Concessions & Eco-Certification in the Peruvian Amazon: Deforestation Impacts of Logging Rights and Restrictions

Jimena Rico-Straffon [1] Zhenhua Wang [2] Stephanie Panlasigui [3]
Colby J. Loucks [4] Jennifer Swenson [3] Alexander Pfaff [3]

[1] UC Santa Barbara

[2] University of Missouri

[3] Duke University

[4] World Wildlife Fund US

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Estimating forest loss impacts of logging rights & FSC certification

- Deforestation in the tropics is mainly driven by economic activities.
  - Conservation vs. development challenge
  - Conservation is not always effective

Research questions

- What happens to **forest loss** when we allow regulated economic activities inside the forest?
  1. **Logging concessions**- rights to extract timber (support development)
  2. **Forest Stewardship Council (FSC) certification** of logging concessions (adds sustainability restrictions)
- Concessions can do better than Protected Areas (PAs) in economic development – for sure – while no worse than weak PAs in conservation?

Theoretical forest loss impacts

1. **Logging concessions** (ambiguous, even in direction)
   - Defend their forest assets & prevent invasions ($\downarrow$ loss)
   - Violate concession terms & extract more than allowed ($\uparrow$ loss)
2. **FSC certification** (serious questions if any impact)
   - At the concession level
     - Sustainable-management standards should not harm forests ($\downarrow$ loss or 0 impacts)
   - At the firm level (ambiguous)
     - Sustainable-management standards should not harm forests ($\downarrow$ loss or 0 impacts)
     - Firms managing multiple concessions *green-wash* timber ($\uparrow$ loss)

Empirics

Methods

First rigorous quasi-experimental evaluation of Peru's concessions & FSC

- considerably longer panel of forests (1986-2018) than previous lit
- new Difference-in-Differences (DID) estimators

These data and estimators allow us to:

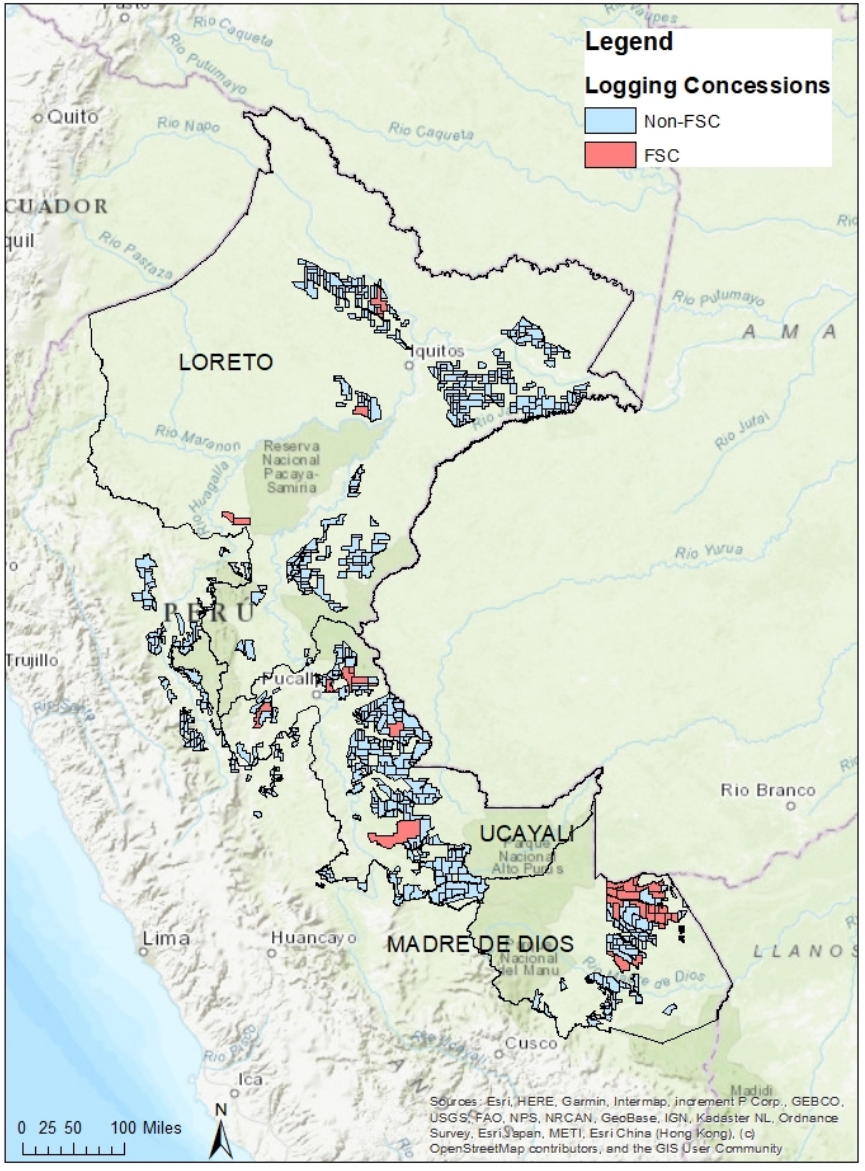
- test for the main identification assumption (parallel trends)
- remove biases from treatment heterogeneity & contamination

Results

1. Logging concessions did not raise forest loss and, if anything, reduced loss slightly by warding off temporary deforestation spikes
2. FSC certification had no *additional* significant impacts on forest loss

Data

- **Outcome:** Annual forest loss (MapBiomas Amazon Project)
- **Study period:** 1986-2018
- **Study area:** Peruvian Amazon
  - World's 4^{th} largest tropical forest
  - Largest timber region in Peru
- 525 logging concessions
  - 491 uncertified
  - 34 ever FSC-certified



Data

- We constructed two annual panel data sets

Table 1. Description of Panel Data Sets

Treatment	**Control**	**Spatial Unit**	**(i,t) obs.**
Uncertified Concessions	Untreated*	9000x9000m pixel	119,955
FSC	Uncertified Concessions	concession	16,929

* Includes forests outside of not only concessions but also PAs and indigenous communities.

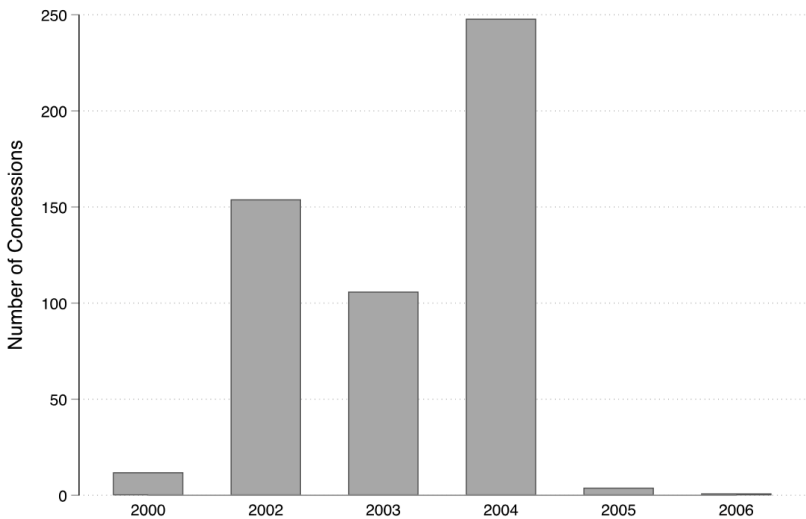
Size of concession= 5,000-40,000 ha. Size of aggregated pixel = 8,100 ha.

Logging concessions in Peru

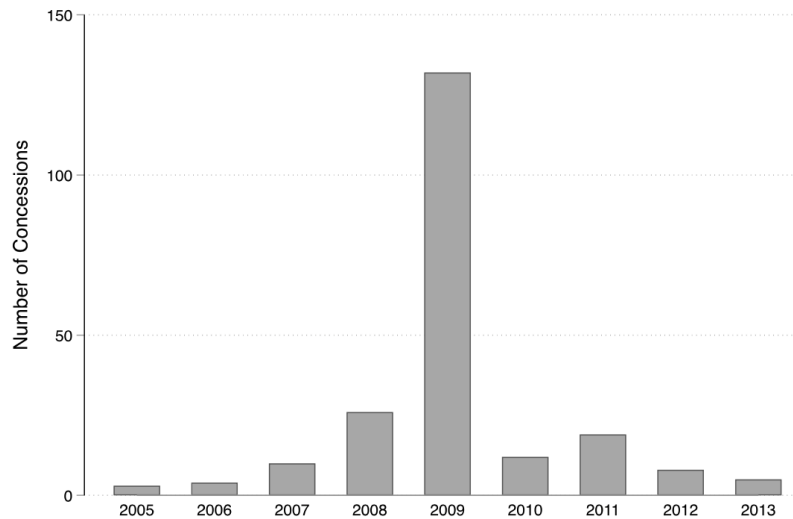
- 40-year contracts allowing regulated timber extraction by private actors
- 45% were cancelled during 2006-2013 due to concession contract violations

Fig. 1. Logging Concessions' Start and End Years

A. *Concession Start Years*



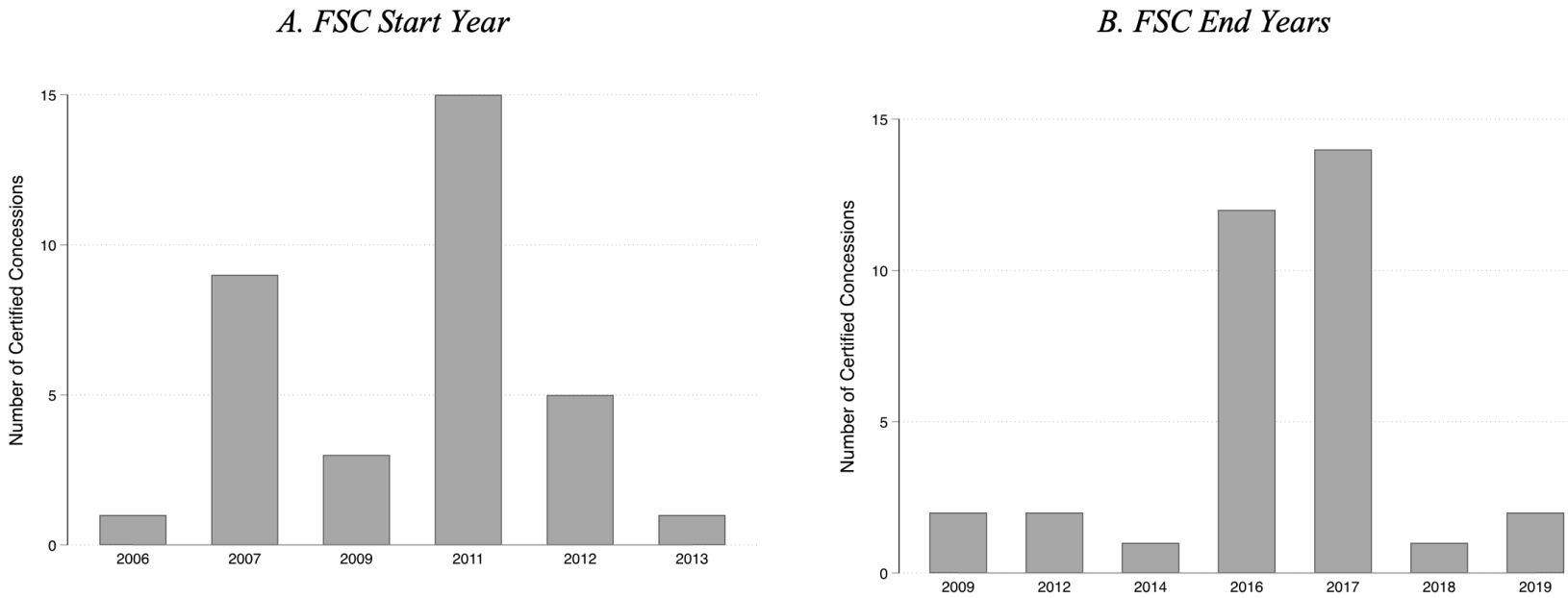
B. *Concession End Years*



FSC Certification in Peru

- FSC certificates were granted for five years and could be renewed
- 5 certificates were suspended in 2009-2014 due to violations of FSC's standards

Fig. 2. FSC Certificates' Start and End Years

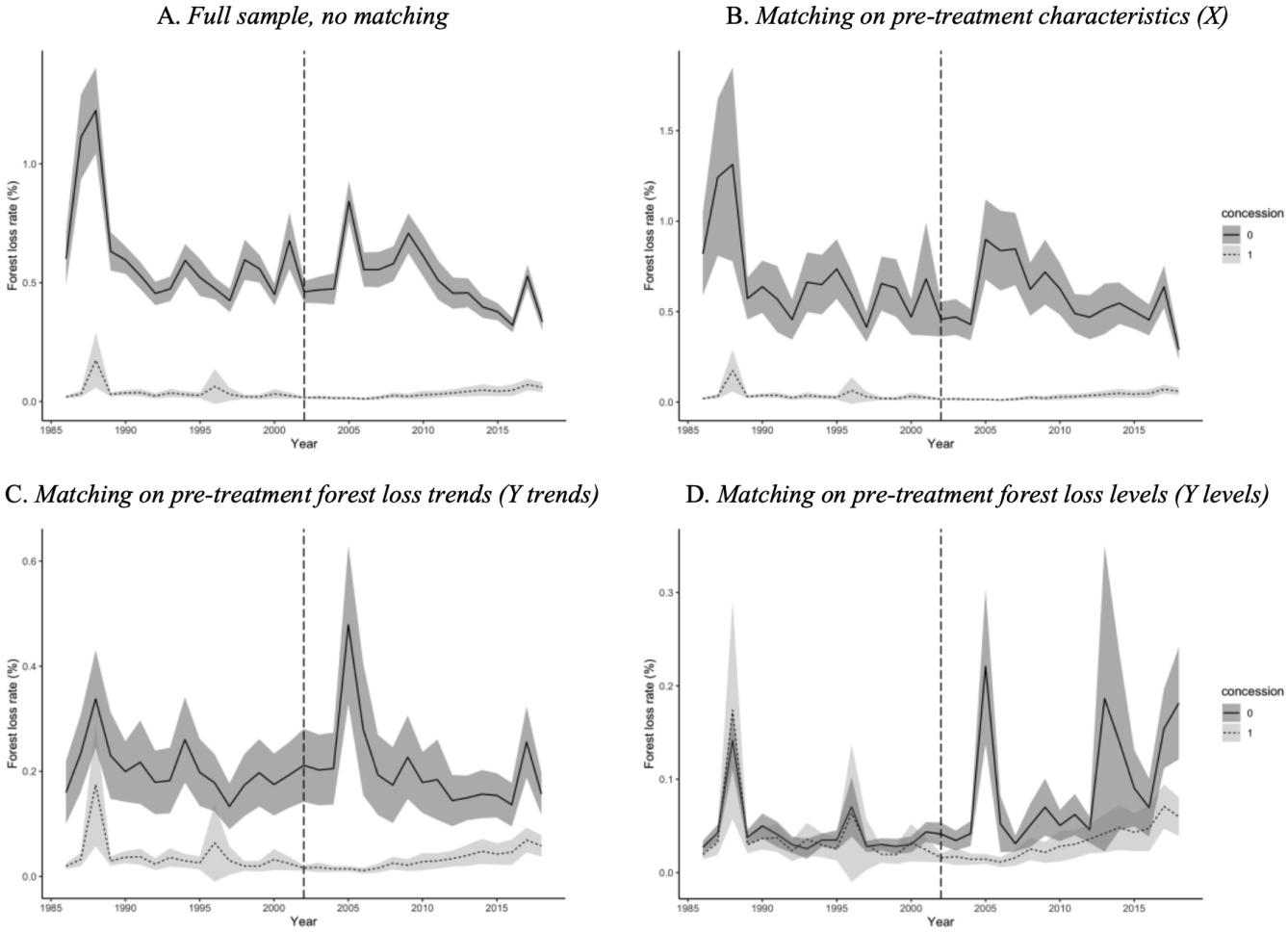


Empirical Strategy

- We exploit this space and time variation to identify the effects of
  1. Uncertified concessions
  2. FSC certification
- We use de Chaisemartin & d'Haultfoeuille's (2021a & 2022b) DID estimators (*did_mutiplegt*)
  - unstaggered design – switching in and out of treatment
  - robust to heterogenous effects and contamination biases
  - multiple treatments
- Key identification assumption: parallel trends
- Robustness: Two-way fixed effects (TWFE), other specifications, and Hansen et al (2013) outcome

Forest loss trends: uncertified concessions

Fig. 3. Mean forest loss trends in forests inside and outside concessions

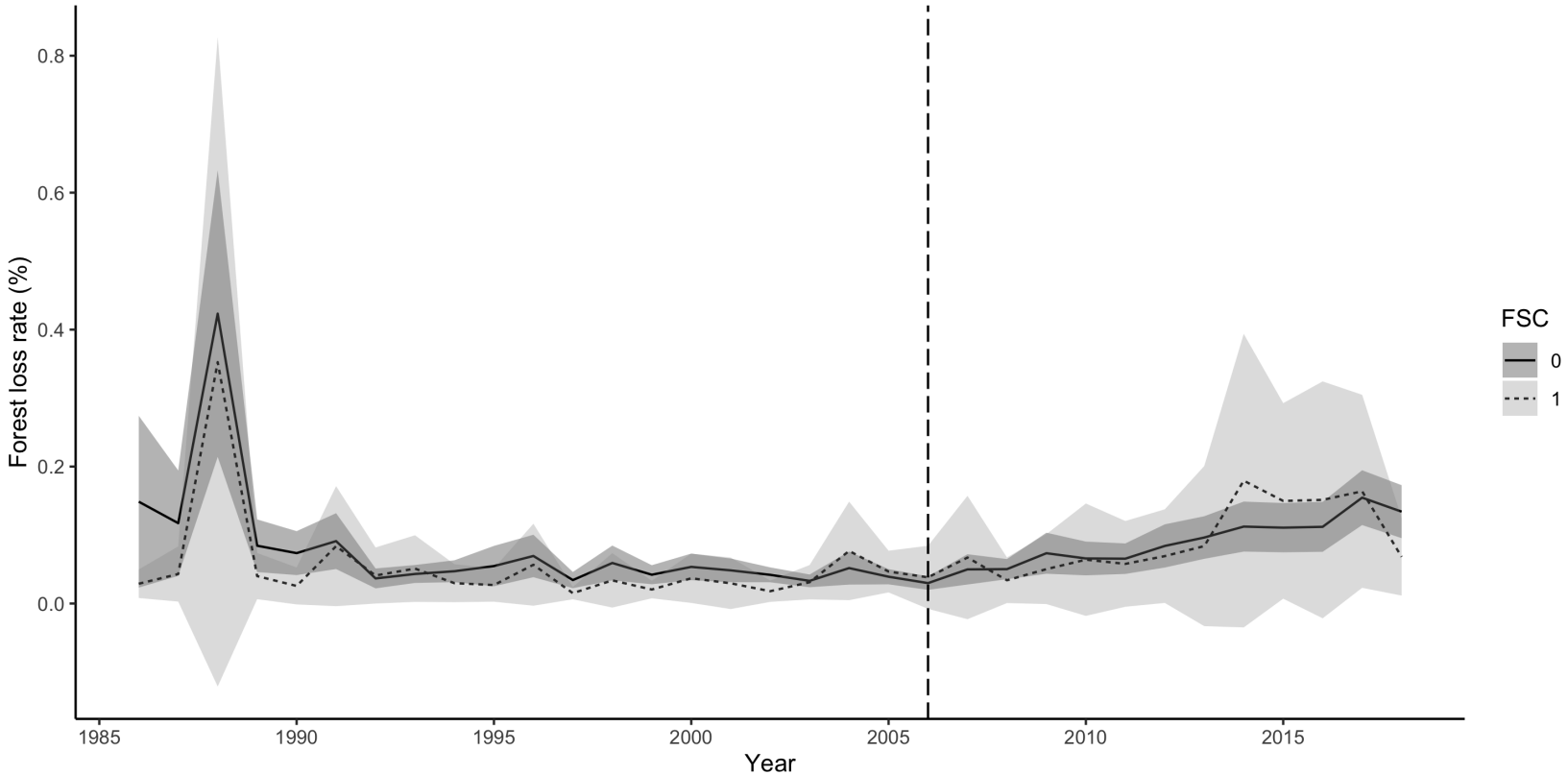


Notes: spatial unit of analysis= 9000x9000m pixels

Vertical line= 2002, when first concessions were granted

Forest loss trends: FSC certification

Fig. 4. Mean forest loss trends in forests inside concessions by FSC status

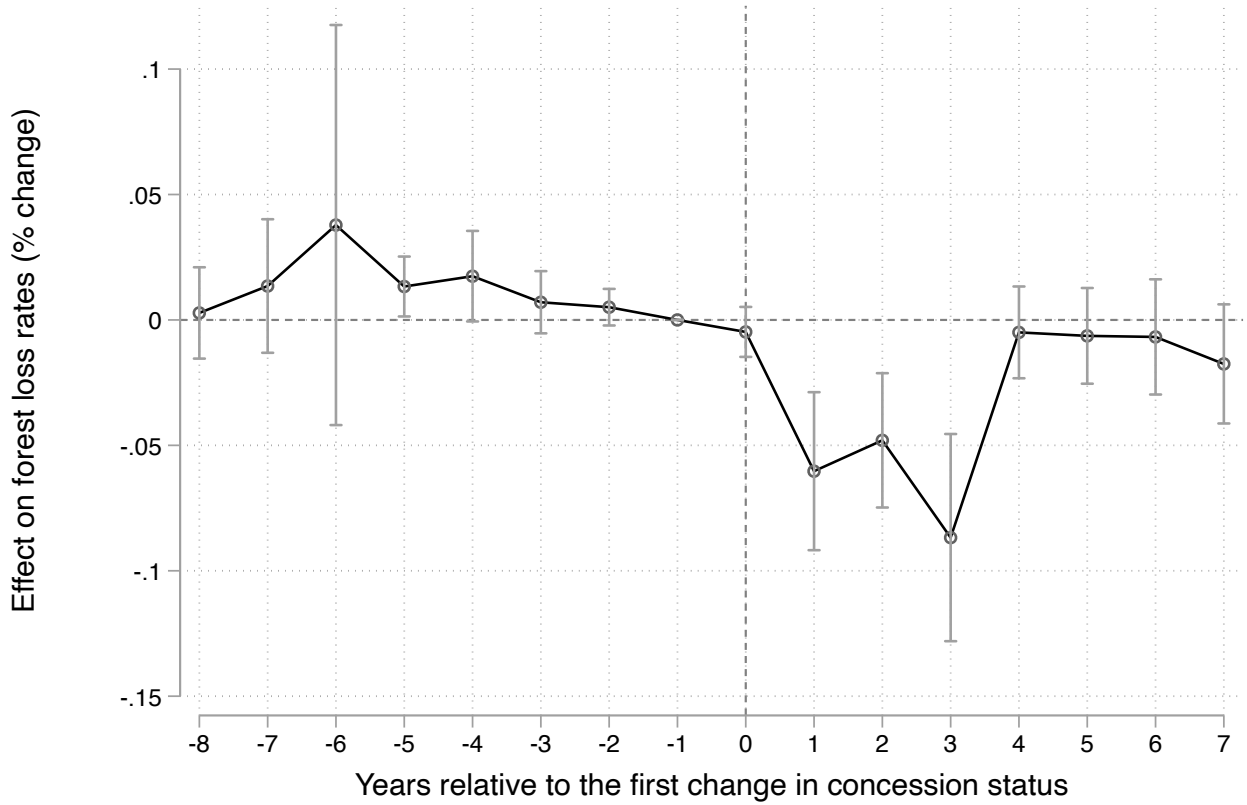


Notes: spatial unit of analysis= concession

Vertical line= 2006, when first FSC certificate was granted

Results: uncertified concessions

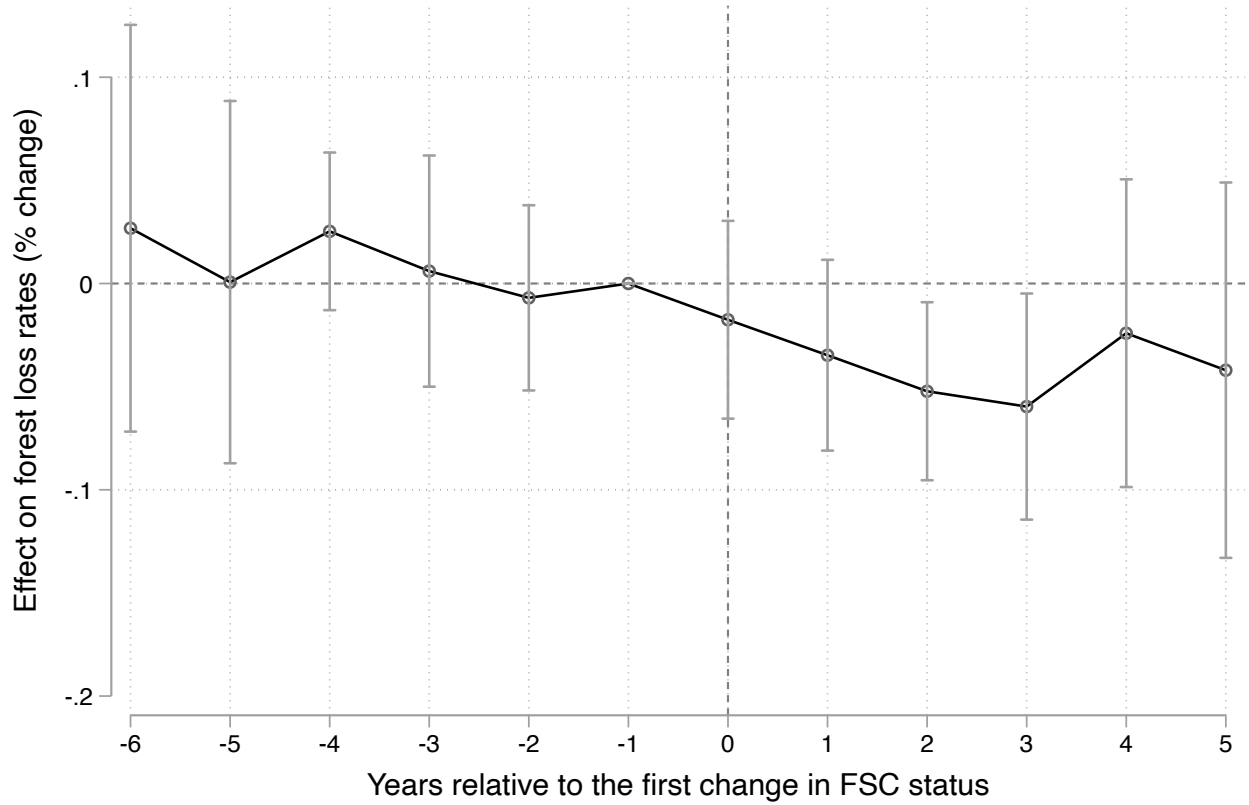
Fig. 5. Forest loss impacts of uncertified concessions



Notes: We ran *did_mutiplegt* on a matched sample of pixels (9000x9000m)
p-value of placebo joint significance test= 0.11.
This includes all concession cohorts except pre-2000.

Results: FSC certification

Fig. 6. Additional forest loss impacts of FSC certification

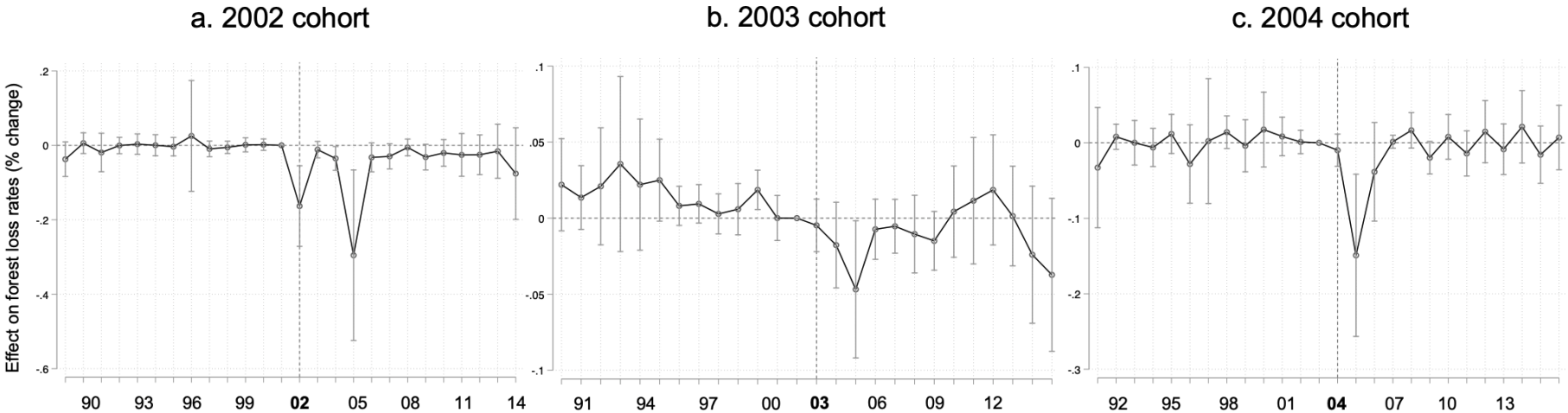


Notes: We ran *did_mutiplegt* on a concession-level panel that excludes inactive concession-year observations. P-value of placebo joint significance test= 0.22

Mechanisms

Concessions blocked temporary spikes in deforestation in the mid-2000s

Fig. 7. Uncertified concessions' forest loss impacts by cohort



Notes: We ran *did_mutiplegt* on a matched sample of pixels (9000x9000m)

Conclusions

- We estimated the forest loss impacts of:
  1. Uncertified concessions
  2. FSC certification
- We find that concessions — which have ambiguous priors —did not raise forest loss and, if anything, reduced it slightly by warding off temporary rises in external deforestation.
- While eco-certifications could reduce forest loss, we find no significant impact.
- Next: evaluate post-2000 conservation policy in Peru
  - Estimate forest impacts of four different PA types

Appendix

Estimators

de Chaisemartin & d'Haultfoeuille's (2021a) DID estimator at period t for first time switchers-in at period $t - l$:

$$\text{DID}_{+,t,\ell} = \sum_{g:F_{g,1}=t-\ell} \frac{N_{g,t}}{N^1_{t,\ell}} \left(Y_{g,t} - Y_{g,t-\ell-1}\right) - \sum_{g:F_{g,1}>t} \frac{N_{g,t}}{N^{nt}_t} \left(Y_{g,t} - Y_{g,t-\ell-1}\right) \tag{1}$$

Two-Way Fixed Effects:

$$L_{it} = \beta_0 + \beta_1 \text{ concession }_{it} + \alpha_i + \lambda_t + \varepsilon_{it} \tag{2}$$

$$L_{jt} = \gamma_0 + \gamma_1 \text{ concession }_{jt} + \gamma_2 FSC_{jt} + \sigma_j + \lambda_t + \mu_{jt} \tag{3}$$

Average Effects

TABLE 1. TWFE AND DID_L ESTIMATORS OF FOREST LOSS IMPACTS OF UNCERTIFIED CONCESSIONS AND FSC CERTIFICATION

	Uncertified Concessions		FSC Certification	
	TWFE (1)	DID_L (2)	TWFE (3)	DID_L (4)
Average effect	-0.0407	-0.0335	-0.0080	-0.0479
S.E.	(0.0114)	(0.0094)	(0.0219)	(0.0260)
N	32,538	22,906	16,929	11,159
Spatial unit of analysis	pixel	pixel	concession	concession
P-value placebo joint test	--	0.1131	--	0.2234
ATTs receiving negative weights/ total ATTs	0/4184	--	4202/ 5937	--
Sum of negative weights	0	--	-1.1007	--

Robustness: Uncertified Concessions

TABLE 2. ROBUSTNESS CHECKS OF THE EFFECT OF UNCERTIFIED CONCESSIONS USING THE DID_L ESTIMATOR

	DID_L (1)	Observations (2)	P-value placebo joint test (3)
Adding linear cohort trends	-0.0335	22,906	0.1561
	(0.0100)		
Adding non-parametric cohort trends	-0.0336	22,906	0.1503
	(0.0100)		
Changing concession threshold to 90 percent	-0.0378	25,225	0.2657
	(0.0108)		
Changing concession threshold to 98 percent	-0.0282	15,308	0.0441
	(0.0095)		
Pre-matching the sample with two neighbors	-0.0393	17,242	0.5458
	(0.0108)		
Pre-matching the sample with one neighbor and no replacement	-0.0132	15,674	0.6916
	(0.0309)		
Eliminating concessions that ever expired	-0.0404	12,304	0.4815
	(0.0107)		
Changing the outcome to Hansen et al's (2013) tree-cover loss rates	-0.0064	22,906	0.6488
	(0.0079)		

Robustness: FSC

TABLE 3. ROBUSTNESS CHECKS OF THE EFFECT OF FSC CERTIFICATION USING THE DID_L ESTIMATOR

	DID_L	Observations	P-value placebo joint test
	(1)	(2)	(3)
Adding linear cohort trends	-0.0283	11,159	0.2409
	(0.0183)		
Without cohort trends	-0.0147	11,159	0.3455
	(0.0179)		
With all concession-year observations	-0.0482	17,781	0.5759
	(0.0232)		
Pre-matching the data	-0.0111	2,160	0.3867
	(0.0247)		
Using Hansen et al's (2013) tree-cover	-0.0342	11,159	0.5355
loss rates as an outcome	(0.0783)		

Hansen et al's (2013) tree cover loss

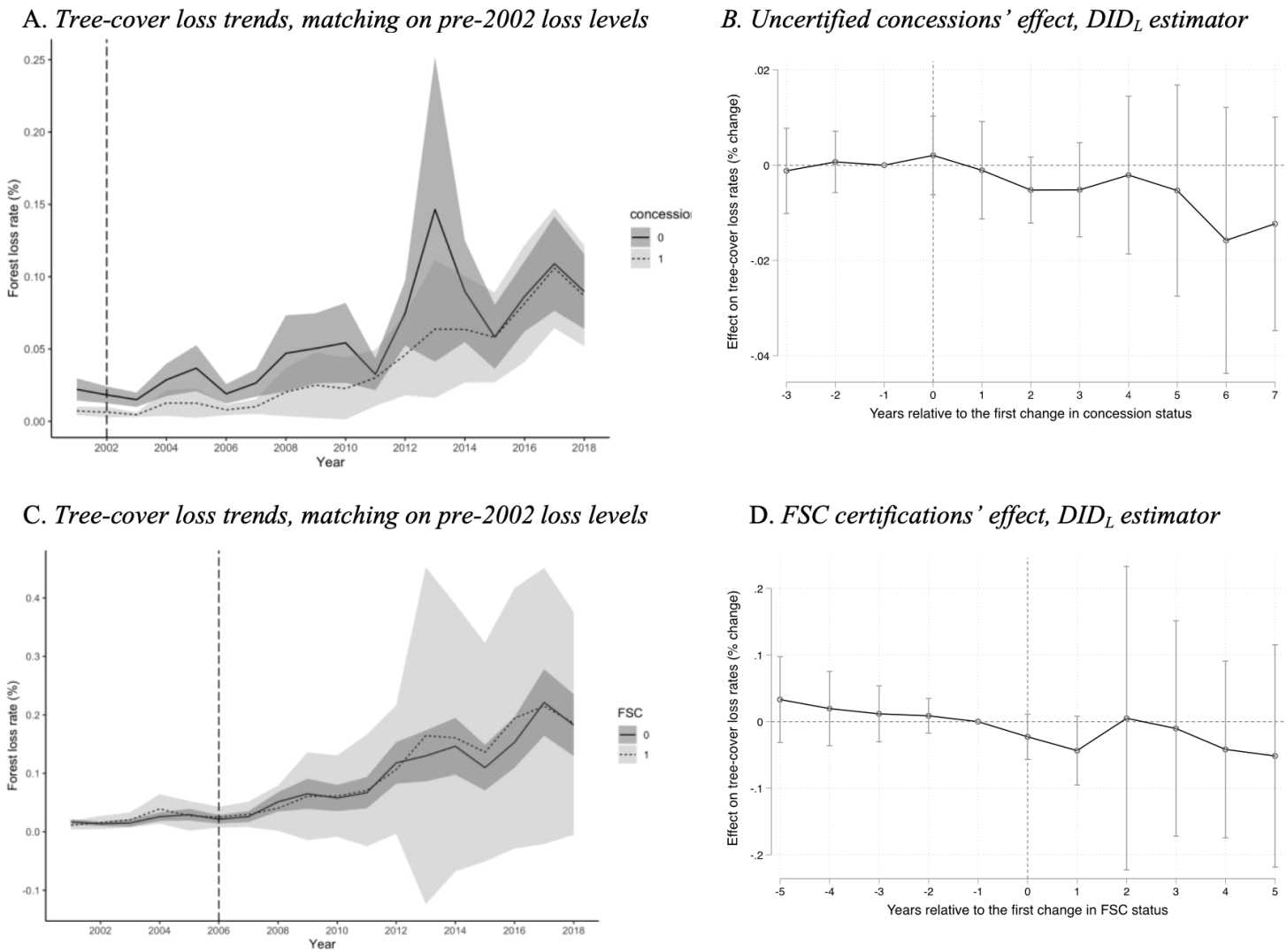


FIGURE A1. TREE-COVER LOSS TRENDS AND EFFECTS WITH HANSEN ET AL (2013) DATA