

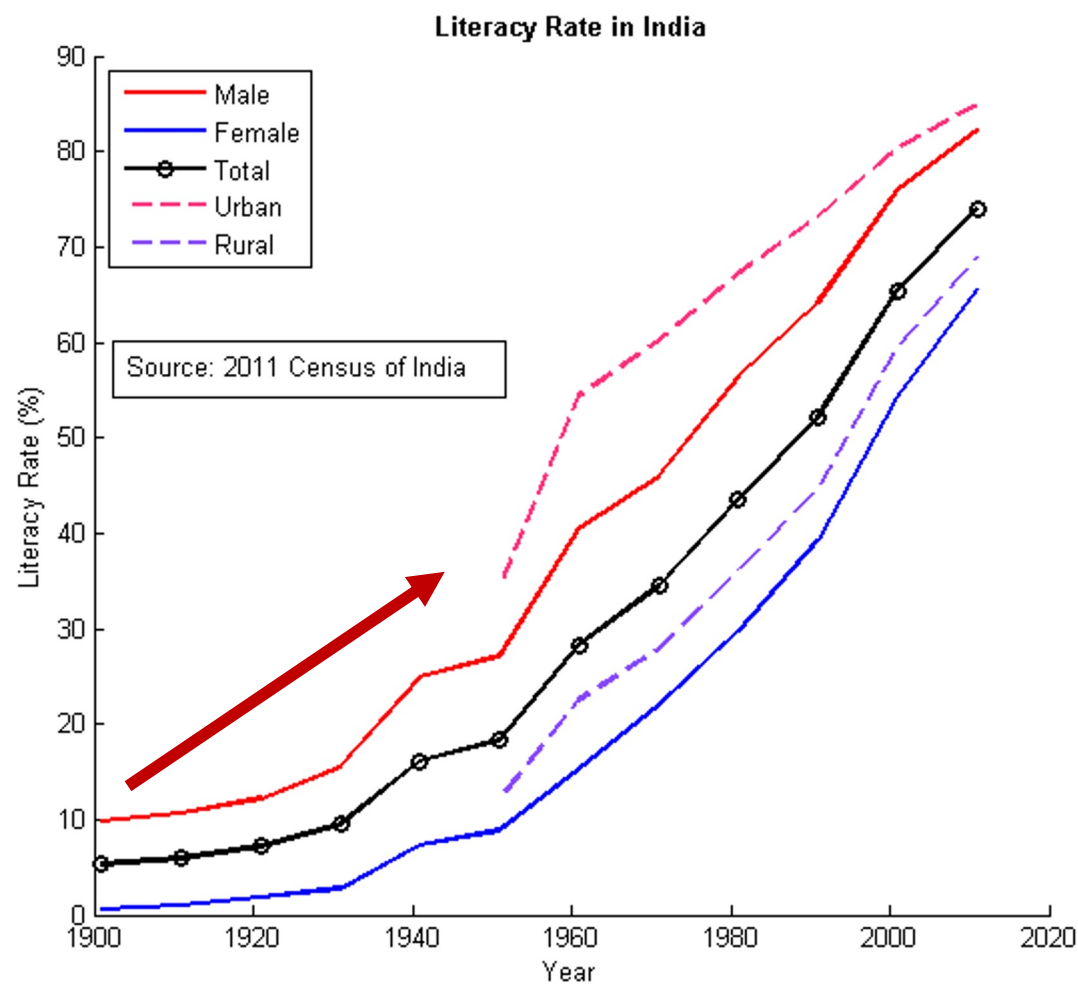
Did Railways Affect Literacy: Evidence from India

by Chaudhary and Fenske

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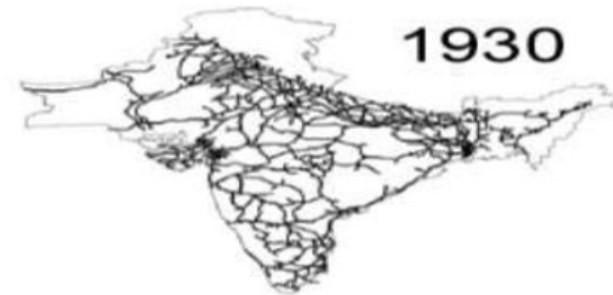
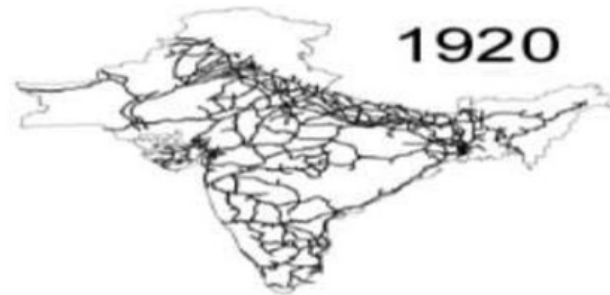
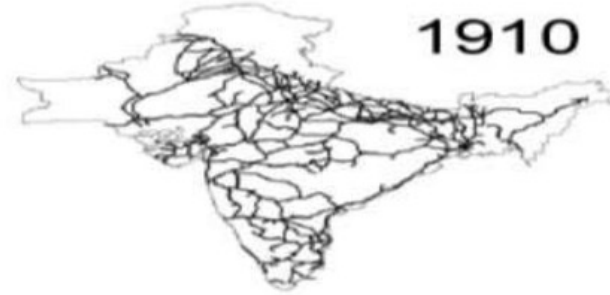
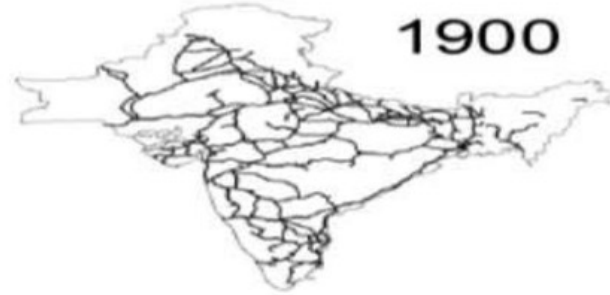
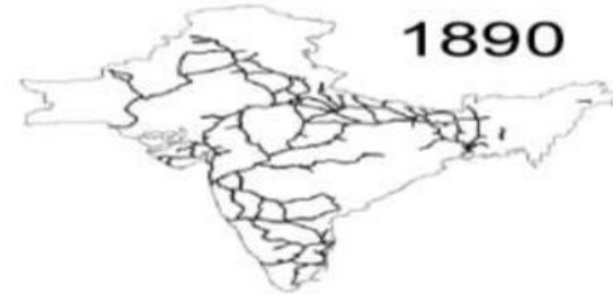
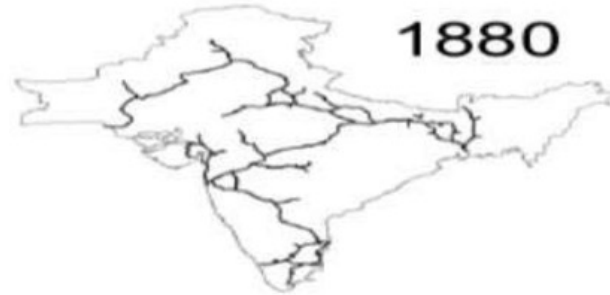
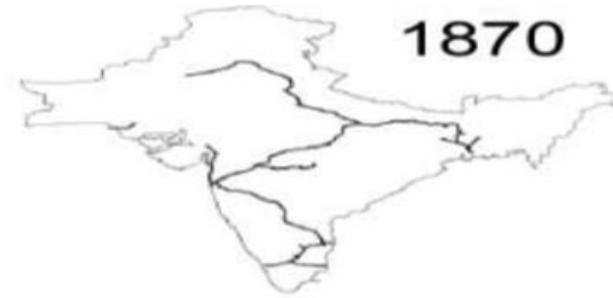
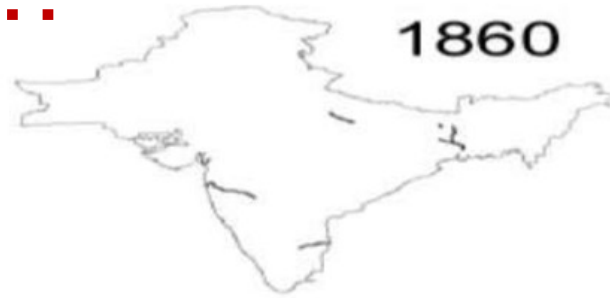
June, 2022

Literacy...



Source: 2011 Census of India

Railroads...



This Paper

□ Effect of railroad on human capital

- Positive and significant effects on male and English literacy
- Raises secondary and elite primary enrollment

□ Mechanisms linking railways and higher schooling?

- Non-agricultural income, urbanization and service sector employment
- Not Agricultural income

□ Why do we care?

- Micro: Impact of colonization; Impact of railroads in India; demand or supply
- Macro: Infrastructure and growth

Discussion

❑ Interesting and Creative

- Railroads not only affect trade, city growth..., but also affect schooling
- Impact of Infrastructure on human capital...not limited to modern economies
- Methodology
 - New measures
 - Consistent results: synthetic panel + cross-sectional IV
 - Mediation analysis

❑ Comments

- Mechanism
- Broader Connections

Results

- ❑ Railroad years and literacy using a synthetic panel:
 - Positive and significant effects on male and English literacy
- ❑ FEs: district, cohort × province and year×province.

TABLE 3. Synthetic Panel: Cohort, District and Year Fixed Effects

	(1)	(2)	(3)
	Total	Male	Female
Literacy			
Cohort Years of Railroad Exposure	0.0202*** (0.0070)	0.0224*** (0.0071)	0.0079 (0.0078)
Obs.	1,609	1,609	1,608
English Literacy			
Cohort Years of Railroad Exposure	0.0234*** (0.0078)	0.0266*** (0.0086)	0.0050 (0.0079)
Obs.	1,598	1,597	1,536
Non-English Literacy			
Cohort Years of Railroad Exposure	0.0212*** (0.0074)	0.0235*** (0.0075)	0.0080 (0.0081)
Obs.	1,607	1,607	1,606
Years	1911-1921	1911-1921	1911-1921

Results

□ Railroad years and literacy using cross-sectional IVs

- 2 IVs: distances to military cantonments and the lines in the Kennedy Plan respectively.

□ FEs: province, religion, geographics, suitability for specific crops, and city population.

TABLE 5. Cross-Section: 1852 Kennedy Plan and Military Cantonment IVs

	(1)	(2)	(3)	(4)	(5)	(6)
	Literacy			Male	Female	English
Year 1881						
Years of Railroad Exposure	0.0350*** (0.0080)	0.0235*** (0.0054)	0.0107** (0.0044)	0.0110** (0.0044)	0.0308*** (0.0103)	
KPF	44.78	34.99	26.56	26.56	26.55	
P-value over-id test	0.0844	0.881	0.194	0.116	0.522	
Year 1891						
Years of Railroad Exposure	0.0216*** (0.0058)	0.0163*** (0.0048)	0.0091** (0.0037)	0.0089** (0.0037)	0.0256*** (0.0073)	
KPF	43.22	33.92	23.60	23.60	23.59	
P-value over-id test	0.0278	0.699	0.143	0.0905	0.585	
Year 1901						
Years of Railroad Exposure	0.0187*** (0.0048)	0.0191*** (0.0043)	0.0127*** (0.0042)	0.0128*** (0.0043)	0.0280*** (0.0079)	0.0376*** (0.0085)
KPF	36.09	29.40	18.71	18.71	18.71	18.71
P-value over-id test	0.258	0.217	0.228	0.163	0.329	0.004
Year 1911						
Years of Railroad Exposure	0.0190*** (0.0047)	0.0191*** (0.0041)	0.0091*** (0.0035)	0.0089** (0.0035)	0.0179*** (0.0063)	0.0316*** (0.0076)
KPF	33.54	26.74	17.17	17.17	17.17	17.17
P-value over-id test	0.0629	0.289	0.343	0.208	0.636	0.426
Year 1921						
Years of Railroad Exposure	0.0172*** (0.0047)	0.0186*** (0.0042)	0.0120*** (0.0038)	0.0109*** (0.0037)	0.0233*** (0.0069)	0.0272*** (0.0071)
KPF	32.31	25.44	17.15	17.15	17.15	17.15
P-value over-id test	0.0409	0.240	0.937	0.698	0.170	0.879
Controls	No	No	Yes	Yes	Yes	Yes
FE	No	Province	Province	Province	Province	Province

Results

- ❑ Railroad years and enrollment
 - positive and significant effect on secondary enrollment
- ❑ FEs: province, religion, geographics, suitability for specific crops, and city population.

TABLE 6. Enrolment

	(1)	(2)	(3)	(4)	(5)	(6)
	Enrolment	Enrolment	Primary Enrolment	Primary Enrolment	Secondary Enrolment	Secondary Enrolment
Panel: District and Year Fixed Effects						
Years of Railroad Exposure	-0.0042 (0.0148)	0.0020 (0.0107)	-0.0130 (0.0173)	-0.0068 (0.0121)	0.0236* (0.0139)	0.0305*** (0.0116)
Obs	1,051	652	1,051	652	1,051	652
Year	All	1894/1897 1901/1905 /1911	All	1894/1897 1901/1905 /1911	All	1894/1897 1901/1905 /1911
Cross-Section						
1901						
Years of Railroad Exposure	0.0035 (0.0022)	0.0158*** (0.0060)	0.0028 (0.0025)	0.0123* (0.0063)	0.0115*** (0.0031)	0.0266*** (0.0085)
Obs	179	179	179	179	179	179
Model	OLS	IV	OLS	IV	OLS	IV
1911						
Years of Railroad Exposure	0.0031* (0.0017)	0.0039 (0.0046)	0.0014 (0.0018)	-0.0004 (0.0049)	0.0128*** (0.0030)	0.0253*** (0.0088)
	178	178	178	178	178	178
Model	OLS	IV	OLS	IV	OLS	IV

Results

□ Mediation analysis (total literacy)

- Agricultural income: insignificant
- Non-agricultural income, urbanisation and service sector employment: significant
- similar results on secondary enrollment

□ FEs: province, religion, geographics, suitability for specific crops, and city population.

TABLE 7. Mediators: Total Literacy, OLS

	(1)	(2)	(3)	(4)	(5)	(6)
	Ag Income		Land Taxes Per-Capita		Income Taxes Per-Capita	
	1901	1911	1901	1911	1901	1911
Years of Railroad Exposure	0.0030* (0.0016)	0.0037*** (0.0013)	0.0041** (0.0017)	0.0046*** (0.0014)	0.0027* (0.0016)	0.0022 (0.0014)
Ln(Ag Income)	-0.0180 (0.0473)	-0.0196 (0.0408)				
Ln(Land Taxes Per-Capita)			0.0134 (0.0443)	0.0565 (0.0403)		
Ln(Income Taxes Per-Capita)					0.1228*** (0.0386)	0.1507*** (0.0300)
% of Total Effect Mediated	-0.059	-0.032	0.016	0.031	0.308	0.459
Obs	163	157	188	188	190	187
	Share Urbanisation		Share Workers in Industry		Share Workers in Services	
	1901	1911	1901	1911	1901	1911
Years of Railroad Exposure	0.0024 (0.0017)	0.0023 (0.0015)	0.0032* (0.0017)	0.0038*** (0.0014)	0.0027* (0.0016)	0.0035** (0.0013)
Ln(Share Urbanisation)	0.0643*** (0.0112)	0.0580*** (0.0122)				
Ln(Shared Workers, Industry)			-0.0244 (0.0656)	0.0790 (0.0578)		
Ln(Shared Workers, Services)					0.2503*** (0.0751)	0.2378*** (0.0636)
% of Total Effect Mediated	0.477	0.380	0.0103	0.0182	0.159	0.0973
Obs	203	203	187	187	187	187

“Political advantage”?

□ Literacy of the region and railroad network expansion?

...best connect provincial capitals based on existing railroads and maximize the “political advantages” of a railroad network (Donaldson, 2018)...

Motivation for Network

□ Railway network

- Commercial and Military

In 1846, the revenue commissioner of Bombay, Thomas Williamson wrote to the chairman of the Great Indian Peninsular Railway Company in London stating that,

The great trunk-line, running by the Malseje Ghaut in the direction of Nagpur, would be most direct which could possibly be selected to connect Bombay to Calcutta. Commercially, it would be best for the cotton of Berar, while for the first 120 miles from Bombay we would proceed in the immediate direction of the military stations of Ahmednuggur, Jaulna and Aurangabad.¹

“Political advantage”?

- ❑ Literacy of the region and railroad network expansion?

...best connect provincial capitals based on existing railroads and maximize the “political advantages” of a railroad network (Donaldson, 2018)...

- ❑ Predictable ex ante?

- ❑ Abandoned lines?

Mechanisms

❑ Wonder if more could be done...

- Transportation costs go down...POSITIVES
 - Supply of teachers/priests/railways → more schooling?...for whom/where?
 - Income goes up; Vol of income goes down → more schooling...for whom?
 - Land price goes up → more taxes → better schools...for whom?
 - Liquidity constraints go down → more schooling...for whom?
 - Urbanization goes up → more returns to schooling...for whom?
 - Returns to schooling/skilling goes up → more schooling...what kinds of job? where?

Opportunities?

❑ Returns to Education?

- Not capital intensive; labor intensive (because cheap)
- Unskilled: Manual labor; diggers/movers; gangs of labor -- "divide and conquer"
- Children frequently employed
- "Mental" versus "Manual" work: Engine drivers/guards (at best)

Mechanisms

❑ Wonder if more could be done...

- Transportation costs go down...NEGATIVES
 - Destruction of sectors → Income of some goes down? → schooling goes down?
 - Opportunities for children to work → schooling goes down?
 - Diseases/contagion → schooling goes down?

Parallels?

□ US

- "Transportation Revolution"
 - Transportation costs went down → integration of markets and better allocation
- Concurrent expansion of education attainment
 - Parents value long run economic well-being of their children...
 - well-being depends positively on schooling
 - ...any factor that raises parental income → schooling goes up
 - Promotes inter- and intra-regional trade...rate of return of schooling goes up

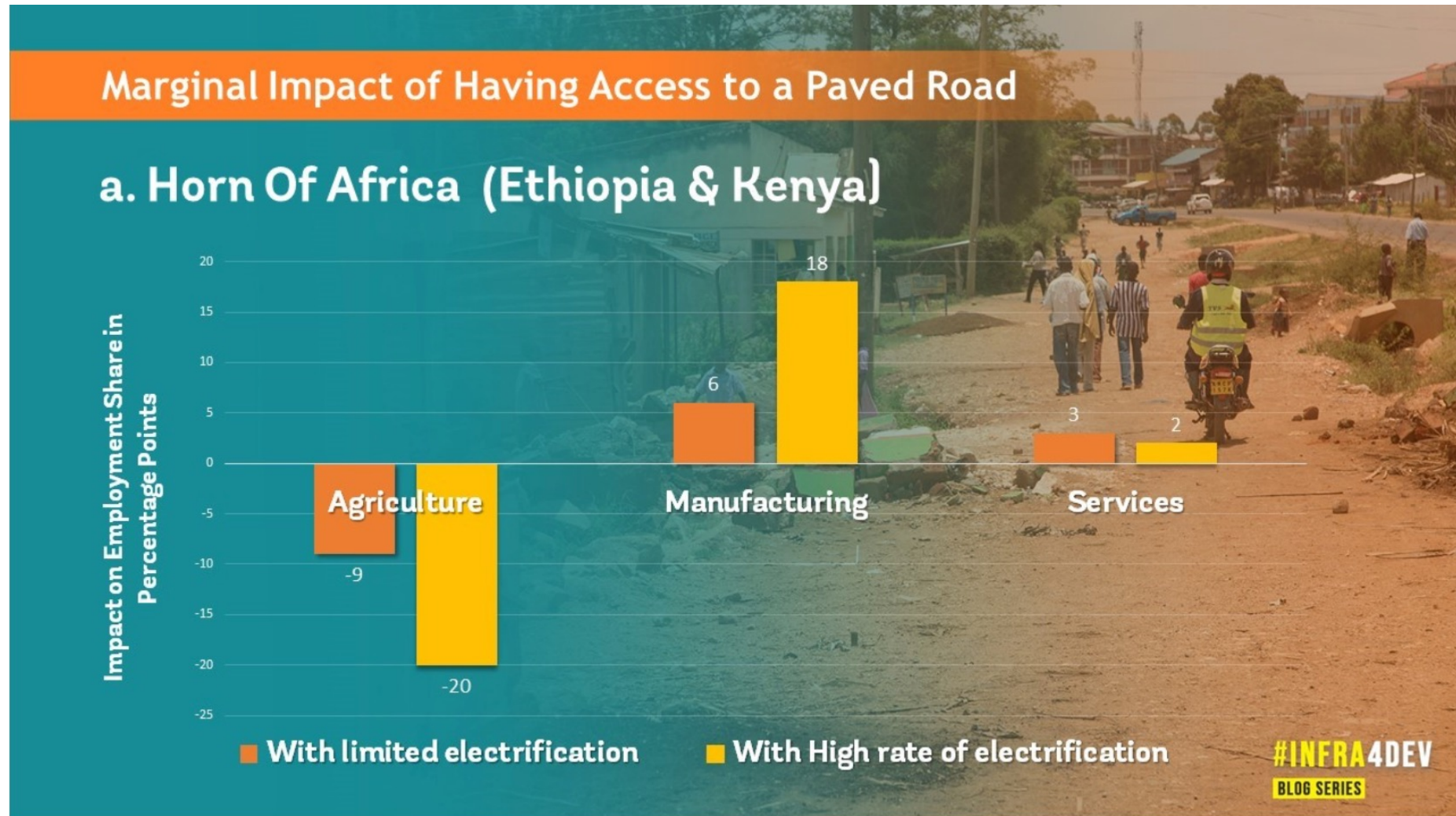
Infrastructure and Growth

□ Infrastructure

- What kinds of infrastructure is more cost effective?...railroad? roads?
 - Join the labor force and find a job?
 - Get better at what they do?
 - Move to better, more productive work?

$$Y = K^{\alpha} N^{\beta} (QL)^{1-\alpha-\beta}$$

Reskilling



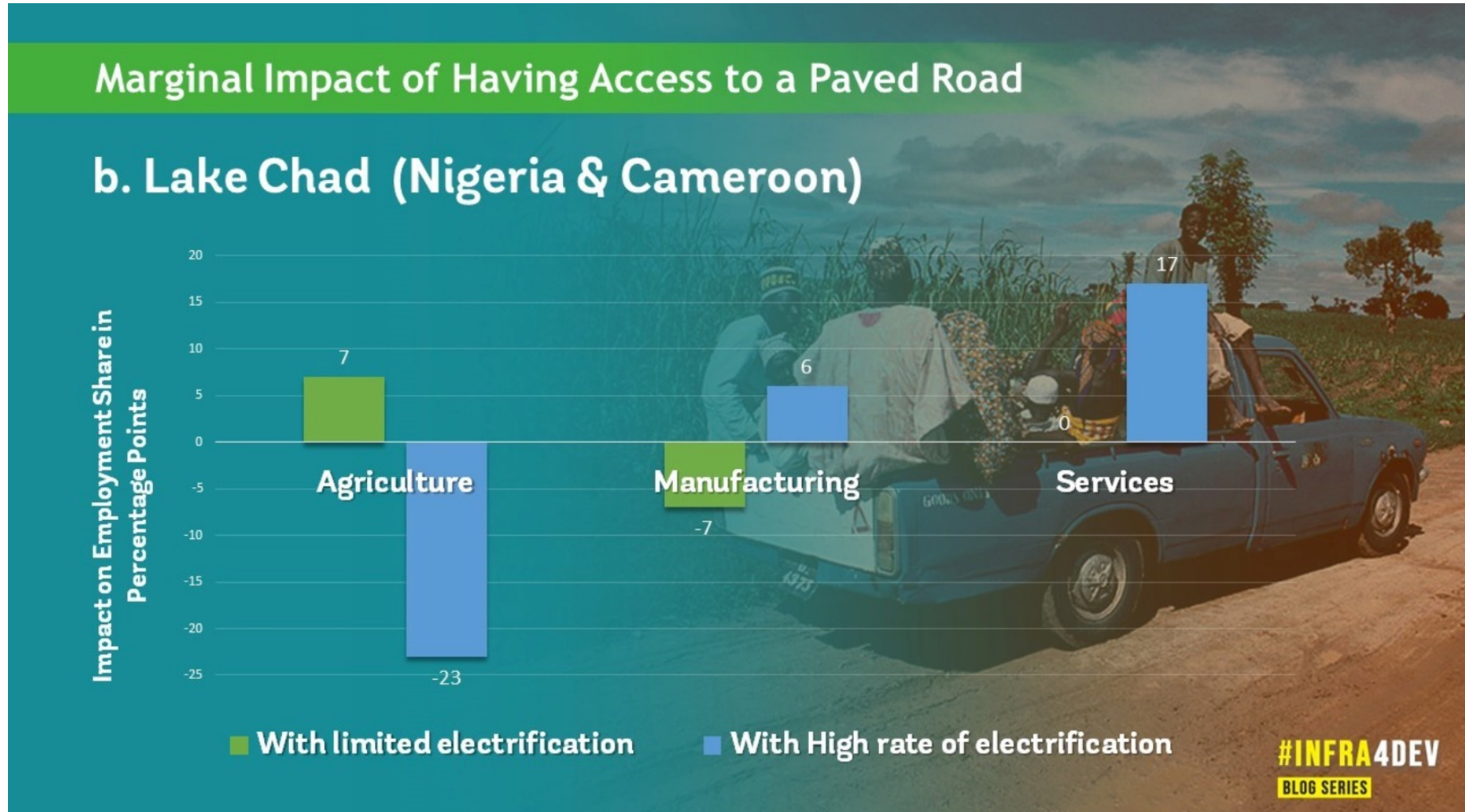
Infrastructure and Growth

□ Infrastructure

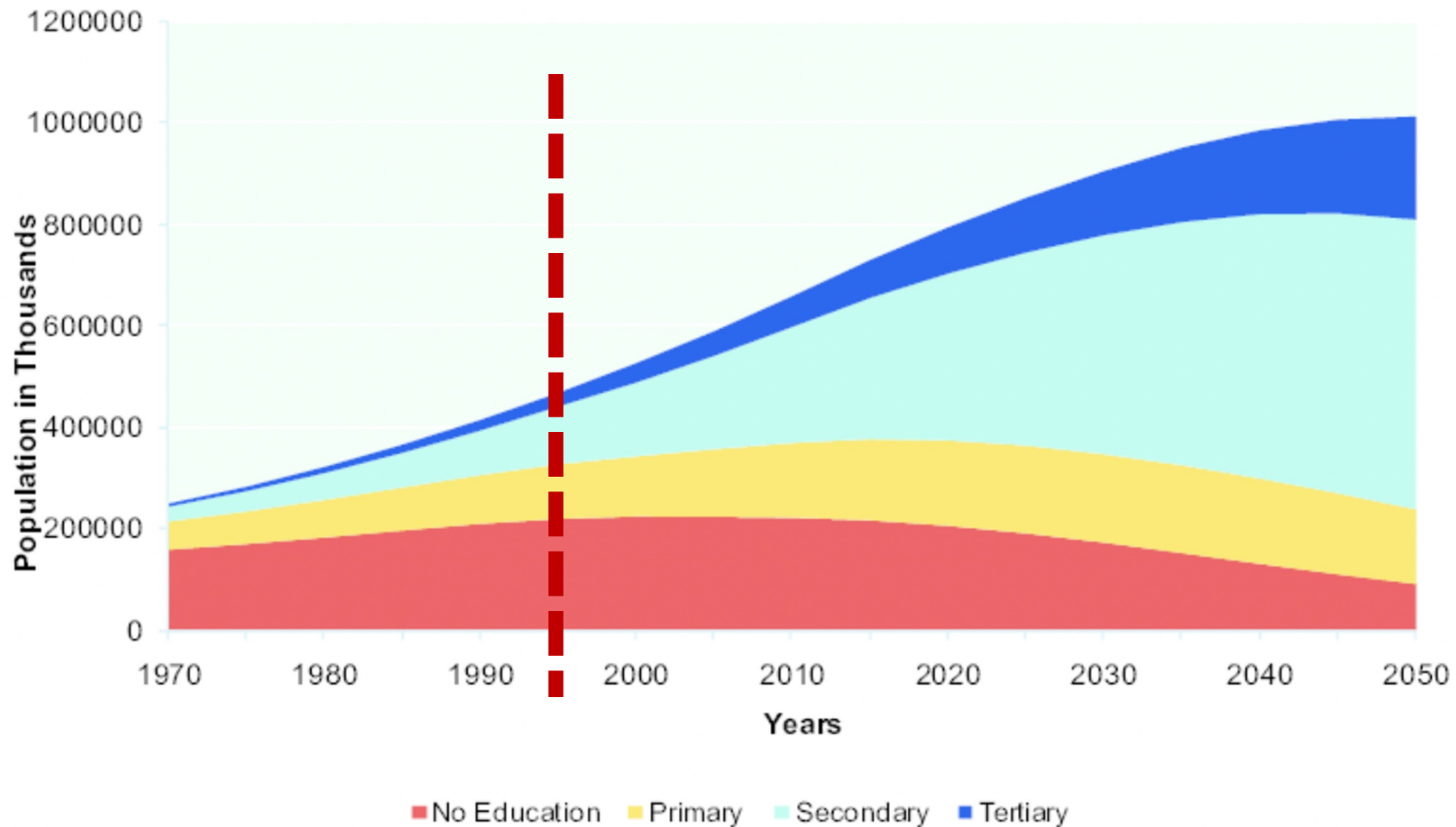
- What kinds of infrastructure is more cost effective?...railroad? Roads?
 - Join the labor force and find a job?
 - Get better at what they do?
 - Move to better, more productive work?
- When does it lead to growth?...what else is necessary?

$$Y = K^{\alpha} N^{\beta} (QL)^{1-\alpha-\beta}$$

Other moderators?



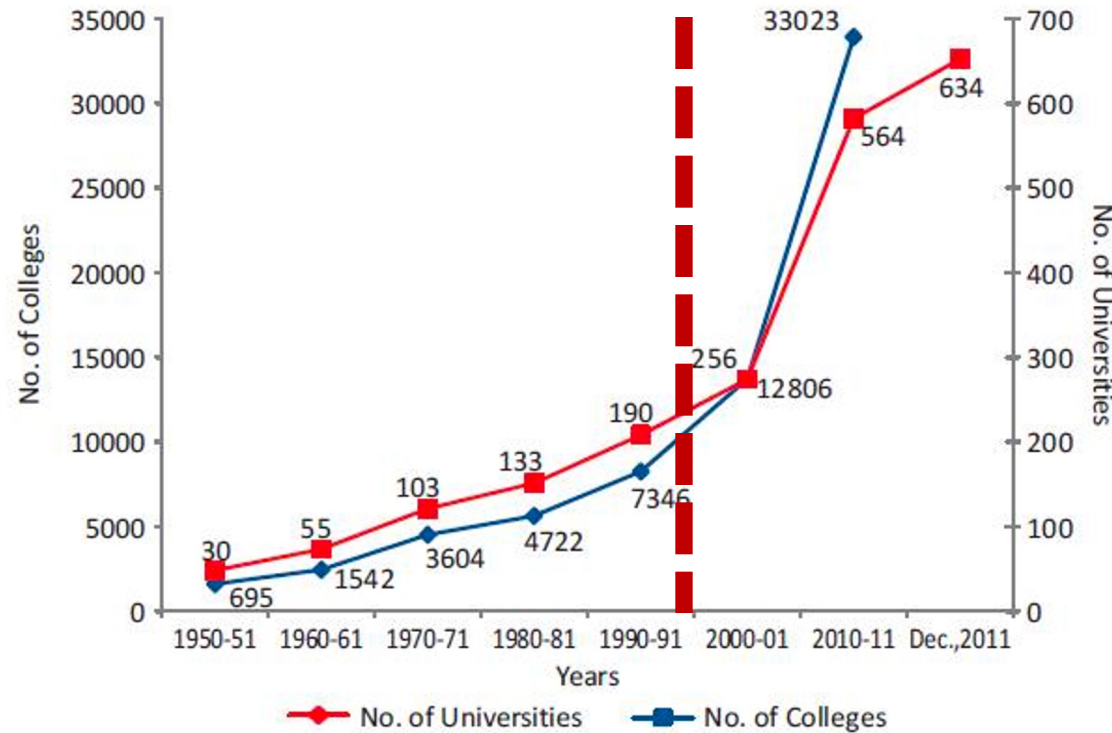
Finance and Growth...?



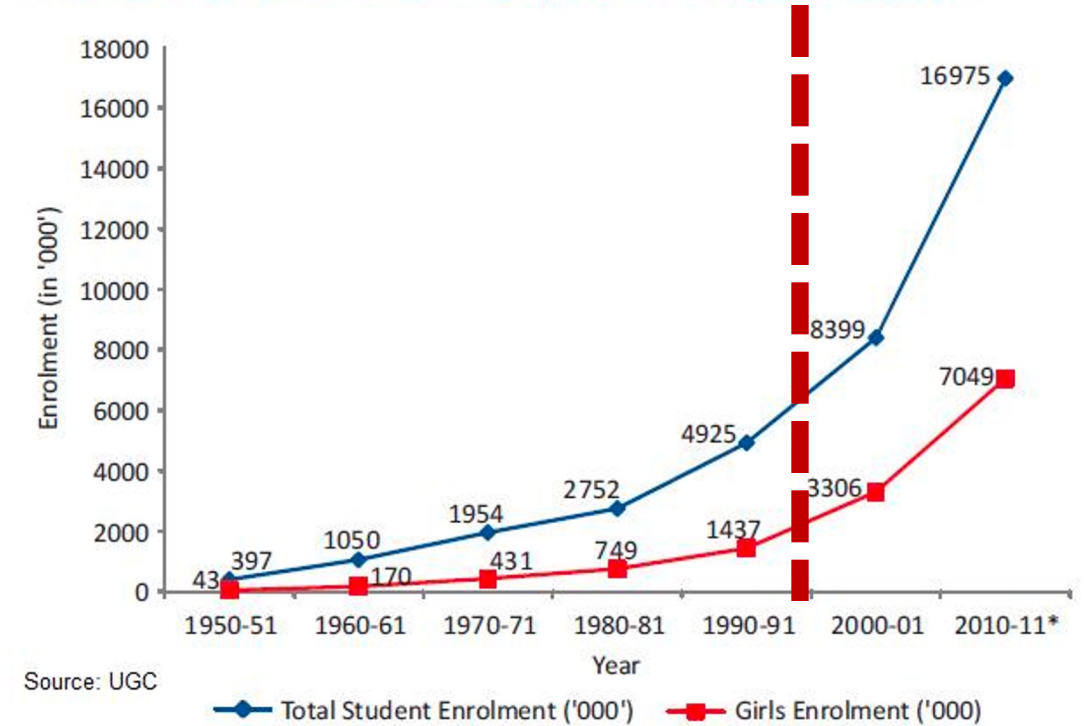
The population of India aged 20-64 by education level, 1970-2050

Finance and Growth?...

Growth of Higher Education Institutions

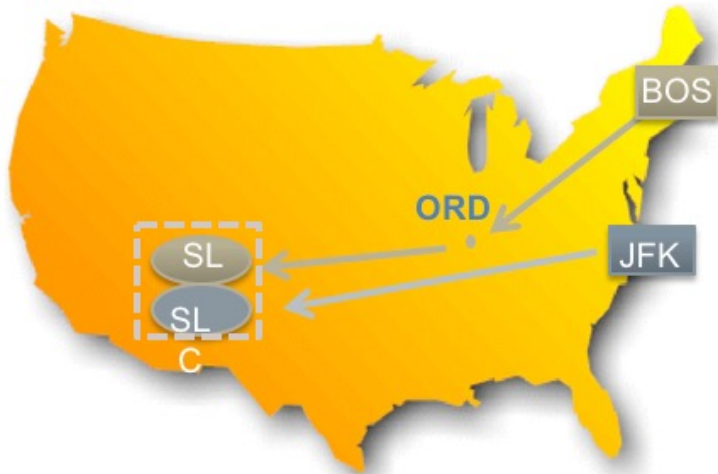


Growth of Students Enrolment ('000') in Higher Education



Proximity (to Finance) and Productivity

Before



After



Post-Investment Monitoring / Advising

In what percentage of the companies do you undertake each activity?



Infrastructure and Growth

□ Infrastructure

- What kinds of infrastructure is more cost effective?...railroad? Roads?
 - Join the labor force and find a job?
 - Get better at what they do?
 - Move to better, more productive work?
- When does it lead to growth?...what else is necessary?

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