oil palm — have been the largest driver of forest loss in Malaysian Borneo since the early 1970s (see also Koh and Wilcove 2008).

Forest loss provides a particularly good measure of land conversion in Liberia. First, as is apparent in figure 4(b), at the beginning of our time series less than one percent of cells within our 40-kilometer bandwidth had experienced forest loss. We are unlikely to miss changes in land use on already cleared land, simply because very little area had been cleared. Second, forest loss captures extraction and investment activities. In the case of logging concessions, forest loss is recorded in areas targeted for felling; in agricultural concessions, clearing and de-stumping represents an initial investment to prepare the land for planing; finally, in mining and all other concessions, forest is cleared to construct roads or other production facilities. Our outcome variable captures actual changes in land use, rather than the acreage codified in concession agreements — figures that often drastically overstate the scale and intensity of commercial activity. Figure 5 demonstrates, for example, that less than five percent of the area within forestry concessions — both forest management and timber sales contracts — saw any forest loss by 2014.

4.2 Concession Areas

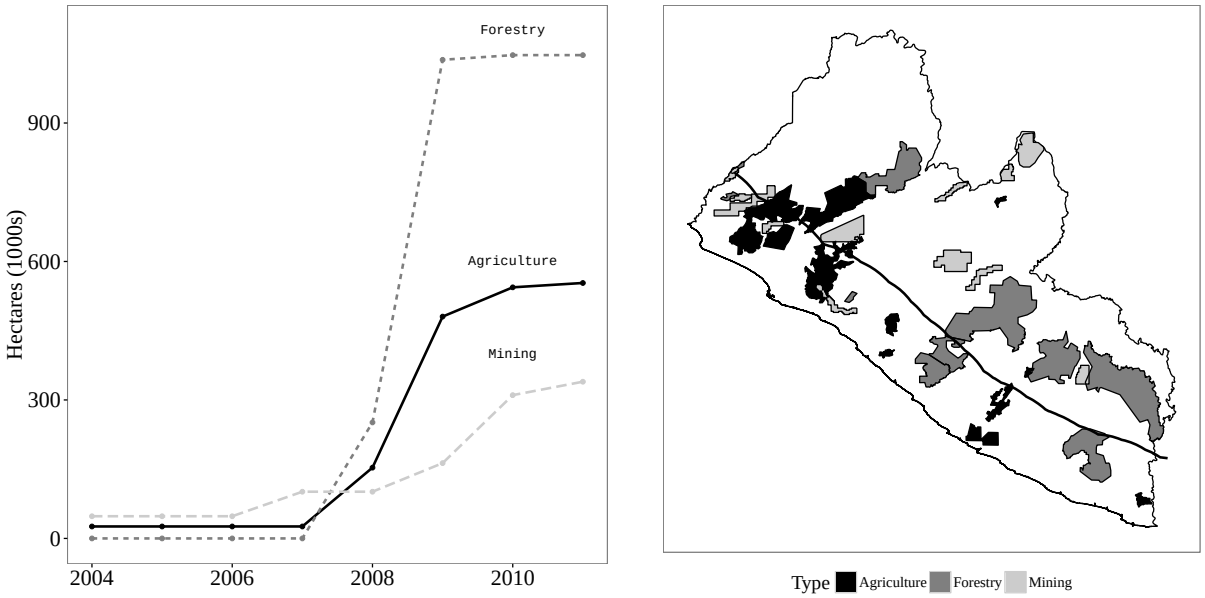
We acquired maps of current concession boundaries from Liberia's National Bureau of Concessions. These include 25 unique concession holders (excluding community managed forests): 8 in agriculture (totaling 553,400 Ha.), 10 in forestry (1,047,100 Ha.), and 7 in mining (339,500 Ha.). These data include the start date for each concession, which allows us to plot the area held under concession agreements over time. As is apparent in figure, agribusiness activity increases after 2007. The area held under Forest Management Contracts increases sharply in 2009 with the passage of the new forestry act.

It is important to remember that these areas reflect the concession boundaries and *not* the area under production. According to the 2015 World Bank report, some agricultural and forestry concessions have seen little activity due, in part, to the challenges associated with negotiating access rights to land . Hence, we rely more heavily on the forest loss measures, which better capture the intensity of land use.

4.3 Agro-Climatic Variables

Our identification strategy addresses concerns about fixed characteristics of places (i.e., cells) that could affect land conversion and investment. We rely, however, on the assumption that areas governed by the different land tenure systems would have followed in the same trends post-2007 had there been no difference

Figure 3: Current Concession Activity in Liberia



(a) Area within Commercial Concessions

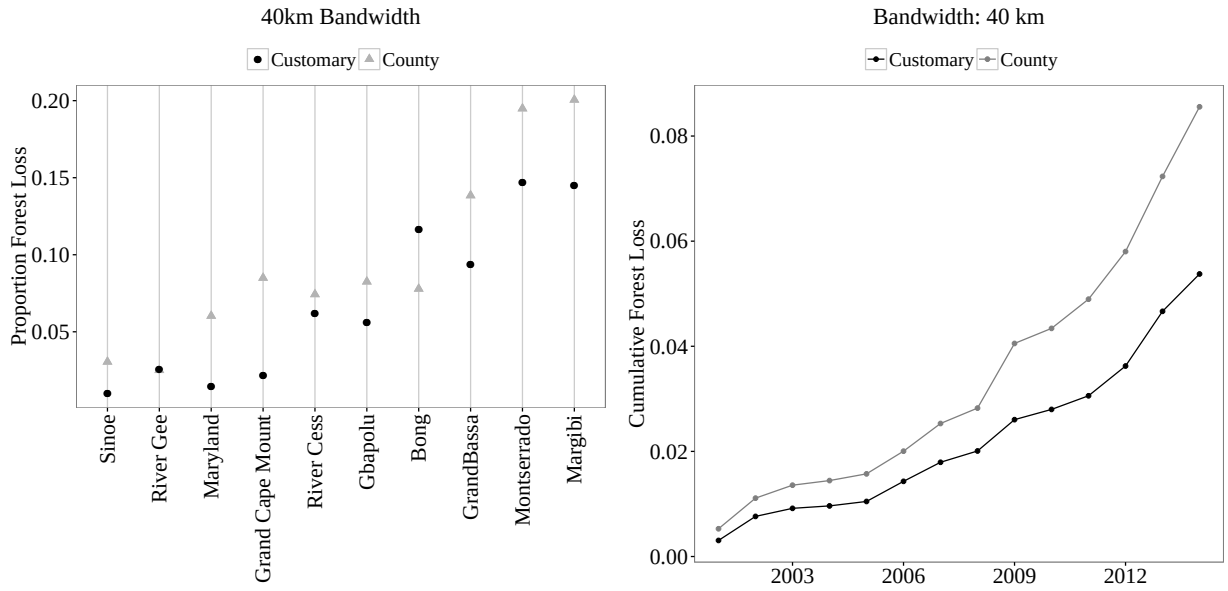
(b) Commercial Concession Boundaries

in land administration. If growing conditions differed dramatically in treatment and control areas, it would be difficult to defend this assumption. We, thus, focus our attention on the places just to either side the discontinuity, where minor variations in agro-climatic conditions are unlikely to account for sharply diverging trends in land use.

To assess differences in terrain and climate near the discontinuity, we employ interpolated climate surfaces from Hijmans et al. (2005), who provide gridded data at a 1-km spatial resolution. In particular, we look at annual temperature and rainfall and altitude. These measures are based on weather station readings, primarily between 1950-2000 from the Global Historical Climate Change Network Dataset, which has undergone extensive quality control.

Figure 6 shows the average differences (after accounting for county-level differences using fixed effects) in these variables using varying bandwidths around the discontinuity. Within ten to forty kilometers of the discontinuity: the average annual temperature is identical, average altitude differs by less than 100 meters, and annual precipitation differs by less than 50 centimeters. While this difference in precipitation might be relevant in drier climates, both sides of our discontinuity receive over 260 centimeters of rainfall annually. At such high levels, estimates from Guan et al. (2015) suggest that 20 percent shifts in total annual rainfall have little effect on crop yields in West Africa.

Figure 4: Cumulative Forest Loss by County & Year using 40km Bandwidth



(a) Proportion Forest Loss by County

(b) Cumulative Forest Loss 2001-2014

Both figures restrict attention to areas that fall within roughly 40 kilometers (25 miles) of the discontinuity. On the left, we show that, in all but one county, a larger proportion of forest has been cleared on the county side of the boundary where private property prevails. On the right, we plot cumulative forest loss on each side of the discontinuity, showing parallel trends up to 2008 and then a differential increase on the county side after the Global Food Crisis. Data on forest loss comes from Global Forest Change (see section 4.1).

5. Results

Our main findings are apparent in the descriptive statistics. We restrict attention to areas that fall within roughly 40 kilometers (or 25 miles) of the discontinuity and first look within counties bisected by the discontinuity. With one exception (Bong), figure 4(a) shows that less (forest) land has been cleared on the customary side. Within the same county, and our relatively narrow band around the discontinuity, we see more land cleared where private property rights prevail.

Second, in figure 4(b) we plot cumulative forest loss on either side of the institutional boundary. While levels of clearing activity were just slightly lower on the customary side in 2001, we see parallel trends in forest loss before 2008. However, after 2008, clearing activity picks up more sharply on the county side of the boundary. While cumulative forest loss increases by roughly five percentage points on the county side between 2008 and 2014, it only increases by only three points on the customary side.

These results do not depend on our choice of bandwidth. Figure 7 shows that, in the periods before the Global Food Crisis, there is virtually no difference in forest loss on either side of the boundary. (The x-axis

in these graphs is the width of the bandwidth on either side of the discontinuity.) However, whether we use a 10 or 40 kilometer bandwidth, the differences in forest loss between the county and customary sides become much more pronounced in the period from 2008-2014. (That is, the difference in the differences pre and post-food crisis is positive at at different bandwidths.)

Table 1: Differential Change in Forest Loss Following Food Crisis

	Dependent variable:			
	Forest Loss as Proportion of Total Area			
	(1)	(2)	(3)	(4)
$\mathbb{1}$(Private Property) $\times$ Post-2007 (D_{it}	$0.015^{\dagger}$	0.022^{*}	0.013^{*}	0.017^{*}
Note: $\mathbb{1}$(Private Property) = $\mathbb{1}$(County Side))	(0.008)	(0.007)	(0.004)	(0.004)
Mean(y_{it})	0.029	0.04	0.029	0.04
Drop Southern Counties		✓		✓
Cell FEs	148544	89654	148544	89654
Year FEs	14	14		
County-Year FEs			196	126
Observations	2,079,616	1,255,156	2,079,616	1,255,156
Note:	Robust SEs clustered on county; $^{\dagger}p < 0.1$, $^{*}p < 0.05$			

Linear models estimated using equation 4. All models include cell and year or county-year fixed effects, which absorb $\mathbb{1}$(Private Property) and Post-2007. The sample is limited to cells within 40 km of the discontinuity, and the unit of observation is a $1km^2$ cell observed in each year. The dependent variable is the proportion of each cell that has experienced forest loss using the data from Global Forest Change (see section 4.1). In models (2) and (4), we drop the southern counties (see figure 1).

Table 1 presents our difference-in-difference estimates from equation 4. (Note that the cell and year or county-year fixed effects absorb $\mathbb{1}$(Private Property) and Post-2007.) These models include a fixed effect for every ($1km^2$) cell, soaking up all time-invariant characteristics that could affect whether an area is cleared (e.g., distance to the coast or capital, soil suitability, elevation, historic settlement patterns, etc.). Moreover, we include year or county-year fixed effects. The latter allow for non-parametric time trends in each county, picking up temporal variation in weather or local governance that could affect investment decisions. Finally, in models (2) and (4), we drop "southern counties," where the codified 40-mile boundary and extents of early land purchases (in the 1850s) diverge (see figure 1).

We find robust evidence that land clearing increased more dramatically where private property rights prevailed (relative to the land held under the customary system). Our results imply that land clearing increases by around two percentage points — a sizable effect, equivalent to roughly half of the mean of the dependent variable. As an alternative benchmark, it took roughly four years after the end of the Liberian Civil War for

cumulative forest loss to increase by two percentage points on either side of the boundary. Our estimates increase slightly when we drop southern counties (potentially due to measurement error related to the exact path of the discontinuity); however, relative to the sample mean the effect sizes are unchanged.

Returning to our model of land investment, we cannot pin down transactions costs or farmers' capacity to resist derisory land leases. However, our empirical findings suggest that the illegibility of the customary system and the associated transactions costs outweigh whatever discounts customary authorities can offer by virtue of their capacity to displace existing land users. Our findings support claims from the political economy literature that investors favor private property rights; the rush for land in Liberia does not target areas where land can be grabbed through sweetheart deals with customary authorities.

5.1 Mechanism: Commercial Investment in Agribusiness

After the Global Food Crisis, we see a larger increase in land clearing on the county side of the discontinuity. We attribute this effect to the different property rights systems that operate on either side of this boundary: customary authority over property rights dampened the realized demand for land. Per figure 3, we also see a dramatic increase in the area under concession agreements after 2007, particularly in agriculture and forestry. Taken together, these findings suggest that new large-scale investments in agribusiness and forestry could be driving these differential trends.

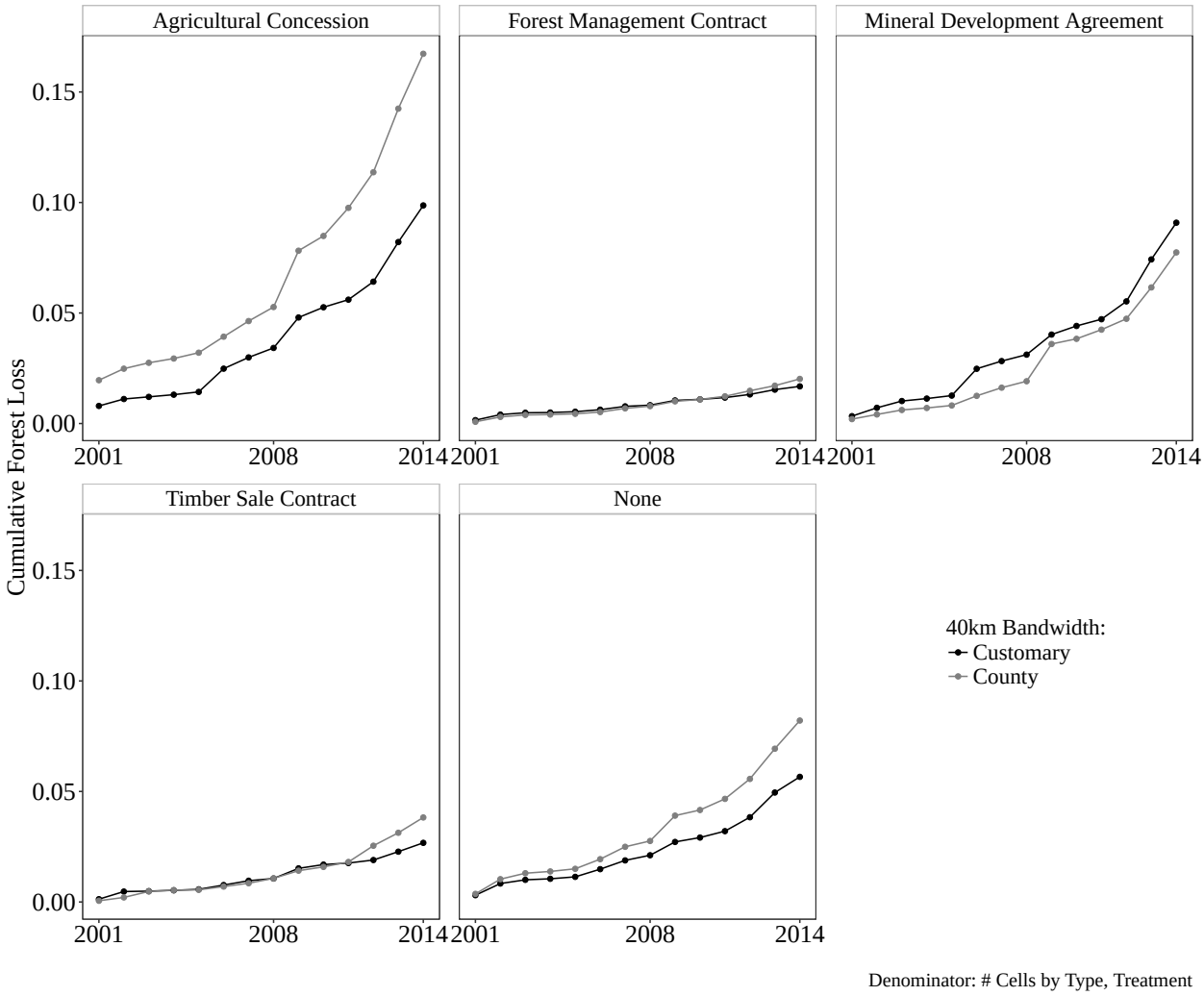
To explore this possibility further, figure 5 looks at cumulative forest loss (as a proportion of cells within each group) for areas now covered by different types of concessions on each side of the boundary (see figure 3 for a map of concessions). This captures the intensive margin — given that land has been acquired, how much has been cleared — for different types of natural resource projects that fall within 40 kilometers of the discontinuity. Looking at the top left panel, we see that land clearing within areas now covered by agricultural concessions increases roughly twice as fast on the county side after 2007. We also see more marked increases on the county side for timber sales contracts and outside of current concession areas. The trends in forest loss are roughly parallel for mineral development agreements — perhaps unsurprisingly, as the national government (which owns all sub-surface deposits) plays a larger role in concluding these agreements.

6. Discussion

Despite increased foreign investment in agribusiness and other natural resources in Liberia and other parts of the developing world, we have limited evidence regarding the welfare implications of these concessions.[8] Some have labeled these projects land grabs, a moniker that suggests prior landowners are being duped or forcibly displaced from land (Cotula et al. 2009). Others regard these land deals as much-needed investment in more productive forms of agriculture and mining. In this account, foreign investment increases land

[8] In recent work, Bunte et al. (2017) find that mining concessions in Liberia increase nightlights; however, they find no consistent evidence that agricultural concessions increase light emissions. The authors interpret nightlights as a measure of local economic growth.

Figure 5: Cumulative Forest Loss by Concession Type



values, provides formal sector employment, and generates positive spillovers to other industries (e.g., through infrastructure investment).

These conflicting assessments likely reflect heterogeneity in the terms of different investment deals. Where farmers cannot bargain with investors and are powerless to resist meager concession agreements, the welfare effects could be minor or even negative. Yet, where investors pay farmers a decent rent and investments generate other positive benefits, concessions could contribute to local development. While we do not have panel data on households' well-being, we can use the model and our empirical findings make predictions about farmers' welfare under different property rights systems.

We have to consider two scenarios. First, suppose the chief pays the farmer the lower price ($\underline{p_f}$) on the customary side of the boundary. Assuming no differences in the quality of land (i.e., k is the same under both

tenure regimes), the farmer's payoff is then higher under a system of private property if

$$\text{Assuming equation (1)}, \quad \mathcal{U}_{pp}^{F} \geq \mathcal{U}_{c}^{F} \quad \text{if}$$
$$\frac{r}{(r-\gamma(2q-1)+t_{pp})^2} \geq \frac{r-c}{4(\underline{p_f}+t_c)^2}$$

The numerator is obviously larger on the left-hand side (as $c > 0$). Furthermore, our empirical findings — that investment is lower under customary tenure — indicate that equation (3) also holds. This ensures that the denominator on the left-hand side is also smaller and, hence, that this inequality is always satisfied. In short, when chief offers the farmer a low price, the farmer is always better off under a system of private property.

Second, suppose instead that the chief offers the farmer the higher price ($\overline{p_f}$), i.e., equation (1) does not hold. Again assuming no differences in the quality of land, the farmer's payoff is higher under private property if

$$\text{Assuming equation (1) does not hold}, \quad \mathcal{U}_{pp}^{F} \geq \mathcal{U}_{c}^{F} \quad \text{if}$$
$$\frac{r}{(r-\gamma(2q-1)+t_{pp})^2} \geq \frac{r-c+2q\gamma}{4(\overline{p_f}+t_c)^2}$$

Our empirical results suggest that equation (2) holds and, thus, that the denominator on the left-hand side is smaller. We can be certain that the farmer's welfare is greater under the system of private property whenever $q \leq c/2\gamma$.

While we leave an empirical exploration of the welfare consequences of different concession deals to future work, this exercise illustrates that the welfare consequences of foreign investments in land differ depending on whether farmers contract directly with investors under a system of private property or, instead, rely on chiefs under a customary system. Perhaps unsurprisingly, for most parameter values, farmers benefit more from investment where local authorities cannot serve as middlemen and siphon off rents.

7. Conclusion

This paper speaks to two intersecting debates in the political economy of development: how do political institutions affect investment, and whether the recent rush for arable land has targeted places that enable the expropriation of current land users. We find conflicting accounts in the literature. On the one hand, collective or customary property rights systems have been portrayed as illegible to outsiders and insufficiently protective of individual claims. In these accounts, customary systems discourage investment relative to systems that provide for private property. On the other hand, others have concluded that increased land acquisition in developing countries suggests that investors care less about strong property rights. In a hurry to acquire tracts of land for agribusiness operations, investors may in fact favor property rights systems that enable them to cheaply displace existing land users.

We propose a model that can rationalize these conflicting claims. If investors care about the transactions costs that come from the illegibility or uncertainty associated with the customary property rights systems, then we expect demand to be greater where private property prevails. However, if a customary system allow chiefs or other local authorities to depress land prices by effectively expropriating current land users, then investors might be wooed by cheap land.

The net effect of these competing forces is, ultimately, and empirical question. We exploit a natural experiment in Liberia, a country that has seen an influx of new investments in natural resources. Liberian law established two parallel property rights systems; we look at changes in land clearing on either side of this institutional discontinuity following the Global Food Crisis of 2007-8 and the consequent increase in the demand for land. Our empirical strategy combines the strengths of a regression discontinuity and difference-in-differences. Focusing on land near the discontinuity, we restrict attention to areas with similar physical characteristics; leveraging changes over time, we difference out any time-invariant characteristics that impact land use.

Using fine-grained data from 2001-2014, we find greater rates of forest loss — a measure of land conversion to more intensive uses — on the county side of the institutional boundary, where private property prevails. Our estimates are roughly half the mean of the dependent variable and similar in magnitude to the change in forest clearing that occurred in the first four years of peace after the Liberian Civil War. We find that these differential changes on either side of the institutional boundary occur at the same time as outside investments in natural resource concessions. We also find more intense forest clearing within agricultural concessions that fall on the county side of the boundary. While more suggestive, these two results suggest that our main findings pick up the effects of property rights systems on the decisions of outside, often foreign, investors.

Finally, we use our findings and model to explore the welfare implications of land acquisitions for prior land users (the "farmers" in our model). We argue that farmers often lose out in customary systems where local authorities serve as middlemen, who siphon off rents by driving a wedge between the land prices paid by investors and the sums received by farmers.

References

Abood, Sinan A, Janice Ser Huay Lee, Zuzana Burivalova, John Garcia Ulloa and Lian Pin Koh. 2015. "Relative Contributions of the Logging, Fiber, Oil Palm, and Mining Industries to Forest Loss in Indonesia." *Conservation Letters* 8(1):58–67.

Acemoglu, Daron, Simon Johnson and James A Robinson. 2005. Institutions as a fundamental cause of long-run growth. In *Handbook of Economic Growth*, ed. Philippe Aghion and Steven N Durlauf. Handbook of economic growth.

Alden-Wiley, Liz. 2007. So Who Owns the Forest? Technical report.

Besley, Timothy J. 1995. "Property Rights and Investment Incentives: Theory and Evidence from Ghana TimothyBesley." *Journal of Political Economy* 103(5):903–937.

Besley, Timothy and Torsten Persson. 2011. *Pillars of Prosperity*. Princeton University Press.

Boone, Catherine. 2014. *Property and Political Order in Africa: Land Rights and the Structure of Politics*. Cambridge University Press.

Bruce, John. 2008. Land Tenure in Post Conflict Liberia. Technical report.

Bunte, Jonas B, Harsh Desai, Kanio Gbala and Brad Parks. 2017. "Natural resource sector FDI and growth in post-conflict settings: Subnational evidence from Liberia." *Working Paper* pp. 1–171.

Burgess, Robin, Matthew Hansen, Benjamin A Olken, Peter Potapov and Stefanie Sieber. 2012. "The Political Economy of Deforestation in the Tropics." *The Quarterly Journal of Economics* 127(4):1707–1754.

Cotula, Lorenzo. 2012. "The international political economy of the global land rush." *The Journal of Peasant Studies* 39(3-4):649–680.

Cotula, Lorenzo, Sonja Vermeulen, Rebeca Leonard and James Keeley. 2009. Land grab or development opportunity? Technical report.

De Wit, Paul. 2012. Land Inventory and Land Management Planning in Sinoe County. Technical report.

Deininger, Klaus. 2011. "Challenges posed by the new wave of farmland investment." *Journal of Peasant Studies* 38(2):217–247.

Deininger, Klaus and Derek Byerlee. 2011. *Rising Global Interest in Farmland*. The World Bank.

Field, Erica. 2005. "Property Rights and Investment in Urban Slums." *Journal of the European Economic Association* pp. 279–290.

Field, Erica. 2007. "Entitled to Work: Urban Property Rights and Labor Supply in Peru." *The Quarterly Journal of Economics* 122(4):1561–1602.

Galiani, Sebastian and Ernesto Schargrodsky. 2004. "Effects of land titling on child health." *Economics & Human Biology* 2(3):353–372.

Gaveau, David L A, Douglas Sheil, Husnayaen, Mohammad A Salim, Sanjiwana Arjasakusuma, Marc Ancrenaz, Pablo Pacheco and Erik Meijaard. 2016. "Rapid conversions and avoided deforestation: examining four decades of industrial plantation expansion in Borneo." *Scientific Reports* 6:32017.

Glaeser, Edward L, Rafael La Porta, Florencio Lopez-de Silanes and Andrei Shleifer. 2004. "Do institutions cause growth?" *NBER Working Paper* p. 31.
URL: `http://www.nber.org/papers/w10568`

Goldstein, M. and C. Udry. 2008. "The profits of power: Land rights and agricultural investment in Ghana." *Journal of Political Economy* 116(6):981–1022.

Government of Liberia. 1956. "Liberian Code of Laws 1956." pp. 1–6.

Guan, Kaiyu, Benjamin Sultan, Michela Biasutti, Christian Baron and David B Lobell. 2015. "What aspects of future rainfall changes matter for crop yields in West Africa?" *Geophysical Research Letters* 42(19):8001–8010.

Hansen, M C, P V Potapov, R Moore, M Hancher, S A Turubanova, A Tyukavina, D Thau, S V Stehman, S J Goetz, T R Loveland, A Kommareddy, A Egorov, L Chini, C O Justice and J R G Townshend. 2013. "High-Resolution Global Maps of 21st-Century Forest Cover Change." *Science* 342(6160):850–853.

Hijmans, Robert J, Susan E Cameron, Juan L Parra, Peter G Jones and Andy Jarvis. 2005. "Very high resolution interpolated climate surfaces for global land areas." *International Journal of Climatology* 25(15):1965–1978.

Jensen, Nathan. 2008. "Political Risk, Democratic Institutions, and Foreign Direct Investment." *The Journal of Politics* 70(04):1040–1052.

Koh, Lian Pin and David S Wilcove. 2008. "Is oil palm agriculture really destroying tropical biodiversity?" *Conservation Letters* 1(2):60–64.

La Porta, Rafael, Florencio Lopez-de Silanes, Andrei Shleifer and Robert W Vishny. 1998. "Law and Finance." *Journal of Political Economy* 106(6):1113–1155.

Lawry, Steven, Cyrus Samii, Ruth Hall, Aaron Leopold, Donna Hornby and Farai Mtero. 2014. "The impact of land property rights interventions on investment and agricultural productivity in developing countries: a systematic review." *Cambell Systematic Reviews* pp. 1–104.

Nolte, Kerstin, Wytske Chamberlain and Markus Giger. 2016. International Land Deals for Agriculture. Technical report.

North, Douglass Cecil. 1981. *Structure and change in economic history*. W W Norton & Co Inc.

Scott, James C. 1999. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*. Yale University Press.

Stevens, Caleb J. 2014. "The Legal History of Public Land in Liberia." *Journal of African Law* 58(02):250–265.

Unruh, Jon D. 2008. "Catalyzing the Socio-Legal Space for Armed Conflict: Land and Legal Pluralism in Pre-War Liberia." *Journal of Legal Pluralism* .

USAID. 2016. "Property Rights and Resource Governance: Liberia." *USAID Country Profile* .

Wily, Liz Alden. 2011. "'The Law is to Blame': The Vulnerable Status of Common Property Rights in Sub-Saharan Africa." *Development and Change* 42(3):733–757.

World Bank Justice for the Poor Program, United Nations Development Program and United Nations Peace Building Support Office. 2015. Citizen Engagement in Liberia's Natural Resource Concessions: improving equity and mitigating conflict. Technical report.

Supporting Information

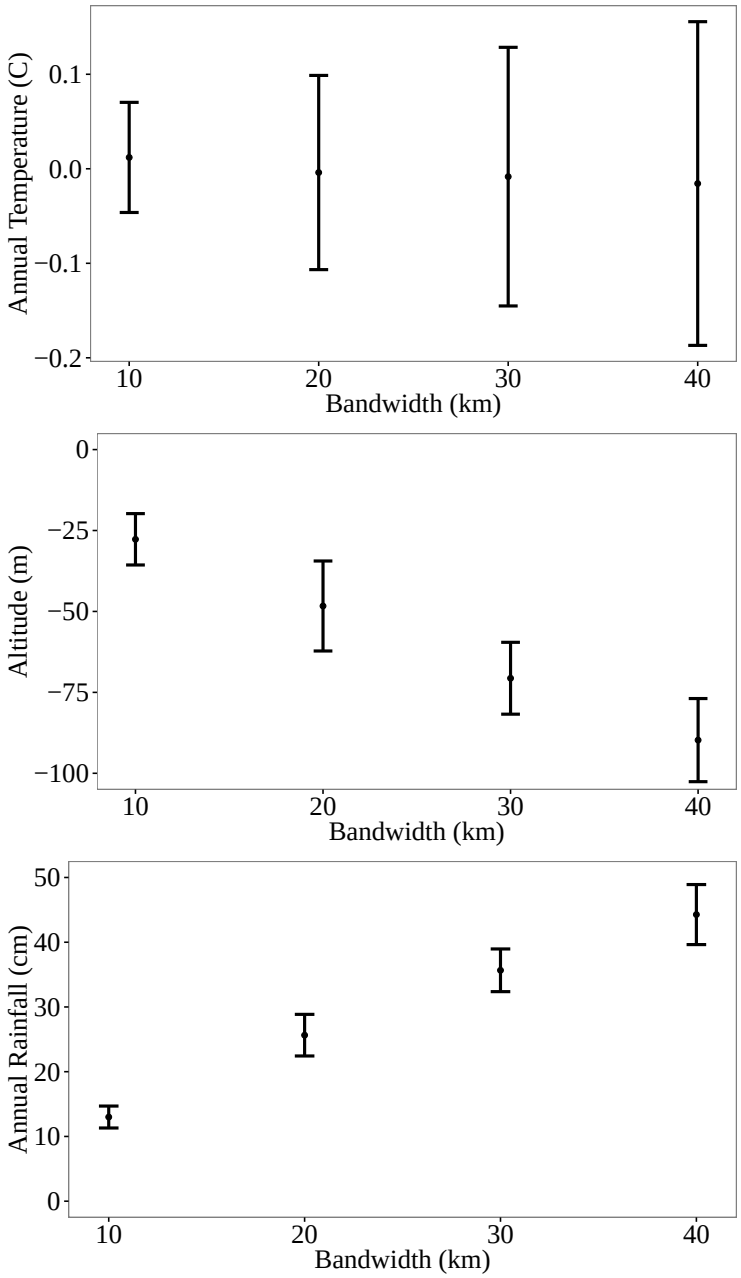
Legible Institutions and Land Demand: The Effect of Property Rights Systems on Investment in Liberia

Following text to be published online.

Contents

A. Agro-Climatic Differences at the Discontinuity

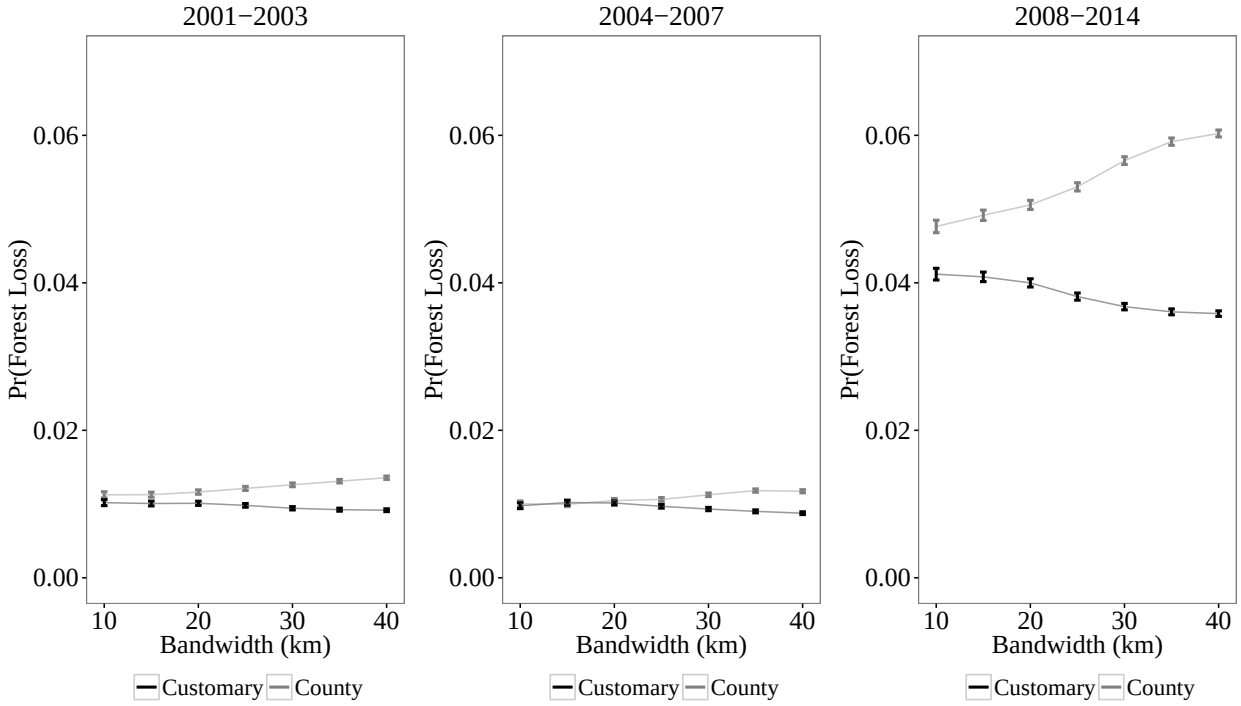
Figure 6: Average Differences in Agro-Climatic Conditions by Bandwidth



These models used to estimate these differences include county fixed effects, and standard errors are clustered on county. The discontinuity is based on the 40-mile buffer from the coast. Outcome data comes from Hijmans et al. (2005), which provides gridded climate data a 1- km spatial resolution.

B. Additional Figures

Figure 7: Pr(Forest Loss) by Bandwidth and Time Period



These figures display the probability of forest loss on either side of the institutional boundary using differently sized bandwidths around the discontinuity (x-axis). The three plots display the different rates during three different time periods: 2001-2003, 2004-2007, and 2008-2014 (post-food crisis). The error bands represent $\pm$ 10 times the standard error.