Property with different rights: The long-run effects of Ecuador's agrarian reform

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Job Market Paper

December 4, 2024

This paper

- The 'classical' literature on agrarian reform in Latin America is, in general, pessimistic (DeJanvry, 1981; Kay, 2002).
- However, contemporary agrarian reforms were complex policies. Governments had different 'ways' of allocating land
  - Far from being a uniform process
- Agrarian reforms were not only about land but also **property rights** allocation

This paper II

- In contemporary agrarian reforms there are several ways of allocating land (Albertus, 2015). The two most important are: public land transfers (PLT) and Expropriations
  - PLT: The transfer of public or abandoned land to private individuals, typically settlers,
  - Expropriations: Government terminates the property of land of some private actor and transfer it to workers.
- Most of the literature only studied expropriations. However, PLT played an important role as well. In some cases PLT was even more important than expropriations Motivation figure
- While most papers study expropriation and some PLT. **This paper compares and studies both**

What I do

Research question: *What are the long-term impacts of public land transfers compared to expropriation on crop choices and productivity?*

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- In the coastal region of Ecuador, an unusual situation occurred: Private land from neighboring and similar locations was intervened by PLT on one side and expropriation on the other.

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- In the coastal region of Ecuador, an unusual situation occurred: Private land from neighboring and similar locations was intervened by PLT on one side and expropriation on the other.
  - Main empirical method: Spatial regression discontinuity

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  - Natural experiment: keep land characteristics constant and focus on the effect of different property rights allocation via PLT and expropriation
- I compare these two property rights regimes broadly with a region that was not intervened by the agrarian reform.

Results

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Lit review and contribution

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Lit review and contribution

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- Areas exposed to expropriations still focus on rice production, relying on informal credit which is a novel mechanism that explains specialization on short-term crops
  - If perennial crops are grown they are mostly bananas (the "safe" choice)
- **Spillovers:** PLT is also associated with ↑economic growth (night lights), ↑efficient land use, and rapid structural transformation (↓ share of active workers in agriculture)

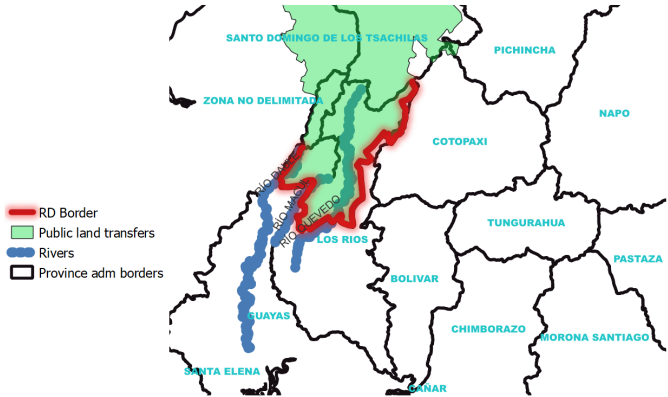
Lit review and contribution

Context: PLT and expropriation during the Ecuadorian agrarian reform

- Ecuador underwent agrarian reform (performed by the government agency IERAC), intensifying in the 1970s, especially in the coastal region.
- Provinces like Guayas and Los Ríos experienced PLT due to unoccupied and **abandoned** land reaching a specific threshold.
- After Ecuador's cocoa boom (end of the 1920s), abandoned land was allocated to workers under PLT legislation, while other land was subject to expropriation.

The setting: Ecuadorean public land transfers project

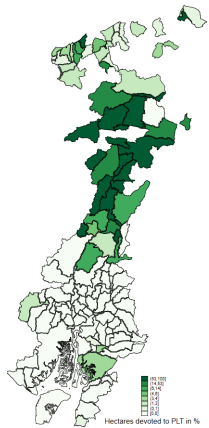
Figure: IERAC historic map: Artificial border PLT intervention area



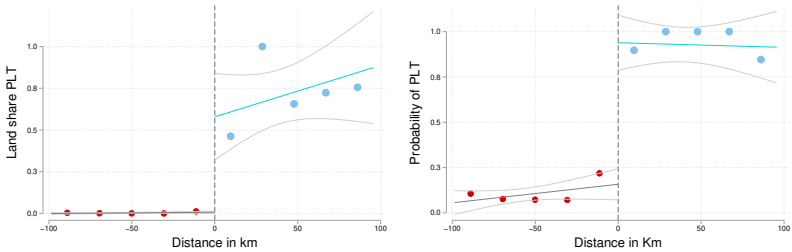
Raw map

The setting: Ecuadorean public land transfers project

Figure: Variation in PLT-Data:IERAC's archive-



Distance to the IERAC border and PLT application



(a) Share of PLT relative to parish area (b) Probability of treatment(public land transfer)

Identification strategy

- Areas closer to the IERAC's (the government's agency in charge of applying the land reform) border, were previously cocoa *haciendas*.
- Owners abandoned their land after the cocoa boom (circa 1920s) (Guerrero, 1994). The boom ended by exogenous reasons (witches' broom plague)

Hacienda at border

- Workers remained on the land. However, when the agrarian reform was implemented, IERAC found it difficult to determine which land should go to PLT, creating a discontinuity in its application.
- Beneficiaries at the border were already established settlers (former workers).

RD tests M

PLT vs expropriations

- The agrarian reform had its own legislation, in which the processes differentiate PLT from expropriations.
- The PLT aimed to expand the agricultural frontier by acting on vacant and abandoned land. Expropriations were mandated to benefit farmers working on haciendas and promote food security.
- In 1970, Decree 1,001 strengthened expropriation legislation in coastal Ecuador to increase rice production and reduce imports.

Data

- Historical maps and archival information from IERAC
- Shape files for administrative borders come from the Ecuadorean Statistical Institute (INEC)
- Geographic characteristics: These data comes from FAO GAEZ, WorldClim, University of Wisconsin-Madison,and the Ecuadorean government
- Granular data on efficient land use: Ministry of agriculture
- Agricultural data: Agricultural censuses 1954, 1974, and **2000**

Empirical framework

$$y_{i,p,b} = \alpha + \tau C_p + X_p + f(lat, lon)_p + \phi_b + \delta_{i,p} + \gamma_{prov} + \epsilon_{i,p,b}$$

- y is the outcome variable in farm/plot i in parish p along segment b of the IERAC boundary.
- C indicator PLT or Expropriation
- X Running variable (distance IERAC boundary)
- $f(lat, lon)$ poly latitude longitude
- $\delta_{i,p}$ Covariates:Self declared tenure status(year 2000), Agro-climatic potentiality for bananas
- ϕ_b, γ_{prov} Border and province FE
- Robust bias corrected estimator and cluster inference from Calonico, et al (2021).
- Fuzzy RD $\rightarrow$ Share of land of a parish devoted to PLT and C as an instrument.

Balance on observable characteristics

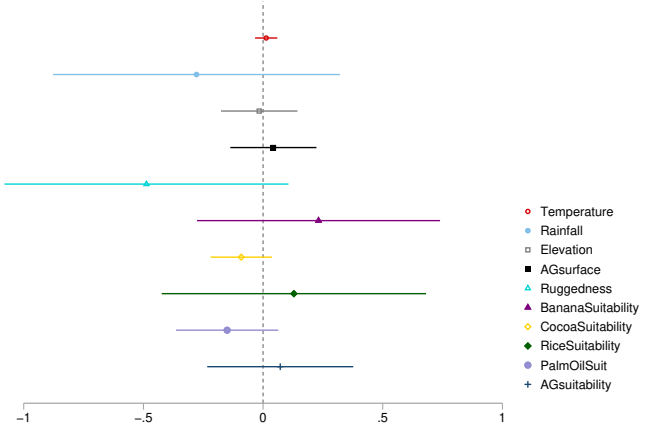
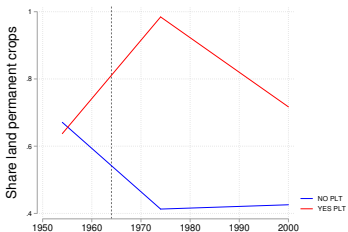


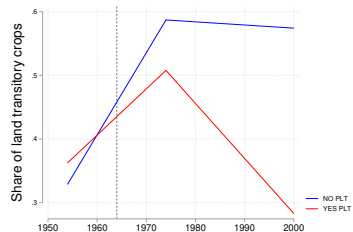
Figure: RD standardise coefficients using bandwidths from Calonico et al. (2017)

Big picture view-Before and after-

Figure: Before-After comparison: Land share perennial and annual crops 1954-2000



(a) Perennial crops



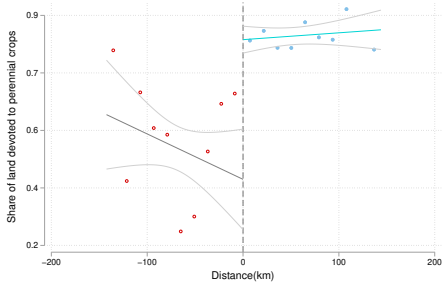
(b) Annual crops

Note: Red: PLT. Blue: Expropriation

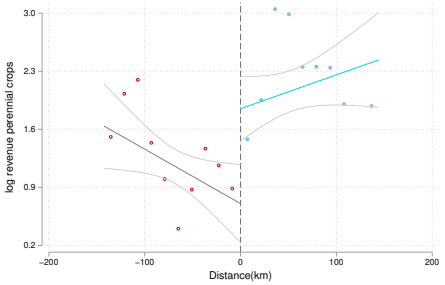
Main outcomes

- Two main sets of outcomes: Land shares and yields
- Land share devoted to perennial crops
- Yields: Perennial, annual crops, non-traditional perennial crops. (PXQ/land; P=FAO prices)
  - Perennial crops: Bananas, cocoa, plantain, sugar cane, and oil palm; annual crops: Rice, maize, beans, and potatoes
- Yields of specific crops: Rice, cocoa, bananas

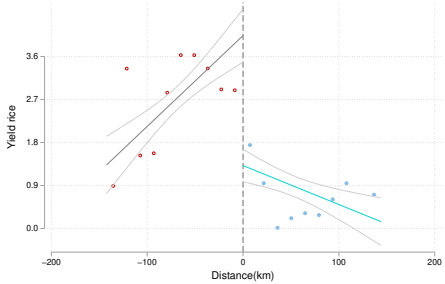
Figure: Discontinuities figures



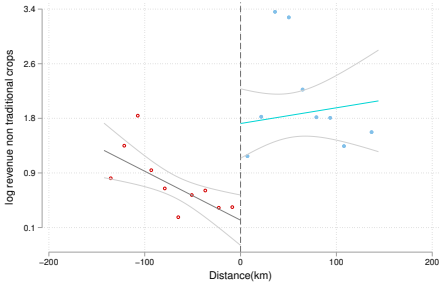
(a) Share land perennial



(b) Perennial



(c) Rice



(d) Perennial non-traditional

Results Fuzzy RD

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Yields					
	Share	Perennial	Annual	Rice	Cocoa	Banana	Else
Panel A: First stage							
PLT	0.319	0.536	0.552	0.774	0.552	0.319	0.552
	(0.121)**	(0.199)**	(0.192)***	(0.215)***	(0.192)***	(0.120)**	(0.192)***
Panel B: Fuzzy RD estimates							
Robust	0.291	0.634	0.313	-1.770	0.036	-1.341	0.905
	(0.065)***	(0.370)*	(0.246)	(0.689)**	(0.021)*	(0.585)**	(0.515)*
Observations	3151	3478	3290	2954	3290	3186	3290
BandwidthL	28	29	32	24	34	31	32
BandwidthR	23	34	25	27	24	22	25
Parishes	18	23	20	18	20	19	20
Mean	0.703	1.142	4.880	2.020	0.079	1.364	0.706
Variation w.r.t mean	41.4	55.5	6.4	-87.6	45.0	-98.3	128.1

Cluster standard errors at the parish level in parentheses

Results Reduced form RD

Table: Geographic RD estimates (reduced form)

		Yields					
	Share	Perennial	Annual	Rice	Cocoa	Banana	Non-traditional
			Sharp RD case				
Robust	0.095	0.239	0.059	-0.598	-0.002	-1.572	0.590
	(0.030)***	(0.120)**	(0.151)	(0.147)***	(0.015)	(0.319)***	(0.166)***
Observations	3513	3513	3513	3513	3513	3513	3513
Bandwidth	35	35	35	35	35	35	35
Parishes	24	24	24	24	24	24	24
Mean	0.719	1.147	4.818	2.123	0.084	1.339	0.759
Variation w.r.t mean	13.2	20.9	1.2	-28.2	-2.9	-117.4	77.8

Cluster standard errors at the parish level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

DiffsampIntensive DiffsampExtensive

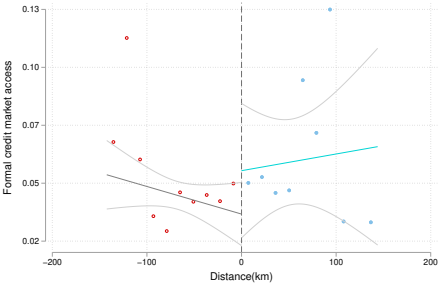
Why does rice production persist in expropriation-exposed areas?

- Decree 1,001 did not have an "expiration date," whereas the expropriation law allowed for forcing farmers to cultivate land for 5-10 years.
- By 2000, all restrictions should have been lifted. However, I found evidence that rice production is deeply rooted in expropriation areas.
- Several explanations might arise. I find evidence and want to expand on **the role of informal credit markets**
  - Literature is vast on formal credit markets.

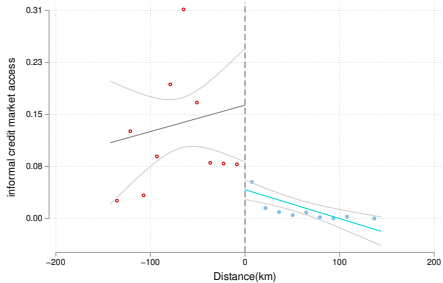
Informal credit markets and preference for annual crops (such as rice)

- Informal credit→Credit received outside of market mechanisms. Interest rates are higher as well as repayment deadlines.
- Can influence farmer's time preferences. Might be more inclined for annual crop growing than perennial crops
- Areas exposed to expropriations have more informal credit access
- Initial rice constraints attracted potential informal creditors, explaining why I observed consistent rice farming in later years.

Figure: Credit markets



(a) Formal credit markets



(b) Informal credit markets

Results-Credit market

	(1) Formal credit market	(2) Informal credit market
	Sharp RD results	
Robust	-0.063	-0.071
	(0.045)	(0.023)***
Observations	962	962
Bandwidth	35	35
Parishes	24	24
Mean	0.172	0.319
Variation w.r.t mean	-36.7	-22.2

Cluster standard errors at the parish level in parentheses

Results-Credit market 2

	(1) Formal credit market	(2) Informal credit market
Panel A: First stage		
PLT	0.593	0.593
	(0.213)**	(0.213)**
Panel B: Fuzzy RD estimates		
Robust	-0.120	-0.136
	(0.089)	(0.062)**
Observations	962	962
Bandwidth	35	35
Parishes	24	24
Mean	0.172	0.319
Variation w.r.t mean	-69.9	-42.5

Cluster standard errors at the parish level in parentheses

Robustness

- Different bandwidth diffbandHW
- Different polynomial diffpoly
- Donut approach donut
- Huber-white standard errors diffbanHW
- Conley SE Conley SE
- No evidence of massive movements in internal migration internal migration
- Results not significant when moving PLT border change border
- Comparing to a non-reform scenario leads to similar conclusions non-reform scenario
- Different agricultural productivity estimation give positive results when comparing to non-reform scenario diff AP

Positive spillovers

- If diversification in perennial crops plays a key role, is land better used in the areas that received flexible property rights (PLT)?
- What are some potential long-term impacts of having (recognized) flexible property rights?
- I explore three dimensions using alternative data sets: Land use, structural transformation, and economic growth (measured with night light data)

Land use | Growth & Structural transformation

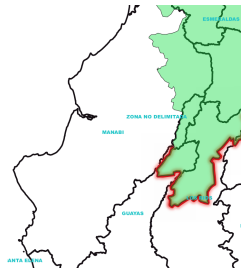
Conclusions

- Contemporary agrarian reforms were not simple policies; land allocation strategies varied, and some may have had positive local spillovers for development.
- In the Ecuadorian case, PLT had a positive impact on agricultural productivity, especially for perennial crops. The effect was due to the flexibility of property rights associated with PLT.
- Probably, the future of agrarian reforms lies in learning from PLTs and avoiding policies like the expropriation practices of the 1960s and 1970s.

Comparing with a non-reform region

- The region Manabí was untouched by the agrarian reform in general.
- The region does not have variation near any border. However, it provides a good comparison case
- I performed an OLS regression, including all controls from the balance test and baseline results for all outcomes. Dependent variable → categorical variable defined as: Non-reform, PLT, and expropriation

Figure: PLT-expropriation-non reform



Note: Historical IERAC map Raw map

Results-Non-reform region

Table: Relative to "control" group- Manabí -

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Yields					
	Share	Perennial	Annual	Rice	Cocoa	Banana	Non-traditional
PLT	-0.130	0.582	0.457	-0.069	-0.051	-0.642	1.301
	(0.066)**	(0.212)***	(0.228)**	(0.286)	(0.023)**	(0.479)	(0.414)***
Expropriation	-0.400	0.259	0.739	1.115	-0.085	-0.160	0.849
	(0.085)***	(0.238)	(0.243)***	(0.373)***	(0.023)***	(0.556)	(0.427)**
Observations	14250	14250	14250	14250	14250	14250	14250
Parishes	194	194	194	194	194	194	194
(all) Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean	0.63	1.16	4.34	1.72	0.07	0.92	0.81

Cluster standard errors at the parish level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

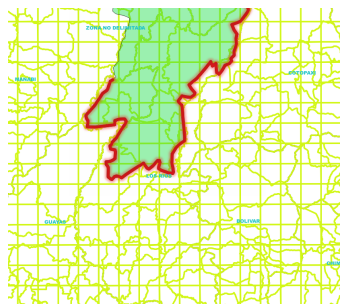
Results-Non-reform region

Table: OLS for credit - Including Manabí

	(1) Formal credit market	(2) Informal credit market
PLT	0.017	-0.034
	(0.128)	(0.056)
Expropriation	-0.020	0.247
	(0.123)	(0.075)***
Observations	7214	7214
Parishes	194	194
Controls	Yes	Yes
Mean	0.16	0.36

Land use

- Data on efficient land use from the Ecuadorian Ministry of Agriculture for 2002 and 2021.
  - Efficient land use $\rightarrow$ Is the crop being cultivated suitable for the type of land?
  - Data is categorical (3), and I collapse it into an indicator variable: Good land use vs. Bad land use.
- I divide my studied areas into 10X10 km pixels to utilize all available land use data, including pixel-fixed effects.



Data image

Efficient land use on perennial crops

Optimal land use index	(1) 2002	(2) 2021
PLT × Perennial	0.233*** [0.064]	0.183*** [0.045]
Observations	5,468	97,106
Pixel FE	yes	yes
Mean	0.45	0.21
R-squared	0.026	0.103

Cluster standard errors (parish) in brackets
*** p $<$ 0.01, ** p$<$0.05, * p$<$0.1

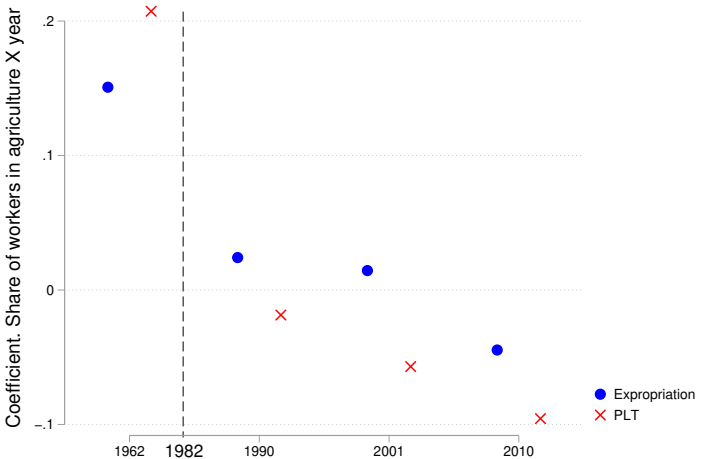
Note: This table presents estimates of an interaction model between areas that received PLT and permanent crops. For the 2002 dataset, I utilize parish-level data from the 2000 agricultural census to classify the type of crop. In the 2021 dataset, specific information is provided regarding whether a plot of

Economic growth and structural transformation

- Flexible property rights allocation, as discussed in this paper, may impact economic growth and structural transformation (Kitamura,2022; Albertus, 2021; Le Rossignol et al, 2022.)
- Structural transformation: I use IPUMS data to explore changes in the share of agricultural workers before and after 1982 (regions with PLT and expropriations manually matched).
  - Event study type graph using time-varying estimation
- Use night-light data to determine if the PLT area has a higher long-term economic activity for different years and bandwidths.

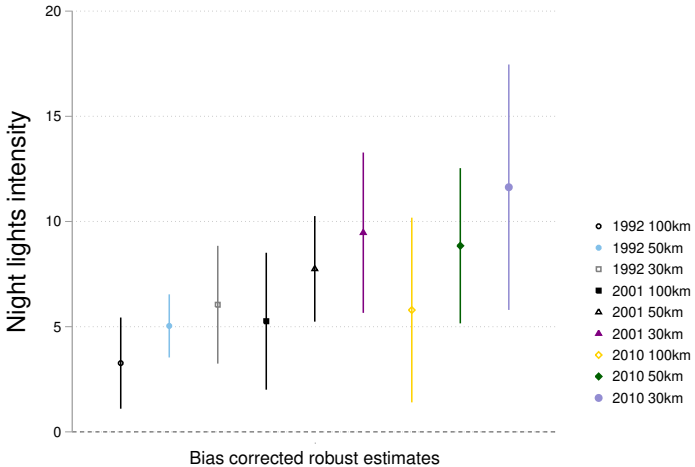
Growth and structural transformation

Figure: Share workers in agriculture



Growth and structural transformation

Figure: Economic growth (Night lights)

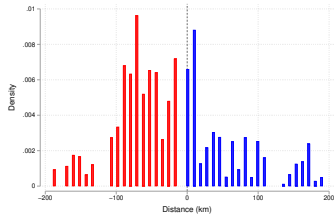


Literature review and contribution

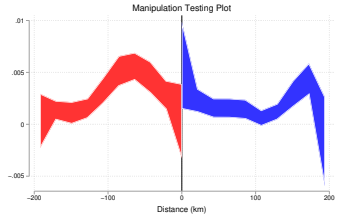
back

- Di Tella et al (2007) and Galiani and Schargrodsky (2010): formal land titling. No effect via credit markets but investment
  - TP: Investment in perennial crops is connected with better economic outcomes. Informal credit market channel
- Libecap and Lueck(2011) and Bellemare et al. (2020): "subtle" changes in the property rights dimension of land received by people in the US and Vietnam $\rightarrow$ better economic outcomes
  - TP: PLT and expropriation had different paths in promoting economic outcomes via property rights channel
- Montero (2023, 2022); Edwards et al. (2022); Galán (2020); Bühler(2021); Smith (2020); Albertus(2015); Do and Iyer (2008): Contemporary lan reform literature
  - TP: Compares the two main land allocation policies in contemporary reforms and evaluates its effects

Manipulation tests



(a) Individual histogram



(b) parishes

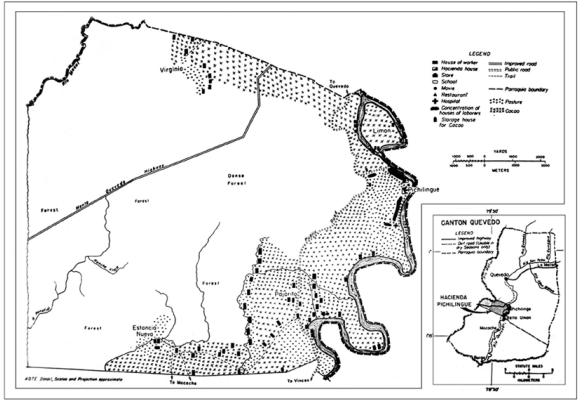
Table: Local randomization smallest window - individual data-

Window	p-value	Obs<c	Obs >= c
-1.576 — 0.221	0.071	249	292

back

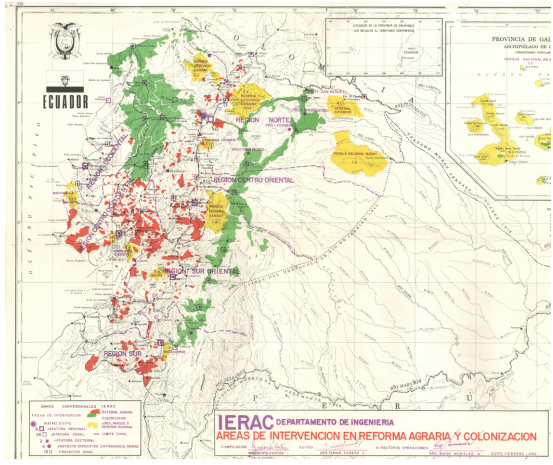
Hacienda in Quevedo (border)

Figure: Pichilingue hacienda



Note: This map shows the location of the Pichilingue hacienda that was later transformed into a research center. Its area was affected by the witches' broom plague. Orlando, 1959 back

Intervention raw map



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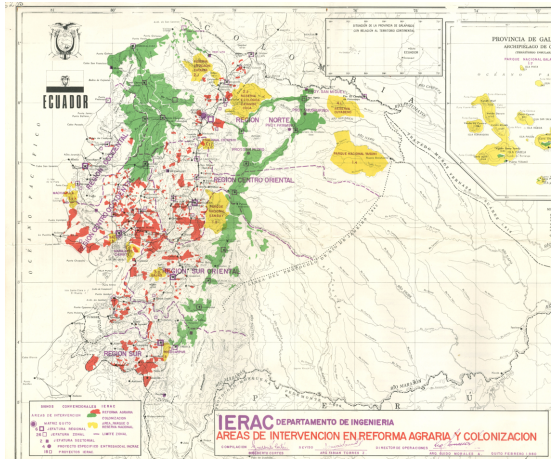
Intervention raw map



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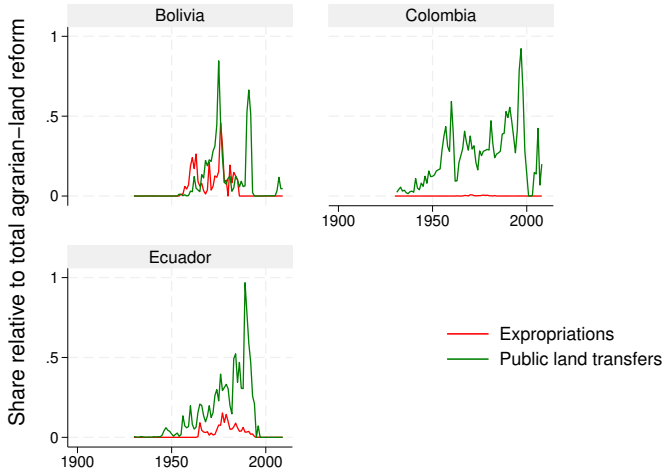
PLT vs Expropriation

back Data: Albertus(2015)



	(1) Perennial	(2) Annual	(3) Rice	(4) Cocoa	(5) Banana	(6) Else
Panel A: First stage						
dd	0.436	0.436	0.436	0.436	0.436	0.436
	(0.215)*	(0.215)*	(0.215)*	(0.215)*	(0.215)*	(0.215)*
Panel B: Fuzzy RD estimates						
Robust	0.206	-0.001	-0.229	0.026	-0.090	0.513
	(0.129)+	(0.042)	(0.139)*	(0.110)	(0.085)	(0.284)*
Observations	3513	3513	3513	3513	3513	3513
Bandwidth	35	35	35	35	35	35
Parishes	24	24	24	24	24	24
Mean	0.668	0.968	0.753	0.574	0.058	0.282
Variation w.r.t mean	30.8	-0.1	-30.4	4.4	-156.6	181.9

Cluster standard errors at the parish level in parentheses

Some ST indicators

	(1) AgShare	(2) ManuShare	(3) UrbanShare	(4) PrimarySchool
PLT	-0.132	0.024	0.181	0.074
	(0.040)***	(0.005)***	(0.066)***	(0.014)***
Observations	50852	50852	43807	60829
Clusters	55	55	46	64
YearXProvinceFE	Yes	Yes	Yes	Yes
Mean	0.44	0.05	0.64	0.57
Variation w.r.t mean	-30.36	47.16	28.23	12.94

Cluster standard errors at the municipality-IPUMS level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

back

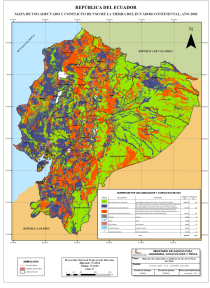
	(1) base sample	(2) all sample
Panel A: First stage		
dd	0.552	0.556
	(0.192)***	(0.188)***
Panel B: Fuzzy RD estimates		
Robust	0.646	1.799
	(0.295)**	(0.495)***

	(1) base sample	(2) all sample
	Sharp RD	
Robust	0.384 (0.133)***	0.878 (0.190)***
Observations	2849	4346
BandwidthL	29	33

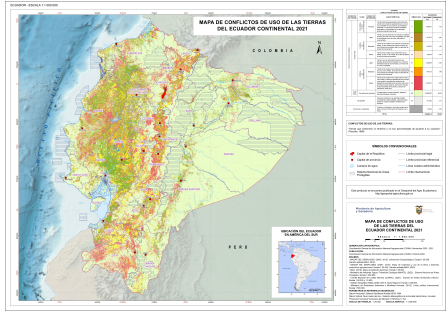
Results

	(1) Else	(2) Palm	(3) Else no palm	(4) I(N diff.Crops)
Panel A: First stage				
PLT	0.580	0.638	0.580	0.373
	(0.205)**	(0.210)***	(0.205)**	(0.157)**
Panel B: Fuzzy RD estimates				
Robust	0.905	0.024	0.881	0.066
	(0.515)*	(0.095)	(0.529)*	(0.036)*
Observations	3290	3352	3290	4057
BandwidthL	32	37	31	45
BandwidthR	25	18	25	24
Parishes	20	20	20	26
Mean	0.783	0.384	0.676	0.232
Variation w.r.t. mean	115.6	6.2	130.3	28.4

Figure: Land-use index



(a) 2002



(b) 2021

Note:

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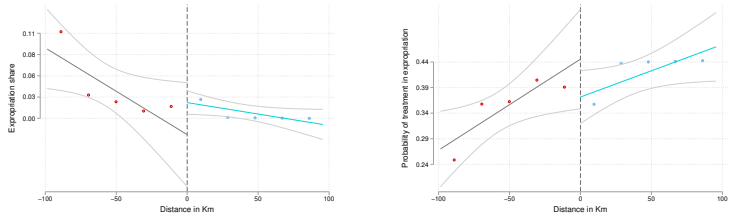
No discontinuity in expropriation

Figure: Share and probability of expropriation

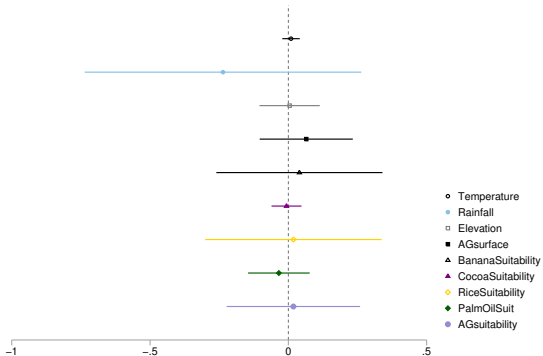


(a) Land share to expropriation (b) Probability of expropriation

Note: This Figure plots the probability of being treated from expropriation and share of parish land affected by expropriation.

Balance observables -Manual bandwidth-

Figure: Balance same bandwidth - 30 km-



Note:

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Robustness checklist (working on more)

Results robust to:

- Different cutoff a la Méndez & Van Patten (2022)
- Different optimal bandwidths on each side.
- Asinh transformation in the aggregates
- quadratic polynomial

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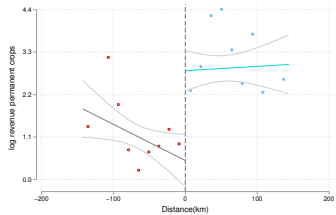
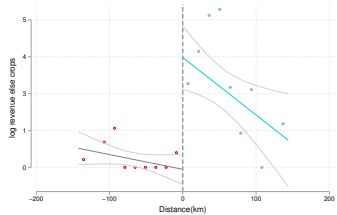
Discontinuity graphs

Figure: All permanent and all except cacao and banana (else)



(a) All permanent



(b) Else

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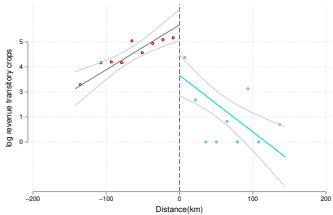
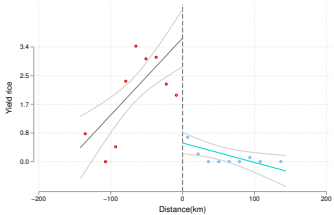
Discontinuity graphs

Figure: All transitory and rice



(a) All transitory



(b) Rice

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Figure: Different bandwidths

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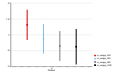
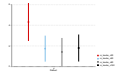
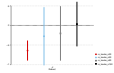


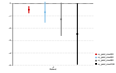
(a) Share



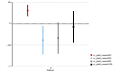
(b) Permanent



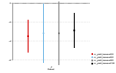
(c) Transitory



(d) Rice



(e) Cocoa



(f) Banana

Figure: RD Conley standard errors -"Manual" RD procedure

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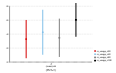
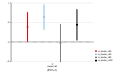
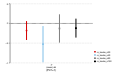


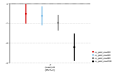
(a) Share



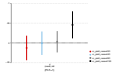
(b) Permanent



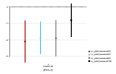
(c) Transitory



(d) Rice



(e) Cocoa



(f) Banana

Figure: Different bandwidths

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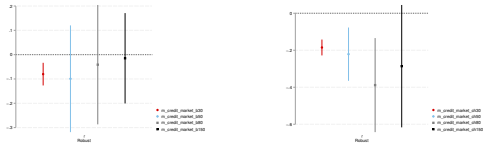

(a) Formal credit market

(b) Informal credit market

Note: Regressions at the parish level. Bandwidth (number of observations[Obs right, Obs. left]):30km(22 [13,9]), 50km(35 [19,16]), 80km (62 [39,23]), 150km (93[62,31])

Figure: RD Conley standard errors -"Manual" RD procedure

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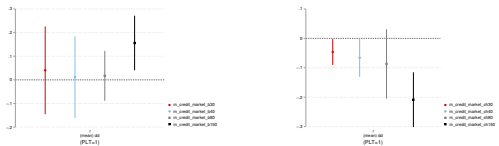

(a) Formal credit market

(b) Informal credit market

Note: Regressions at the parish level. Bandwidth (number of observations[Obs right, Obs. left]): 50km(35 [19,16]), 80km (62 [39,23]), 150km (93[62,31]), 200km (125 [69,56])

Results RD full sample

	(1) Share	(2) Permanent	(3) Transitory	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
			Panel A: First stage				
dd	0.534	0.502	0.556	0.559	0.556	0.561	0.746
	(0.196)**	(0.175)**	(0.188)***	(0.193)***	(0.188)***	(0.193)***	(0.196)***
			Panel B: Fuzzy RD estimates				
Robust	0.257	0.126	1.608	-0.609	0.025	-3.429	0.072
	(0.090)***	(0.107)	(0.631)**	(0.782)	(0.029)	(1.198)***	(0.180)
Observations	6248	4293	5599	5837	5102	4689	4266
BandwidthL	30	24	31	31	33	30	28
BandwidthR	39	22	23	30	24	29	23
Parishes	24	15	20	23	20	22	16
Mean	0.720	1.068	4.880	2.138	0.079	1.326	0.764
Variation w.r.t mean	35.7	11.8	32.9	-28.5	31.3	-258.5	9.4

Cluster standard errors at the parish level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Results assuming fuzzy RD -Donut-

Table: Fuzzy geographic RD -Donut-

	(1) Share	(2) Permanent	(3) Transitory	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
			Panel A: First stage				
dd	0.579	0.579	0.579	0.579	0.579	0.579	0.579
	(0.268)**	(0.268)**	(0.268)**	(0.268)**	(0.268)**	(0.268)**	(0.268)**
			Panel B: Fuzzy RD estimates				
Robust	0.347	1.314	-0.247	-1.491	-0.035	-2.488	1.938
	(0.098)***	(0.777)*	(0.348)	(0.951)+	(0.035)	(2.658)	(1.454)
Observations	3185	3185	3185	3185	3185	3185	3185
Bandwidth	35	35	35	35	35	35	35
Parishes	22	22	22	22	22	22	22
Mean	0.704	1.203	3.334	1.527	0.075	2.106	0.872
Variation w.r.t mean	49.3	109.3	-7.4	-97.6	-46.5	-118.1	222.3

Cluster standard errors at the parish level in parentheses

OLS-All producers

	(1) Share	(2) Permanent	(3) Transitory	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
dd	0.413	0.832	-1.795	-1.729	0.041	-0.186	1.035
	(0.047)***	(0.168)***	(0.316)***	(0.206)***	(0.009)***	(0.445)	(0.203)***
Observations	20393	21688	22193	21752	19049	17057	19823
Parishes	125	125	125	125	125	125	125
Mean	0.59	1.18	4.52	2.21	0.07	1.10	0.84
Variation w.r.t mean	69.60	70.46	-39.76	-78.36	56.54	-16.96	123.79

Cluster standard errors at the parish level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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diff band

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
			Panel A: First stage				
dd	0.544	0.544	0.544	0.544	0.544	0.544	0.544
	(0.201)**	(0.201)**	(0.201)**	(0.201)**	(0.201)**	(0.201)**	(0.201)**
			Panel B: Fuzzy RD estimates				
Robust	0.209	0.589	-0.106	-1.328	-0.033	-4.150	1.442
	(0.111)*	(0.391)+	(0.462)	(0.430)***	(0.044)	(1.770)**	(0.713)**
Observations	3912	3912	3912	3912	3912	3912	3912
Bandwidth	40	40	40	40	40	40	40
Parishes	28	28	28	28	28	28	28
Mean	0.695	1.277	3.246	1.534	0.073	2.232	0.929
Variation w.r.t mean	30.1	46.2	-3.3	-86.6	-44.8	-186.0	155.1

Cluster standard errors at the parish level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Second degree polynomial

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
Panel A: First stage							
dd	0.639	0.639	0.639	0.639	0.639	0.639	0.639
	(0.185)***	(0.185)***	(0.185)***	(0.185)***	(0.185)***	(0.185)***	(0.185)***
Panel B: Fuzzy RD estimates							
Robust	0.128	0.894	-0.401	-2.052	-0.033	-5.030	2.245
	(0.100)	(0.487)*	(0.369)	(0.857)**	(0.034)	(2.937)*	(1.153)*
Observations	3513	3513	3513	3513	3513	3513	3513
Bandwidth	35	35	35	35	35	35	35
Parishes	24	24	24	24	24	24	24
Mean	0.698	1.160	3.411	1.567	0.073	2.029	0.821
Variation w.r.t mean	18.4	77.0	-11.7	-130.9	-45.0	-247.9	273.5

Cluster standard errors at the parish level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Second degree polynomial

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
			Shard RD case				
Robust	0.042	0.293	-0.131	-0.676	-0.011	-1.653	0.738
	(0.023)*	(0.096)***	(0.066)**	(0.122)***	(0.011)	(0.317)***	(0.096)***
Observations	3513	3513	3513	3513	3513	3513	3513
Bandwidth	35	35	35	35	35	35	35
Parishes	24	24	24	24	24	24	24
Mean	0.698	1.160	3.411	1.567	0.073	2.029	0.821
Variation w.r.t mean	6.0	25.3	-3.8	-43.1	-14.8	-81.5	89.9

Cluster standard errors at the parish level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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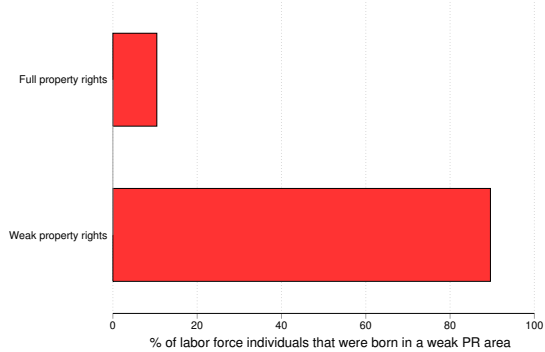
IHS

	(1) Permanent	(2) Transitory	(3) Else
Panel A: First stage			
dd	0.536	0.536	0.536
	(0.193)***	(0.193)***	(0.193)***
Panel B: Fuzzy RD estimates			
Robust	0.714	0.141	1.704
	(0.437)+	(0.393)	(0.926)*

Internal migration

Figure: Internal migration-% of workers that were born in weak PR and continue there



Note: Internal migration with IPUMS and provinces match.

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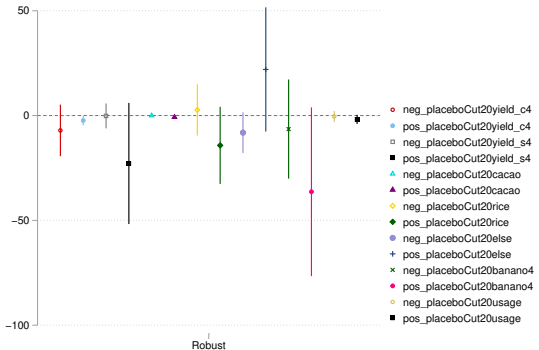
Different cutoff



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Intensive margins-diff sample-

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Table: Intensive margins

		Yields					
	Share	Permanent	Transitory	Rice	Cocoa	Banana	Non traditional
			Sharp RD case				
Robust	0.129	0.093	0.199	-0.444	-0.001	-10.886	0.512
	(0.028)***	(0.137)	(0.055)***	(0.105)***	(0.015)	(5.828)*	(0.265)*
Observations	2211	2151	2712	2210	1743	219	1139
BandwidthL	25	30	22	20	32	36	38
BandwidthR	23	26	25	31	23	36	41
Parishes	15	20	16	19	19	25	27
Mean	0.892	1.571	5.034	2.775	0.128	19.749	1.557
Variation w.r.t mean	14.5	5.9	3.9	-16.0	-1.2	-55.1	32.9

Cluster standard errors at the parish level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Extensive margins-diff sample-

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Table: Extensive margins

	Share	Yields					
		Perennial	Annual	Rice	Cocoa	Banana	Non traditional
		Sharp RD case					
Robust	0.215	0.309	0.568	0.045	0.001	-1.742	0.552
	(0.076)***	(0.068)***	(0.408)	(0.261)	(0.019)	(0.794)**	(0.048)***
Observations	4578	5319	5952	5569	4620	2766	4707
BandwidthL	25	29	35	38	33	36	28
BandwidthR	29	28	28	29	29	31	40
Parishes	19	22	23	25	23	23	21
Mean	0.897	1.593	5.007	2.942	0.132	22.346	1.598
Variation w.r.t mean	24.0	19.4	11.3	1.5	0.5	-7.8	34.5

Cluster standard errors at the parish level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Results assuming sharp RD -Donut-

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Table: Sharp geographic RD estimates

		Yields					
	Share	Perennial	Annual	Rice	Cocoa	Banana	Non-traditional
				Sharp RD case			
Robust	0.145	0.550	-0.103	-0.626	-0.015	-1.038	0.810
	(0.059)**	(0.139)***	(0.109)	(0.226)***	(0.013)	(0.468)**	(0.156)***
Observations	3185	3185	3185	3185	3185	3185	3185
Bandwidth	35	35	35	35	35	35	35
Parishes	22	22	22	22	22	22	22
Mean	0.716	1.178	4.781	2.089	0.085	1.358	0.799
Variation w.r.t mean	20.3	46.7	-2.2	-29.9	-17.2	-76.4	101.4

Cluster standard errors at the parish level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$