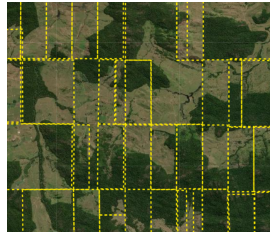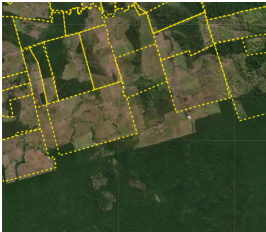# Agricultural Elites, Special Interest Politics, and Deforestation: Property-Level Evidence from the Amazon
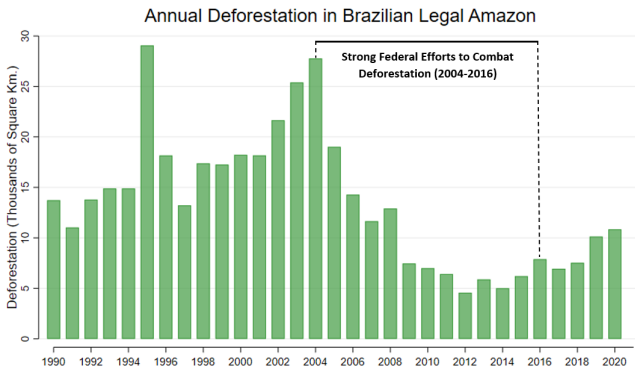
Erik Katovich and Fanny Moffette

UW-Madison

March 9th, 2022

Tropical Deforestation Accounts for 20% of Global Greenhouse Gas Emissions, and 70% of Brazil's Emissions (Asner, 2010)

Annual Deforestation in Brazilian Legal Amazon

Strong Federal Efforts to Combat Deforestation (2004-2016)

Source: PRODES (2021)

OCTOBER 1, 2021

In Brazilian Amazon, savannization and climate change will expose 12 million to lethal heat stress

by Fiocruz Piauí

Article | Open Access | Published: 10 May 2021

Deforestation reduces rainfall and agricultural revenues in the Brazilian Amazon

Argemiro Teixeira Leite-Filho, Britaldo Silveira Soares-Filho, Juliana Leroy Davis, Gabriel Medeiros Abrahão & Jan Börner

Deforestation and Local Politics are Connected in Brazilian Amazon

- ▶ Deforestation is driven by **economic incentives**, including **commercial cattle and soy production**

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- ▶ Deforestation is driven by **economic incentives**, including **commercial cattle and soy production**

- ▶ Economic interest groups may influence local politics through **campaign donations** or **candidate selection**

- ▶ Environmental governance mostly set at federal and state levels, but municipal leaders can influence deforestation for electoral motives:

  - ▶ **Dahis & Bragança (2021):** Deforestation and agricultural promotion ↑ when self-declared farmer mayors elected during weak enforcement period (2000); no effects in 2004–2012

  - ▶ **Pailler (2018):** Deforestation ↑ in election years; self-financed campaign contributions linked to more deforestation

  - ▶ **Abman (2014):** Eligibility for reelection reduces deforestation after introduction of municipal blacklist policy

Research Questions and Preview of Results

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4. **Municipality-Level Mechanisms:**

   Landowner-financed mayors promote ag. (spending & grants ↑); no evidence they block environmental enforcement (embargos ↑)

What Do We Contribute?

- ▶ Existing studies:
  - ▶ Limited to municipality-level outcomes
  - ▶ Rely on self-reported occupation of candidates to identify farmers
  - ▶ Don't observe donors' landholdings or occupations, so can't measure behavior on donor properties or effects of landowner donations

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- ▶ We use data on 5 municipal elections spanning period with significant variations in federal enforcement effort (2000-2020)

- ▶ We contribute to literatures on:
    - ▶ Decentralization and environmental federalism
    - ▶ Special interest groups and campaign finance
    - ▶ Elite capture
    - ▶ Political economy of tropical deforestation

Data I: Building a Property-Level Land Use Database

Identified land registries:

- *Cadastro Ambiental Rural* (MT/PA/RO)
- Terra Legal (Legal Amazon)
- SIGEF (subset of SNCR) (Brazil)

Annual satellite data on land use (2000-2020):

- MapBiomas

CAR property boundaries in Mato Grosso, Pará, and Rondônia

## Data II: Connecting Property Panel with Candidate/Donor Panels

Candidates: TSE (2000, 2004, 2008, 2012, 2016): names/IDs, demographic information, declared occupation and property, political affiliations, and vote total for all mayoral and council candidates

Donations: TSE (2004, 2008, 2012, 2016): names/IDs, donation value, donation type, and recipient candidate for all donations

Municipality-Level Outcome Panels: deforestation, land conversion to agriculture and pasture, greenhouse gas emissions (SEEG)

Municipality-Level Mechanism Panels: public finances (FINBRA), matching grants between federal ministries and municipal governments (PGU), environmental violations (IBAMA)

Data II: Connecting Property Panel with Candidate/Donor Panels

2004

2008

% of Politicians Matched
in Land Registries
100
80
60
40
20
0
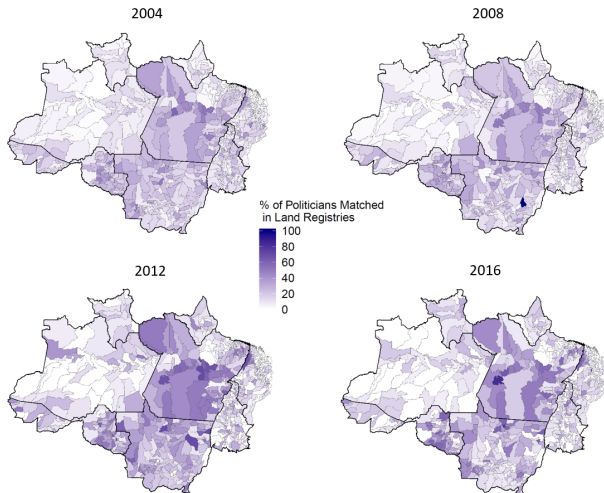
2012

2016

Potential measurement error: politicians could own untitled land or title properties in someone else's name

Descriptive Statistics: Candidates and Donors

	Legal Amazon (2000, 2004, 2008, 2012, 2016)		
	Candidates (Mayor)	Candidates (Council)	Donors (CPF/CNPJ)
Number (Total)	5,124	210,549	336,678
Number (Landholders)	2,122	20,228	26,986
% Landholders	41.41	9.61	8.02
% Resource-Linked Occup.	15.81	16.38	NA
	(36.49)	(37.01)	
Value Donations Received/Given	70,448	2,269	3,445
	(319,409)	(30,370)	(53,145)
Among Landholders:			
Property Size (ha.)	2,240	1,943	2,150
	(7,219)	(22,497)	(21,539)
No. Properties	2.58	1.35	1.74
	(3.75)	(0.83)	(2.32)
% Forest Cover Loss to 2020	90.30	76.64	69.44
	(110.37)	(67.92)	(33.00)
YearsxProperties Under IBAMA Embargo	5.34	0.53	1.90
	(30.20)	(3.75)	(15.79)
Avg. Cultivated Soy Hectares (2000-2020)	119.12	18.32	32.57
	(813.50)	(471.97)	(467.53)
% Appearing on Forced Labor List	1.08	0.08	0.62
	(11.64)	(3.14)	(9.41)
% Resource-Linked Occup.	25.97	41.33	NA
	(43.86)	(49.24)	
Value Donations Received/Given	98,035	3,154	7,583
	(285,858)	(12,044)	(47,100)

Descriptive Statistics: *Successful* Candidates and Donors

	Legal Amazon (2000, 2004, 2008, 2012, 2016)		
	Mayors	Councilors	Donors (CPF/CNPJ)
Number (Total)	2,952	103,404	108,200
Number (Landholders)	858	10,497	9,822
% Landholders	29.07	10.15	9.08
% Resource-Linked Occup.	15.72	18.29	NA
	(36.40)	(38.65)	
Value Donations Received/Given	75,513	2,057	2,579
	(225,093)	(171,48)	(19,130)
Among Landholders:			
Property Size (ha.)	2,950	1,728	2,089
	(8,579)	(21,514)	(16,776)
No. Properties	3.02	1.38	1.93
	(4.59)	(0.87)	(2.71)
% Forest Cover Loss to 2020	100.96	79.64	69.57
	(148.34)	(75.91)	(32.69)
YearsxProperties Under IBAMA Embargo	7.61	0.61	2.45
	(41.94)	(4.20)	(19.73)
Avg. Cultivated Soy Hectares (2000-2020)	178.26	21.64	43.26
	(983.98)	(516.42)	(398.74)
% Appearing on Forced Labor List	1.52	0.08	0.87
	(14.00)	(3.09)	(11.34)
% Resource-Linked Occup.	24.71	40.21	NA
	(43.16)	(49.03)	
Value Donations Received/Given	120,141	3,322	8,410
	(294,898)	(14,566)	(51,240)

Property-Level Empirical Strategy: Event Studies

▶ Regress outcome d (deforestation, land conversion) on properties belonging to mayoral candidate i in municipality m in year t on relative time dummies around year of entry into office:

$$d_{ikmt} = \sum_{k=-4}^{+8} \beta_k T_{imt} \mathbb{1}\{s = k\} + \theta_i + \lambda_t + \epsilon_{ikmt}$$

▶ **"Treated"** individuals are candidates who win a close election (5 or 10% win margin, where the outcome was "quasi-random")

▶ **"Control"** units are candidates who lose a close election

▶ Include individual and year fixed effects, cluster standard errors at individual level

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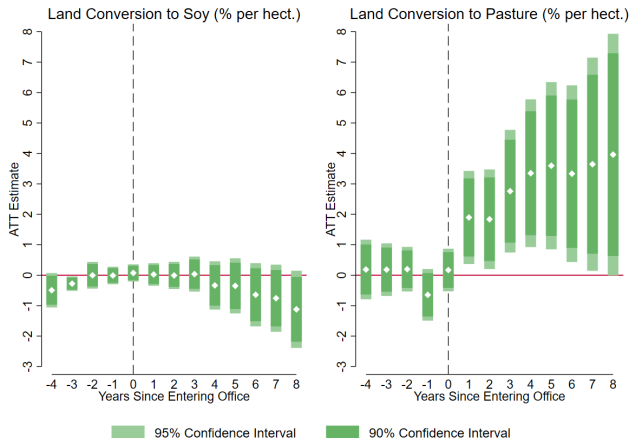▶ Include individual and year fixed effects, cluster standard errors at individual level

TWFE Problems: Already-treated units introduce bias into TWFE estimates. Implement **Callaway and Sant'Anna *csdid* estimator** with not-yet-treated controls

Candidates: Effects of Close Election Victory (≤10% Win Margin) on Deforestation
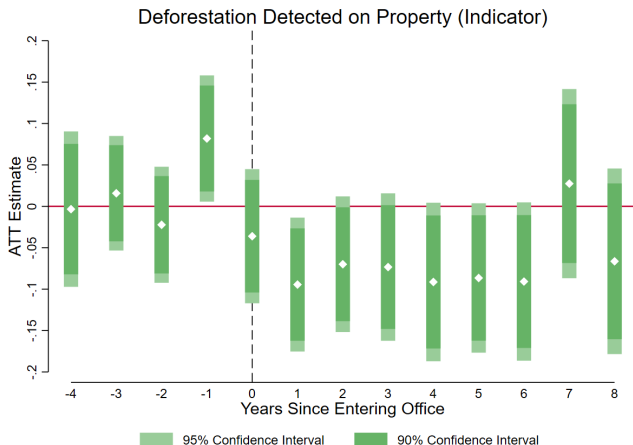
Deforestation Detected on Property (Indicator)

Note: Figure shows dynamic event study ATT estimates and 90 and 95% confidence intervals from Callaway and Sant'Anna (2021) csdid estimator. ATTs are aggregated from pairwise candidate-year comparisons. Standard errors are clustered at the candidate-level. Sample is 20-year candidate-level panel (2000-2019) for all municipal election candidates in 2000, 2004, 2008, 2012, and 2016 elections in Legal Amazon. Sample is restricted to winner and runner-up mayors in elections with ≤ 10% win margin. Outcome is indicator of whether >2 ha. of natural vegetation was lost in a year on candidate's properties.

# Candidates: Effects of Close Election Victory (≤10%) on Land Conversion

Land Conversion to Soy (% per hect.)

Land Conversion to Pasture (% per hect.)

ATT Estimate — Years Since Entering Office

95% Confidence Interval   90% Confidence Interval

Note: Figures show dynamic event study ATT estimates and 90 and 95% confidence intervals from Callaway and Sant'Anna (2021) csdid estimator. ATTs are aggregated from pairwise candidate-year comparisons. Standard errors are clustered at the candidate-level. Sample is 20-year candidate-level panel (2000-2019) for all municipal election candidates in 2000, 2004, 2008, 2012, and 2016 elections in Legal Amazon. Sample is restricted to winner and runner-up mayors in elections with ≤ 10% win margin. Outcomes measures ha. converted to soy and pasture over property area on candidate's properties. ▸ **Additional Candidate Outcomes**

Donors: Effects of Close Election Victory ($\leq$5% Win Margin) on Deforestation
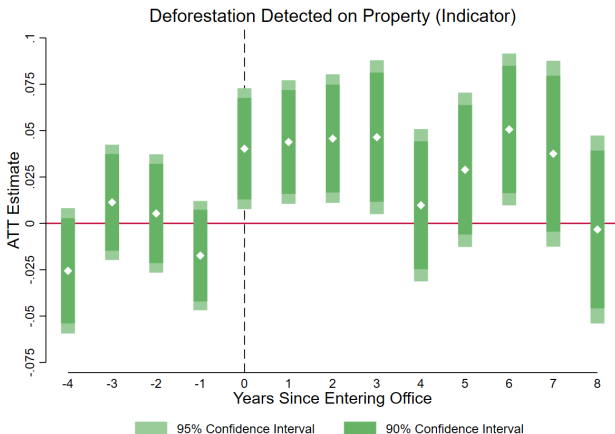
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Note: Figure shows dynamic event study ATT estimates and 90 and 95% confidence intervals from Callaway and Sant'Anna (2021) csdid estimator. ATTs are aggregated from pairwise donor-year comparisons. Standard errors are clustered at the donor-level. Sample is 20-year donor-level panel (2000-2019) for all donors to municipal election candidates in 2004, 2008, 2012, and 2016 elections in Legal Amazon. Sample is restricted to donors to winner and runner-up mayors in elections with $\leq$ 5% win margin. Outcome is indicator of whether >2 ha. of natural vegetation was lost in a year on donor's properties.

Donors: Effects of Close Election Victory (≤5%) on Land Conversion
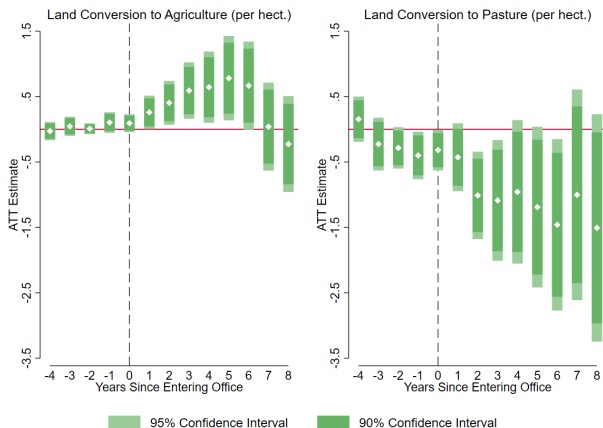
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▸ Additional Donor Outcomes

Municipality-Level Difference-in-Differences

$$d_{me} = \beta T_{me} + \mu X'_{ime} + \delta_m + \theta_e + \epsilon_{me}$$

- ▶ d_{me} are municipality-level outcomes over four years following mayor's election
- ▶ T_{me} is treatment indicator = 1 if elected mayor:
    - ▶ is a landowner
    - ▶ is a large landowner ($\geq$500 ha.)
    - ▶ received any donations from landowners
    - ▶ received $\geq$25% donations from landowners
    - ▶ received $\geq$50% donations from landowners
- ▶ X_{ime} is vector of winner i covariates (sex and education)
- ▶ δ_m and θ_e are municipality and election-period FEs; standard errors are clustered at municipality-level

Restrict sample to close elections ($\leq$5% Win Margin)

Municipality-Level: Effects of Landowning Candidate or Donors on Land Use
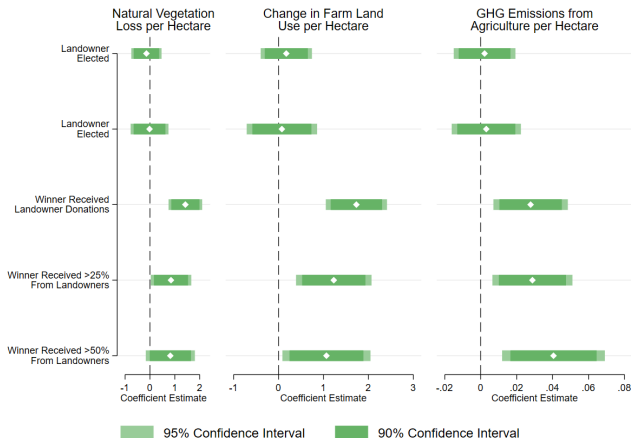

Note: Figures report coefficient estimates and 90 and 95% confidence intervals from regression of outcome on municipality-election level treatment dummies (landowner/large landowner (> 500 ha.) in office, mayor who received landowner donations in office, and mayor who received more than 25/50% of donation value from landowners in office). Specifications include municipality and election FEs, candidate-level controls (sex and education), and cluster standard errors at municipality level. Left figure reports effect on natural vegetation loss per hectare. The central figure reports effect on change in farm land use per hectare. The right figure reports effect on greenhouse gas emissions from agriculture per hectare.

Municipality-Level: Public Finance Mechanism
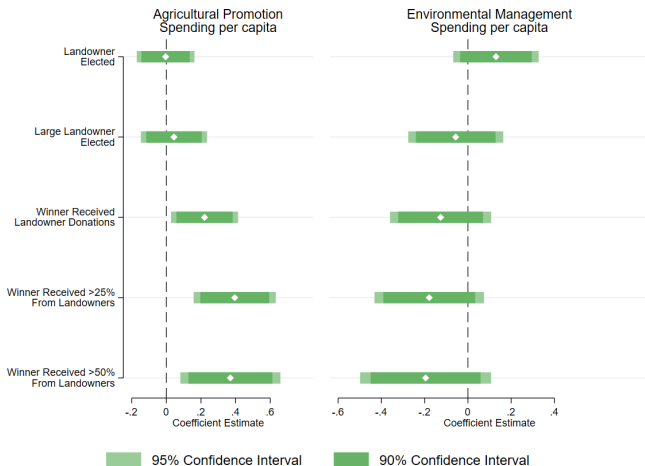
Left figure reports effects on municipal spending on agricultural promotion (Agriculture, Colonization, Agro-livestock Defense and Sanitation, Rural Extension, Irrigation, Agrarian Organization, Agro-Livestock Promotion, Land Reform, and Other Agricultural Subfunctions); right figure reports effects on municipal spending on environmental mgmt (Environmental Control, Management, Preservation and Conservation, Recuperation of Degraded Areas, and Other Environmental Subfunctions). Monetary values deflated to constant 2010 $BRL.

Municipality-Level: Effort Mechanism (Federal Matching Grants)
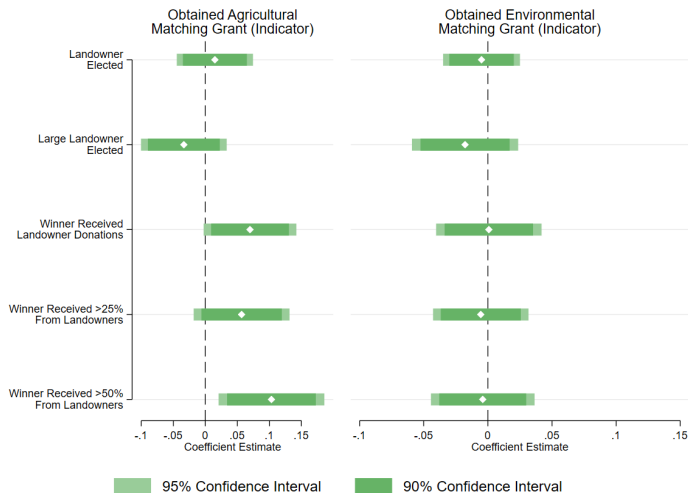
Left figure reports effects on indicator of whether the municipality received a federal matching grant from the Ministry of Agriculture in that election period. Right figure reports effects on indicator of whether the municipality received a federal matching grant from the Ministry of the Environment.

Municipality-Level: Corruption Mechanism (IBAMA Environmental Violations)

Left figure reports effects on the number of environmental violations reported in the municipality (IBAMA embargos) per capita. Right figure reports the same outcome in per hectare terms.

Robustness:

▶ Restrict sample to MT/PA/RO (more complete land registries, less statistical power)

▶ Restrict properties to Amazon biome (more likely deforestation is illegal, less statistical power and missing some intense land conversion regions)

Next step:

▶ Test pre-trends and implement Callaway and Sant'Anna for municipality-level analysis

Descriptive Statistics: Candidates and Donors (MT/PA/RO)

| | MT/PA/RO (2004, 2008, 2012, 2016) | | |
	Candidates (Mayor)	Candidates (Council)	Donors (CPF/CNPJ)
Number (Total)	4,134	107,059	216,469
Number (Landholders)	1,530	15,343	26,664
% Landholders	37.01	14.33	12.32
% Resource-Linked Occup.	15.41	15.82	NA
	(36)	(36)	
Value Donations Received/Given	87,318	2,840	3,379
	(353,534)	(39,347)	(32,246)
Among Landholders:			
Property Size (ha.)	2582.68	1418.60	1969.78
	(7,943)	(10,496)	(11,044)
No. Properties	2.71	1.36	1.87
	(3.34)	(0.80)	(2.71)
% Forest Cover Loss to 2020	90.38	81.44	82.37
	(118.19)	(68.37)	(97.38)
Years $\times$ Properties Under Embargo	5.95	0.56	2.12
	(28.55)	(3.93)	(18.77)
Avg. Cultivated Soy Ha. (2000-2020)	163.98	23.94	94.72
	(954.17)	(541.78)	(1,148)
% Appearing on Forced Labor List	1.44	0.08	0.70
	(13.46)	(3.33)	(9.93)
% Resource-Linked Occup.	27.12	43.56	NA
	(0.44)	(0.50)	
Value Donations Received/Given	110,749	3,295	8,432
	(301,299)	(11,376)	(50,571)

## Descriptive Stats: *Successful* Cand. and Donors (MT/PA/RO)

	MT/PA/RO (2004, 2008, 2012, 2016)		
	Winners (Mayor)	Winners (Council)	Donors (CPF/CNPJ)
Number (Total)	1,353	43,506	67,781
Number (Landholders)	629	7,921	9,786
% Landholders	46.49	18.21	14.44
% Resource-Linked Occup.	16.41	18.28	NA
	(0.37)	(0.39)	
Value Donations Received/Given	106,317	2,925	2,682
	(268,766)	(10,318)	(17,383)
Among Landholders:			
Property Size (ha.)	3,523	1,399	2,191
	(9,690)	(9,138)	(11,497)
No. Properties	3.36	1.42	2.10
	(4.67)	(0.89)	(3.34)
% Forest Cover Loss to 2020	99.17	84.13	85.43
	(164.99)	(78.91)	(106.23)
YearsxProperties Under IBAMA Embargo	7.92	0.65	2.84
	(36.66)	(4.46)	(25.20)
Avg. Cultivated Soy Hectares (2000-2020)	241.29	28.41	132.35
	(1,142.73)	(594.31)	(1,317.42)
% Appearing on Forced Labor List	2.07	0.08	0.94
	(0.16)	(0.03)	(0.11)
% Resource-Linked Occup.	26.23	42.52	NA
	(0.44)	(0.49)	
Value Donations Received/Given	124,699	3,411	9,497
	(264,395)	(13,120)	(55,424)

Candidates: Effects of Close Election Victory (≤10%) on Other Outcomes
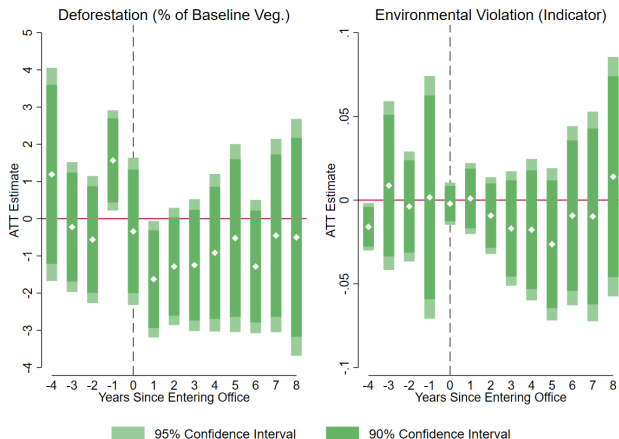
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Donors: Effects of Close Election Victory (≤5%) on Other Outcomes
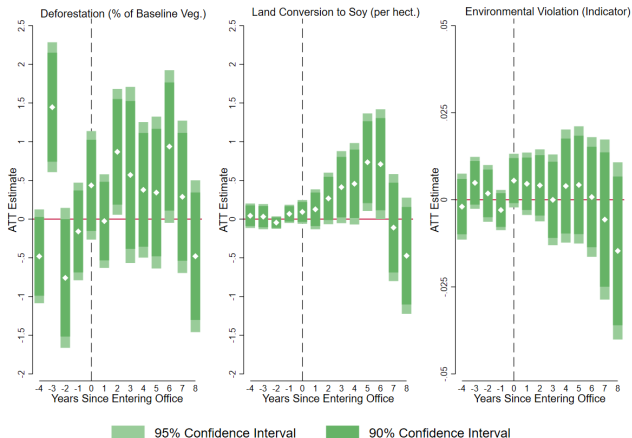
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▸ Return