Indirect Rule and Public Goods Provision: Evidence from Colonial India

Online Appendix

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A Literature and Historical Evidence

The existing literature provides conflicting findings about both direct and indirect rule (Mamdani, 1996; Fisher, 1998; Lange, 2004; Iyer, 2010; Baldwin, 2016; Naseemullah and Staniland, 2016; Mukherjee, 2017). Some scholars claim that direct rule allows for better use of colonizer's institutional capacity in terms of proper provision of developmental goods (Lange, 2009); however it is not inclusive to the local population. Indirect rule, on the other hand, is more integrated into the local environment (Lange, 2009). It can prevent rulers' despotic intentions and the exclusion of natives from civil freedoms (Fisher, 1998) which could lead to better self-governance and prosperity, and, as a result, to better socio-economic outcomes (Iyer, 2010). Such engagement and local connections of the native rulers may also decrease colonial resistance and reduce dissatisfaction and potential violence from natives towards colonizers (Ferwerda and Miller, 2014). At the same time, the effects of indirect rule vary across territories. Some studies show negative effects of indirect rule on development (Lange, 2004) which may result in despotic and autocratic regimes, like decentralized despotism (Mamdani, 1996).

In this paper, I follow the argument of Mamdani (1996) but emphasize the principal-agent dynamics between colonizer and two types of local leaders: direct colonizer's local leaders and native princes. The colonial organization of power in the directly ruled areas was structured such that upward accountability was more important than downward accountability (Ribot, 1999). British representatives in the directly ruled territories were subject to more control from the colonial government than the local princes. The delegated authority that was given to native princes was hard to remove without additional costs for the center, whereas the British leaders and their bureaucrats could have been easily punished. Their attempts to violate the orders of the center may have led to the loss of their positions, benefits and privileges. Since their salary and promotion was in the jurisdiction of the central government, the punishment could have been reflected in their incomes or in the trajectories of their career paths.[1] Even despite the fact that prior to 1857, East India Company did not have much of a formal accountability system and could have proceeded with its own interests (Erikson, 2016), there is evidence of political control from the British side.[2] As a result, in these territories it was more demanding for the colonizer's subordinates to hold accountability to the center rather than to the local population. Local princes in the indirectly ruled territories, on the

[1]For instance, there is an example of Richard Wellesley, who served as Governor-General in 1798-1805. It is established that his military activity and his independent economic decisions made him removed from this position. "During the greater part of this time Wellesley's relations with the court of directors [until 1858 the headquarter of the East India Company located in London, which was proceeded by India Office - the British government department established in London in 1858] were far from satisfactory. They resented his somewhat autocratic proclivities, and they especially disapproved of his mode of exercising his patronage." (Lee, 1899, 216) "Both the court of directors and the board of control under Castlereagh had all along questioned the policy of the Mahratta war, and accordingly, when the intelligence of the disaster reached England, it was at once determined to recall Wellesley and to reverse his policy. Lord Cornwallis was sent out to relieve him, and reached Calcutta on 29 July 1805. Wellesley was not taken by surprise. Indeed from the time of Monson's disaster he had felt that the opponents of his policy in England would bring about his removal from his post." (Lee, 1899, 217).

[2]For instance, the case of Governor-General Warren Hastings (Marshall, N.d.).

other hand, had much less established institutional system and much less strict obligations to the central authority (the Crown), because of their gained autonomy in policy-making. Additionally, they were natives, and the local population could have used local networks as instruments of informal accountability (Tsai, 2007; Lechler and McNamee, 2018; Singh, 2015; Xu and Yao, 2015). However, these networks did not prevent local princes from becoming highly autonomous proto-autocrats who used the co-ethnicity and co-residency to create trust in favor of their power. The lack of any formal mechanisms of accountability in these areas (like elections or external control from the center) enhanced the uncontrolled rule of the native princes.

Following the growing literature that exploits colonial-era borders (Dell, 2010; Bubb, 2013; Michalopoulos and Papaioannou, 2016; Lechler and McNamee, 2018; Ali et al., 2018), methodologically, this paper uses a spatial regression discontinuity design to estimate the effects of indirect rule as opposed to the direct colonial governance.

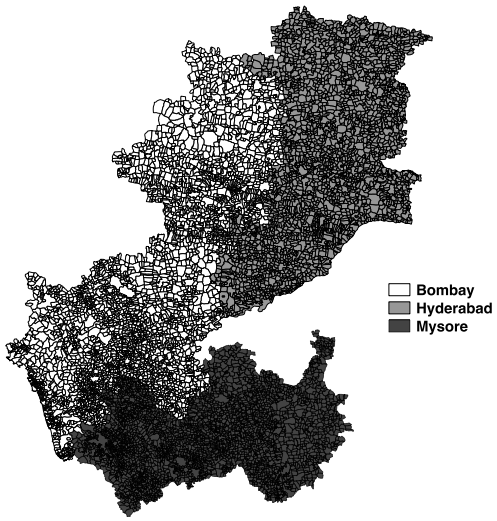
The analysis and results of this study also have broader implications. They bridge the extensive literature on the incentives under political and administrative decentralization (Prud'Homme, 1995; Grindle, 2007; Treisman, 2007; Brancati, 2008; Chhibber and Kollman, 2009) with that on the long-term consequences of colonial presence in developing countries (Sokoloff and Engerman, 2000; Acemoglu, Johnson and Robinson, 2001; Nunn, 2008; Dell, 2010; Gerring et al., 2011; Lee and Schultz, 2012).

B Graphic Appendix

Figure B.1: Map of Princely States and British Provinces (pre-1947)

Source of the map: British Indian Empire 1909 Imperial Gazetteer of India (URL Source: https://goo.gl/8t1iQq).

Figure B.2: Village polygons Mysore-Bombay-Hyderabad



Note: The map is constructed using GIS village polygons of the 2001 Indian Census.

C Summary Statistics of the Dependent Variables

Table C.1: Summary Statistics for the Dependent Variables. Bandwidth=20km around Mysore-Bombay Border

Statistic	N	Mean	St. Dev.	Min	Max
Health Centers	1,158	0.231	0.422	0	1
Paved Roads	1,158	0.845	0.362	0	1

Table C.2: Summary Statistics for the Dependent Variables. Bandwidth=20km around Hyderabad-Bombay Border

Statistic	N	Mean	St. Dev.	Min	Max
Health Centers	940	0.280	0.449	0	1
Paved Roads	940	0.878	0.328	0	1

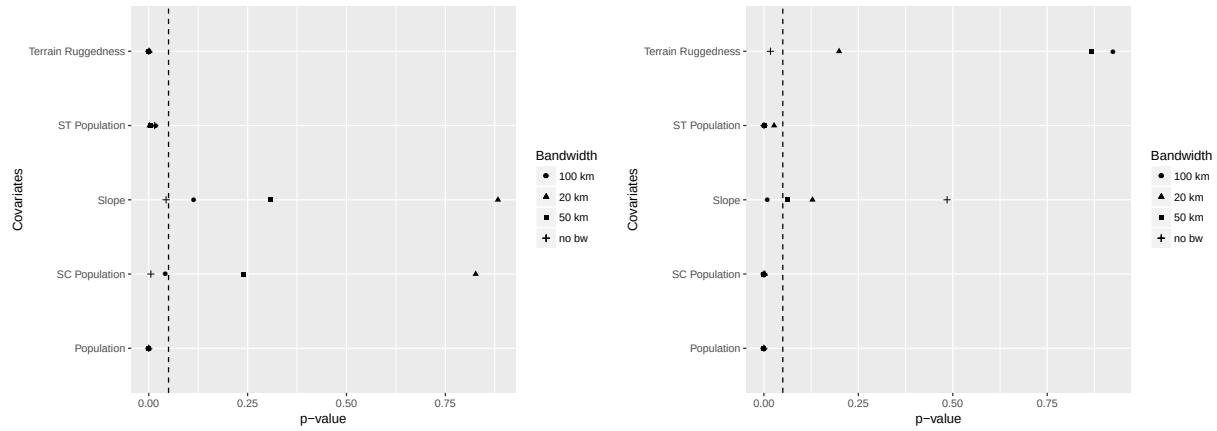
D Balance Tests

Figure D.1 shows balance tests for the chosen covariates. The imbalance in terrain ruggedness can be explained by the differences in elevation. To adjust for potential geographic heterogeneity, I control for the slope which is balanced across the border.

Additionally, I observe some imbalance in the population characteristics, particularly in scheduled castes and scheduled tribes population. These are generally the economically poor population groups. Figure D.1 indicates that scheduled castes population is balanced only for Mysore-Bombay border at twenty kilometers and fifty kilometers bandwidths; the rest of the variables are not balanced. This demonstrates the existence of a population variability across the border. However, I argue that the creation of the borders is exogenous to the socio-economic status of the territories, and is defined by exogeneity in the conflict and in the annexation process. Moreover, tables D.1 and D.2 provide evidence that the indirectly ruled territories on average have less scheduled castes and scheduled tribes population. That helps to rule out a mechanism that the negative effect on the provision of public goods in the indirectly ruled areas can be explained by the economic poverty of these territories.

Figure D.1: Balance Tests of pre-treatment covariates around the borders

(a) Mysore-Bombay border **(b) Hyderabad-Bombay border**



Note: Figures present p-values. P-values are calculated for the null hypotheses about the absence of statistical differences between the covariates' means. Different symbols correspond to different bandwidths around the border. The dashed line shows a cutoff of p-value = 0.05.

Table D.1: Balance Tests for Mysore-Bombay border (Bandwidth=20km)

	Mean Tr	Mean Cont	T-Test P.Value
Total Population	844.766	1,445.905	0
Total Scheduled Castes Pop	278.085	282.091	0.827
Total Scheduled Tribes Pop	160.096	206.048	0.002
Slope	88.837	88.740	0.883
Terrain Rugness	2.312	2.755	0.002

Table D.2: Balance Tests for Hyderabad-Bombay border (Bandwidth=20km)

	Mean Tr	Mean Cont	T-Test P.Value
Total Population	1,385.179	1,669.790	0.00002
Total Scheduled Castes Pop	354.623	423.661	0.003
Total Scheduled Tribes Pop	248.146	210.045	0.027
Slope	88.702	87.302	0.129
Terrain Rugness	1.130	1.206	0.199

E Additional Balancing

Figure E.1: Covariates distribution across Mysore-Bombay Border (bw=20 km)

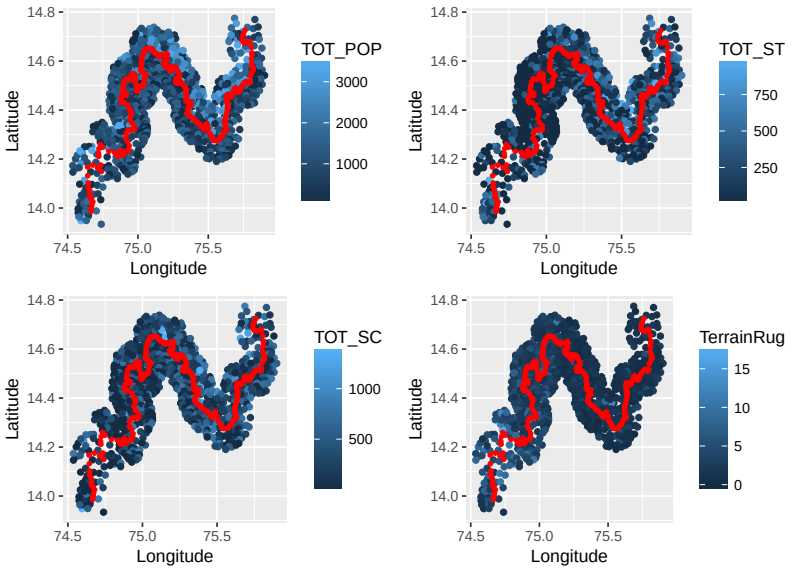


Figure E.2: Covariates distribution across Mysore-Bombay Border (bw=200 km)

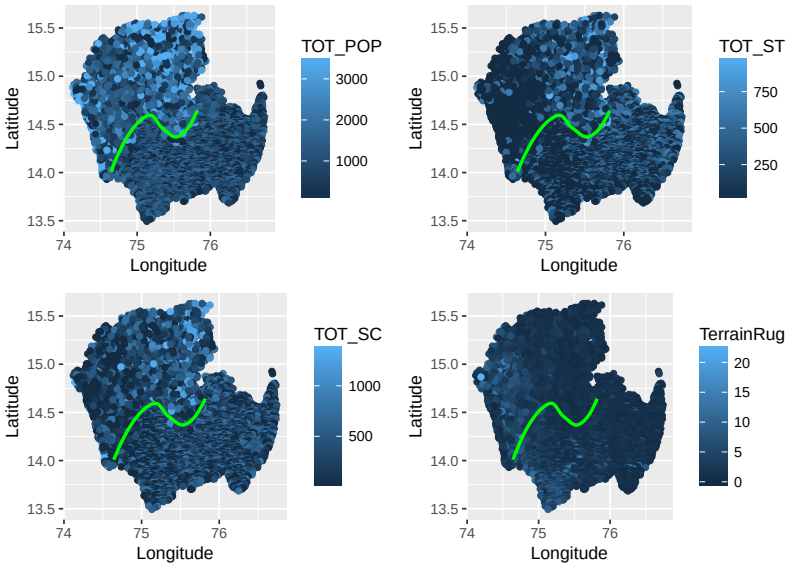


Figure E.3: Covariates distribution across Hyderabad-Bombay Border (bw=20 km)

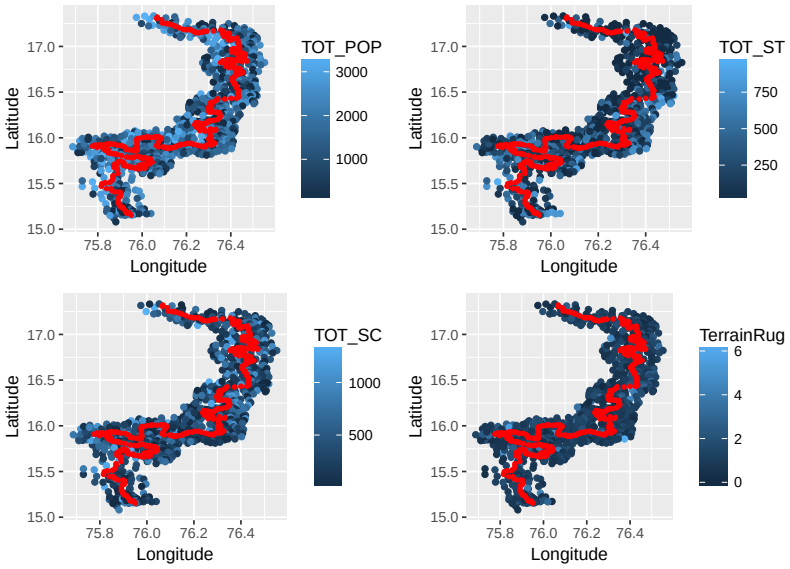
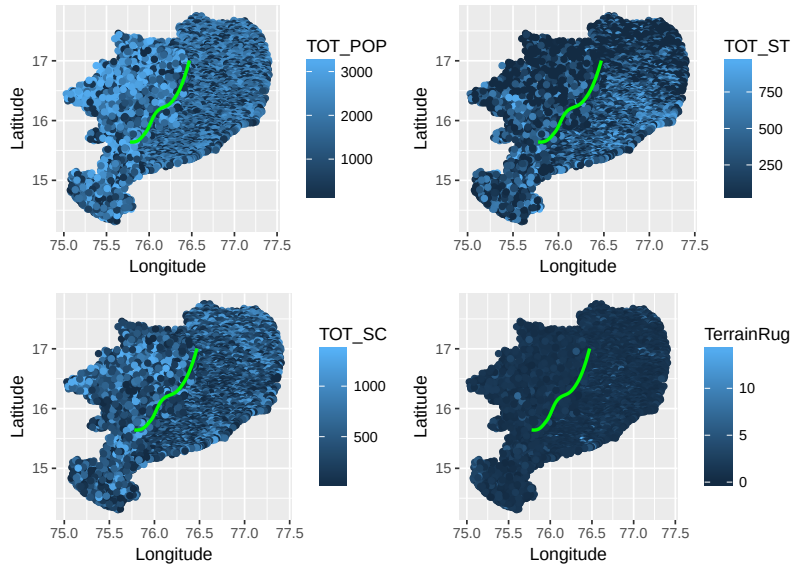


Figure E.4: Covariates distribution across Hyderabad-Bombay Border (bw=200 km)



F Alternative Specification

Table F.1: OLS Estimation of the Indirect Rule on the Public Goods Outcomes controlled for the Cubic Polynomial (bandwidth=20 kilometers)

	Dependent variable:			
	Health Centers	Paved Roads	Health Centers	Paved Roads
	(1)	(2)	(3)	(4)
Indirect Rule (Mysore)	−0.001	−0.126***		
	(0.011)	(0.035)		
Indirect Rule (Hyderabad)			−0.093***	−0.009
			(0.021)	(0.073)
Constant	−46,305.380	−49,469.980	−96,428.040	−57,746.760
	(47,332.330)	(40,972.960)	(60,642.290)	(53,923.800)
Controls	✓	✓	✓	✓
Observations	1,158	1,158	940	940

Note: *p<0.1; **p<0.05; ***p<0.01. Robust standard errors clustered on districts are in the parentheses. Models 1 and 2 show the results for the effect of indirect rule on the Mysore-Bombay border, and models 3 and 4 present results for the effect of indirect rule on Hyderabad-Bombay border. All models are controlled for the cubic polynomial of the latitude and longitude, slope, terrain ruggedness, total population, scheduled castes and scheduled tribes population.

G Alternative Estimation

The existing literature is skeptical about linear estimation of the spatial regression discontinuity models, because it evaluates the average effect alongside the border (Keele and Titiunik, 2015). Here I provide a non-parametric estimation, which helps to identify the potential heterogeneous effects and take them into account in the estimation of an average treatment effect. Table G.1 demonstrates the results of this estimation.[3] Here the border is presented as a set of points, and the estimated effect is the mean of the average treatment effects at each of these points. The results show a consistent negative effect of indirect rule without any heterogeneity between princely states and between different types of public good.

Table G.1: Non-Parametric Estimation of the Indirect Rule Effect on Public Goods Outcomes

Mysore-Bombay Border	Outcomes	Coefficient	Lower CI Bound	Upper CI Bound
	Health Centers	-0.046	-0.058	-0.034
	Paved Roads	-0.172	-0.187	-0.157

Hyderabad-Bombay Border	Outcome	Coefficient	Lower CI Bound	Upper CI Bound
	Health Centers	-0.119	-0.130	-0.107
	Paved Roads	-0.019	-0.036	-0.001

Note: Coefficients show the average effects of indirect rule on the availability of health centers and paved roads across the border points. They were calculated using the bootstrap technique from the coefficients estimated on the set of points alongside the border. CI stands for the 95% confidence intervals for the estimated average effects across the border points, also calculated using a bootstrap technique.

[3]For the estimation of the treatment effects on each point of the border, I used the methodology offered by Keele and Titiunik (2015). Confidence intervals were constructed using a bootstrap method (Larget, 2014).

H Alternative Bandwidths

Table H.1: OLS Estimation of Indirect Rule Effect on Public Goods Outcomes (10 km bandwidth: 5 km from each side of the border)

	Dependent variable:			
	Health Centers	Paved Roads	Health Centers	Paved Roads
	(1)	(2)	(3)	(4)
Indirect Rule (Mysore)	0.045^{***}	-0.092^{*}		
	(0.008)	(0.048)		
Indirect Rule (Hyderabad)			-0.097^{***}	-0.013
			(0.012)	(0.061)
Constant	-5.414	3.723	10.976	-0.534
	(6.881)	(6.487)	(8.069)	(12.294)
Controls	✓	✓	✓	✓
Observations	626	626	578	578

Note: *p<0.1; **p<0.05; ***p<0.01. Robust standard errors clustered on districts are in the parentheses. Models 1 and 2 show the results for the effect of indirect rule on the Mysore-Bombay border, and models 3 and 4 present results for the effect of indirect rule on Hyderabad-Bombay border. All models are controlled for the latitude and longitude, slope, terrain ruggedness, total population, scheduled castes and scheduled tribes population.

Table H.2: OLS Estimation of Indirect Rule Effect on Public Goods Outcomes (15 km bandwidth: 7,5 km from each side of the border)

	Dependent variable:			
	Health Centers	Paved Roads	Health Centers	Paved Roads
	(1)	(2)	(3)	(4)
Indirect Rule (Mysore)	-0.023	-0.106^{**}		
	(0.018)	(0.046)		
Indirect Rule (Hyderabad)			-0.090^{***}	-0.0002
			(0.014)	(0.066)
Constant	-8.059^{*}	2.969	3.583	3.458
	(4.339)	(6.145)	(8.167)	(10.262)
Controls	✓	✓	✓	✓
Observations	886	886	776	776

Note: *p<0.1; **p<0.05; ***p<0.01. Robust standard errors clustered on districts are in the parentheses. Models 1 and 2 show the results for the effect of indirect rule on the Mysore-Bombay border, and models 3 and 4 present results for the effect of indirect rule on Hyderabad-Bombay border. All models are controlled for the latitude and longitude, slope, terrain ruggedness, total population, scheduled castes and scheduled tribes population.

Table H.3: OLS Estimation of Indirect Rule Effect on Public Goods Outcomes (50 km bandwidth: 25 km from each side of the border)

	Dependent variable:			
	Health Centers	Paved Roads	Health Centers	Paved Roads
	(1)	(2)	(3)	(4)
Indirect Rule (Mysore)	−0.024	−0.119***		
	(0.028)	(0.036)		
Indirect Rule (Hyderabad)			−0.061***	0.008
			(0.022)	(0.061)
Constant	−6.162**	−2.865	7.196*	7.311
	(2.876)	(2.147)	(4.344)	(4.494)
Controls	✓	✓	✓	✓
Observations	2,525	2,525	1,849	1,849

Note: *p<0.1; **p<0.05; ***p<0.01. Robust standard errors clustered on districts are in the parentheses. Models 1 and 2 show the results for the effect of indirect rule on the Mysore-Bombay border, and models 3 and 4 present results for the effect of indirect rule on Hyderabad-Bombay border. All models are controlled for the latitude and longitude, slope, terrain ruggedness, total population, scheduled castes and scheduled tribes population.

Table H.4: OLS Estimation of Indirect Rule Effect on Public Goods Outcomes (100 km bandwidth: 50 km from each side of the border)

	Dependent variable:			
	Health Centers	Paved Roads	Health Centers	Paved Roads
	(1)	(2)	(3)	(4)
Indirect Rule (Mysore)	−0.018	−0.113***		
	(0.030)	(0.038)		
Indirect Rule (Hyderabad)			−0.048**	0.022
			(0.021)	(0.050)
Constant	−2.205	1.064	3.994	9.453**
	(2.200)	(3.190)	(2.455)	(4.491)
Controls	✓	✓	✓	✓
Observations	4,493	4,493	3,445	3,445

Note: *p<0.1; **p<0.05; ***p<0.01. Robust standard errors clustered on districts are in the parentheses. Models 1 and 2 show the results for the effect of indirect rule on the Mysore-Bombay border, and models 3 and 4 present results for the effect of indirect rule on Hyderabad-Bombay border. All models are controlled for the latitude and longitude, slope, terrain ruggedness, total population, scheduled castes and scheduled tribes population.

I Placebo Tests

Table I.1: Placebo Tests for Mysore-Bombay Border

	Dependent variable:			
	Health Centers	Paved Roads	Health Centers	Paved Roads
	-10 km		+10 km	
	(1)	(2)	(3)	(4)
Placebo Indirect Rule	−0.051	0.001	0.006	0.033
	(0.032)	(0.027)	(0.007)	(0.021)
Constant	−8.571***	−8.057***	−9.155	−0.148
	(0.474)	(2.923)	(5.599)	(0.970)
Controls	✓	✓	✓	✓
Observations	1,014	1,014	1,110	1,110

Note: *p<0.1; **p<0.05; ***p<0.01. Robust standard errors clustered on districts are in the parentheses. Models 1 and 2 show the results for placebo border that is -10 kilometers (closer to the princely state) from the original Mysore-Bombay, and models 3 and 4 show the results for placebo border that is +10 kilometers (further to the princely state) from the original Mysore-Bombay. All models are controlled for latitude, longitude, slope, terrain ruggedness, total population, scheduled castes and scheduled tribes population.

Table I.2: Placebo Tests for Hyderabad-Bombay Border

	Dependent variable:			
	Health Centers	Paved Roads	Health Centers	Paved Roads
	-10 km		+10 km	
	(1)	(2)	(3)	(4)
Placebo Indirect Rule	−0.009	−0.013	−0.052***	0.010
	(0.041)	(0.028)	(0.011)	(0.020)
Constant	−2.010	8.087***	23.063**	1.711
	(3.585)	(1.776)	(10.229)	(8.803)
Controls	✓	✓	✓	✓
Observations	740	740	819	819

Note: *p<0.1; **p<0.05; ***p<0.01. Robust standard errors clustered on districts are in the parentheses. Models 1 and 2 show the results for placebo border that is -10 kilometers (closer to the princely state) from the original Hyderabad-Bombay, and models 3 and 4 show the results for placebo border that is +10 kilometers (further to the princely state) from the original Hyderabad-Bombay. All models are controlled for latitude, longitude, slope, terrain ruggedness, total population, scheduled castes and scheduled tribes population.

J Alternative Public Goods. Extraction Mechanism Testing

Table J.1: OLS Estimation of Indirect Rule Effect on Education Outcomes

	Dependent variable:							
	Education: High Schools Availability							
	bw:10km	bw:20km	bw:50km	bw:100km	bw:10km	bw:20km	bw:50km	bw:100km
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Indirect Rule (Mysore)	0.036**	0.006	−0.007	0.009				
	(0.015)	(0.031)	(0.042)	(0.038)				
Indirect Rule (Hyderabad)					0.085*	0.087*	0.112*	0.128***
					(0.048)	(0.052)	(0.057)	(0.044)
Constant	−6.262	−7.310**	−8.219**	−3.100	29.315***	20.684*	17.877*	15.305***
	(7.282)	(3.128)	(3.195)	(2.267)	(11.174)	(11.704)	(9.891)	(5.215)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Observations	595	1,100	2,404	4,221	551	901	1,787	3,306

Note: *p<0.1; **p<0.05; ***p<0.01. Robust standard errors clustered on districts are in the parentheses. Dependent variable is a binary variable indicating the presence of high schools in a village. Models 1-4 show the results for the effect of indirect rule on the Mysore-Bombay border for the respective bandwidths around the border, and models 5-8 present results for the effect of indirect rule on Hyderabad-Bombay border for the respective bandwidths around the border. All models are controlled for the latitude and longitude, slope, terrain ruggedness, total population, scheduled castes and scheduled tribes population.

K Alternative Mechanisms

The long-term effects can be explained by physical or cultural persistence. Public goods that were provided during colonial times can be used and expanded in a certain capacity today, which forms physical persistence. At the same time historical experience may result in a greater propensity to maintain and improve these goods, which would indicate cultural persistence. In the main part of the paper, I show that the driving mechanism of long-term effects of indirect rule was physical persistence. Here I provide some empirical evidence that allows me to rule out cultural persistence as a potential alternative mechanism.

Cultural persistence mechanism suggests that differences between the leaders in directly and indirectly ruled areas created differences in the local populations' mobilization activity and their propensity to carry out collective actions.[4] Poor incentives of the local leaders and population apathy in the princely states built a lack of interest in collective action, which led to the lack of mobilization. Direct rule, on the contrary, pushed the local population to unite in the face of a common enemy – colonizer's authority, and to mobilize against it. Historians show that people in the Bombay region had myriad grievances driven by the presence of colonizers and their extraction interests (Ramaswamy and Patagundi, 2007). Although there is evidence that certain norms, like collective action ability and local cooperation, or certain attitudes towards authorities were preserved even in post-colonial times (Wucherpfennig, Hunziker and Cederman, 2016; Lowes et al., 2017; Dell, Lane and Querubin, 2018), I argue that in this case cultural persistence is not the main mechanism that explains long-term effects on contemporary public goods heterogeneity.

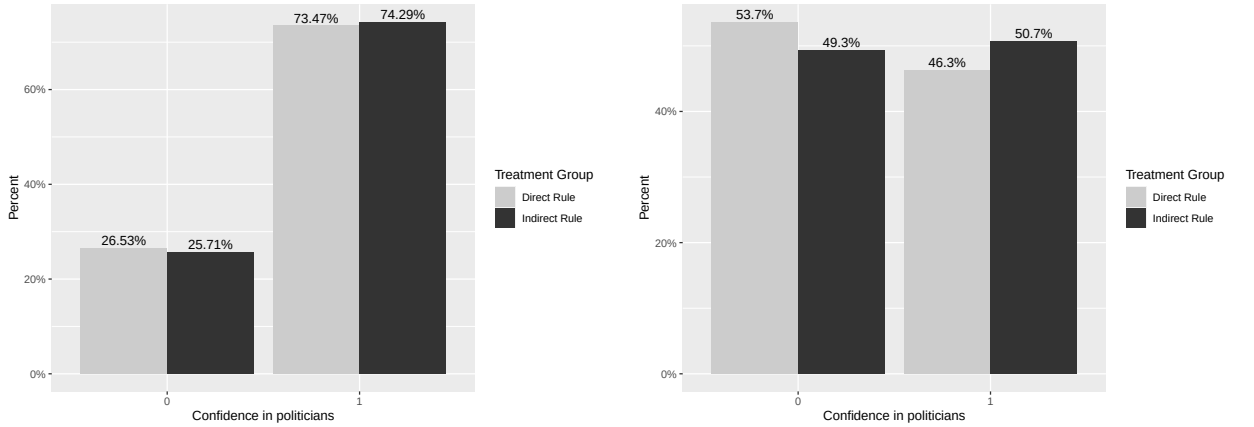
People in the directly ruled territories had less trust of local leaders. This enhanced the collective action and more efficient mobilization capacity. Local population in the indirectly ruled areas, on the contrary, had more trust of local leaders, which led to a lack of mobiliza-

[4] Lawrence (2013) cites Hechter (2000) and says that "direct rule prompts nationalist mobilization, but indirect rule thwarts nationalism because it reduces the demand for sovereignty and raises the costs of collective action".

tion against these leaders and absence of any potential collective actions. Cultural persistence mechanism will argue that these trust attitudes on both sides of the former borders persist today and affect the ability of the local population to be vocal with their authorities and demand public goods provision. To see whether the persistence of trust holds through the

Figure K.1: Indian Human Development Survey Results

(a) First Wave of the Survey (2005) **(b) Second Wave of the Survey (2011-2012)**



Note: The charts are based on the individual survey data and present the survey results only for the districts of Karnataka that were used in the baseline results. For confidence level, the category 1 was constructed with the aggregation of responses - "A great deal" and "Only some" for 2005 wave, and "A great deal of confidence" and "Only some confidence" for 2011-2012 wave. Category 0 means "Hardly any confidence". The first wave of the survey (2005) consisted such options for the respondents as "Don't know", "Valid blank", "Valid skip", and "-". Dropping of the"Don't know" category could have impacted the results of the first wave. The exact question in the survey was the following: "I am going to name some institutions in the country. As far as the people running these institutions are concerned, would you say you have confidence in politicians to fulfill their promises?".

time, I provide the results for the two waves of the Indian Human Development Survey: wave of 2005[5] and wave of 2011-2012[6]. Figure K.1 presents the summary of the responses about confidence in politicians to fulfill their promises.[7] I choose respondents from the districts of Karnataka that are used in the baseline models, identifying the districts of the former princely states as the treatment group and the districts of the British province as the control group. These figures show that, in both time periods, there is no significant differences

[5]Data is available at the ICPSR website: https://www.icpsr.umich.edu/icpsrweb/DSDR/studies/22626.

[6]Data is available at the ICPSR website: https://www.icpsr.umich.edu/icpsrweb/DSDR/studies/36151.

[7]Here I grouped the three-level scale of the responses to a binary measure.

between confidence in politicians in both former directly and indirectly ruled territories. It indicates that even if the variation in trust and confidence in authorities attitudes existed back during the colonial times, it does not hold today. This helps to eliminate a cultural persistence mechanism and point towards the original physical persistence explanation.

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