

**Comment on  
“Did Railways Affect Literacy?  
Evidence From India”  
by Chaudhary and Fenske**

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Inaugural Conference of the Hoover Institution  
Working Group on the Foundations of Long Run  
Prosperity, June 3rd, 2022

# What do we know about transport infrastructure?

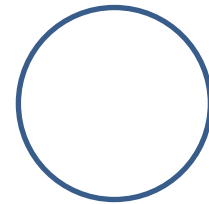
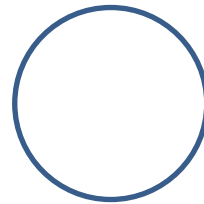
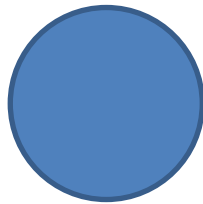
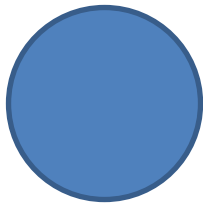
- Recent literature
  - Careful measurement of ex post effects of infrastructure investments on outcome variables
  - Some studies are general equilibrium
    - Key due to the network characteristics of transport infrastructure
    - Can estimate the total impact of infrastructure if removed
  - Careful consideration of the possible endogenous placement of infrastructure, e.g. where the development potential is highest or the political payoff is largest
  - Not designed to answer whether policies are optimal
    - No measurement of rates of return
    - Does not compare with the optimal policy

# What do we know about transport infrastructure?

- Infrastructure
  - Facilitates trade and fosters price convergence (Donaldson and Hornbeck, 2016; Donaldson, 2018; Duranton et al. 2014; Keller and Shiue, Germany; 2008)
  - Affects population distribution and urbanization (Atack et al., 2010; Baum Snow, 2007; Baum Snow et al. 2017; Bryan et al., 2014; Bird and Straub, 2014; Duranton and Turner 2012, Morten and Oliveira, 2016 )
  - Sometimes, it integrates labor markets (Asher and Novosad, 2017, Michaels, 2008)
  - May increase or decrease local income and growth (Aggarwal, 2018; Banerjee et al. 2020; Bird and Straub, 2014; Donaldson and Hornbeck, 2016; Donaldson, 2018; Ghani et al., 2015; Faber, 2014; Storeygard, 2016)
  - May increase or decrease school enrolment (Atack et al, 2012; Adukia et al., 2020; Aggarwal, 2018)
- Some studies find large effects, others find small effects, some even negative effects
- Most gains from infrastructure investments stem from the realization of gains from trade

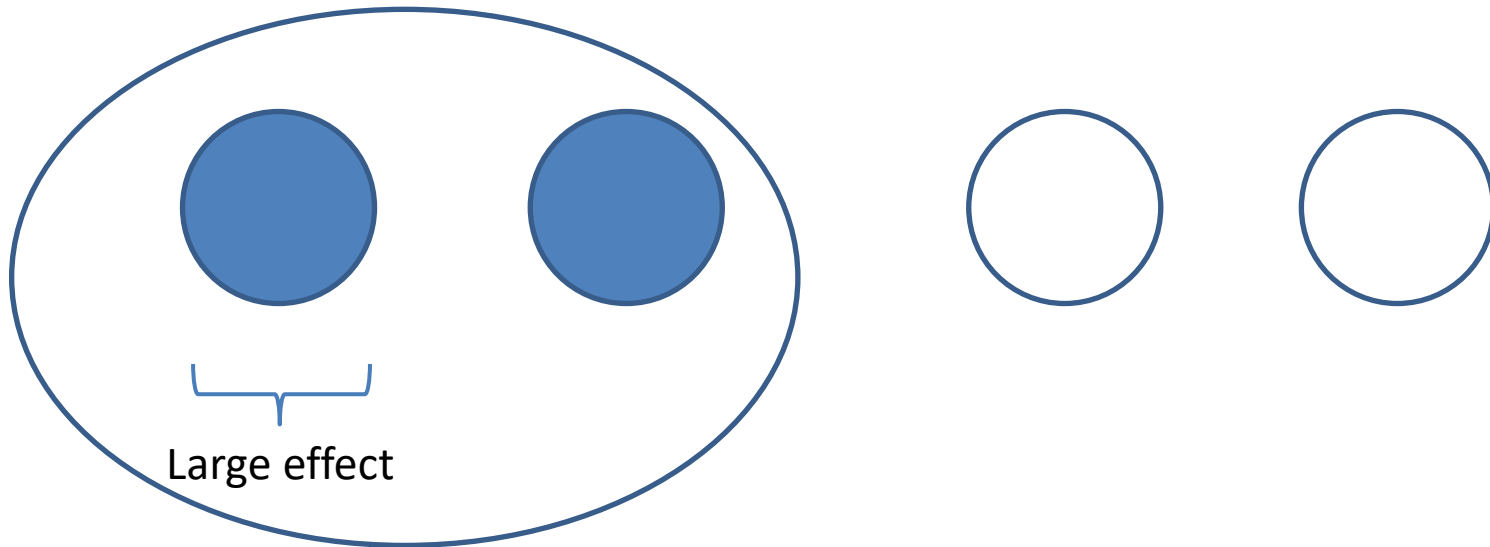
# A lesson from the literature on transport infrastructure

- The impact of infrastructure is conditional on another factor being there (“gains from trade”)
- Assume two identical economies, but for the potential to realize gains from trade



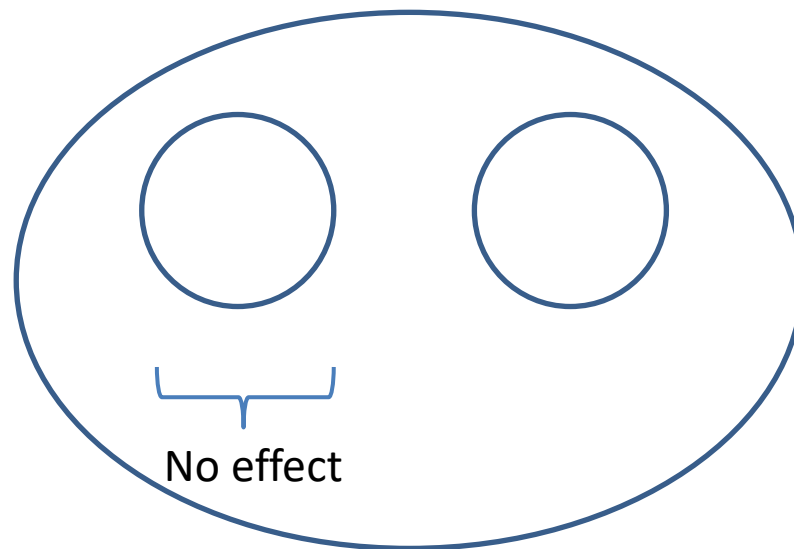
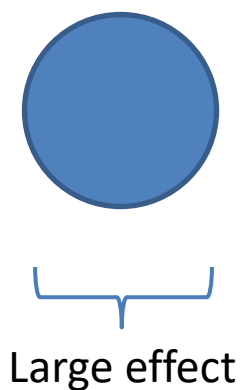
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# This paper

- India expanded its railroad network in the late 19<sup>th</sup> century and early 20<sup>th</sup> century
  - 1881: 52 percent of Indian districts
  - 1901: 87 percent of Indian districts
  - 1921: 96 percent of Indian districts
- Significant effect on trade (Donaldson, 2018)
  - Decreased trade costs and interregional price gaps
  - Increased interregional and international trade
  - Increased agricultural income levels ( $\approx$  16 percent)
- This paper: was there a demand-driven increase in education in colonial India in response to the extension of the rail network?
- It would not be surprising to find a large impact of railroads on literacy & education; trade makes literacy more valuable ...
- Large effects in nineteenth century United States: Atack et al. (2012) find that railroads explain about half of the increase in school enrollment in the 1850s, about 5 pp

# Estimation: synthetic panel

$$\ln(\text{Literacy Rate}_{cdt}) = \beta(\text{Railroad Years}_{cdt}) + \theta_d + \delta_P \cdot \eta_t + \delta_P \cdot \gamma_c + \varepsilon_{cdt}$$

- Treatment variable: how many years where railroads in the district when the youngest in the cohort was 6 or 12 (“exposure”)
- Exploits differential exposure of districts’ student cohorts to the railroad in 1910 and 1921
- Variation in railroad exposure comes from differences across cohorts within a district, and how this differs from the same cross-cohort differences in other districts



# A novel and intriguing mechanics

- The paper posits that literacy increases with the time of exposure to railroads

$$\ln(\text{Literacy Rate}) = \beta(\text{Railroad Years}) + \dots$$

- Implies that the effect of infrastructure
  - Is protracted and accumulates with the passage of time
  - Differences across districts/cohorts persist over time (key to the estimation)
- Over time, mere exposure to infrastructure generates gains in literacy
  - Gains from trade take time to realize?
  - What is the mechanics of this effect?

## Results: synthetic panel

- When significant, one additional year of exposure increases the literacy *rate* by  $\approx 2$  percent of the rate (10pp + 0.2pp; 1pp + 0.02pp)
- A standard deviation increase in railroad exposure (17 years) increases
  - Total literacy by 0.25 standard deviations (1.2 pp)
  - Male literacy by 0.31 standard deviations (1.8 pp)
  - Male English literacy by 0.25 standard deviations (0.5 pp)
- Insignificant effect on female literacy

# Estimation: cross section, IVs

$$\ln(\text{Literacy Rate}_{dt}) = \beta(\text{Railroad Years}_{dt}) + \gamma' x_{dt} + \delta_p + \varepsilon_{dt}$$

- Exposure: how many years where railroads in the district at the time of the census
- Instruments
  - Distance to military cantonments
  - Distance to the railroad lines drawn in 1852 by Major Kennedy

## Results: Cross section, IVs

- When significant, one additional year of exposure increases
  - Total and male literacy *rates* by  $\approx 1$  percent of the rate
  - The female literacy rate by  $\approx 2$  percent of the rate
  - The English literacy rate by  $\approx 3$  percent of the rate
- 1901: A standard deviation increase in railroad exposure (15 years) increases
  - English literacy (s.d. 1.11 pp), 0.54 standard deviations (0.6 pp)
  - Female literacy (s.d. 1.45 pp) 0.43 standard deviations (0.6 pp)
  - Male literacy (s.d. 5.26 pp ) 0.36 standard deviations (1.9 pp)

## A puzzle: why is the effect small?

- Trade should make literacy and numeracy valuable
- Why are gains for getting educated so small, despite of the fact that railroads had a large impact on interregional and international trade?
  - Measurement error
  - Districts are not the right unit of measurement
  - Few gains from trade to be realized by getting literate in colonial India
  - Generalized literacy was not necessary to exploit the gains from trade wrought by railroads

# Conclusions

- Indian railroads had a modest impact on literacy
- Gains from trade from getting literate in early 20th century India were small
- A puzzle: why are gains for getting educated so small, despite of the fact that trade should have made literacy more valuable?
- Infrastructure may have a cumulative effect over time ...

**Thank you**