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Revisiting the historical state: Long-term effects of institutional history on deforestation

Matthias Schündeln *, Johannes Van Vlodrop

Goethe University Frankfurt, Germany

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ABSTRACT

Existing work has shown long-run effects of historical institutions on economic development. However, few studies examine long-run effects of institutions on the environment. In this paper, we build on work by Dell et al. (2018) to demonstrate the effect of historical institutions in southern Vietnam on forest cover. Using a spatial regression discontinuity design, we find a larger coverage of forest and a lower rate of deforestation in a region that historically delegated administrative tasks from the central state to the village, fostering local cooperation. Thus, our findings are in line with previous work suggesting a connection between local cooperation and the preservation of common pool resources. Further, the results suggest that historical institutional differences should be considered for a better understanding of determinants and possible remedies of forest loss.

1. Introduction and historical background

History matters for economic divergence across (Acemoglu et al., 2005; Nunn, 2008) and within (Dell, 2010; Jia, 2014) countries, for example through the effect of colonial (Acemoglu et al., 2001; Banerjee and Iyer, 2005), or precolonial institutions (Dell et al., 2018; Gennaioli and Rainer, 2007; Michalopoulos and Papaioannou, 2013). However, unlike for the link between historical institutions and economic development, there is little evidence on how historical institutions shape environmental outcomes.

This note contributes to the literature with an analysis of the effect of historical institutions on environmental outcomes today. We revisit a historical setting investigated previously by Dell et al. (2018), namely the effect of historical boundaries in southern Vietnam between the Dai Viet state and the Khmer Empire. Unlike with the socioeconomic characteristics studied in Dell et al. (2018), which are only available for a subset of communities in the area, the availability of finely disaggregated forest data enables a spatial regression discontinuity design that covers the full study region.

By 1698, the Dai Viet had established the southern province of Gia Dinh, which separated the region into a Khmer and a Dai Viet side (Dell et al., 2018). Fig. 1 shows the location of the region within Vietnam; the yellow line indicates the border. Because the Khmer were preoccupied with civil conflict elsewhere, this boundary between the Dai Viet and Khmer persisted for almost 150 years and Khmer territories to the west of the boundary were only incorporated into Dai Viet a few years before the French colonization. Local governance was an important difference during the time of separation of this region: While the Dai Viet state was heavily influenced by Chinese statecraft and delegating important administrative tasks from the central state to the village, the Khmer followed a patron-client model where the village did not play a major role.

Dell et al. (2018) provide evidence for long-lasting effects of the institutional differences, finding that consumption today is considerably higher in Dai Viet communes. They identify local cooperation as the key channel of persistence. Since cooperation is also associated with "better" management of common pool resources (Rustagi et al., 2010), we hypothesize that the historical state also affected the use of forest resources. Indeed, we find sizable effects of the historical institutional differences on forests, with larger levels of forest cover and lower rates of deforestation in the former Dai Viet region. Taken together with the findings by Dell et al. (2018), our results are in line with previous work that suggests decentralization and local self-governance affect cooperation positively (Rustagi, 2022; Banerjee and Iyer, 2005) and the sustainable use of environmental resources (Agrawal and Ostrom, 2001).

2. Data

To measure forest, we use the Global Forest Change (GFC) dataset (Hansen et al., 2013), which provides data on the initial tree cover density in 2000 and on forest loss for the years 2001 to 2019. We aggregate

* Correspondence to: Goethe University Frankfurt, 60323 Frankfurt, Germany.
E-mail addresses: schuendeln@wiwi.uni-frankfurt.de (M. Schündeln), vanvlodrop@wiwi.uni-frankfurt.de (J. Van Vlodrop).

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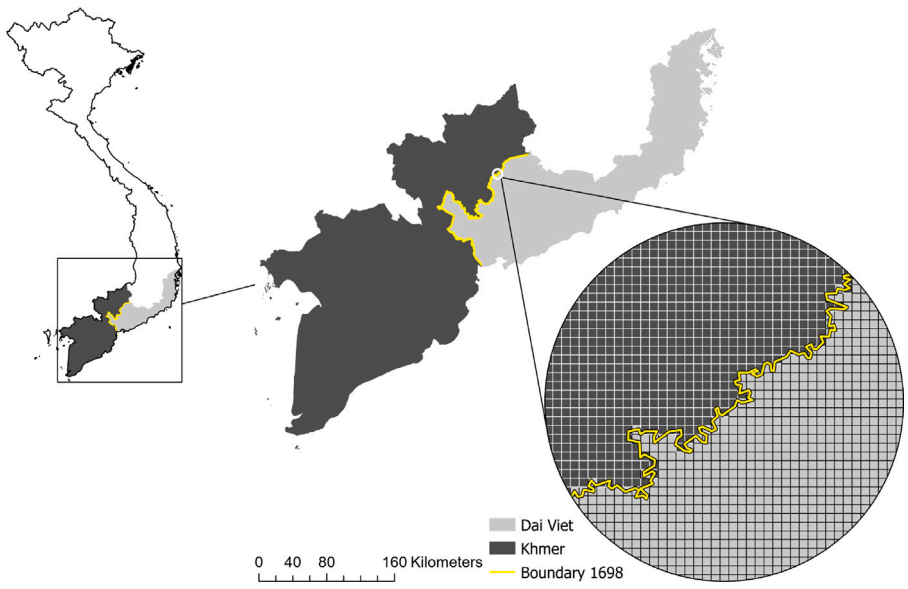

Fig. 1. Illustration of study site and 33 × 33 pixel zones.
Source: Own illustration, based on GFC raster data and Dell et al. (2018).

the GFC data into zones of 33 × 33 pixels, i.e., areas of approximately one square kilometer. For each of these zones we compute the average forest cover across all land pixels. In addition, we calculate the amount of forest loss between 2001 and 2019. Specifically, we use the data on initial (2000) forest cover to calculate the share of forest lost.

As an alternative measure for forest outcomes, we employ data from the MODIS land cover product for 2001 and 2020, which provide global land cover at 500 m spatial resolution. We use land cover classifications 1–5 from the International Geosphere–Biosphere Programme to identify forest. We compute the share of forest pixels in each zone for the year 2020. Further, using data for both years, we derive the share of lost forest pixels for the transition period from 2001 to 2020. Generally, we omit from the data zones that overlap the Dai Viet-Khmer boundary.

Information on the location of the border is taken from the supplementary materials accompanying Dell et al. (2018).

3. Empirical strategy

Following Dell et al., we leverage the multidimensional geographic discontinuity along the boundary of the historical states of Dai Viet and Khmer as follows:

$$y_z = \alpha + \tau Dai\,Viet_z + f\left(Dai\,Viet_z, X_z\right) + \sum_{i=1}^{n} bseg_z^i + \delta dist\_hcm_z + \nu_z, \quad (1)$$

where y_z is either the forest cover in zone z (both linear and log-transformed variable; to deal with zeros, we add the smallest observed value to the forest cover before taking logs) or a measure of forest loss. $Dai\,Viet_z$ is an indicator function equal to 1 if zone z was located on the Dai Viet side of the 1698 boundary, and 0 otherwise. $f\left(Dai\,Viet_z, X_z\right)$ is the regression discontinuity (RD) polynomial in $Dai\,Viet_z$ and X_z, where X_z denotes a zone's distance to the boundary, $bseg_z^i$ represent boundary segment fixed effects. We also include distance to Ho Chi Minh City. The coefficient τ identifies the long-term treatment effect of the Dai Viet rule on forest outcomes.

For estimation, we use a linear polynomial (Gelman and Imbens, 2019) and the mean squared error (MSE)-optimal bandwidth with a triangular kernel function. We cluster standard errors at the commune level.[1]

Dell et al. (2018) conduct balance checks for several characteristics and demonstrate their continuity at the boundary. We confirm the continuity of geographic and climate characteristics at the boundary based on our units of analysis. Results are in Table S2 of the supplementary materials. First, the point estimates for all topographic zone characteristics are small relative to their means and there are no statistically significant differences at the boundary. Second, for the climate variables, we also find very small point estimates, though the point estimate for the average maximum temperature between 2000 and 2018 is borderline significant at the 10% significance level. However, we note that the magnitude of the estimate is small, amounting to 0.06 °C. Overall, these tests suggest that units of observations located just across the Khmer side of the boundary offer a valid control group for Dai Viet units of observation located close to the boundary.

4. Results

Table 1 reports treatment effect estimates from (1). Results derived from GFC data are in columns (1)–(3) and estimates based on MODIS data are in columns (4)–(5). Overall, the point estimates indicate a significant effect of the historical Dai Viet state on forest-related outcomes. Forest cover in 2000 was on average 16.5 percentage points higher in Dai Viet zones than in Khmer zones. This indicates that forest degradation before 2000 was more severe in former Khmer areas. The large treatment effect in absolute terms is also confirmed when using the logarithmic version of forest cover as outcome variable in column (2). The point estimate of 0.77 corresponds to a treatment effect of 115% in relative terms, i.e., average forest cover in 2000 was more than twice as large on the Dai Viet side.

While forest cover in 2000 mirrors forest loss for all times before 2000, deforestation after 2000 reflects ongoing effects of the historical state. The point estimate in column (3) suggests that less forest was lost between 2001 and 2019 on the Dai Viet side. On average, Dai Viet zones have lost a 20 percentage points lower share of their forested area in 2000. The results based on MODIS land cover data confirm findings from GFC data.[2]

[1] For estimation, we use the Stata package `rdrobust` (Calonico et al., 2014, 2017).

[2] These results are robust to controlling for the earliest forest cover that we observe (for 2000 in the GFC data, for 2001 for MODIS data) in the specifications of columns (3) and (6).

Table 1
The effect of Dai Viet rule on forest loss.

	GFC			MODIS		
	Forest cover in 2000		Share of forest lost 2000–2019	Forest cover in 2020		Share of forest lost 2001–2020
	(1) level	(2) log	(3)	(4) level	(5) log	(6)
Dai Viet	16.555	0.767	−0.204	22.980	1.507	−0.068
	(3.883)	(0.237)	(0.031)	(5.312)	(0.363)	(0.019)
Robust 95% CI	[6.270; 23.381]	[0.125; 1.279]	[−0.271; −0.131]	[10.219; 32.449]	[0.614; 2.136]	[−0.110; −0.034]
Robust *p*-value	0.001	0.017	0.000	0.000	0.000	0.000
MSE-optimal BW	36.49	28.20	29.21	27.33	26.55	20.82
Eff. Number Obs.	20,444	16,203	16,453	15,626	15,246	12,500

Notes: Results are based on regressions of Eq. (1) applying a linear polynomial in distance to boundary and the *Dai Viet* indicator. Standard errors (in parentheses) are clustered at the commune level and offer conventional inference. Point estimates for the indicator variable Dai Viet are MSE-optimal. The table also reports robust bias-corrected confidence intervals and p-values. Forest cover ranges between 0 and 100.

5. Robustness

We conduct a large number of robustness checks that confirm our results (details regarding all robustness analyses are available from the Supplementary Materials). We use GFC data for robustness analyses. Results are robust to (i) using a second-order polynomial in the RD, (ii) alternative bandwidth choices, (iii) omitting observations around the cutoff, (iv) dropping boundary segments one at a time, (v) dropping boundary segments in a particularly densely forested area in the north east of the boundary (see Figure S4), (vi) including further controls. Finally, falsification tests with placebo cutoffs between 5 and 25 km from the actual border do not result in significant estimates.

6. Conclusion

Exploiting historical borders in southern Vietnam, we show that past institutional differences between the former Dai Viet and Khmer states have long-run effects on forest cover. Dell et al. (2018) show that – in line with the historical states' internal organization – local cooperation today is larger in former Dai Viet localities. Thus, our findings are in line with previous work suggesting a connection between local cooperation and the preservation of common pool resources. Further, given the importance of preserving forests globally, the present results suggest that historical institutional differences should be considered for a better understanding of determinants and possible remedies of forest loss.

Data availability

All data are publicly available. Details are provided in the Supplementary Materials

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.econlet.2023.111401.

References

Acemoglu, D., Johnson, S., Robinson, J., 2001. The colonial origins of comparative development: An empirical investigation. Amer. Econ. Rev. 91 (5), 1369–1401.

Acemoglu, D., Johnson, S., Robinson, J., 2005. The rise of Europe: Atlantic trade, institutional change, and economic growth. Amer. Econ. Rev. 95 (3), 546–579.

Agrawal, A., Ostrom, E., 2001. Collective action, property rights, and decentralization in resource use in India and Nepal. Polit. Soc. 29 (4), 485–514.

Banerjee, A., Iyer, L., 2005. History, institutions, and economic performance: The legacy of colonial land tenure systems in India. Amer. Econ. Rev. 95 (4), 1190–1213.

Calonico, S., Cattaneo, M.D., Farrell, M.H., Titiunik, R., 2017. `rdrobust`: Software for regression-discontinuity designs. Stata J. 17 (2), 372–404.

Calonico, S., Cattaneo, M.D., Titiunik, R., 2014. Robust data-driven inference in the regression-discontinuity design. Stata J. 14 (4), 909–946.

Dell, M., 2010. The persistent effects of Peru's mining mita. Econometrica 78 (6), 1863–1903.

Dell, M., Lane, N., Querubin, P., 2018. The historical state, local collective action, and economic development in Vietnam. Econometrica 86 (6), 2083–2121.

Gelman, A., Imbens, G., 2019. Why high-order polynomials should not be used in regression discontinuity designs. J. Bus. Econom. Statist. 37 (3), 447–456.

Gennaioli, N., Rainer, I., 2007. The modern impact of precolonial centralization in Africa. J. Econ. Growth 12 (3), 185–234.

Hansen, M.C., Potapov, P.V., Moore, R., Hancher, M., Turubanova, S.A., Tyukavina, A., Thau, D., Stehman, S.V., Goetz, S.J., Loveland, T.R., Kommareddy, A., Egorov, A.V., Chini, L., Justice, C.O., Townshend, J.R.G., 2013. High-resolution global maps of 21st-century forest cover change. Science 342 (6160), 850–853.

Jia, R., 2014. The legacies of forced freedom: China's treaty ports. Rev. Econ. Stat. 96 (4), 596–608.

Michalopoulos, S., Papaioannou, E., 2013. Pre-colonial ethnic institutions and contemporary African development. Econometrica 81 (1), 113–152.

Nunn, N., 2008. The long-term effects of Africa's slave trades. Q. J. Econ. 123 (1), 139–176.

Rustagi, D., 2022. Historical Self-Governance and Norms of Cooperation. CeDEx Discussion Paper Series.

Rustagi, D., Engel, S., Kosfeld, M., 2010. Conditional cooperation and costly monitoring explain success in forest commons management. Science 330 (6006), 961–965.