Supplementary Material

(This is dummy text) Supplementary material for this research note is available at <https://doi.org/10.1017/Sxxxxxxxxxx>.

Appendix

Legibility and External Investment: An Institutional Natural Experiment in Liberia

Contents

A1. Formalization

Investment under Private Property

We start with external land investment under a private property rights system (see left side of Figure A1). An external investor (I) approaches land holders (F), who control a plot of size $L \in \mathbb{R}^+_1$. The investor proposes to lease an amount of land ($\ell \geq 0$) at a unit price ($p \geq 0$). Investors maximize profits given by $\pi(\ell, p, t_{pp}) = 2k\ell^{1/2} - \ell(p + t_{pp})$ where $k > 0$, which incorporates transaction costs ($t_{pp} \geq 0$) and diminishing marginal returns. We permit transaction costs to vary under private property and the customary system described below. These transaction costs capture, for example, the challenges associated with coordinating purchases across land owners.[A1] The land holders can reject this deal, end the game, and earn the prevailing rental rate ($r > 0$) for their land. In that case, the investor pays and earns nothing. Let $d^F \in \{0, 1\}$ indicate whether the land holder accepts, the implied expected utility functions for the investor and land holder are:

$$U^I_{pp} = d^F \cdot \pi(\ell, p, t_{pp})$$
$$U^F_{pp} = d^F \cdot p\ell + (1 - d^F) \cdot r\ell + r[L - \ell]$$

We use the Subgame Perfect Nash Equilibrium as a solution concept throughout the analysis. In that equilibrium, the investor offers the lowest price that leaves the land holders indifferent between accepting and rejecting: $p^*_{pp} = r$.[A2] Given that price and assuming an internal solution, the investor maximizes profits by leasing $\ell^*_{pp} = [k/(r + t_{pp})]^2$. Unsurprisingly, land acquisition falls as price increases, either due to higher transaction costs or an increased rental rate. We do not separate the investor's decisions about, first, how much land to acquire and, second, what of that acreage to clear and cultivate. In addition to simplifying the exposition, our case study suggests that similar factors affect both choices.

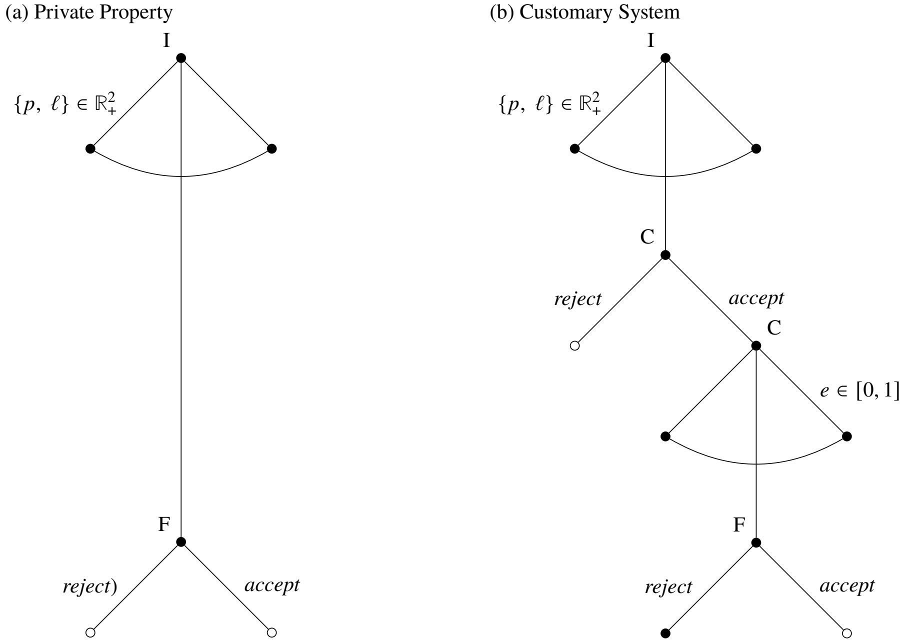
Investment under Customary System

In the customary system, a local leader assumes a role in negotiations with outside investors.[A3] For shorthand, we refer to this person as the chief (C); in practice, this

A1. We do not include the central government as a separate actor; all large-scale land leases for agriculture, mining, or forestry in Liberia are codified in concession agreements—contractual arrangements in which the central Government of Liberia grants land for commercial development. External investors in Liberia thus enjoy the same legal protections throughout the country, in both the County and Hinterland areas. Nonetheless, any differences in the way the central government operates across these two areas would be captured in the transaction costs term.

A2. We further assume that the land owner and chief accept offers when indifferent.

A3. Logan 2013, 354.



Notes: Extensive form. I represents the investor; F, land holders; and C, the chief. p, ℓ, and e are variables representing the unit price that the investor offers to pay, the amount of land they offer to lease, and the share of the offer value that the chief consumes, respectively. We omit a final move by nature if F rejects under the customary system.

FIGURE A1. *Land Investment under Private Property vs. Customary Systems*

could be one or more elites that negotiate on the community's behalf. We amend our model to incorporate this third actor (see right side of Figure A1).

In this new game, the chief accepts or rejects the investor's proposed price and lease area $\{p, \ell\}$. If they reject, the game ends with the investor paying and earning nothing, the land holder earning the rental rate for their land (rL), and the chief receiving a tribute of $\tau r L$ where $\tau \in (0, 1)$.[A4] If the chief accepts this deal ($d^C \in \{0, 1\}$), they "eat" a proportion of the lease payment ($ep\ell$, where $e \in [0, 1]$) and pass along the remainder to the land holders.

The land holders can accept that share ($d^F \in \{0, 1\}$), ending the game with the investor earning $\pi(\ell, p, t_{cu})$; the land holder, $(1 - e)p\ell + r[L - \ell]$; and the chief, $ep\ell + \tau r[L - \ell]$. ($t_{cu} > 0$ are transaction costs in the customary area.) Alternatively,

A4. τ does not function as a tax on the land holder; rather, this is an office benefit (e.g., social status) that the chief enjoys by virtue of their ability to allocate (un-leased) land.

the land holders can contest the chief's allocation. With probability $q \in (0, 1)$, the chief withstands this challenge and pockets all of the lease payment; otherwise, with complementary probability, the land holders succeed in their challenge, and the investment is cancelled. In the latter case the land holders earn the rental rate for their land; the investor earns and pays nothing; and the chief is punished at a cost $c > 0$, which is scaled by ℓ. q in this model captures the chief's ability to flout their constituents and withstand the consequent challenge; $(1 - q)$ then represents the chief's accountability.

Given this setup, we can write the expected utility functions of the investor, chief, and land owner as follows:

$$U^I_{cu} = d^C d^F \cdot \pi(\ell, p, t_{cu}) + d^C(1 - d^F) \cdot q\pi(\ell, p, t_c)$$

$$U^C_{cu} = \underbrace{d^C d^F \cdot ep\ell}_{\text{C and F accept}} + \underbrace{d^C(1 - d^F) \cdot \ell[qp - (1 - q)c]}_{\text{C accepts, F rejects}} + \underbrace{(1 - d^C) \cdot \tau r\ell}_{\text{C rejects}} + \tau r[L - \ell]$$

$$U^F_{cu} = d^C d^F \cdot (1 - e)p\ell + d^C(1 - d^F) \cdot (1 - q)r\ell + (1 - d^C) \cdot r\ell + r[L - \ell]$$

Working backwards, the land holder accepts the chief's allocation iff $e \leq \overline{e}$, where $\overline{e} = 1 - [(1 - q)r]/p]$. There is a level of rent-seeking (above $\overline{e}$) that the land holder simply cannot abide. Knowing this, the chief either provokes the land holders into a challenge, choosing $e^* \in (\overline{e}, 1]$, or chooses the largest amount of rent-seeking that the land holders tolerate $e^* = \overline{e}$. The chief opts for the latter iff $p \geq r - c$. To simplify, we reasonably assume that defeat by their own constituents is very costly for the chief, such that $c \geq r$ and this condition always holds.

Given what they can eat from the lease payment, the chief has to decide whether to agree to the investor's terms, accepting iff $p \geq \underline{p}$, where $\underline{p} = r[\tau + (1 - q)]$. Finally, the investor offers the lowest price that leaves the chief indifferent between accepting and rejecting, $p^*_{cu} = \underline{p}$. Assuming an internal solution, the investor maximizes profits by leasing $\ell^*_{cu} = [k/(\underline{p} + t_{cu})]^2$.

Comparing Investment under the Different Property Rights Systems

We can now compare equilibrium investment levels (ℓ^*_{pp} and ℓ^*_{cu}) under the two different property rights systems.[A5] The model focuses attention on two sources of divergence: transaction costs and the chief's (or other local elites') accountability to their constituents.

First, suppose the investor can offer the same unit price for land under both systems ($p^*_{pp} = p^*_{cu}$). Yet, transaction costs can differ due, for example, to the illegibility of

A5. To illustrate how the models relate, consider the extreme case of the feckless chief who receives no tribute ($\tau = 0$) and is unable to flout their constituents ($q = 0$). This chief accepts an offer of $p = r$ from the investor and passes along all lease payments to the land holder ($\overline{e} = 0$).

the customary system. If $t_{cu} > t_{pp}$, then the investor prefers to lease more land under a system of private property where the ultimate cost (net of transaction costs) is lower.

Second, to see the role of accountability, suppose that transaction costs are the same across the two systems ($t_{cu} = t_{pp}$). Investors will acquire more land under a system of private property if they can lease at a lower price—when $p^*_{pp} < p^*_{cu}$ which occurs when $q < \tau$. This condition *fails* where constituents struggle to challenge the chief's authority. Where chiefs are unaccountable, they can flout the land holder's interests and eat more of the lease payment ($\overline{e}$ is increasing in q). As the the chief's cut of the lease payment grows, the price they demand from the investor falls (p^*_{cu} is decreasing in $\overline{e}$). Put simply, when the chief does not have to share, they are satisfied with a lower price. In practice, this looks like displacement or "land grabbing"—existing land holders forced to give up their land to outside investors with little compensation while local authorities pocket rents.[A6]

Combining these two dynamics, the amount of land leased in equilibrium will be greater under the private property rights system iff:

$$\ell^*_{pp} > \ell^*_{cu}$$
$$t_{cu} - t_{pp} > r(q - \tau) \tag{A1}$$

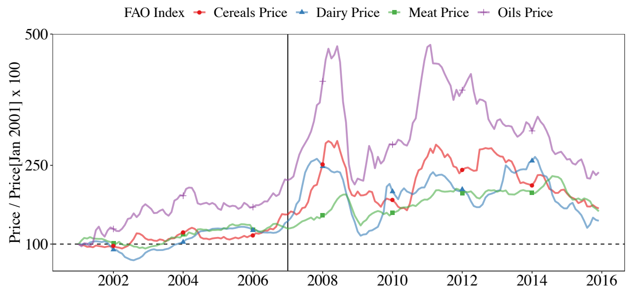
Intuitively, the amount of land leased depends on the ultimate price (including transaction costs). Whether this is higher under a system of private property depends on the accountability of the chief and the relative transaction costs under the two systems.

Much of the debate around land grabs—and our own empirical strategy—focuses on changes in investment driven by external demand, particularly rising global food prices. In our model, this price change can be mapped to an increase in k, which scales the value of land for the external investor. The question then is whether investment increases more sharply under a system of private property as k rises (i.e., $\partial\ell^*_{pp}/\partial k - \partial\ell^*_{cu}/\partial k > 0$)? So long as Equation (A1) holds, this difference in differences will be positive.

A6. Acemoglu, Reed and Robinson (2014, 355) find that less accountable chiefs in neighboring Sierra Leone exercise greater control over the use and transfer land.

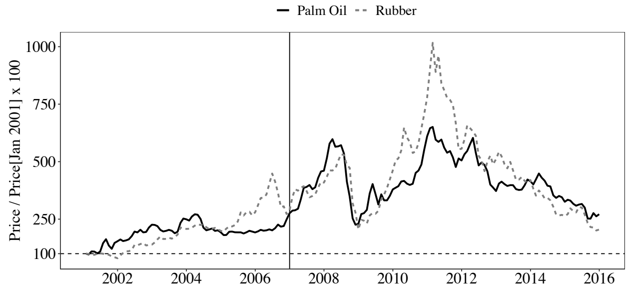
A2. Global Trends in Commodity Prices and Land Investments

Commodity Prices



Notes: Monthly international prices for baskets of food commodities, weighted by the average export shares of each of the baskets for 2002-2004 (http://www.fao.org/worldfoodsituation/foodpricesindex/en/). The "Oils" index is a basket of 10 different vegetable oils (e.g., soybean, coconut, palm, etc.).

FIGURE A2. *FAO Food Price Indexes*

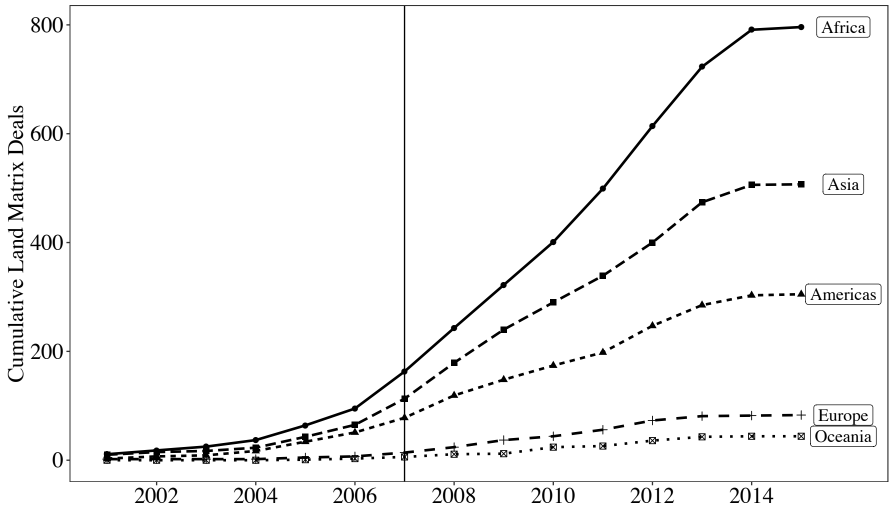


Notes: Monthly rubber (dashed) and palm oil (solid) prices come from the International Monetary Fund, "Global price of Rubber" [PRUBBUSDM] and "Global price of Palm Oil" [PPOILUSDM]; retrieved from FRED, Federal Reserve Bank of St. Louis (fred.stlouisfed.org).

FIGURE A3. *World Prices for Rubber and Palm Oil*

Land Investments

To be included in the Land Matrix, deals must entail a transfer of land for eventual commercial use, be initiated after 2000, and cover an area of at least 200 hectares.

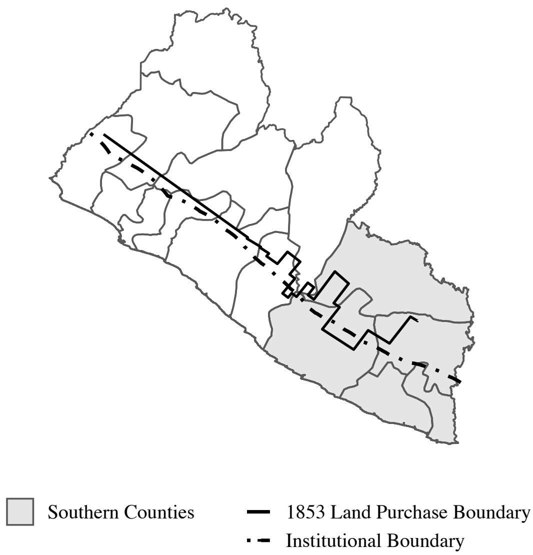


Notes: Cumulative land investments according to the Land Matrix (https://landmatrix.org/). We use the implementation date of the deal to code the year of investment. A spatial merge was used to place projects within countries; 2 percent of projects do not fall within country boundaries.

FIGURE A4. *Cumulative Land Investment Deals; Source: Land Matrix*

A3. Institutional Boundary and Historical Land Purchases

Figure A5 displays the institutional boundary (dashed) forty miles from the coast, as well as the inland extent of land purchases by early settlers as of 1853. This 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 "indigenous" populations unless they became "civilized."



Notes: The institutional boundary 40 miles inland (dashed) and land purchase boundaries of settlers (solid) 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.

FIGURE A5. *Liberia's Parallel Property Rights Systems*

A4. Additional Results

Forest Loss within and outside of Concessions

Results in Table A1 indicate that forest loss increases dramatically after a cell is incorporated into an agricultural concession.

TABLE A1. *Forest Loss and Concession Activity*

	Dependent variable:			
	Cumulative Forest Loss			
	(1)	(2)	(3)	(4)
𝟙(Agricultural)	0.027**	0.013	0.016**	0.015*
	(0.008)	(0.008)	(0.007)	(0.007)
𝟙(Forestry)	-0.026**	-0.040**	-0.015**	-0.028**
	(0.005)	(0.005)	(0.005)	(0.006)
𝟙(Mining)	0.010	-0.005	-0.001	-0.002
	(0.007)	(0.006)	(0.005)	(0.005)
Mean(y_{it})	0.029	0.04	0.029	0.04
Drop Southern Counties		✓		✓
Cell FEs	148,544	89,654	148,544	89,654
Year FEs	14	14		
County-Year FEs			196	126
Observations	2,079,616	1,255,156	2,079,616	1,255,156

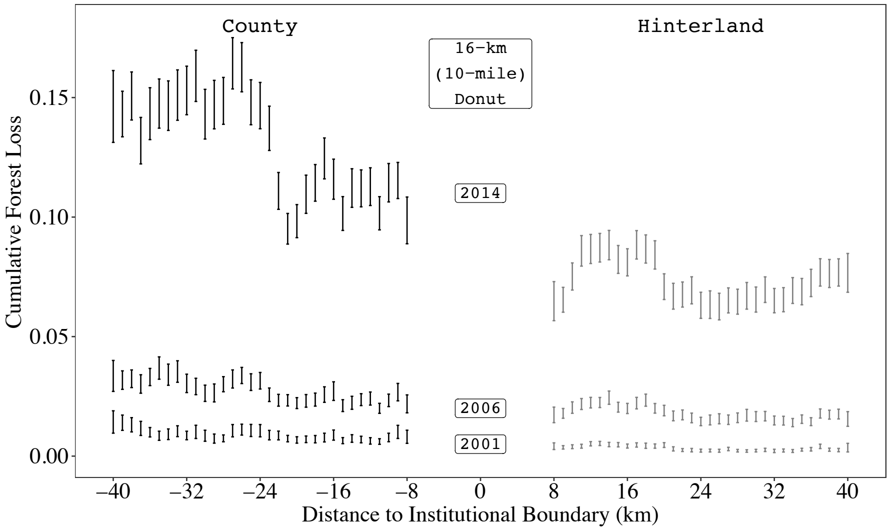
Notes: Linear models where the regressors capture whether a cell fell within an active concession area in a given year. The sample is limited to cells within 40 km of the institutional boundary, and the unit of observation is a 1km^2 cell observed in each year. The dependent variable is the proportion of each cell that has experienced forest loss using the data from Global Forest Change. Robust standard errors clustered on district; significance: $^*p < 0.1$, $^{**}p < 0.05$

Rates of loss in forestry concessions are lower than outside of concession areas. This negative effect is largest for forest management agreements designed to promote conservation, but we estimate significantly reduced rates of loss under all types of forestry concessions, including Timber Sales Contracts, which permit clear cutting. Even by 2016 (two years after our study period) most Timber Sales Contracts still have not become fully active: "[commercial] logging operations are not yet fully up to scale and impact on forest should be gradual as extraction rates should be kept at or close to sustainable limits".[A7] Compare this to areas outside of concession areas, where swidden (i.e., slash-and-burn) agriculture and unregulated chainsaw milling erode forest cover. Estimates in Table A1 suggest that mining concessions do not meaningfully affect on forest loss.

A7. Rivard 2016, 31.

Regression Discontinuity Design

We also employ a regression discontinuity design using cross-sectional data on cumulative forest loss in 2006 before the Global Food Crisis and in 2014 at the end of our study period. As noted above, the 40-mile boundary is not a strictly enforced border, but rather a rough dividing line between Liberia's two property rights systems.[A8] This generates significant interference (i.e., spillovers) right at the 40-mile boundary. Table A3 illustrates this point; we estimate a standard regression discontinuity specification and then "donut" regression discontinuities, which omit observations within 2 through 8 kilometers of the boundary. To create a buffer that accounts for spillover effects, we opt for a donut regression discontinuity that excludes the first 8 kilometers (5 miles) on each side of the institutional boundary, though our results are robust to using a 6 kilometer donut (less than 4 miles).



Notes: We create 1-km bins of cells based on their distance from the institutional boundary. Bars represent the 95% confidence intervals around average forest loss in each bin. Bars at the bottom of the figure are the means in 2001; above that, in 2006; and the uppermost series, in 2014. Consistent with the donut RD we estimate, we exclude 8 km (5 miles) on either side of the boundary.

FIGURE A6. *Cumulative Forest Loss at Varying Distances from the Boundary*

Figure A6 plots average cumulative forest loss on each side of the institutional boundary (bin width = 1 km) in 2001, 2006, and 2014. Forest loss levels are comparable on both sides of the institutional boundary in 2001 and 2006. However,

A8. Bruce 2008.

the increase between 2006 and 2014—before and after the Global Food Crisis—is considerably larger in the County Area. This analysis excludes the southern counties, where the 40-mile boundary does not correspond to historic divisions between the property rights systems.

Using methods developed by Calonico, Cattaneo and Titiunik (2014), we estimate the optimal bandwidth to be 7 kilometers. We restrict attention to cells within this bandwidth and estimate the regression discontinuity using a model that is linear in the forcing variable (i.e., a local linear regression). Our primary models include distance to the institutional boundary as the forcing variable, which is interacted with the treatment indicator.[A9] As a robustness check, we substitute latitude and longitude as forcing variables. We include county fixed effects (i.e., boundary-segment fixed effects, with segments determined by county boundaries) in selected models. Standard errors are clustered on district to account for spatial dependence.

Focusing on models 3–4 in Table A2, which include county fixed effects, we find no difference between the County and Hinterland sides of the institutional boundary in 2006, before the Global Food Crisis. However, by 2014, we find significantly greater clearing—a 3 percentage point difference—in the County Area. These models leverage grid cells within 15 kilometers of the institutional boundary and restrict attention to within-county comparisons.Table A3 shows that our results are robust to using a smaller donut of 6 kilometers (model 8).

These RD results present a qualitatively similar picture as the difference-in-differences results. We estimate larger coefficients with the RD strategy for two reasons: (1) the RD evaluates cumulative effects in 2014, rather than averaging all interim years; and (2) the RD coefficients also incorporate small (insignificant) level differences that emerge prior to the Global Food Crisis.

A9. More precisely, the forcing variable is the distance to the edge of the donut.

TABLE A2. *Regression Discontinuity before and after the Global Food Crisis*

	Dependent variable:							
	Cumulative Forest Loss							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\mathbb{1}$(County)	0.007	0.043**	0.005	0.033**	0.036**	0.165**	0.006	0.063*
	(0.005)	(0.015)	(0.003)	(0.011)	(0.010)	(0.044)	(0.011)	(0.037)
Year	2006	2014	2006	2014	2006	2014	2006	2014
Dist. Boundary	✓	✓	✓	✓				
Lat. & Long.					✓	✓	✓	✓
County FEs			9	9			9	9
Observations	16,138	16,138	16,138	16,138	16,138	16,138	16,138	16,138

Notes: Local linear regression restricted to a bandwidth of 7 km, selected optimally per Calonico, Cattaneo and Titiunik (2014). Models 3–4 and 7–8 include county fixed effects. In models 1–4, the forcing variable is euclidean distance to the institutional boundary interacted with the treatment indicator. In models 5–8, the forcing variables are latitude and longitude. Odd columns use cross-sectional data from 2006, before the Global Food Crisis; even columns from 2014, after the Global Food Crisis. Robust standard errors clustered on district; significance: $^{*}p < 0.1$, $^{**}p < 0.05$.

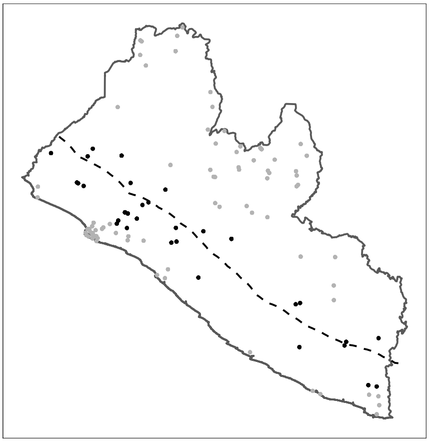
TABLE A3. *Regression Discontinuity Results with Varying Donut Sizes*

	Dependent variable:									
	Cumulative Forest Loss									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\mathbb{1}$(County)	0.005*	−0.011	−0.006*	−0.023	−0.005	0.003	0.002	0.038**	0.005	0.033**
	(0.003)	(0.010)	(0.003)	(0.020)	(0.006)	(0.021)	(0.004)	(0.013)	(0.003)	(0.011)
Year	2006	2014	2006	2014	2006	2014	2006	2014	2006	2014
Donut Size	0 km	0 km	2 km	2 km	4 km	4 km	6 km	6 km	8 km	8 km
County FEs	9	9	9	9	9	9	9	9	9	9
Observations	16,042	16,042	16,077	16,077	16,099	16,099	16,134	16,134	16,138	16,138

Notes: Local linear regression with county fixed effects restricted to a bandwidth of 7 km. The forcing variable is euclidean distance to the institutional boundary interacted with the treatment indicator. Odd columns use cross-sectional data from 2006, before the Global Food Crisis; even columns from 2014, after the Global Food Crisis. Robust standard errors clustered on district; significance: $^{*}p < 0.1$, $^{**}p < 0.05$.

Survey Evidence on the Role of Customary Authorities

The Afrobarometer provides three survey waves from Liberia: rounds 4 (2008), 5 (2012), and 6 (2015). Pooling across waves, the sample includes 3,598 respondents across 450 enumeration areas. The round 4 survey fortuitously included several questions about traditional leadership and land that we use to assess cross-sectional differences in attitudes among respondents living on either side of the institutional boundary. Figure A7 maps the 111 enumeration areas from round 4, indicating the enumeration areas we retain which fall within 40 kilometers of the institutional boundary. These are the dark grey dots near the dashed boundary in Figure A7. Each dot represents many respondents. Our resulting sample includes 304 respondents, 100 in the Customary Area; 204 on the County side.



Notes: Round 4 enumeration areas (111 total) for the Afrobarometer survey. The black points fall within 40 kilometers of the 40-mile institutional boundary (dashed line).

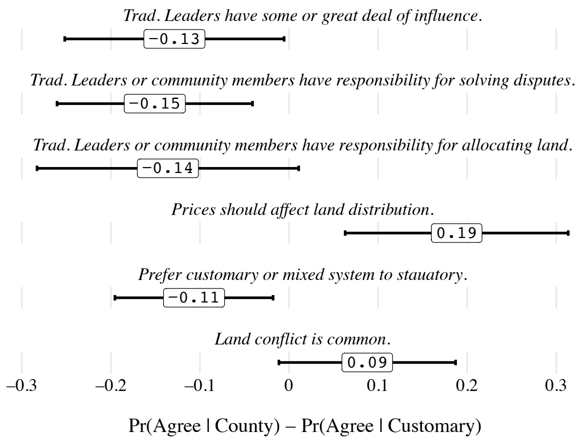
FIGURE A7. *Round 4 (2008) Afrobarometer Enumeration Areas*

The Round 4 instrument includes a number of questions related to traditional leaders and land that were dropped from subsequent survey rounds. We focus on the following questions:

- Q65: *How much influence do traditional leaders currently have in governing your local community?* Indicator: 𝟙(A great deal OR Some).
- Q58: *Who do you think actually has primary responsibility for managing each of the following tasks: solving local disputes (58E), allocating land (58F)?* Indicator: 𝟙(Traditional leaders OR Members of the community).
- 75C-LIB: *In your opinion, what is the best way to manage land distribution in Liberia?* Indicator: 𝟙(By means of purchase at any price set by the owners of land OR By means of purchase at affordable prices set by the national or local government).

- 76-LIB: *If you were asked to choose between living under the customary laws from the cultural practices of your people and statutory laws made by the national government, which would you prefer?* Indicator: 𝟙(Prefer customary laws OR Prefer combined system).
- 75B-LIB. *In your experience, how often do violent conflicts arise over land ownership and distribution in Liberia?* Indicator: 𝟙(All the time OR Often).

Figure A8, we plot the differences in the proportion of respondents that agree with statements about traditional leadership and land in the County Area relative to the Hinterland.

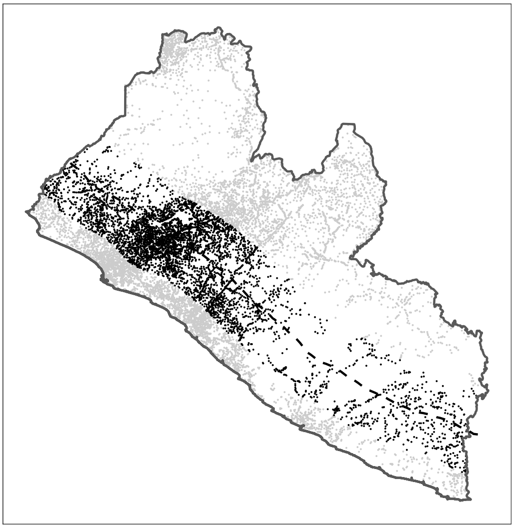


Notes: Difference in proportion of respondents agreeing in County Area vs. Hinterland. The sample excludes enumeration areas in the southern counties (see Figure 1). The plot displays 90% confidence intervals; standard errors are clustered on enumeration area.

FIGURE A8. *Differences in Attitudes Toward Customary Authority and Land*

Controlling for Census (2008) Variables Interacted with Post-2007

Census microdata have been aggregated to 13,365 geo-coded localities (see Figure A9). In addition to population counts, the census includes whether the locality is urban; what proportion of residents were displaced, widowed, orphaned, or disabled by the civil war; what proportion of residents are literate, have any school, or are under age 18; and a locality wealth index.[A10] The data provide the most comprehensive snapshot of population density, conflict experience, basic education, and wealth in Liberia during our study period.



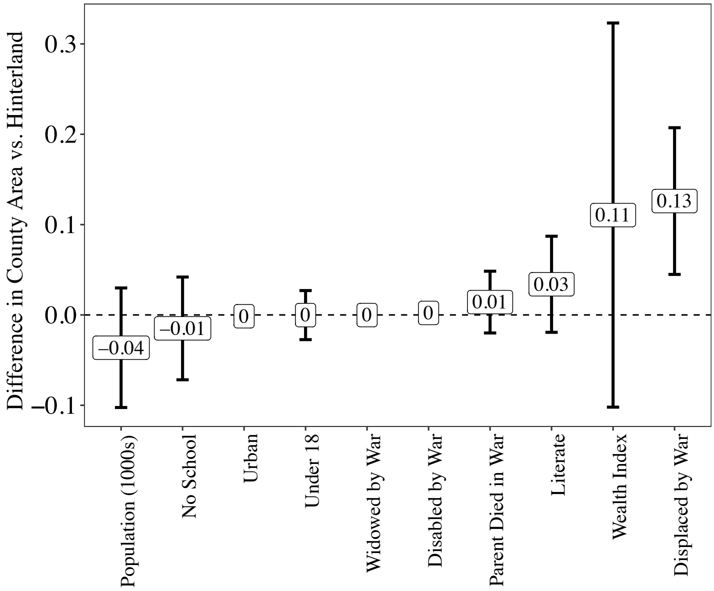
Notes: Localities (13,365 total) from the 2008 nationwide Census. The black points fall within 40 kilometers of the institutional boundary, which is represented by the thick dashed line.

FIGURE A9. *2008 Census Localities*

To merge our gridded forest-loss data with the 2008 census, we (1) create a two-kilometer buffer around the centroid of each grid cell; (2) identify all census localities that fall within that buffer and are on the same side of the institutional boundary; (3) take the average across those localities for each cell. If a grid cell does not have a census locality within two kilometers of its centroid, then it is dropped from this analysis. Figure A10 shows the cross-sectional differences across census variables (residualized by County) for grid cells in the County Area vs. Hinterland. Within 40 kilometers of the institutional boundary, we find negligible differences across most measures; only one covariate, the proportion displaced by the war, is

A10. The wealth index is a locality-level average of six asset ownership questions: does the household own furniture, a mattress, radio, tv, cell phone, motorcycle, vehicle, or refrigerator?

significantly higher in the County Area.[A11] As the census is cross-sectional, the direct effect of census variables is absorbed by the cell fixed effects in Table A4. However, balance across nearly all of these variables increases our confidence that different institutions—and not differences in demographics—-drive the differential trends we document.



Notes: We restrict attention to localities in our 40-km bandwidth and residualize census variables by county. We then plot the difference in means (95% confidence intervals) between the County Area and Hinterland; standard errors are clustered on county.

FIGURE A10. *Mean Differences in 2008 Census Variables*

A11. Similar to work by Mattingly (2017) or Lee and Schultz (2012), we demonstrate the persistent effects of a historic geographic discontinuity. Unlike these authors, we do not find persistent level differences at the discontinuity—unsurprisingly so, as our institutional boundary does not demarcate areas that were controlled by different colonial powers as in these past works.

TABLE A4. *Controlling for Census Variables Interacted with Post-2007*

	Dependent variable:										
	Cumulative Forest Loss										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
D_{it}	0.012^{**}	0.012^{**}	0.012^{**}	0.010^{*}	0.012^{**}	0.012^{**}	0.012^{**}	0.012^{**}	0.012^{**}	0.013^{**}	0.010^{**}
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Interacted Census Variable(s)	Pop.	Urban	Wealth	Displaced	Widowed	Orphaned	Disabled	Literate	School	Under 18	All
	Observations: 1,115,926		Cell FEs: 79,709		Year FEs: 14		Mean(y_{it}) = 0.046				

Notes: Re-estimation of equation (1) with inclusion of the census variables interacted with our post-2007 indicator. Standard errors clustered on district; significance: $^{*}p < 0.1$, $^{**}p < 0.05$.

TABLE A5. *Controlling for Census Variables Interacted with Post-2007 (County-Year Fixed Effects)*

	Dependent variable:										
	Cumulative Forest Loss										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
D_{it}	0.011**	0.011*	0.010*	0.010*	0.011*	0.011*	0.011*	0.009*	0.010*	0.011*	0.009*
	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
Interacted Census Variable(s)	Pop.	Urban	Wealth	Displaced	Widowed	Orphaned	Disabled	Literate	School	Under 18	All

Observations: 1,115,926 Cell FEs: 79,709 County-Year FEs: 196 Mean(y_{it}) = 0.046

Notes: Re-estimation of equation (1) with inclusion of the census variables interacted with our post-2007 indicator and county-year fixed effects. Standard errors clustered on district; significance: $^{*}p < 0.1$, $^{**}p < 0.05$.

Controlling for Market Access Variables Interacted with Post-2007

We compute the distance from each cell to Monrovia, to the nearest primary road, and the average distance to the country's four ports (Buchanan, Greenville, Harper, and Monrovia). These are then interacted with our indicator for the post-2007 period; the direct effects are absorbed by the cell fixed effects.

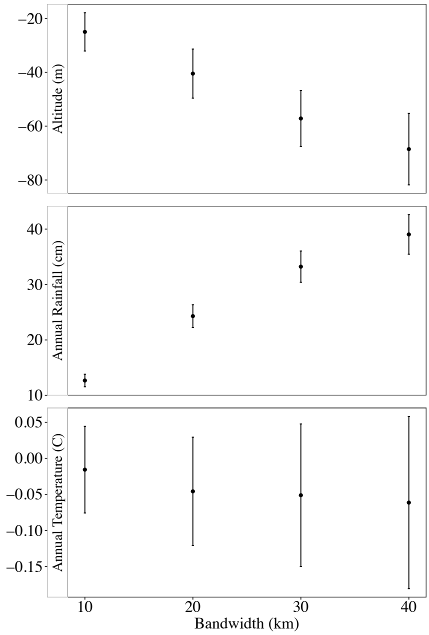
TABLE A6. *Controlling for Market Access Interacted with Post-2007*

	Dependent variable:						
	Cumulative Forest Loss						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
D_{it}	0.015**	0.013**	0.011**	0.011**	0.011**	0.016**	0.009**
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.005)	(0.003)
Dist to Road × Post-2007		−0.001**	−0.001**				
		(0.0002)	(0.0001)				
Dist to Monrovia × Post-2007				−0.0002**	−0.0001		
				(0.00003)	(0.0001)		
Dist to Port × Post-2007						0.0001	−0.0003**
						(0.0001)	(0.0001)
Mean(y_{it})	0.029	0.029	0.029	0.029	0.029	0.029	0.029
Cell FEs	148,544	148,544	148,544	148,544	148,544	148,544	148,544
Year FEs	14	14		14		14	
County-Year FEs			196		196		196
Observations	2,079,616	2,079,616	2,079,616	2,079,616	2,079,616	2,079,616	2,079,616

Notes: Re-estimation of equation (1) with inclusion of the market-access variables interacted with our post-2007 indicator. Standard errors clustered on district; significance: $^{*}p < 0.1$, $^{**}p < 0.05$.

Cross-sectional Differences in Agro-Climatic Variables

To assess differences in terrain and climate near the institutional boundary, we employ gridded data from from Hijmans et al. (2005). Figure A11 shows the differences (after accounting for district-level differences using fixed effects) in these agro-climatic variables at different bandwidths. Within forty kilometers of the institutional boundary: the average temperature is identical, altitude differs by less than 100 meters, and precipitation differs by less than 50 centimeters. Guan et al. (2015) suggest that differences in total annual rainfall of this magnitude have little effect on crop yields in West Africa given the high baseline levels. We also looked at raster data on soil type and fertility, and there is no change in soil attributes around the institutional boundary.

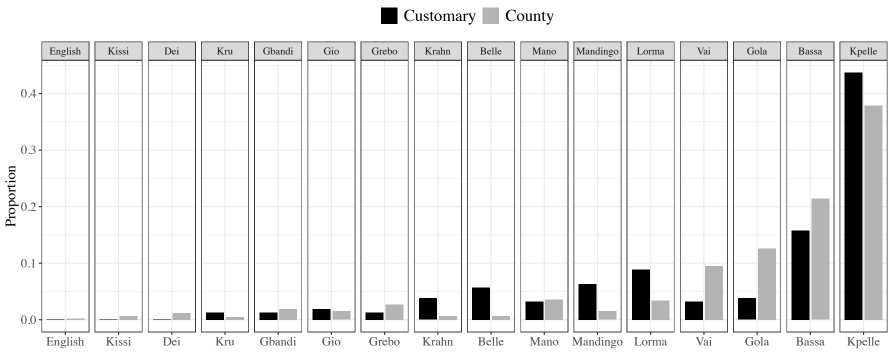


Notes: We restrict attention to observations in our 40-km bandwidth and residualize variables by district. We then plot the difference in means (95% confidence intervals) between the County Area and Hinterland; standard errors are clustered on district. Outcome data comes from Hijmans et al. (2005), who provide gridded data a 1-km resolution.

FIGURE A11. *Average Differences in Agro-Climatic Conditions by Bandwidth*

Cross-sectional Differences in Ethnic Composition

The Afrobarometer asks what tribe or ethnic group respondents identify with. Aggregating across waves, Figure A12 plots the proportion of individuals on each side of the institutional boundary (but within the 40-kilometer bandwidth) that identify with different ethnic groups. The Kpelle and Bassa represent just under 60 percent of the sample on both sides of the boundary. We see some divergence among the smaller groups, though none except the Gola make up even 10 percent of the sample on either side of the institutional boundary.



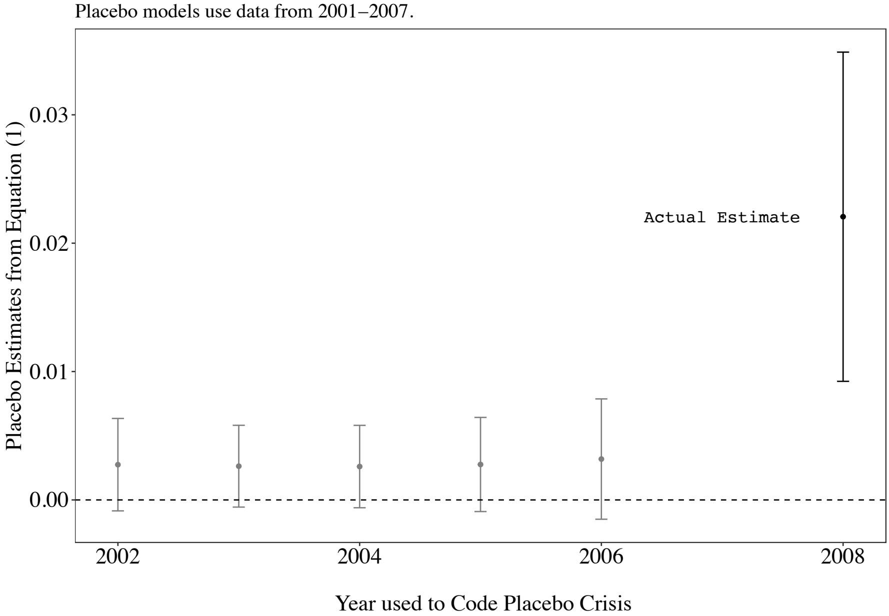
Notes: Proportion of respondents within 40 kilometers of the institutional boundary on the County and Hinterland sides of the institutional boundary. We stack respondents from rounds 4 (2008), 5 (2012), and 6 (2015) but exclude the southern counties.

FIGURE A12. *Ethnic Composition of Afrobarometer Enumeration Areas*

Given the relative sparsity of the Afrobarometer data—it contains only 99 enumeration areas across three waves that fall within our 40 kilometer bandwidth—we do not attempt to merge this with our gridded forest data. It does, however, increase our confidence that there are not substantial differences in the ethnic composition on either side of the boundary.

Placebo Crises

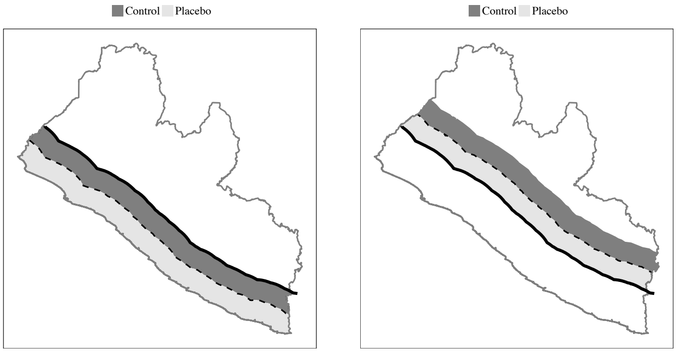
We estimate equation (1) using data from 2001-2007 and coding D_{it} using years prior to the actual crisis. These "placebo" crises consistently generate null findings, indicating that cells on either side of the boundary do not follow divergent trends prior to 2008. The right-most result uses the actual crisis and is identical to the coefficient from Table 1, model 2.



Notes: Point estimates and 95% confidence intervals for $\hat{\beta}$ from equation (1) coding years prior to the Global Food Crisis as "placebos." We cannot use 2007 as a placebo crisis, as there would be no post-treatment data that does not overlap with the true post-treatment period.

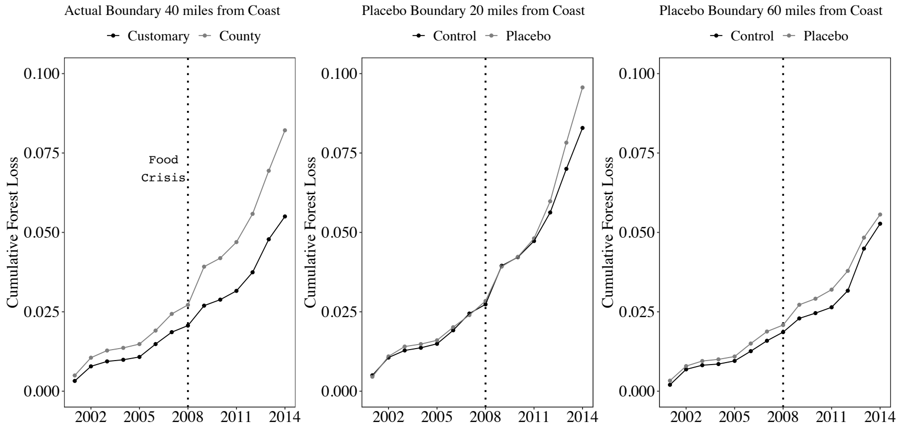
FIGURE A13. *Placebo Results using Years Before the Food Crisis*

Placebo Boundaries



Notes: We shift the boundary 20 miles towards the coast (left) or further inland (right) to construct "placebo" boundaries. These maps illustrate the areas coded as "treated" and "control" when use these placebo boundaries that are 20 and 60 miles from the coast, respectively.

FIGURE A14. *Map of Placebo Boundaries*



Notes: We recreate Figure 3 using the actual institutional boundary, 40 miles from the coast (left); a placebo boundary 20 miles from the coast (center); and a placebo boundary 60 miles from the coast (right). The bandwidth around these boundaries is the same (32 km) for all three figures.

FIGURE A15. *Trends in Forest Loss across Actual and Placebo Boundaries*

Alternative Bandwidths around Institutional Boundary

TABLE A7. *Robustness: Bandwidth Choices*

	Dependent variable:				
	Cumulative Forest Loss				
	(1)	(2)	(3)	(4)	(5)
$\mathbb{1}$(County) × Post-2007 (D_{it})	0.022	0.018	0.009	0.006	−0.004
Clustered on District	(0.006)**	(0.006)**	(0.005)	(0.006)	(0.008)
Spatial HAC (10 year, 50 km)	(0.003)**	(0.003)**	(0.002)**	(0.002)**	(0.003)
Bandwidth	40 km	30 km	20 km	10 km	5 km
Mean(y_{it})	0.04	0.039	0.038	0.038	0.041
Drop Southern Counties	✓	✓	✓	✓	✓
Cell FEs	89,654	67,840	45,868	22,930	11,438
Year FEs	14	14	14	14	14
Observations	1,255,156	949,760	642,152	321,020	160,132

Notes: Re-estimation of model 2 from Table 1 using bandwidths around the institutional boundary of 40–5 km. We report standard errors clustered on district, as well as Conley standard errors that account for spatial and temporal autocorrelation. Significance: $^{*}p < 0.1$, $^{**}p < 0.05$.

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