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

Alexander Galetovic
UAI, Hoover and CRIEP

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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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Large effect
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Large effect
No effect
This paper

• India expanded its railroad network in the late 19th century and early 20th 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 (≈ 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

\[ \ln(\text{Literacy Rate}) = \beta(\text{Railroad Years}) + \ldots. \]

• 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

\[
\ln(\text{Literacy Rate}_{dt}) = \beta(\text{Railroad Years}_{dt}) + \gamma^t \chi_{dt} + \delta_p + \epsilon_{dt}
\]

• 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