The Political Economy of Deforestation in the Tropics

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Online Appendix
April 2012

This Appendix presents additional tables that are discussed in the text, as follows:

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Timing of District Splits

Appendix Table 1: Timing of District Splits

VARIABLES	(1) Year First Split	(2) Year First Split	(3) Year First Split
Population in 1996 (millions)	-0.959	-1.052	-1.464
	(0.730)	(0.808)	(1.024)
Total area (million pixels)	0.549	0.812	-0.982
	(1.335)	(1.653)	(2.121)
Mean per-capita exp. 1996 (US$)	-0.0428	-0.0342	-0.0243
	(0.0720)	(0.0790)	(0.0895)
Oil and gas revenue 2001 (million US$)	-0.00782	-0.00895	0.00366
	(0.0104)	(0.0110)	(0.0144)
Share of land forested in 2000	0.0456	0.0498	-0.0504
	(0.0626)	(0.0657)	(0.0478)
Share of forest deforested in 2001	-3.790	-4.062	-2.687
	(2.819)	(3.120)	(2.761)
Golkar vote share	21.12	17.81	63.50
	(56.92)	(67.60)	(96.27)
Missing rice	0.00285	-0.0117	0.0162
	(0.0363)	(0.0392)	(0.0404)
(No info on missing rice)	0.154	0.0396	-0.688
FE	None	Island	Province
Observations	73	73	73
R-squared	0.068	0.073	0.485

Notes: An observation is a district as defined by 1996 borders, excluding cities, and including only districts where at least one split took place between 2001 and 2008. The dependent variable is the year the first split took place, conditional on there being a split. The 'missing rice' variable captures leakage from a public distribution system (see Olken, 2006) and the 'no info on missing rice' variable is a dummy for districts where this data is not available. Province fixed effects are defined using the 2008 provincial boundaries (21 provinces). Robust standard errors are used.

Full Results of Principal Regressions (Including Individual Lag Coefficients)

Appendix Table 2: Impact of Number of Districts in Province on Deforestation as Measured with Satellite Data

VARIABLES	(1) All Forest	(2) Production/Conversion	(3) Conservation/Protection	(4) Conversion	(5) Production	(6) Conservation	(7) Protection
Panel A							
Number of districts	0.0385**	0.0443**	0.0472	0.0387	0.0535***	0.0976**	0.00870
in province	(0.0160)	(0.0179)	(0.0331)	(0.0305)	(0.0199)	(0.0411)	(0.0349)
Observations	608	296	312	128	168	144	168
Panel B: Lags							
Number of districts	0.0385	0.0448	0.0900***	0.0538	0.0520	0.113***	0.0691*
in province	(0.0287)	(0.0333)	(0.0294)	(0.0398)	(0.0352)	(0.0391)	(0.0393)
Lag 1	0.0425	0.0448	-0.127*	0.0117	0.0426	-0.160	-0.0776
	(0.0459)	(0.0477)	(0.0672)	(0.0653)	(0.0448)	(0.131)	(0.0635)
Lag 2	-0.0723***	-0.0747***	0.0209	-0.0925***	-0.0624**	0.104	-0.0780
	(0.0271)	(0.0254)	(0.0808)	(0.0356)	(0.0258)	(0.157)	(0.0765)
Lag 3	0.0735*	0.0660	0.118*	0.112	0.0472	0.0949	0.138**
	(0.0435)	(0.0436)	(0.0665)	(0.0892)	(0.0387)	(0.0634)	(0.0670)
Sum of L0-L3	0.0822***	0.0809***	0.101**	0.0850	0.0795***	0.151***	0.0513
	(0.0204)	(0.0193)	(0.0426)	(0.0594)	(0.0217)	(0.0575)	(0.0373)
Joint p	<0.001	<0.001	0.0162	<0.001	<0.001	0.0205	0.0610
Observations	608	296	312	128	168	144	168

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. An observation is a forest-zone in a province in a year. The dependent variable is the number of forest cells deforested in a given year in the given province-forest zone. The 'number of districts in province' variable counts the number of districts within each province in a given year, where provinces are defined using the 2008 boundaries (21 provinces). The regressions include province and island-by-year fixed effects. In Panel B, we include the number of districts variable and three lags of the number of districts variable; the coefficient reported as 'sum of L0-L3' is the sum of the coefficients on the number of districts variable and the first three lags. Robust standard errors are clustered at the 1990 province boundaries (17 provinces) and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Appendix Table 3: Impact of Number of Districts in Province on Prices and Quantities as Reported by Official Forest Production Statistics

	(1)	(2)	(3)	(4)	(5)	(6)
	2001-2007		2001-2007		1994-2007	
	All wood observations		Balanced panel of wood observations		All wood observations	
VARIABLES	Log Price	Log Quantity	Log Price	Log Quantity	Log Price	Log Quantity
Panel A						
Number of districts	-0.017	0.084*	-0.019	0.103**	-0.024**	0.080***
in province	(0.012)	(0.044)	(0.013)	(0.039)	(0.010)	(0.017)
Observations	1003	1003	532	532	2355	2355
Panel B: Lags						
Number of districts	-0.025*	0.096	-0.029	0.123	-0.031***	0.072**
in province	(0.014)	(0.076)	(0.016)	(0.082)	(0.009)	(0.024)
Lag 1	0.010***	-0.039	0.009**	-0.033	0.011***	-0.004
	(0.003)	(0.034)	(0.004)	(0.041)	(0.003)	(0.034)
Lag 2	-0.001	0.040	-0.001	0.021	-0.000	0.019
	(0.009)	(0.041)	(0.010)	(0.022)	(0.005)	(0.028)
Lag 3	-0.017**	0.038	-0.018*	0.045	-0.015*	0.033
	(0.007)	(0.042)	(0.008)	(0.044)	(0.008)	(0.036)
Sum of L0-L3	-0.0336**	0.135**	-0.0384**	0.156**	-0.0344**	0.119***
	(0.0134)	(0.0561)	(0.0150)	(0.0592)	(0.0139)	(0.0383)
Joint p	0.000917	0.000477	0.00366	0.000724	6.74e-05	0.00890
Observations	1003	1003	532	532	1960	1960

Notes: The price and quantity data has been compiled from the `Statistics of Forest and Concession Estate', and are official government statistics for the production zone only. The dependent variable in columns (1), (3), and (5) is the log price of a given wood type produced in the province-year, determined by dividing the total value of wood produced by the quantity and taking logs. The dependent variable in columns (2), (4), and (6) is the quantity of a given wood type produced in the province-year. An observation is a wood species type in a given province and year. The specification in columns (1) and (2) includes all wood types, for the years 2001 to 2007; columns (3) and (4) include only wood types whose production is observed in all years for a given province, for the years 2001 to 2007; columns (5) and (6) include all wood types, for the years 1994 to 2007. The 'number of districts in province' variable counts the number of districts within each province in a given year, including both rural and urban districts where provinces are defined using the 2008 boundaries (21 provinces). In Panel B, we include the number of districts variable and three lags of the number of districts variable; the coefficient reported as 'sum of L0-L3' is the sum of the coefficients on the number of districts variable and the first three lags. All regressions include wood-type-by-province and wood-type-by-island-by-year fixed effects and are weighted by the first volume reported by wood type and province. Robust standard errors are clustered at the 1990 province boundaries (17 provinces) and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Leads and Other Robustness Checks

Appendix Table 4: Impact of Number of Districts in Province on Deforestation as Measured with Satellite Data, Including Leads

VARIABLES	(1) All Forest	(2) Production/Conversion	(3) Conservation/Protection	(4) Conversion	(5) Production	(6) Conservation	(7) Protection
Number of districts	0.0390	0.0433	0.0844**	-0.0155	0.0631	0.124**	0.0173
in province	(0.0389)	(0.0455)	(0.0379)	(0.0351)	(0.0491)	(0.0550)	(0.0633)
Lag 1	0.0245	0.0205	-0.110	-0.0146	0.0171	-0.130	-0.0595
	(0.0504)	(0.0534)	(0.0738)	(0.0853)	(0.0492)	(0.112)	(0.0794)
Lag 2	-0.0574	-0.0532	0.0108	-0.0646	-0.0389	0.0651	-0.0737
	(0.0366)	(0.0347)	(0.0902)	(0.0565)	(0.0332)	(0.135)	(0.0866)
Lag 3	0.0844	0.0749	0.131	0.148	0.0578	0.141	0.132
	(0.0551)	(0.0530)	(0.0935)	(0.121)	(0.0440)	(0.0962)	(0.105)
Lead 1	0.0891	0.0930	0.0522	0.329*	0.0371	0.167	0.0444
	(0.109)	(0.115)	(0.135)	(0.170)	(0.106)	(0.137)	(0.147)
Lead 2	-0.137	-0.168	-0.0601	-0.315*	-0.152	0.0347	-0.103
	(0.149)	(0.149)	(0.187)	(0.185)	(0.145)	(0.232)	(0.207)
Lead 3	0.0527	0.0740	-0.00308	0.173	0.0708	-0.0549	0.0260
	(0.105)	(0.103)	(0.120)	(0.120)	(0.106)	(0.153)	(0.133)
Sum of lag 0 - lag 3	0.0904***	0.0855***	0.116*	0.0534	0.0991***	0.200**	0.0164
	(0.0279)	(0.0238)	(0.0667)	(0.0681)	(0.0224)	(0.0972)	(0.0771)
Sum of lead 1 - lead 3	0.00488	-0.000459	-0.0110	0.188	-0.0439	0.147	-0.0326
	(0.0635)	(0.0555)	(0.0968)	(0.135)	(0.0537)	(0.152)	(0.0870)
Joint p lags	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.00133
Joint p leads	0.939	0.993	0.909	0.165	0.413	0.334	0.708
Observations	456	222	234	96	126	108	126

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. An observation is a forest-zone in a province in a year. The dependent variable is the number of forest cells deforested in a given year in the given province-forest zone. The 'number of districts in province' variable counts the number of districts within each province in a given year, where provinces are defined using the 2008 boundaries (21 provinces); three lags and three leads of this variable are also included. The coefficient reported as 'sum of lag 0 - lag 3' is the sum of the coefficients on the number of districts variable and the first three lags. The coefficient reported as 'sum of lead 0 - lead 3' is the sum of the coefficients on the first three leads. 'Joint p lags' represents the p-value on a joint test of the contemporaneous effect and the first three lags. 'Joint p leads' is the p-value of a joint significance test for the first three leads. Robust standard errors are clustered at the 1990 province boundaries (17 provinces) and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Appendix Table 5: Impact of Number of Districts in Province on Deforestation as Measured with Satellite Data, Robustness to Including Different Subsets of Island Groups in Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Dropping islands one-by-one				Examining islands one-by-one			
VARIABLES	Baseline Specification	Dropping Sumatra	Dropping Kalimantan	Dropping Sulawesi	Dropping Papua	Sumatra Only	Kalimantan Only	Sulawesi Only	Papua Only
Panel A									
Number of districts in province	0.0385**	0.0460*	0.0409***	0.0373**	0.0344**	0.0310	0.0352	0.0990	0.105++
	(0.0160)	(0.0271)	(0.0147)	(0.0165)	(0.0172)	(0.0200)	(0.0439)	(0.0761)	(0.0498)
Observations	608	360	496	424	544	248	112	184	64
Panel B: Incl. Lags									
Number of districts in province (sum of L0-L3)	0.0822***	0.0817***	0.0719***	0.0814***	0.0837**	0.0707+++	0.0835+++	0.199	0.0495
	(0.0204)	(0.0217)	(0.0253)	(0.0211)	(0.0207)	(0.0215)	(0.0313)	(0.130)	(0.0436)
Observations	608	360	496	424	544	248	112	184	64

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The dependent variable is the number of forest cells deforested in a given province-year. The 'number of districts in province' variable counts the number of districts within each province in a given year, where provinces are defined using the 2008 boundaries (21 provinces). The regressions include province and island-by-year fixed effects. In Panel B, we include the number of districts variable and three lags of the number of districts variable; the coefficient reported is the sum of the coefficients on the number of districts variable and the first three lags. For columns (1) – (5), the robust standard errors are clustered at the 1990 province boundaries (17 provinces) and reported in parentheses, and significance is shown with *** 0.01, ** 0.05, * 0.1. For columns (6) – (9), given the small numbers of provinces in each regression, non-clustered standard errors are reported, and significance is shown with +++ 0.01, ++ 0.05, + 0.1.

Appendix Table 6: Impact of Number of Districts in Province on Deforestation as Measured with Satellite Data, Estimated Using OLS

VARIABLES	(1) Baseline Specification (Poisson QMLE)	(2) OLS (no weights)	OLS (weight by amount of forest in 2000)	(3) OLS (weight by amount of forest)	OLS (weight by amount of logging in 2001)	OLS (weight by average amount of logging)
Panel A						
Number of districts in province	0.0385**	0.0215	0.0301	0.0301	0.0410	0.0328
	(0.0160)	(0.0265)	(0.0198)	(0.0199)	(0.0237)	(0.0218)
Observations	608	596	596	596	583	596
Panel B: Incl. Lags						
Number of districts in province (sum of L0-L3)	0.0822***	0.0474*	0.0473*	0.0470*	0.0549**	0.0608***
	(0.0204)	(0.0250)	(0.0231)	(0.0230)	(0.0193)	(0.0195)
Observations	608	596	596	596	583	596

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The dependent variable is the number of forest cells deforested in a province-year. The 'number of districts in province' variable counts the number of districts within each province in a given year, where provinces are defined using the 2008 boundaries (21 provinces). The regressions include province and island-by-year fixed effects. In Panel B, we include the number of districts variable and three lags of the number of districts variable; the coefficient reported is the sum of the coefficients on the number of districts variable and the first three lags. Robust standard errors are clustered at the 1990 province boundaries (17 provinces) and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Appendix Table 7: Direct and Indirect Effects of Number of Districts on Deforestation as Measured with Satellite Data

VARIABLES	(1) All Forest	(2) Production/Conversion	(3) Conservation/Protection
Panel A			
Number of districts in original district boundaries	-0.0984	-0.166*	0.0680
	(0.0954)	(0.0941)	(0.0857)
Number of districts elsewhere in province	0.0680*	0.0937**	0.0363
	(0.0376)	(0.0433)	(0.0549)
Observations	3152	1488	1664
Panel B: Lags			
Number of districts in original district boundaries	-0.0590	-0.0921	0.111*
	(0.0970)	(0.136)	(0.0578)
Lag 1	-0.0185	-0.0775	-0.0766
	(0.144)	(0.185)	(0.151)
Lag 2	-0.0772	-0.127	0.0249
	(0.125)	(0.152)	(0.142)
Lag 3	0.190**	0.217***	0.196*
	(0.0799)	(0.0825)	(0.102)
Number of districts elsewhere in province	0.0676	0.0864	0.0919*
	(0.0538)	(0.0744)	(0.0484)
Lag 1	0.0601	0.0819	-0.142
	(0.121)	(0.147)	(0.0902)
Lag 2	-0.0656	-0.0543	0.0215
	(0.0892)	(0.1000)	(0.124)
Lag 3	0.0328	0.0122	0.0954
	(0.0832)	(0.0963)	(0.0980)
Number of districts in original district boundaries (sum of L0-L3)	0.0356	-0.0794	0.255*
	(0.120)	(0.118)	(0.154)
Number of districts elsewhere in province (sum of L0-L3)	0.0948*	0.126**	0.0668
	(0.0498)	(0.0606)	(0.0739)
Observations	3152	1488	1664

Appendix Table 7 continued

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. An observation is a forest-zone in a 1990-borders district in a year. The dependent variable is the number of forest cells deforested in a given year in the given district-forest zone. The 'number of districts in original district boundaries' variable counts into how many districts the original 1990 district split into by the given year and the 'number of districts elsewhere in province' variable counts how many other districts there are within the same province in the given year, where provinces are defined using the 2008 boundaries (21 provinces). In Panel B, we include three lags of each of these variables; the coefficients reported as 'sum of L0-L3' represent the sum of the coefficients on the contemporaneous variable and the first three lags. All regressions include district-by-forest zone and island-by-year fixed effects. Cluster-bootstrapped standard errors, clustered at provincial borders, shown in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Appendix Table 8: Impact of Number of Districts in Province on Deforestation as Measured with Satellite Data, in Non-Cities and Cities

VARIABLES	(1) All Forest	(2) Production /Conversion	(3) Conservation /Protection	(4) Conversion	(5) Production	(6) Conservation	(7) Protection
Panel A							
Number of districts	0.0352*	0.0402*	0.0541	0.0243	0.0523**	0.106**	0.0113
excluding cities	(0.0189)	(0.0215)	(0.0377)	(0.0340)	(0.0237)	(0.0415)	(0.0419)
Observations	608	296	312	128	168	144	168
Panel B							
Number of city districts	0.139	0.171	0.116	-0.475*	0.162	0.00295	0.218
	(0.134)	(0.114)	(0.290)	(0.282)	(0.108)	(0.709)	(0.214)
Observations	608	296	312	128	168	144	168

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. An observation is a forest-zone in a province in a year. The dependent variable is the number of forest cells deforested in a given year in the given province-forest zone. The 'number of districts excluding cities' variable counts the number of districts within each province in a given year, excluding *kotamadya* (major cities), where provinces are defined using the 2008 boundaries (21 provinces). The 'number of city districts' variable counts the number of *kotamadya* districts within each province in a given year, again defining provinces using the 2008 boundaries. The regressions include province and island-by-year fixed effects. Robust standard errors are clustered at the 1990 province boundaries (17 provinces) and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Appendix Table 9: Impact of Number of Districts in Province on Prices and Quantities as Reported by Official Forest Production Statistics, Alternative Specifications

	(1)	(2)	(3)	(4)	(5)	(6)
	2001-2007		2001-2007		1994-2007	
	All wood observations		Balanced panel of wood observations		All wood observations	
VARIABLES	Log Price	Log Quantity	Log Price	Log Quantity	Log Price	Log Quantity
Panel A: Contemporaneous weights						
Number of districts	-0.017	0.092*	-0.022	0.106*	-0.024***	0.055**
in province	(0.013)	(0.048)	(0.014)	(0.049)	(0.008)	(0.019)
Observations	1003	1003	532	532	2357	2357
Panel B: No cities						
Number of districts	-0.018*	0.088*	-0.020*	0.106**	-0.026***	0.073***
in province	(0.008)	(0.042)	(0.009)	(0.036)	(0.008)	(0.020)
Observations	1003	1003	532	532	2355	2355
Panel C: Cities only (falsification)						
Number of districts	0.098	0.420	0.157	0.494	-0.001	0.184**
in province	(0.131)	(0.353)	(0.130)	(0.319)	(0.043)	(0.084)
Observations	1003	1003	532	532	2355	2355

Appendix Table 9 continued

	(1)	(2)	(3)	(4)	(5)	(6)
	2001-2007		2001-2007		1994-2007	
	All wood observations		Balanced panel of wood observations		All wood observations	
VARIABLES	Log Price	Log Quantity	Log Price	Log Quantity	Log Price	Log Quantity
Panel D: Leads						
Number of districts	-0.020**	0.118	-0.020**	0.160*	-0.019**	0.096*
in province	(0.007)	(0.078)	(0.009)	(0.073)	(0.009)	(0.048)
Lag 1	0.007	-0.044	0.006	-0.040	0.008	-0.016
	(0.006)	(0.034)	(0.007)	(0.042)	(0.005)	(0.039)
Lag 2	-0.003	0.027	-0.002	-0.001	-0.007	0.017
	(0.005)	(0.053)	(0.008)	(0.028)	(0.005)	(0.030)
Lag 3	-0.016**	0.051	-0.017*	0.060	-0.019*	0.036
	(0.007)	(0.050)	(0.008)	(0.047)	(0.009)	(0.036)
Lead 1	0.016	0.092	0.033	0.290*	-0.011	0.002
	(0.014)	(0.131)	(0.025)	(0.151)	(0.010)	(0.023)
Lead 2	-0.018	-0.086	-0.028	-0.192	-0.009*	-0.043
	(0.048)	(0.207)	(0.055)	(0.159)	(0.005)	(0.063)
Lead 3	0.003	-0.057	0.004	-0.087	-0.016*	0.019
	(0.026)	(0.140)	(0.045)	(0.161)	(0.008)	(0.041)
Sum of lag 0 - lag 3	-0.0326***	0.152**	-0.0338**	0.178**	-0.0372**	0.133**
	(0.0111)	(0.0633)	(0.0108)	(0.0740)	(0.0152)	(0.0484)
Sum of lead 1 - lead 3	0.000675	-0.0501	0.00960	0.0111	-0.0363***	-0.0209
	(0.0435)	(0.188)	(0.0440)	(0.283)	(0.0110)	(0.0414)
Joint p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Observations	865	865	456	456	1822	1822

Notes: The price and quantity data has been compiled from the `Statistics of Forest and Concession Estate', and are official government statistics for the production zone only. The 'number of districts in province' variable counts the number of districts within each province in a given year, where provinces are defined using the 2008 boundaries (21 provinces). In Panel B, the 'number of districts in province' variable only counts the number of *kabupaten* (rural districts) within each province. In Panel C, the 'number of districts in province' variable only counts the number of *kotamadya* (major cities) within each province. In Panel A, the equation is weighted using contemporaneous volumes in production ($deforest_{wpt}$) rather than initial volumes ($deforest_{wp0}$). In Panel D, the coefficient reported as 'sum of lag 0 - lag 3' is the sum of the coefficients on the number of districts variable and the first three lags, and the coefficient reported as 'sum of lead 1 - lead 3' is the sum of the coefficients on the first three leads. The regressions include wood-type-by-province and wood-type-by-island-by-year fixed effects and are weighted by the first volume reported by wood type and province. Robust standard errors are clustered at the 1990 province boundaries (17 provinces) and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Appendix Table 10: Impact of Number of Districts in Province on Prices as Reported by Official Forest Production Statistics, Further Alternative Specifications

	(1)	(2)	(3)	(4)	(5)	(6)
		Additional control variables included:				
	Baseline Specification (log prices)	Pre-period Population X Linear Trend	Pre-period Per-Capita Exp X Linear Trend	Pre-period Forest X Linear Trend	Pre-period Pop, PCE, Forest X Linear Trend	Province-specific Linear Trends
Panel A: 2001-2007						
Number of districts	-0.017	-0.017	-0.017	-0.016	-0.016	-0.015
in province	(0.012)	(0.012)	(0.011)	(0.013)	(0.013)	(0.018)
Observations	1003	1003	1003	1003	1003	1003
Panel B: 2001-2007 Including Lags						
Number of districts	-0.0336**	-0.0336**	-0.0336**	-0.0346**	-0.0347**	-0.0571
in province (sum of L0-L3)	(0.0134)	(0.0134)	(0.0133)	(0.0129)	(0.0118)	(0.0659)
Observations	1003	1003	1003	1003	1003	1003
Panel C: 1994-2007						
Number of districts	-0.024**	-0.024**	-0.025**	-0.025**	-0.025**	-0.014
in province	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Observations	2355	2355	2355	2355	2355	2355
Panel D: 1994-2007 Including Lags						
Number of districts	-0.0344**	-0.0344**	-0.0353**	-0.0384**	-0.0382**	-0.0101
in province (sum of L0-L3)	(0.0139)	(0.0139)	(0.0139)	(0.0146)	(0.0148)	(0.0149)
Observations	1960	1960	1960	1960	1960	1960

Notes: The price data has been compiled from the `Statistics of Forest and Concession Estate', and are official government statistics for the production zone only. Panels A and B use data from 2001 to 2007; Panels C and D use data from 1994 to 2007. The 'number of districts in province' variable counts the number of districts within each province in a given year, where provinces are defined using the 2008 boundaries (21 provinces). Additional control variables include (by column): (2) pre-period provincial population interacted with a linear time trend; (3) pre-period per-capita expenditure interacted with a linear time trend; (4) pre-period amount of forest interacted with a linear time trend; (5) all three of these additional controls; (6) arbitrary province-specific linear time trends. The regressions include province and island-by-year fixed effects. In Panels B and D, we include the number of districts variable and three lags of the number of districts variable; the coefficient reported is the sum of the coefficients on the number of districts variable and the first three lags. Robust standard errors are clustered at the 1990 province boundaries (17 provinces) and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Appendix Table 11: Direct and Indirect Effects of Number of Districts on Deforestation as Measured with Satellite Data, Using 5 Lags

VARIABLES	(1) All Forest	(2) Production/ Conversion	(3) Conservation/ Protection
Number of districts in			
original district boundaries	-0.0375	-0.0677	0.110**
Lag 1	(0.0803)	(0.105)	(0.0546)
	-0.0323	-0.0906	-0.0590
Lag 2	(0.123)	(0.148)	(0.102)
	-0.0500	-0.0936	0.0149
Lag 3	(0.101)	(0.135)	(0.0791)
	0.207***	0.232**	0.176**
Lag 4	(0.0770)	(0.0909)	(0.0839)
	-0.0371	-0.0451	0.0431
Lag 5	(0.0811)	(0.0891)	(0.106)
	0.0397	0.0531	-0.0282
Number of districts	(0.0794)	(0.0905)	(0.120)
elsewhere in province	0.0602	0.0759*	0.0900***
Lag 1	(0.0379)	(0.0442)	(0.0333)
	0.0653	0.0899	-0.139**
Lag 2	(0.0583)	(0.0623)	(0.0577)
	-0.0474	-0.0377	0.0366
Lag 3	(0.0450)	(0.0484)	(0.0729)
	0.0186	-0.00978	0.0863
Lag 4	(0.0475)	(0.0491)	(0.0746)
	-0.0140	0.00248	-0.0203
Lag 5	(0.0350)	(0.0336)	(0.0599)
	0.0617*	0.0538	0.0594
	(0.0339)	(0.0346)	(0.0688)
Sum of L0-L5 original	0.0896	-0.0121	0.256*
	(0.123)	(0.120)	(0.147)
Sum of L0-L5 elsewhere	0.144***	0.175***	0.113*
	(0.0456)	(0.0486)	(0.0637)
Joint p original	0.118	0.0164	0.0674
Joint p elsewhere	0.0143	0.00721	0.0251
Observations	3152	1488	1664

Appendix Table 11 continued

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. An observation is a forest-zone in a 1990-borders district in a year. The dependent variable is the number of forest cells deforested in a given year in the given district-forest zone. The 'number of districts in original district boundaries' variable counts into how many districts the original 1990 district split into by the given year and the 'number of districts elsewhere in province' variable counts how many other districts there are within the same province in the given year, where provinces are defined using the 2008 boundaries (21 provinces). We include five lags of each of these variables; the coefficients reported as 'sum of L0-L5' represent the sum of the coefficients on the contemporaneous variable and the first five lags. 'Joint p' represents the p-value on a joint test of the contemporaneous effect and all five lags. All regressions include district-by-forest zone and island-by-year fixed effects. Robust standard errors clustered at 1990 district borders in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

District Splits and New Versus Old Parts of District

Appendix Table 12: Direct and Indirect Effects of Number of Districts on Deforestation as Measured with Satellite Data, in New Versus Old Parts of Districts

VARIABLES	(1) All Forest	(2) Production/ Conversion	(3) Conservation/ Protection	(4) Conversion	(5) Production	(6) Conservation	(7) Protection
Panel A							
Number of districts in	-0.0527	-0.0707	0.0594	0.0336	-0.0730	0.124**	-0.0209
original district boundaries	(0.0774)	(0.0993)	(0.0520)	(0.160)	(0.107)	(0.0591)	(0.100)
Number of districts	-0.0383	-0.0508	-0.00116	-0.0190	-0.0740	0.00417	-0.125
in orig. district boundaries	(0.0836)	(0.0846)	(0.0855)	(0.118)	(0.107)	(0.0469)	(0.0802)
× has original capital in 2008							
Observations	5488	2512	2816	896	1568	1072	1616
Panel B: Lags							
Number of districts in	-0.00514	-0.0192	0.113	0.0654	-0.0229	0.182**	0.0305
original district boundaries	(0.0943)	(0.128)	(0.0690)	(0.178)	(0.127)	(0.0843)	(0.0526)
Lag 1	0.106	0.106	0.0600	0.371	0.0430	0.0526	0.104
	(0.150)	(0.176)	(0.126)	(0.252)	(0.142)	(0.126)	(0.0830)
Lag 2	-0.285***	-0.366***	-0.105*	-0.777***	-0.268**	-0.0312	-0.204**
	(0.110)	(0.131)	(0.0617)	(0.244)	(0.120)	(0.0681)	(0.102)
Lag 3	0.207***	0.260***	0.101	0.334**	0.211**	0.0405	0.191
	(0.0671)	(0.0741)	(0.0849)	(0.144)	(0.0850)	(0.119)	(0.129)
Number of districts	-0.167*	-0.177	-0.138***	-0.134	-0.201	-0.189**	-0.169***
× has original capital in 2008	(0.0879)	(0.127)	(0.0440)	(0.101)	(0.160)	(0.0932)	(0.0546)
Lag 1	-0.0160	-0.00289	-0.168*	-0.0485	-0.00209	-0.122	-0.154
	(0.126)	(0.160)	(0.0885)	(0.188)	(0.169)	(0.105)	(0.124)
Lag 2	0.357***	0.416***	0.313***	0.446***	0.412***	0.340***	0.0818
	(0.0744)	(0.0987)	(0.0940)	(0.0879)	(0.141)	(0.113)	(0.0859)
Lag 3	-0.107	-0.202*	0.178*	-0.217**	-0.196*	0.180	0.251**
	(0.0871)	(0.104)	(0.0971)	(0.102)	(0.115)	(0.141)	(0.127)
Sum of L0-L3 original	0.0219	-0.0188	0.168*	-0.00702	-0.0372	0.244	0.122
	(0.114)	(0.121)	(0.0910)	(0.229)	(0.121)	(0.149)	(0.0910)
Sum of L0-L3 interaction	0.0668	0.0339	0.186	0.0463	0.0127	0.210**	0.0103
	(0.121)	(0.0898)	(0.158)	(0.171)	(0.0886)	(0.105)	(0.147)
Joint p original	0.000419	0.000183	0.0882	<0.001	0.0683	0.137	0.0856
Joint p interaction	0	<0.001	<0.001	<0.001	<0.001	0.0139	0.00623
Observations	5488	2512	2816	896	1568	1072	1616

Appendix Table 12 continued

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. An observation is a forest-zone in a 1990-borders district in a year. The dependent variable is the number of forest cells deforested in a given year in the given district-forest zone. The 'number of districts in original district boundaries' variable counts into how many districts the original 1990 district split into by the given year, and 'has original capital in 2008' is a dummy for whether the capital city of the original 1990 district is located within the borders of the district in 2008. In Panel B, we include three lags of each of these variables; the coefficients reported as 'sum of L0-L3' represent the sum of the coefficients on the contemporaneous variable and the first three lags. 'Joint p' represents the p-value on a joint test of the contemporaneous effect and all three lags. All regressions include 2008-district-by-forest zone and island-by-year fixed effects. Robust standard errors clustered at 1990 district borders in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Clustering Oil and Gas Revenues Results at Province Level

Appendix Table 13: Effects of District-Level Oil and Gas Revenues on Deforestation as Measured with Satellite Data with Province-Level Clustering

VARIABLES	(1) All Forest	(2) Production/Conversion	(3) Conservation/Protection
Panel A			
Oil and gas revenue	-0.00316**	-0.00284**	-0.00597***
per capita	(0.00137)	(0.00142)	(0.00217)
Observations	6464	3064	3400
Panel B: Lags			
Oil and gas revenue	-0.00492***	-0.00432**	-0.0113***
per capita	(0.00172)	(0.00168)	(0.00230)
Lag 1	0.000652	8.87e-05	0.00561***
	(0.00121)	(0.00135)	(0.00110)
Lag 2	0.00112	0.00132	0.000731
	(0.00164)	(0.00186)	(0.000667)
Lag 3	0.00519**	0.00530***	0.00574
	(0.00216)	(0.00202)	(0.00420)
Sum of L0-L3	0.00205	0.00240	0.000768
	(0.00135)	(0.00149)	(0.00197)
Joint p	<0.001	<0.001	<0.001
Sum of L0-L3 = L0 effect p-value	<0.001	<0.001	<0.001
Observations	6464	3064	3400

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. The dependent variable is the number of forest cells deforested in the district-zone-year. A unit of observation is a 1990-borders district-forest zone. The 'oil and gas revenue per capita' variable reports the value of per capita revenue from oil and gas extraction at the district level in US dollars. A unit of observation is a 2008-borders district-forest zone. In Panel B, we include the oil and gas revenue variable and three lags of the oil and gas revenue variable; the coefficient reported as 'sum of L0-L3' is the sum of the coefficients on the oil and gas revenue variable and the first three lags. P-values are reported for tests of joint significance of the contemporaneous and lagged oil and gas revenue variables ('joint p') and a test of whether the sum of the coefficients on the contemporaneous oil and gas revenue variable and the first three lags is equal to the contemporaneous coefficient ('sum of L0-L3 = L0'). All regressions include district-by-forest zone and island-by-year fixed effects and the number of districts the 1990 district has split into by year *t* (and 3 lags of this variable in Panel B), where a district is counted as having split when it reports receiving its own oil and gas revenue. Robust standard errors are clustered at the 2008 province boundaries and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Additional Results on the Political Economy Implications of Oil and Gas Revenue

Appendix Table 14: Effects of Oil and Gas Revenues on District-Level Election Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Number of Candidates		Number of Parties in Winning Coalition		Incumbent Re-elected	
Panel A: Oil and Gas in Year of Election						
Oil and gas per capita	-0.00230***	-0.00290***	0.000789	0.00194*	0.000270	-4.50e-05
in election year	(0.000505)	(0.000938)	(0.00110)	(0.00113)	(0.000390)	(0.000471)
Island and year FE	NO	YES	NO	YES	NO	YES
Observations	241	241	220	220	242	242
Panel B: Initial level and changes						
Oil and gas per capita	-0.00107	0.00246	-0.0127***	-0.0132***	-0.000643	-0.00125
in 2003	(0.00258)	(0.00279)	(0.00205)	(0.00262)	(0.00154)	(0.00185)
Annual change in oil	-0.00985**	-0.0199***	0.0306***	0.0361***	0.00284	0.00248
and gas per capita between election year and 2003	(0.00473)	(0.00612)	(0.00382)	(0.00444)	(0.00289)	(0.00331)
Island and year FE	NO	YES	NO	YES	NO	YES
Observations	241	241	220	220	242	242

Notes: Each column reports OLS cross-sectional regressions of the dependent variable listed in the column, using data from Skoufias et al. (2010). An observation is a district with 2008 borders. Even-numbered columns also include year fixed effects and island fixed effects. Robust standard errors in parentheses.

Appendix Table 15: Effects of Political Variables on District-Level Deforestation as Measured with Satellite Data

VARIABLES	(1) All Forest	(2) Production /Conversion	(3) Conservation /Protection	(4) Conversion	(5) Production	(6) Conservation	(7) Protection
Panel A: Number of candidates							
Post-election	0.699**	0.491*	1.727***	0.528*	0.503*	2.441***	0.607
	(0.277)	(0.255)	(0.497)	(0.294)	(0.299)	(0.646)	(0.468)
Post-election ×	-0.115	-0.0649	-0.311***	-0.142*	-0.0538	-0.527***	-0.0775
number of candidates	(0.0716)	(0.0659)	(0.107)	(0.0849)	(0.0685)	(0.102)	(0.0869)
Observations	4707	2230	2477	792	1438	1017	1460
Panel B: Number of parties in winning coalition							
Post-election	0.197	0.154	0.509*	-0.156	0.255	-0.0515	0.474
	(0.139)	(0.149)	(0.296)	(0.231)	(0.185)	(0.438)	(0.290)
Post-election ×	0.0209	0.0295	-0.0288	0.0378	0.0154	0.119	-0.0643
Number of parties	(0.0627)	(0.0667)	(0.0691)	(0.0780)	(0.0802)	(0.134)	(0.0930)
Observations	4204	1966	2238	664	1302	914	1324
Panel C: Incumbent re-elected							
Post-election	0.110	0.146	0.00669	-0.00223	0.175	-0.646	0.177
	(0.198)	(0.202)	(0.264)	(0.348)	(0.190)	(0.468)	(0.225)
Post-election ×	0.255	0.178	0.599**	-0.0188	0.252	0.920**	0.212
Incumbent re-elected	(0.159)	(0.152)	(0.272)	(0.209)	(0.165)	(0.383)	(0.173)
Observations	4739	2246	2493	800	1446	1025	1468

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. The dependent variable is the number of forest cells deforested in the district-zone-year. A unit of observation is a 2008-borders district-forest zone. The 'post-election' variable is a dummy capturing whether the new direct election for district heads has taken place. All regressions include district-by-forest zone and island-by-year fixed effects and the number of districts the 1990 district has split into by year *t*, where a district is counted as having split when it reports receiving its own oil and gas revenue. Robust standard errors are clustered at the 1990 district level and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Changing the Oil Per Capita Variable to Missing Rather than Zero Prior to 2001

Appendix Table 16: Effects of District-Level Oil and Gas Revenues on Deforestation as Measured with Satellite Data, with Data Prior to 2001 Coded as Missing Rather than Zero

VARIABLES	(1) All Forest	(2) Production/ Conversion	(3) Conservation/ Protection
Oil and gas revenue	-0.00450**	-0.00371*	-0.0127***
per capita	(0.00203)	(0.00196)	(0.00400)
Lag 1	0.00132	0.00101	0.00406***
	(0.000943)	(0.00110)	(0.00142)
Lag 2	0.00147	0.00144	0.00461***
	(0.000929)	(0.00102)	(0.00150)
Lag 3	0.0175**	0.0218**	-0.0292***
	(0.00887)	(0.00947)	(0.00979)
Sum of L0-L3	0.0158	0.0205*	-0.0332***
	(0.0107)	(0.0111)	(0.0127)
Joint p	8.51e-08	1.63e-07	0
Sum of L0-L3 p	0.138	0.0644	0.00910
Observations	3885	1855	2030

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. The dependent variable is the number of forest cells deforested in the district-zone-year. The 'oil and gas revenue per capita' variable reports the value of per capita revenue from oil and gas extraction at the district level in US dollars. Three lags of this variable are also included. A unit of observation is a 2008-borders district-forest zone. The coefficient reported as 'sum of L0-L3' is the sum of the coefficients on the oil and gas revenue variable and the first three lags. P-values are reported for tests of joint significance of the contemporaneous and lagged oil and gas revenue variables ('joint p') and for significance of the 'sum of L0-L3' coefficient ('sum of L0-L3 p'). All regressions include district-by-forest zone and island-by-year fixed effects and the number of districts the 1990 district has split into by year *t* and 3 lags of this variable, where a district is counted as having split when it reports receiving its own oil and gas revenue. Robust standard errors are clustered at the 1990 district level and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Dropping 2001 (Restricting to the Period when District Governments Could Not Issue Small-Scale Forestry Permits)

Appendix Table 17: Impact of Number of Districts in Province on Deforestation as Measured with Satellite Data, Dropping 2001

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	All Forest	Production/ Conversion	Conservation/ Protection	Conversion	Production	Conservation	Protection
Panel A							
Number of districts	0.0553**	0.0587**	0.0961**	0.100***	0.0537**	0.151**	0.0754**
in province	(0.0265)	(0.0284)	(0.0432)	(0.0348)	(0.0264)	(0.0755)	(0.0375)
Observations	532	259	273	112	147	126	147
Panel B: Lags							
Number of districts	0.0812***	0.0782***	0.116***	0.121***	0.0675***	0.167**	0.0846*
in province (sum of L0-L3)	(0.0182)	(0.0189)	(0.0471)	(0.0263)	(0.0180)	(0.0818)	(0.0480)
Observations	532	259	273	112	147	126	147

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. An observation is a forest-zone in a province in a year. The dependent variable is the number of forest cells deforested in a given year in the given province-forest zone. The 'number of districts in province' variable counts the number of districts within each province in a given year, where provinces are defined using the 2008 boundaries (21 provinces). The regressions include province and island-by-year fixed effects. In Panel B, we include the number of districts variable and three lags of the number of districts variable; the coefficient reported is the sum of the coefficients on the number of districts variable and the first three lags. Robust standard errors are clustered at the 1990 province boundaries (17 provinces) and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Appendix Table 18: Effects of District-Level Oil and Gas Revenues on Deforestation as Measured with Satellite Data, Dropping 2001

VARIABLES	(1) All Forest	(2) Production/ Conversion	(3) Conservation/ Protection
Panel A			
Oil and gas revenue	-0.00335**	-0.00300*	-0.00633**
per capita	(0.00158)	(0.00160)	(0.00264)
Observations	5621	2667	2954
Panel B			
Oil and gas revenue	-0.00450**	-0.00371*	-0.0127***
per capita	(0.00203)	(0.00196)	(0.00400)
Lag 1	0.00132	0.00101	0.00406***
	(0.000943)	(0.00110)	(0.00142)
Lag 2	0.00147	0.00144	0.00461***
	(0.000929)	(0.00102)	(0.00150)
Lag 3	0.0175**	0.0218**	-0.0292***
	(0.00887)	(0.00947)	(0.00979)
Sum of L0-L3	0.0158	0.0205*	-0.0332***
	(0.0107)	(0.0111)	(0.0127)
Joint p	<0.001	<0.001	<0.001
Sum of L0-L3 p	0.138	0.0644	0.00910
Observations	3885	1855	2030

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. The dependent variable is the number of forest cells deforested in the district-zone-year. A unit of observation is a 1990-borders district-forest zone. The 'oil and gas revenue per capita' variable reports the value of per capita revenue from oil and gas extraction at the district level in US dollars. A unit of observation is a 2008-borders district-forest zone. In Panel B, we include the oil and gas revenue variable and three lags of the oil and gas revenue variable; the coefficient reported as 'sum of L0-L3' is the sum of the coefficients on the oil and gas revenue variable and the first three lags. P-values are reported for tests of joint significance of the contemporaneous and lagged oil and gas revenue variables ('joint p') and for significance of the 'sum of L0-L3' coefficient ('sum of L0-L3 p'). Robust standard errors are clustered at the 1990 district boundaries and reported in parentheses. All regressions include district-by-forest zone and island-by-year fixed effects and the number of districts the 1990 district has split into by year *t* (and 3 lags of this variable in Panel B), where a district is counted as having split when it reports receiving its own oil and gas revenue. *** implies significance at the 0.01 level, ** 0.05, * 0.1.

Results using 1990 Provincial Border Definitions

Appendix Table 19: Impact of Number of Districts in Province on Deforestation as Measured with Satellite Data, Using 1990 Province Border Definitions

VARIABLES	(1) All Forest	(2) Production/ Conversion	(3) Conservation/ Protection
Panel A			
Number of districts	0.0210	0.0259	0.0368
in province	(0.0186)	(0.0214)	(0.0329)
Observations	504	240	264
Panel B: Lags			
Number of districts	0.0747**	0.0727**	0.118***
in province (sum of L0-L3)	0.0229	0.0232	0.0351
Observations	504	240	264

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 3.3. The production and conversion zones are those in which legal logging can take place, while the conservation and protection zones are those in which all logging is illegal. An observation is a forest-zone in a province in a year. The dependent variable is the number of forest cells deforested in a given year in the given province-forest zone. The 'number of districts in province' variable counts the number of districts within each province in a given year, where provinces are defined using the 1990 boundaries (17 provinces). The regression includes province and island-by-year fixed effects. In Panel B, we include the number of districts variable and three lags of the number of districts variable; the coefficient reported is the sum of the coefficients on the number of districts variable and the first three lags. Robust standard errors are clustered at the 1990 province boundaries and reported in parentheses. *** implies significance at the 0.01 level, ** 0.05, * 0.1.