What Explains the Geographic Variation in Corporate Investment?

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Motivation

- Investment is geographically concentrated
  - E.g., Steel City, Motor City, Silicon Valley, Wall Street, etc.

- Understanding the forces behind such clusters is fundamental to understanding the origins of geographic inequality
  - Why are certain areas richer than others?
  - What *(if anything)* can be done to address these differences?

Research Objective

What explains geographic variation in investment?

- Conventional Answers
  - Availability and cost of factors of production
  - Geographic advantages
  - Firm characteristics
  - Self-fulfilling expectations

- This Paper:
  - Can *History* Explain the Geographic Concentration of Investment?
    - What is the channel?

# Relationship Between History and Investment
Empirical Challenge

- The central role of history may seem obvious if investment is assumed to follow a path dependent process
  - Ethier (1982), Panagariya (1986), Arthur (1986), and Krugman (1987)

- However, establishing the empirical relationship between history and investment is difficult because:
  - The eventual choice of the equilibrium can either be driven by the history or self-fulfilling expectations (Krugman (1991))
  - Other confounding factors
    - Availability and cost of factors of production ((Marshall, 1920))
    - Geographic advantage (Ellison & Glaeser, 1997)

Our Approach

1. Use within-country geographic variation in historical circumstances to explain the spatial differences in investment

   - Colonial occupation of India provides such an environment
   - During the colonial era, parts of the Indian subcontinent fell under *direct rule* or *indirect rule*
     - ★ Direct ruled areas faced greater exploitation
     - ★ Indirect ruled areas had higher institutional quality (Iyer, 2010)
     - ★ Similar in precolonial characteristics (balanced)
   - All areas, regardless of historical origins, were integrated in a uniform legal and administrative framework post independence

2. Granular data on investment projects

3. Address omitted variable bias & selection issue
   - Local Identification Approach
   - IV: Death of ruler without male heir (Doctrine of Lapse)

Historical Setting: India

Pre-Colonial India
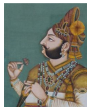
Colonial Rule in India

Indirect Rule
High Institutional Quality (Iyer, 2010)

Pre-colonial elites had
administrative power

Direct Rule
Low Institutional Quality (Iyer, 2010)

British took over
complete control

- All areas subject to uniform *de-jure* administrative, legal and political structure post independence

This Paper in a Nutshell

1. **Fact:** Investment in India is geographically concentrated
   - Concentration is 20 pp higher than a frictionless benchmark
   - History can explain 13% of total geographic variation in investment

2. **Key Result:** History affects investment
   - **Intensive Margin**: Projects are 10.8% smaller in size in direct ruled districts relative to indirect ruled districts by the same firm within a district-pair
   - **Extensive Margin**: Projects are 25% less likely to be announced in direct ruled districts relative to indirect ruled districts

3. **Mechanism:** History can have long-run consequences through its effect on:
   - Economic Organization

Overview

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Current and Colonial Boundaries

	Ceded	Conquest	Grant	Lapse	Misrule	Total
Initial Settlement	0	6	3	0	0	9
Ring Fence (1765-1818)	58	114	15	0	3	190
Subordinate Isolation (1819-1856)	5	22	0	27	17	71
Post 1857 Revolt	2	0	0	0	0	2
Direct Ruled	65	142	18	27	20	272
Indirect Ruled						152
Total						424

What Predicts Direct British Rule

Dep Var: Direct Rule (=1)	(1)	(2)	(3)	(4)	(5)
Altitude (MSL)	0.0002				0.0002
	(0.0003)				(0.0002)
Coast (=1)	0.1820				0.1720
	(0.1176)				(0.1179)
ln(Area)	-0.0637				-0.0692
	(0.0816)				(0.0799)
Slope	-1.0837				2.6706
	(3.6432)				(2.3314)
Rain (cm)	0.0015				0.0012
	(0.0010)				(0.0009)
Max-Temp	0.0061				-0.0010
	(0.0113)				(0.0113)
Min-Temp	0.0126				0.0028
	(0.0104)				(0.0090)
ln(Distance)		0.0396			0.0707
		(0.0611)			(0.0577)
Maratha Ruler			0.2279		0.2449
			(0.1550)		(0.1524)
Muslim Ruler			0.3853***		0.3319**
			(0.1276)		(0.1420)
Prop Muslim				0.2663	-0.1818
				(0.3447)	(0.2848)
Prop Sikhs				0.6377	-0.2291
				(1.0841)	(0.9907)
Prop Lower Caste				0.5613	0.5439
				(0.3940)	(0.3518)
Prop Elites				-0.3153	-0.1544
				(0.6895)	(0.6948)
Constant	0.5330	0.4275	0.4336***	0.5111***	0.3777
	(0.8825)	(0.3253)	(0.0933)	(0.1445)	(0.9042)
# Obs	294	294	294	294	294
R^2	0.0814	0.0042	0.1257	0.0293	0.1939

Data: Geography of Project Announcements
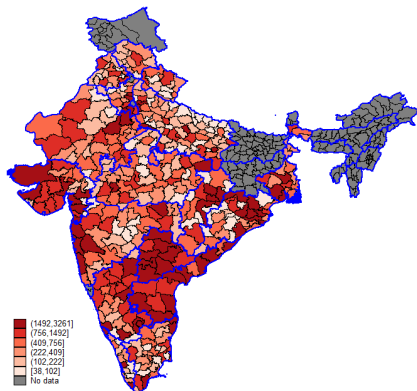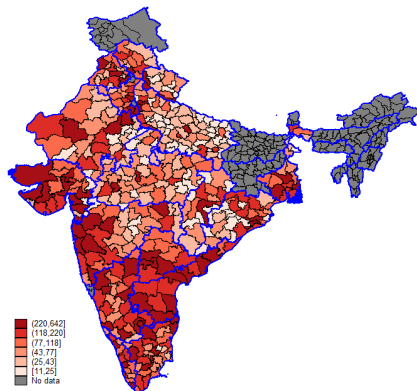
(a) Total Amount (in ₹ bn) (b) # Projects

- Source: CMIE CapEx (1995-2018)

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Fact: Investment is Geographically Concentrated
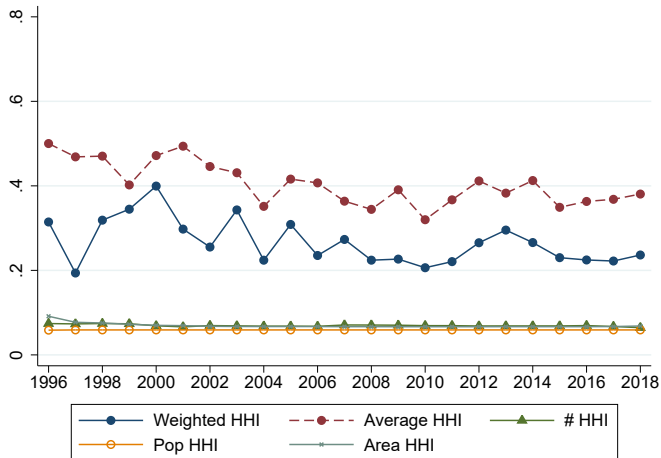
Geographic Concentration of Investment and Direct Rule

Investment Concentration and State Characteristics

$$HHI_s = \beta \cdot \% \text{ Direct Rule}_s + \Gamma X_s + \varepsilon_s$$

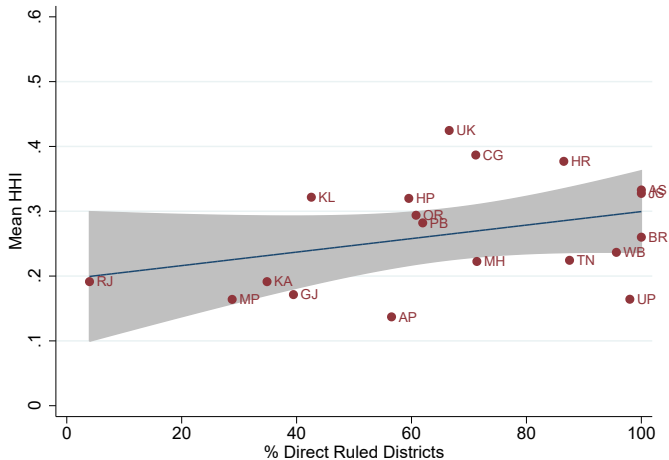| Dep Var: HHI	(1)	(2)	(3)	(4)	(5)	(6)
% Direct Rule	0.1213*	0.1463**	0.1227*	0.1522*	0.1514*	0.1369*
	(0.0661)	(0.0531)	(0.0685)	(0.0793)	(0.0813)	(0.0778)
# Districts		-0.0182***	-0.0188***	-0.0180***	-0.0194***	-0.0183***
		(0.0038)	(0.0039)	(0.0042)	(0.0047)	(0.0053)
Area per District			-0.0582	-0.1081	-0.1354	-0.1090
			(0.1128)	(0.1402)	(0.1391)	(0.1541)
Population Density				-0.8775	-1.2064	-0.8094
				(0.8750)	(0.9068)	(1.0235)
GDP per capita					-0.1159	0.0302
					(0.1124)	(0.2965)
% Urban						-0.0087
						(0.0144)
# Obs	19	19	19	19	19	19
R^2	0.1269	0.5086	0.5227	0.5422	0.5753	0.5933

Baseline: Investment and Direct Rule

Investment is 8% lower in direct ruled areas relative to indirect ruled areas

$$Ln(Y_{i,j,t}) = \beta \cdot \text{Direct Rule}_j + \theta_{i,y} + \theta_{s(j \in s),y} + \theta_t + \text{Latitude}_j + \text{Longitude}_j + \varepsilon_{i,j,t}$$

Dep Var: Ln(Project Size)	(1)	(2)	(3)	(4)	(5)
Direct Rule (=1)	-0.1755**	-0.1130***	-0.1146**	-0.0864**	-0.0881***
	(0.0836)	(0.0416)	(0.0526)	(0.0348)	(0.0326)
	[0.0548]***	[0.0356]***	[0.0371]***	[0.0332]***	[0.0331]***
State FE	Yes	Yes	Yes	Yes	
Firm FE		Yes	Yes		
Qtr × Year FE			Yes	Yes	Yes
Firm × Year FE				Yes	Yes
State × Year FE					Yes
Lat/Long	Yes	Yes	Yes	Yes	Yes
# Obs	28,820	28,820	28,820	28,820	28,820
R^2	0.0303	0.5067	0.5465	0.7088	0.7160

Balanced Panel Analysis: Investment and Direct Rule

$$I_{j,t} = \beta \cdot \text{Direct Rule}_j + \theta_{s(j \in s),t} + \varepsilon_{j,t}$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Announce=1	$I_{j,t}$	$I_{j,t}\|I_{j,t} > 0$	Projects$_{j,t}$	Projects$_{j,t}\|\# > 0$	$\frac{I_{j,t}}{\sum_{j\in s} I_{j,t}}$	$\frac{\text{Projects}_{j,t}}{\sum_{j\in s}\text{Projects}_{j,t}}$
Direct Rule (=1)	-0.2534*	-16174.5813**	-28350.1337**	-4.1791**	-6.8549**	-7.0724**	-7.1912*
	(0.1346)	(7910.8774)	(11777.6353)	(2.0257)	(2.7350)	(2.9954)	(3.7650)
State × Qtr × Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample Average	0.6453	19861.4928	37851.9045	4.4693	7.7296	8.7459	8.8529
	(0.0931)	(5367.5117)	(7901.4838)	(1.3584)	(1.8328)	(2.0333)	(2.5316)
# Obs	35,256	35,256	17,052	35,256	19,050	35,256	35,256
R^2	0.1854	0.2363	0.3115	0.1800	0.1621	0.0500	0.1070

- **Extensive Margin**: Projects are 25% less likely to be announced in direct ruled districts relative to indirect ruled districts

- Share of investment & share of number of projects are 7% lower in direct ruled districts relative to indirect ruled districts

Robustness of Baseline Results

- Balance Test Assumption (▸ Results)(▸ Moran's I statistic)
- Controls for Geography (▸ Results)
- Controls for Other Covariates (▸ Results)
- Placebo Test (▸ Results)
- Log Investment Robustness for Balanced Panel Analysis (▸ Results)

Local Identification Approach: Investment and Direct Rule
Empirical Strategy

$$Ln(Y_{i,j,t}) = \beta \cdot \text{Direct Rule}_j + \boxed{\theta_{i,p(j\in p)y}} + \theta_t + Latitude_j + Longitude_j + \varepsilon_{i,j,t}$$

- Sample of bordering districts within a state ▸ Sample
- Compare investment projects of the same firm within a contiguous district-pair using firm $\times$ district-pair $\times$ year fixed effects
- Whether a district within a contiguous direct-indirect ruled pair was under direct British rule or not is likely a matter of chance

- **Identifying Assumption:**
  - ▶ Adjacent districts are expected to follow similar paths had India not been colonized
  - ▶ $\theta_{i,p(j\in p)y}$ implicitly controls for:
    - ★ Costs of moving goods, people, and ideas
    - ★ Geography
    - ★ Shocks to Local Investment Opportunities

Local Identification Approach: Investment and Direct Rule
Empirical Results

$$Ln(Y_{i,j,t}) = \beta \cdot \text{Direct Rule}_j + \theta_{i,p(j \in p)y} + \theta_t + Latitude_j + Longitude_j + \varepsilon_{i,j,t}$$

Dep Var: Ln(Project Size)	(1)	(2)	(3)
Direct Rule (=1)	-0.0974**	-0.1090**	-0.1084**
	(0.0469)	(0.0488)	(0.0457)
Qtr × Year FE	Yes	Yes	Yes
Firm × Year FE	Yes	Yes	
District-Pair × Year FE	Yes	Yes	
Firm × District-Pair FE		Yes	
Firm × District-Pair × Year FE			Yes
Lat/Long	Yes	Yes	Yes
# Obs	11,947	11,947	11,947
R^2	0.7856	0.7940	0.7944

- Projects announced in direct ruled districts are 10.8% smaller in size relative to the projects announced in indirect ruled districts by the same firm within a contiguous district-pair

Local Identification Approach: Falsification

Sample of Hinterland Districts Sample ▸ Sample

Dep Var: Ln(Project Size)	(1)	(2)	(3)
Hinterland (=1)	0.0382	0.0353	0.0355
	(0.0549)	(0.0391)	(0.0353)
Qtr × Year FE	Yes	Yes	Yes
Firm × Year FE	Yes	Yes	
District-Pair × Year FE	Yes	Yes	
Firm × District-Pair FE		Yes	
Firm × District-Pair × Year FE			Yes
Lat/Long	Yes	Yes	Yes
# Obs	4,953	4,953	4,953
R^2	0.8340	0.8431	0.8432

- Results only appear when we cross a boundary separating direct and indirect ruled districts
- Results unlikely to be driven by spatial autocorrelation, as posited by Kelly (2019)

Addressing Selection: IV Strategy

Death of Ruler with No Male Heir

Dep Var: ln(Project Size)	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	2SLS		Falsification	
			Second Stage	First Stage		
Direct Rule (=1)	-0.2236***		-0.2239**			
	(0.0604)		(0.0960)			
Ruler Death, No Heir, Lapse (=1)		-0.1475*		0.6589***		
		(0.0766)		(0.1225)		
Ruler Death, No Heir, No Lapse (=1)					0.0037	
					(0.0568)	
Ruler Death, Yes Heir, Lapse (=1)						0.0072
						(0.0764)
Qtr × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Lat/Long	Yes	Yes	Yes	Yes	Yes	Yes
# Obs	10,293	10,293	10,293	10,293	8,129	8,129
R^2	0.5692	0.5693	-0.0563	0.6691		
KP LM Statistic				5.9527**		
KP Wald F Statistic				28.9393		

- Under the policy of *Doctrine of Lapse*, Lord Dalhousie took direct control of areas where the incumbent Indian ruler died without a natural heir

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Mechanism

- Direct British rule affects corporate investment in the present

  - **Destruction of existing economic organizations**

# Destruction of Economic Organizations
The Case of Cotton

- Cotton-producing districts were more likely to be under direct British rule
- These areas were subject to adverse economic policies, resulting in the destruction of existing economic organizations with long-run detrimental effects

Pre-Colonial History of Cotton in India

- India produced about 25% of the world's manufacturing output in 1750, of which, textiles constituted a significant share (Marks, 2019)

- Indian textiles dominated the world textile market in the 18th century, accounting for 25% of the global textile trade (Maddison et al., 1995)

- The Indian cotton textiles were the most important manufactured goods in the 18th century (Parthasarathi, 2011) with India being home to the world's most important cotton textile industry (Robson, 1957)

First Stage: Cotton & Direct British Rule

Cotton-producing districts were more likely to be under direct British rule
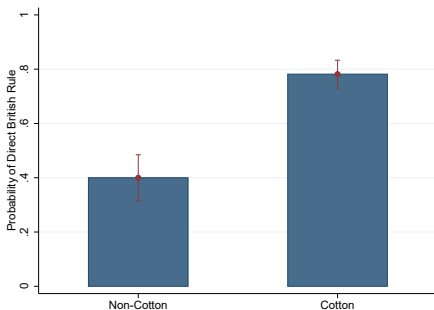
- A cotton producing district was 40% more likely to be under direct British rule, relative to indirect rule

Capture of Cotton Industry
Why did the British took direct control of cotton producing areas?

- Cypher, 2008 notes that the Indian textile production was marked by the presence of skilled laborers and large factory towns, which threatened the British textile industry – a leading sector of the British economy
- Direct rule of cotton producing areas allowed British to
  - Directly control the supply of cotton, securing a monopoly on the supply of Indian goods and products (Sahoo (2015))
  - Protect the interests of the British textile industry and increase Britain's share of global trade

"England began with driving the Indian cottons from the European market; it then introduced twist into Hindostan, and in the end inundated the very mother country of cotton with cottons"

- Karl Marx, The British Rule in India, 1853

Event Study: Invention of Whitney's Cotton Gin

- Emergence of the American colonies as a low-cost supplier of cotton by 1801 reduced incentives of the British to continue their exploits of cotton in India
- Transformation began with Whitney's cotton gin in 1794 and adoption in 1800
  - Whitney cotton gin removed seeds from long-staple efficiently
  - India farmed short-staple variety and did not benefit from the invention

Trade Flows and Cotton Commodity

Dep Var: Trade Flows	(1)	(2)	(3)	(4)	(5)	(6)
Cotton Commodity & Early Annexation	-0.4985***	-0.6209***	-0.6173***	-0.4649***	-0.4417***	-0.4384***
	(0.0974)	(0.1009)	(0.0923)	(0.0359)	(0.0287)	(0.0433)
Early Annexation	0.2020	0.0800	0.0805	0.0985		
	(0.1566)	(0.0657)	(0.0649)	(0.0583)		
Cotton Commodity	0.1365**					
	(0.0518)					
Year FE		Yes				
Commodity FE		Yes				
Export. Prov. × Import. Prov. FE		Yes				
Export. Prov. × Import. Prov. × Year FE			Yes	Yes	Yes	Yes
Commodity × Year FE			Yes	Yes	Yes	Yes
Export. Prov. × Import. Prov. × Commodity FE				Yes	Yes	Yes
Export. Block × Year FE					Yes	
Import. Block × Year FE					Yes	
Export. Block × Import. Block × Year FE						Yes
# Obs	47,447	47,447	47,447	47,447	47,447	47447
R^2	0.0117	0.2723	0.3125	0.4188	0.5458	0.6569

- Widespread adoption of Whitney cotton gin by 1800
- Domestic cotton exports of provinces annexed before 1800 are lower than the domestic exports of provinces annexed after 1800

Long Run Effects of Capture of Cotton Industry
IV with Local Identification Approach: Precolonial Cotton Production

Dep Var: ln(Project Size)	(1) IV	(2) 2SLS	(3)	(4) Falsification
		Second Stage	First Stage	
Direct Rule (=1)		-0.2272* (0.1270)		
Precolonial Cotton (=1)	-0.2073* (0.1166)		0.9120*** (0.1326)	0.0344 (0.0876)
Qtr × Year FE	Yes	Yes	Yes	Yes
Firm × District-Pair × Year FE	Yes	Yes	Yes	Yes
Lat/Long	Yes	Yes	Yes	Yes
# Obs	9,491	9,491	9,491	1,871
R^2	0.7901		0.7786	0.8077
KP LM Statistic			7.3567***	
KP Wald F Statistic			47.3955	

- Results from Full Sample ▸ Results

Investment and Precolonial Cotton Production

Impact on present day corporate investment among direct ruled areas that were annexed before 1800 relative to areas annexed after 1800

Dep Var: ln(Project Size)	(1)	(2)	(3)
Precolonial Cotton (=1)	-0.3838*	-0.1160	-0.0564
	(0.1879)	(0.1740)	(0.1944)
Early Annexation (=1)		-0.5800***	0.0341
		(0.1938)	(0.1601)
Precolonial Cotton × Early Annexation			-0.6448**
			(0.3073)
Qtr × Year FE	Yes	Yes	Yes
Firm × Year FE	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes
Lat/Long	Yes	Yes	Yes
# Obs	9,465	9,465	9,465
R^2	0.8058	0.8069	0.8070

- Reduced investment in direct ruled areas is primarily driven by cotton producing areas that were annexed before 1800
- Before 1800, British had greater incentives to destroy the existing cotton industry

Why the Long-Run Effect?

- The destruction of strong economic organizations hampers the intergenerational transfer of skills and knowledge
- The destruction of a dominant industry that developed over a long period of time disrupts the natural evolution process of Marshallian forces and renders the comparative advantage of the area and its people futile

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Alternative Explanations

These alternative explanation cannot explain our results

- Provision of Public Goods ▸ Results
- Differences in Law Enforcement ▸ Results
- Trust in the State ▸ Results
- Community Cooperation & Conflict ▸ Results

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Conclusion

1. History can explain investment concentration
   - **Aggregate Result:** History explains 13% of total geographic variation in investment
   - **Micro-level Estimate:** Investment is 8-10% lower in direct ruled districts

2. History can have long-run consequences through its effect on:
   - Economic Organizations