

Which Firms Drive the Gains from Connectivity and Competition?

The Impact of India's Golden Quadrilateral across the Firm Life Cycle

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NBER Pre-conference on Place-Based Policies and Entrepreneurship

July 19, 2026

Place-based infrastructure: Market access vs competition

- ▶ Transport infrastructure changes both **market access** and **competition faced by firms**.
- ▶ The welfare and aggregate productivity effects depend on **which firms expand, contract, survive, or exit** which changes the (i) traditional Ricardian channel and pro-competitive changes in mark-up; (ii) improved allocative efficiency; (iii) changes in relative terms of trade.
- ▶ For place-based policy, the key question is not simply whether treated places grow relative to untreated ones, but whether it activates entrepreneurial **reallocation within** treated places.

Takeaway

The GQ is a natural setting to ask whether connectivity reallocates activity within treated locations toward young, high-capability firms or protects incumbents.

Key Contribution

Whereas much of the infrastructure/place-based policy literature estimates reallocation *across* treated and untreated locations, by studying firm-life-cycle and capabilities, this paper identifies the margins through which connectivity changes local economic performance *within* treated districts.

	Location-level	Firms in location
Treated vs. untreated locations	Baum-Snow (2007); Duranton and Turner (2012); Donaldson and Hornbeck (2016); Donaldson (2018); Faber (2014); Ghani, Grover and Kerr (2016)	Datta (2012); Gibbons et al. (2019); Görg and Mulyukova (2024)
Within treated locations	Das et al. (2024)	This paper

Place-based Policies: From places to plants

1. **Age:** Do young, mature, and old plants respond differently to improved connectivity?
2. **Complementarities:** Which district and industry conditions amplify or dampen the gains?
3. **Capabilities:** Are high-skill, capital-intensive, productive plants better able to escape competition?
4. **Time dimension:** How long does the adjustment process continue after connection to the GQ network?

Takeaway

The paper reframes connectivity as a shock to the *local* selection environment, not just to aggregate market access.

Setting: India's Golden Quadrilateral

- ▶ The GQ upgraded a 5,846 km highway network connecting Delhi, Mumbai, Chennai, and Kolkata.
- ▶ Construction began in 2001; completion progressed rapidly through the 2000s.
- ▶ Exposure is measured by district distance to the GQ network: nodal, 0–10 km, 10–50 km, and 50+ km.

Interpretation

Districts close to the GQ receive a large, plausibly exogenous improvement in physical connectivity and competitive exposure.

Main treatment focus: non-nodal districts within 0–10 km of the GQ, relative to more distant comparison districts.

Plant data

- ▶ Annual Survey of Industries, 1999–2000 to 2008–2009.
- ▶ Organized manufacturing plants across Indian districts.
- ▶ Outcomes: plant count, employment, output, plant size, labor productivity, TFPR, exit.

Age cohorts

- ▶ Young: 0–5 years.
- ▶ Mature: 6–24 years.
- ▶ Old: 25+ years.
- ▶ Plants born after GQ upgrades began are excluded in the cohort analysis.

Takeaway

The design isolates the response of pre-existing cohorts rather than conflating effects with new post-GQ entry. [▶ Data appendix](#)

Identification: long differences across distance bands

$$\Delta Y_i = \sum_{d \in D} \beta_d \cdot \text{GQ distance band}_{i,d} + \gamma X_i + Y_{i,2000} + \varepsilon_i$$

- ▶ Compare changes from 2000 to 2009 across GQ distance bands.
- ▶ Estimate separately for young, mature, and old cohorts.
- ▶ Control for baseline outcomes and district characteristics, including infrastructure, population, urbanization, demographics, literacy, and state fixed effects.

Identifying variation

District proximity to the GQ, with robustness to expanded distance bands, new segments versus upgrades, planned-but-unfinished highways, and straight-line instruments.

▶ Robustness

▶ Distance bands

Main result I: Aggregate gains are driven by young plants

Table 1: Long-differenced estimations of the impact of GQ improvements, comparing 2009 to 2000

<i>DV - Change in logged values of manufacturing trait listed in column header:</i>	Output	Employment	Plant count	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Young plants (0-5 years)							
(0.1) Nodal district	1.037 (1.011)	0.917 (0.893)	0.711 (0.643)	0.489 (0.481)	0.522 (0.498)	-0.049 (0.247)	0.284++ (0.129)
(0.1) District 0-10 km from GQ	0.701++ (0.290)	0.270 (0.233)	0.088 (0.202)	0.311+ (0.185)	0.643++ (0.272)	0.409++ (0.179)	0.239++ (0.120)
(0.1) District 10-50 km from GQ	0.062 (0.469)	-0.093 (0.324)	-0.046 (0.230)	-0.203 (0.266)	-0.040 (0.397)	0.226 (0.276)	0.121 (0.120)
B. Mature plants (6-24 years)							
(0.1) Nodal district	1.420 (0.945)	1.235+ (0.681)	0.813 (0.531)	0.467 (0.389)	0.623 (0.510)	-0.078 (0.261)	0.105 (0.113)
(0.1) District 0-10 km from GQ	0.358 (0.333)	0.218 (0.225)	0.416++ (0.176)	-0.139 (0.172)	0.027 (0.253)	0.032 (0.150)	-0.014 (0.088)
(0.1) District 10-50 km from GQ	-0.055 (0.418)	-0.108 (0.257)	-0.173 (0.214)	-0.133 (0.243)	0.070 (0.382)	0.143 (0.228)	-0.007 (0.122)
C. Old plants (25 years and above)							
(0.1) Nodal district	1.142 (0.809)	1.054 (0.787)	1.198+ (0.651)	-0.036 (0.364)	0.064 (0.359)	0.036 (0.166)	0.278++ (0.126)
(0.1) District 0-10 km from GQ	0.335 (0.273)	0.197 (0.203)	0.342++ (0.172)	-0.013 (0.161)	0.012 (0.207)	0.157 (0.144)	0.048 (0.082)
(0.1) District 10-50 km from GQ	-0.540 (0.415)	-0.553+ (0.288)	-0.239 (0.260)	-0.507++ (0.233)	-0.374 (0.314)	0.150 (0.192)	-0.032 (0.099)

Notes: Long-differenced estimations consider changes in the location and productivity of organized-sector manufacturing activity in 283 Indian districts from 2000 to 2009 from the Annual Survey of Industries (ASI). Explanatory variables are indicators for distance from the GQ network that was upgraded starting in 2001. Estimations consider the effects relative to districts more than 50 km from the GQ network. Column headers list dependent variables. Young plants are those less than four years old. Labor productivity is total output per employee in district, and TFP is weighted average of Sivadasan (2009) approach to Olley-Pakes estimations of establishment-level productivity with repeated cross-section data. Outcome variables are winsorized at their 1% and 99% levels, and entry variables are coded at the 1% level where no entry is observed to maintain a consistent sample. Estimations report standard errors, have 283 observations, control for the level of district activity in 2000, and weight observations by log total district population in 2001. Initial district conditions include variables for national highway access, state highway access, and broad-gauge railroad access and district-level measures from 2000 Census of log total population, age profile, female-male sex ratio, population share in urban areas, population share in scheduled castes or tribes, literacy rates, and an index of within-district infrastructure. Estimations include state fixed effects as well.

Table 1. Long-differenced estimations comparing 2009 to 2000.

► Full-size table

Stylized Fact 1: young plants expand; older plants "neither up nor out"

- ▶ For young plants, proximity to the GQ raises output, average plant size, labor productivity, and TFPR.
- ▶ Mature and old cohorts show insignificant or adverse effects on many economic outcomes.
- ▶ Plant count rises for mature and old cohorts, consistent with reduced exit rather than strong expansion.

Key takeaways

- ▶ **Reallocation margin:**
Connectivity induces reallocation across age cohorts within treated districts: young cohort drives aggregate performance.
- ▶ **No exit margin:**
Old plants "neither up nor out"

Identification Challenge: The Endogeneity of Road Infrastructure

Core concern: Roads are not randomly placed. Governments may build highways in areas that are already growing or in lagging regions targeted for development. Observed firm outcomes may therefore reflect pre-existing trends rather than the causal effect of infrastructure. [?]

How has the literature addressed this?

1. Historical plans as instruments

- Use planned transport networks that predate contemporary economic activity.
- Examples: Baum-Snow (2007); Michaels (2008); Donaldson and Hornbeck (2016).

2. Geographic or engineering constraints

- Exploit terrain, historical routes, or physical geography that shape road placement.
- Examples: Banerjee et al. (2012); Faber (2014); Jedwab and Moradi (2016).

3. Incidental treatment from network design

- Compare locations that happen to lie along routes connecting major cities.
- Examples: Chandra and Thompson (2000); Ghani, Grover and Kerr (2016).

Identification: Our Approach

- ▶ Follow Ghani, Grover and Kerr (2016): districts located close to the Golden Quadrilateral are compared with districts farther away.
- ▶ Use distance to the planned corridor, which was designed to connect India's four largest metropolitan centers rather than specific local firms.
- ▶ Verify robustness using:
 1. upgraded segments versus entirely new segments;
 2. the unfinished North–West/East–West corridor as a placebo;
 3. straight-line distance instruments connecting nodal cities.

Key point: Our contribution is not a new identification strategy, but rather opening the black box of the previously identified GQ effect by studying how reallocation occurs *within treated districts* across firm age cohorts and capabilities.

Tracking the Evolution of Impact Over Time

$$Y_i = \sum_{t,c} \beta_{tc} \left(GQ_{0-10km,i} \times TimeToCompletion_c \right) + \phi_i + \vartheta_t + \varepsilon_i$$

- ▶ β_{tc} is the estimated coefficient for non-nodal districts located within 10 km of the GQ network with time to completion of GQ upgrades ranging from 3 years prior to six years or more after completion.
- ▶ ϕ_i district and state fixed effects.
- ▶ ϑ_t year FE

The coefficients β_{tc} trace the evolution of outcomes before and after completion of the nearest GQ segment, allowing us to compare how young and old plant cohorts adjust over time.

Main result II: the effects accumulate slowly

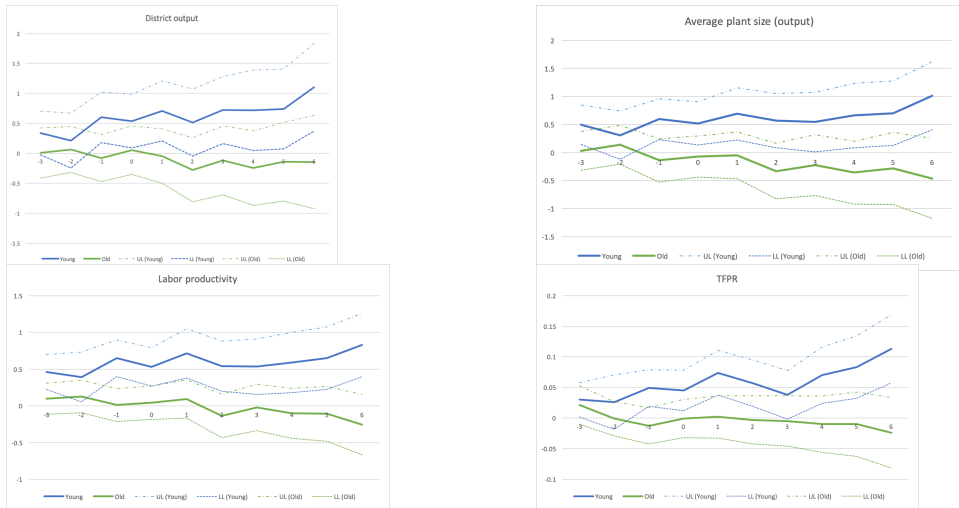


Figure 1 panels. Evolution relative to nearest GQ segment completion.

► All Figure 1 panels

► Cumulative effects

Stylized fact 2: adjustment is a long transition

- ▶ Young-plant coefficients rise over time after connection to the GQ.
- ▶ Old-plant coefficients often drift downward, especially for output and plant size.
- ▶ The divergence shows little evidence of quick convergence to a new steady state.

Short-run evaluations may understate the full reallocation effects

Infrastructure expands the opportunity set quickly, but reallocation across cohorts unfolds slowly as capabilities, market relationships, and survival margins adjust.

Local conditions: Hard infrastructure needs soft complements

Table 2: Long-differenced estimations of the impact of GQ improvements, comparing 2009 to 2000, interacted with initial conditions

DV- Logged values of	Young					Mature					Old				
	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(12)	(13)	(14)	(15)	(16)
A. Base OLS estimation that excludes nodal districts and measures effects relative to districts 10-50 km from the GQ network															
(0,1) District 0-10 km from GQ	0.701++ (0.290)	0.311+ (0.185)	0.643++ (0.272)	0.409++ (0.179)	0.239++ (0.120)	0.358 (0.333)	-0.139 (0.172)	0.027 (0.253)	0.032 (0.150)	-0.014 (0.088)	0.335 (0.273)	-0.013 (0.161)	0.012 (0.207)	0.157 (0.144)	0.048 (0.082)
B. Panel A with interaction split using median of district distance from nodal cities															
(0,1) District 0-10 km from GQ	0.781+ (0.405)	0.360 (0.262)	0.775++ (0.352)	0.543++ (0.241)	0.444++ (0.180)	0.113 (0.436)	-0.351 (0.242)	-0.107 (0.360)	0.032 (0.226)	0.044 (0.154)	0.291 (0.284)	0.063 (0.203)	0.096 (0.273)	0.235 (0.189)	-0.014 (0.117)
Above median															
(0,1) District 0-10 km from GQ	0.661++ (0.312)	0.288 (0.201)	0.582++ (0.294)	0.344+ (0.183)	0.146 (0.124)	0.473 (0.379)	-0.044 (0.187)	0.087 (0.266)	0.032 (0.155)	-0.037 (0.093)	0.354 (0.320)	-0.047 (0.185)	-0.027 (0.228)	0.123 (0.148)	0.074 (0.088)
Median value and below															
C. Panel A with interaction split using median of district access to banking services (% Households with access to Bank)															
(0,1) District 0-10 km from GQ	0.827++ (0.340)	0.436++ (0.218)	0.741++ (0.340)	0.434++ (0.216)	0.329+++ (0.118)	0.384 (0.315)	-0.018 (0.206)	0.084 (0.260)	-0.037 (0.155)	0.038 (0.097)	0.444 (0.311)	0.068 (0.181)	0.169 (0.222)	0.159 (0.151)	0.114 (0.098)
Above median															
(0,1) District 0-10 km from GQ	0.596 (0.366)	0.208 (0.230)	0.561+ (0.300)	0.387+ (0.197)	0.160 (0.163)	0.337 (0.489)	-0.243 (0.230)	-0.022 (0.349)	0.099 (0.202)	-0.066 (0.118)	0.242 (0.333)	-0.081 (0.203)	-0.121 (0.259)	0.155 (0.179)	-0.012 (0.099)
Median value and below															
D. Interaction split using median of Output market misallocation															
(0,1) District 0-10 km from GQ	0.428 (0.381)	0.007 (0.236)	0.483 (0.345)	0.581+++ (0.221)	0.264+ (0.155)	0.035 (0.480)	-0.373 (0.227)	-0.287 (0.339)	-0.025 (0.208)	-0.110 (0.118)	0.345 (0.325)	-0.204 (0.208)	0.025 (0.256)	0.358++ (0.160)	0.089 (0.098)
Above median															
(0,1) District 0-10 km from GQ	0.905+++ (0.330)	0.542++ (0.209)	0.767+++ (0.295)	0.288 (0.187)	0.221+ (0.131)	0.613+ (0.335)	0.045 (0.187)	0.276 (0.255)	0.075 (0.148)	0.059 (0.092)	0.326 (0.313)	0.139 (0.177)	0.001 (0.226)	-0.000 (0.158)	0.016 (0.095)
Median value and below															
E. Interaction split using median of Input market misallocation															
(0,1) District 0-10 km from GQ	0.522 (0.359)	0.114 (0.211)	0.482 (0.319)	0.480++ (0.212)	0.257++ (0.130)	0.313 (0.424)	-0.118 (0.207)	-0.005 (0.309)	0.016 (0.184)	-0.023 (0.103)	0.450 (0.299)	-0.175 (0.178)	0.05 (0.227)	0.332++ (0.152)	0.123 (0.091)
Above median															
(0,1) District 0-10 km from GQ	0.914++ (0.354)	0.567++ (0.240)	0.852+++ (0.318)	0.322 (0.197)	0.216 (0.156)	0.416 (0.371)	-0.168 (0.210)	0.068 (0.277)	0.053 (0.161)	-0.003 (0.107)	0.182 (0.344)	0.205 (0.210)	-0.04 (0.258)	-0.083 (0.163)	-0.053 (0.103)
Median value and below															

Notes: See Table 1. Long-differenced estimations consider changes in the location and productivity of organized-sector manufacturing activity in 106 non-nodal districts located within 0-50 km of GQ for the time period starting from 2000 to 2009 from the Annual Survey of Industries (ASI). Panel (a) repeats the base estimation for this group. In panels (B)-(E), the base effect is interacted with indicator variables for above or below median values for indicated district traits. Estimation controls for unreported main effects of district traits. District level access to infrastructure, literacy, access to banking, population density is extracted from 2001 census, while distance from nodal cities to district is computed from district edge using India's district level GIS maps. Lastly, initial TFP is plant-level TFP for the year 2000.01 computed following LP-Sivasadan methodology on ASI data. misallocation matrices are computed using the methodology proposed in Duranton et al. (2015a).

Table 2. Long-differenced GQ effects interacted with initial district conditions.

► Full-size table

Stylized fact 3: young plants need enabling environment

Young plants respond more where:

- ▶ markets are dense;
- ▶ finance is more available;
- ▶ output and input markets are less distorted.

Older plants differ:

- ▶ generally less sensitive to complementary conditions as have established ways of resolving missing markets;
- ▶ may perform better in more distorted areas that allows them to defend their market shares while accessing cheaper inputs, consistent with incumbency advantages.

Takeaway

Building roads is not sufficient. For entrepreneurial growth, connectivity must be paired with finance and conducive business environment.

Sectoral attributes shape who can use connectivity

Table 3: Long-differenced estimations of the impact of GQ improvements, comparing 2009 to 2000, by industry traits

DV- Logged values of	Young					Mature					Old				
	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(12)	(13)	(14)	(15)	(16)
A. Base OLS estimation that excludes nodal districts and measures effects relative to districts 10-50 km from the GQ network															
(0,1) District 0-10 km from GQ	0.701++ (0.290)	0.311+ (0.185)	0.643++ (0.272)	0.409++ (0.179)	0.239++ (0.120)	0.358 (0.333)	-0.139 (0.172)	0.027 (0.253)	0.032 (0.150)	-0.014 (0.088)	0.335 (0.273)	-0.013 (0.161)	0.012 (0.207)	0.157 (0.144)	0.048 (0.082)
B. Panel A split regressions using median of industry GVC intensity															
(0,1) District 0-10 km from GQ	0.950++ (0.388)	0.540++ (0.264)	0.539+ (0.320)	0.103 (0.134)	0.124 (0.119)	0.662+ (0.372)	0.280 (0.220)	0.026 (0.245)	-0.131 (0.140)	0.022 (0.084)	0.585 (0.363)	0.408+ (0.226)	0.134 (0.260)	-0.141 (0.158)	-0.005 (0.111)
Above median industry															
(0,1) District 0-10 km from GQ	0.129 (0.342)	0.182 (0.211)	0.368 (0.319)	0.286 (0.224)	0.155 (0.151)	0.111 (0.301)	-0.219 (0.185)	0.087 (0.276)	0.154 (0.171)	0.026 (0.125)	-0.159 (0.295)	-0.388++ (0.182)	-0.191 (0.246)	0.154 (0.172)	-0.025 (0.102)
Median value and below															
C. Panel A split regressions using median of industry external finance dependence															
(0,1) District 0-10 km from GQ	1.117++ (0.440)	0.668+++ (0.251)	0.745++ (0.348)	0.022 (0.147)	0.076 (0.140)	0.496 (0.381)	0.149 (0.249)	-0.127 (0.278)	-0.110 (0.161)	-0.038 (0.106)	0.529 (0.384)	0.327 (0.239)	0.186 (0.287)	-0.003 (0.147)	0.067 (0.105)
Above median industry															
(0,1) District 0-10 km from GQ	0.335 (0.338)	0.283 (0.210)	0.424 (0.286)	0.242 (0.215)	0.064 (0.134)	0.396 (0.326)	-0.033 (0.194)	0.199 (0.263)	0.142 (0.147)	-0.008 (0.105)	0.032 (0.318)	-0.136 (0.199)	-0.098 (0.249)	-0.013 (0.177)	-0.017 (0.096)
Median value and below															
D. Panel A split regressions using median of industry contractual intensity															
(0,1) District 0-10 km from GQ	0.452 (0.742)	0.279 (0.381)	0.475 (0.508)	0.193 (0.328)	0.114 (0.163)	0.671 (0.627)	0.149 (0.393)	0.425 (0.500)	0.022 (0.188)	0.034 (0.137)	0.419 (0.658)	0.207 (0.399)	0.317 (0.453)	0.089 (0.208)	-0.182 (0.190)
Above median															
(0,1) District 0-10 km from GQ	0.708++ (0.317)	0.383+ (0.196)	0.744++ (0.300)	0.433++ (0.194)	0.315++ (0.128)	0.329 (0.327)	-0.155 (0.185)	0.040 (0.263)	0.035 (0.166)	-0.026 (0.099)	0.299 (0.262)	-0.003 (0.165)	0.002 (0.212)	0.164 (0.149)	0.062 (0.086)
Median value and below															
E. Panel A split regressions using median of industry relationship stickiness															
(0,1) District 0-10 km from GQ	0.543 (0.353)	0.161 (0.198)	0.453 (0.306)	0.425++ (0.208)	0.287++ (0.120)	0.367 (0.333)	-0.167 (0.182)	0.101 (0.267)	0.180 (0.161)	-0.007 (0.102)	0.166 (0.293)	-0.253 (0.163)	0.008 (0.216)	0.237 (0.150)	-0.019 (0.087)
Above median															
(0,1) District 0-10 km from GQ	1.015++ (0.469)	0.866+++ (0.325)	1.077+++ (0.395)	0.100 (0.205)	0.165 (0.145)	0.931++ (0.427)	0.423 (0.304)	0.385 (0.368)	-0.044 (0.146)	0.028 (0.098)	1.198++ (0.571)	0.578++ (0.291)	0.517 (0.414)	0.105 (0.146)	0.097 (0.104)
Median value and below															

Table 3. GQ effects by industry characteristics.

[Full-size table](#)

Stylized fact 4: young plants in tradable activities gain from connectivity

- ▶ Young plants respond more in GVC-intensive industries.
- ▶ They also respond more in industries with greater external-finance dependence.
- ▶ Their gains are stronger in sectors less reliant on relationship-specific contracting and sticky buyer-supplier relationships.

The GQ appears to enable a form of **domestic offshoring**: young plants expand into value-chain activities where physical connectivity substitutes for proximity, but cannot substitute for weak contracting institutions.

True Plant Panel Estimation

The geo-coded plant panel allows us to distinguish within-plant adjustment from changes arising through entry, exit, and reallocation across plant cohorts.

$$Y_{p,d,t} = \sum_{d \in D} \beta_d GQDistanceBand_{i,d} \times GQSegmentCompleted_{d,t} + \Gamma_p + \Omega_t + \varepsilon_{p,d,t}$$

- ▶ $Y_{p,d,t}$ is the outcome measure for plant p in district d in year t .
- ▶ Γ_p captures the vector of time-invariant plant-specific traits.
- ▶ Ω_t captures year-specific factors and secular trends.
- ▶ The estimate of β_1 is the focal parameter.
- ▶ It captures the plant-level difference-in-differences effect of the nearest GQ highway segment opening among plants located in non-nodal districts within 10 km of the GQ network, relative to plants more than 50 km away.

True Plant panel: separating survival and within-plant adjustment

Table 4: Plant-level effects of GQ access: estimation of plant exit/closure and performance outcomes

<i>DV - Logged values of</i>	Sample scheme				
	Exit[0/1]	Output	Avg. plant size (emp.)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)
A. All					
(0,1) District 0-10 km from GQ	-0.114++ (0.054)	0.123+++ (0.040)	0.016 (0.021)	0.113++ (0.045)	0.015 (0.020)
N	18321	10213	10211	10172	9853
R ²	0.022	0.947	0.926	0.912	0.907
B. Young					
(0,1) District 0-10 km from GQ	-0.140++ (0.057)	0.145++ (0.063)	0.071 (0.046)	0.050 (0.061)	0.013 (0.033)
N	6255	3486	3486	3479	3373
R ²	0.026	0.944	0.905	0.910	0.912
C. Mature					
(0,1) District 0-10 km from GQ	-0.100+ (0.056)	0.111+ (0.058)	-0.014 (0.025)	0.145++ (0.057)	0.017 (0.029)
N	9459	5245	5243	5222	5051
R ²	0.019	0.950	0.936	0.911	0.909
D. Old					
(0,1) District 0-10 km from GQ	-0.106++ (0.050)	0.114+ (0.061)	-0.019 (0.044)	0.164+++ (0.064)	0.015 (0.052)
N	2607	1482	1482	1471	1429
R ²	0.024	0.939	0.937	0.915	0.878

Note: The table limits the sample to plants from the sample scheme observed in the data in the five before and after the nearest GQ segment being completed. "Exit" is an indicator variable measured as the failure to observe the same plant in the post-GQ period. Table reports OLS coefficient estimates of the effect on plant outcomes due to proximity to the GQ segment. All specifications include an unreported constant term, regressors for completion interacted with an indicator for nodal district and district 10 - 50 km from the nearest GQ segment, and plant and year fixed effects. Sample is restricted to comprise the same set of districts available in the repeated cross-section analysis above. Standard errors are clustered by district. Significance levels are indicated by < .1, ++ < .05, +++ < .01.

Table 4. Plant-level DD estimates of exit and performance.

► Full-size table

Stylized fact 5: survival rises, especially among younger plants

- ▶ In the plant panel, exit falls with GQ proximity across age groups.
- ▶ The decline is largest for young plants in the sample-scheme panel, implying higher survival of young SMEs, but also old SMEs.
- ▶ This helps reconcile rising plant counts with weak or negative economic outcomes among older cohorts.

Takeaway

Connectivity can reduce exit before it induces full productive reallocation; survival and growth are distinct margin.

Capabilities: who escapes competition?

Table 5: Plant heterogeneity and the impact of market access: Sample Scheme

DV - Logged values of	Young					Mature					Old				
	Exit[0/1]	Output	plant size (emp.)	Labor productivity	TFPR	Exit[0/1]	Output	plant size (emp.)	Labor productivity	TFPR	Exit[0/1]	Output	plant size (emp.)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
A. Sample scheme interactions with initial skill intensity															
(0,1) District 0-10 km from GQ	-0.138++	0.098++	0.074++	-0.012	0.024	-0.107+	0.004	0.034	-0.076++	0.016	-0.104+	0.017	0.098+	-0.05	0.002
*above median	(0.066)	(0.043)	(0.031)	(0.043)	(0.022)	(0.061)	(0.037)	(0.022)	(0.037)	(0.017)	(0.054)	(0.043)	(0.056)	(0.041)	(0.027)
(0,1) District 0-10 km from GQ	-0.139+++	-0.045	-0.06	0.041	-0.017	-0.095+	0.011	-0.044++	0.096++	-0.005	-0.110++	-0.118++	-0.066+	-0.001	-0.019
*below median	(0.053)	(0.042)	(0.039)	(0.035)	(0.022)	(0.054)	(0.039)	(0.021)	(0.037)	(0.016)	(0.053)	(0.053)	(0.040)	(0.045)	(0.036)
B. Sample scheme interactions with initial capital intensity															
(0,1) District 0-10 km from GQ	-0.170+++	0.132+++	0.036	0.103+++	0.059+++	-0.100+	0.081++	0.038+	0.025	1.055+++	-0.098+	-0.007	0.05	-0.024	0.024
*above median	(0.063)	(0.035)	(0.027)	(0.036)	(0.022)	(0.055)	(0.034)	(0.020)	(0.033)	(0.018)	(0.056)	(0.051)	(0.056)	(0.044)	(0.041)
(0,1) District 0-10 km from GQ	-0.112++	-0.091++	-0.04	-0.064	-0.061+++	-0.101+	-0.069+	-0.041+	-0.02	0.044+++	-0.110++	-0.085+	-0.017	-0.013	-0.038
*below median	(0.056)	(0.041)	(0.030)	(0.041)	(0.021)	(0.059)	(0.037)	(0.021)	(0.033)	(0.016)	(0.051)	(0.045)	(0.028)	(0.038)	(0.033)
C. Sample scheme interactions with initial TFPR															
(0,1) District 0-10 km from GQ	-0.148++	0.027	0.044	-0.013	-0.012	-0.092	0.005	0.02	-0.029	-0.016	-0.099++	-0.023	0.066	-0.006	-0.053
*above median	(0.058)	(0.040)	(0.035)	(0.037)	(0.025)	(0.059)	(0.030)	(0.019)	(0.032)	(0.018)	(0.049)	(0.036)	(0.055)	(0.045)	(0.036)
(0,1) District 0-10 km from GQ	-0.147++	0.028	-0.044	0.065	0.019	-0.114++	0.015	-0.017	0.034	0.03	-0.110++	-0.087	-0.033	-0.045	0.051
*below median	(0.061)	(0.041)	(0.032)	(0.043)	(0.021)	(0.055)	(0.043)	(0.019)	(0.036)	(0.020)	(0.055)	(0.062)	(0.038)	(0.048)	(0.036)
D. Sample scheme interactions with initial labor productivity															
(0,1) District 0-10 km from GQ	-0.126++	0.028	0.092+++	-0.087+	-0.03	-0.104+	-0.018	0.039+	-0.097+++	-0.011	-0.093+	-0.032	0.062	-0.039	0.008
*above median	(0.061)	(0.048)	(0.032)	(0.047)	(0.025)	(0.060)	(0.038)	(0.021)	(0.033)	(0.015)	(0.049)	(0.050)	(0.054)	(0.050)	(0.025)
(0,1) District 0-10 km from GQ	-0.152+++	0.029	-0.069++	0.108+++	0.038+	-0.096+	0.039	-0.047++	0.120+++	0.026	-0.110+	-0.043	-0.034	0.003	-0.017
*below median	(0.057)	(0.040)	(0.035)	(0.038)	(0.023)	(0.053)	(0.037)	(0.021)	(0.033)	(0.018)	(0.058)	(0.051)	(0.035)	(0.047)	(0.045)

Notes: See Table 4. Estimations in the base effect presented in Table 4 is interacted with indicator variables for above or below median values for indicated plant traits.

Table 5. Plant-level heterogeneity by initial capabilities.

► Full-size table

Stylized fact 6: capabilities determine the sign of the response

Young plants

- ▶ High-skill and high-capital-intensity plants expand.
- ▶ Low-capability young plants do not show comparable gains.

Old plants

- ▶ High-capability old plants are better able to defend size and do not contract.
- ▶ Low-capability old plants drive contractionary tendencies.

The evidence is consistent with an “escape competition” channel: frontier or high-capability plants exploit new market access, while weaker incumbents are exposed.

Conclusions

1. **Targeting places has plant-level effects:** The composition of economic activity changes through entry, reallocation and exit margin across plants.
2. **Reallocation margin:** it rewards **young, capable** plants more than the average incumbent.
3. **Only in places that have complementary business environment** finance, market density, and lower distortions are necessary for young plants to exploit connectivity.
4. **Time horizon matters:** reallocation unfolds over a long transition, so early evaluations may miss key effects.

Takeaway

Place-based infrastructure is best viewed as part of an entrepreneurial ecosystem policy, not a stand-alone industrial stimulus.

Backup A.1: Data summary

Table A.1: Descriptive statistics

DV - Change in logged values of manufacturing trait listed in column header:	Count of districts	A. Total levels of activity in 2000, combining districts within spatial range						B. Total Levels of activity in 2009 combining districts within spatial range					
		Output (MM Rs.)	Employment	Plant count	Avg. plant size (output, MM Rs.)	Avg. plant size (emp.)	Labor productivity	Output (MM Rs.)	Employment	Plant count	Avg. plant size (output, MM Rs.)	Avg. plant size (emp.)	Labor productivity
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(9)	(10)	(11)	(12)	(13)
Young cohort of plants (0-5 years)													
Total	311												
Nodal district for GQ	9	1.07E+10	1.17E+05	1,927	5.57E+06	61	92,001	2.14E+10	1.79E+05	2,123	1.01E+07	84	119,487
District 0-10 km from GQ	69	3.05E+10	3.37E+05	6,310	4.83E+06	53	90,377	6.55E+10	5.57E+05	6,361	1.03E+07	88	117,487
District 10-50 km from GQ	37	1.27E+10	8.44E+04	1,871	6.79E+06	45	150,498	2.10E+10	1.12E+05	1,710	1.23E+07	66	186,666
District over 50 km from GQ	196	3.73E+10	4.09E+05	9,610	3.88E+06	43	91,247	6.81E+10	6.19E+05	9,453	7.20E+06	65	109,954
Nodal district for NS-EW	9	7.48E+09	1.01E+05	1,661	4.51E+06	61	74,030	2.42E+10	2.41E+05	1,899	1.27E+07	127	100,088
District 0-10 km from NS-EW	75	1.40E+10	1.64E+05	3,918	3.57E+06	42	85,370	3.87E+10	3.50E+05	5,321	7.27E+06	66	110,355
District 10-50 km from NS-EW	54	1.23E+10	1.47E+05	2,901	4.24E+06	51	83,531	1.73E+10	1.50E+05	2,465	7.02E+06	61	115,356
District over 50 km from NS-EW	173	5.75E+10	5.35E+05	11,238	5.11E+06	48	107,391	9.57E+10	7.26E+05	9,962	9.61E+06	73	131,929
Mature cohort of plants (6-24 years)													
Total	311												
Nodal district for GQ	9	2.49E+10	2.68E+05	5,578	4.46E+06	48	92,788	2.14E+10	1.79E+05	2,123	1.01E+07	84	119,487
District 0-10 km from GQ	69	7.71E+10	1.04E+06	14,890	5.18E+06	70	74,054	6.55E+10	5.57E+05	6,361	1.03E+07	88	117,487
District 10-50 km from GQ	37	2.00E+10	1.98E+05	3,651	5.49E+06	54	100,979	2.10E+10	1.12E+05	1,710	1.23E+07	66	186,666
District over 50 km from GQ	196	9.95E+10	1.23E+06	21,615	4.60E+06	57	80,868	6.81E+10	6.19E+05	9,453	7.20E+06	65	109,954
Nodal district for NS-EW	9	1.94E+10	2.48E+05	4,207	4.62E+06	59	78,241	3.49E+10	4.31E+05	3,126	1.12E+07	138	80,810
District 0-10 km from NS-EW	75	4.19E+10	4.98E+05	9,756	4.29E+06	51	84,033	7.62E+10	7.11E+05	8,594	8.86E+06	83	107,052
District 10-50 km from NS-EW	54	3.08E+10	4.25E+05	6,817	4.52E+06	62	72,373	3.38E+10	3.18E+05	3,647	9.26E+06	87	106,129
District over 50 km from NS-EW	173	1.29E+11	1.57E+06	24,954	5.19E+06	63	82,646	1.62E+11	1.30E+06	17,048	9.50E+06	76	124,898
Old cohort of plants (25 and above years)													
Total	311												
Nodal district for GQ	9	2.67E+10	2.61E+05	3,021	8.84E+06	86	102,339	6.83E+10	5.31E+05	6,377	1.07E+07	83	128,736
District 0-10 km from GQ	69	5.00E+10	9.33E+05	4,991	1.00E+07	187	53,603	1.72E+11	1.47E+06	15,854	1.08E+07	93	116,618
District 10-50 km from GQ	37	6.70E+09	1.03E+05	1,053	6.36E+06	98	65,195	2.91E+10	2.07E+05	3,023	9.64E+06	68	141,052
District over 50 km from GQ	196	5.86E+10	8.97E+05	8,193	7.16E+06	110	65,348	1.99E+11	1.92E+06	22,682	8.77E+06	85	103,553
Nodal district for NS-EW	9	1.10E+10	1.28E+05	1,608	6.82E+06	79	85,940	4.97E+10	4.99E+05	4,916	1.01E+07	102	99,479
District 0-10 km from NS-EW	75	2.44E+10	3.41E+05	3,670	6.66E+06	93	71,637	8.83E+10	9.98E+05	11,447	7.72E+06	87	88,501
District 10-50 km from NS-EW	54	1.83E+10	3.02E+05	2,617	7.01E+06	115	60,753	3.99E+10	3.69E+05	5,581	7.16E+06	66	108,181
District over 50 km from NS-EW	173	8.83E+10	1.42E+06	9,363	9.43E+06	152	62,041	2.90E+11	2.26E+06	25,992	1.12E+07	87	128,166

Notes: Descriptive statistics calculated from Annual Survey of Industries. Districts are local administrative units that generally form the tier of local government immediately below that of India's subnational states and territories. These are the smallest entities for which data is available for the organized sector. Nodal districts include Delhi, Mumbai, Kolkata, and Chennai and their contiguous suburbs (Gurgaon, Faridabad, Ghaziabad, and Noida for Delhi; Thane for Mumbai). The indicator variable for District 0-10 km from GQ takes a unit value for non-nodal districts that have minimum straight-line distance from the GQ network of less than 10 km; other distance-related indicator variables are defined analogously. For the NS-EW network, we define Delhi, Chandigarh, Noida, Gurgaon, Faridabad, Ghaziabad, Hyderabad, and Bangalore to be the nodal districts. Labor productivity is total output per employee.

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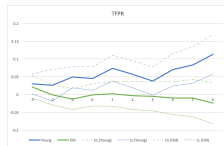
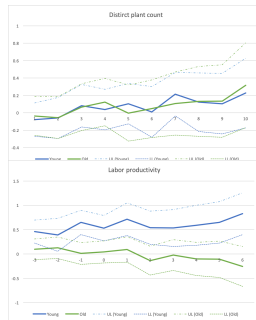
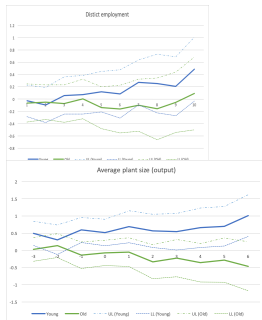
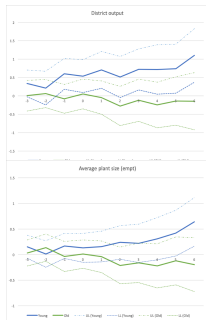
Backup A.2: Aggregate gains are driven by young plants

Table 1: Long-differenced estimations of the impact of GQ improvements, comparing 2009 to 2000

<i>DV - Change in logged values of manufacturing trait listed in column header:</i>	Output	Employment	Plant count	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Young plants (0-5 years)							
(0,1) Nodal district	1.037 (1.011)	0.917 (0.893)	0.711 (0.643)	0.489 (0.481)	0.522 (0.498)	-0.049 (0.247)	0.284++ (0.129)
(0,1) District 0-10 km from GQ	0.701++ (0.290)	0.270 (0.233)	0.088 (0.202)	0.311+ (0.185)	0.643++ (0.272)	0.409++ (0.179)	0.239++ (0.120)
(0,1) District 10-50 km from GQ	0.062 (0.469)	-0.093 (0.324)	-0.046 (0.230)	-0.203 (0.266)	-0.040 (0.397)	0.226 (0.276)	0.121 (0.120)
B. Mature plants (6-24 years)							
(0,1) Nodal district	1.420 (0.945)	1.235+ (0.681)	0.813 (0.531)	0.467 (0.389)	0.623 (0.510)	-0.078 (0.261)	0.105 (0.113)
(0,1) District 0-10 km from GQ	0.358 (0.333)	0.218 (0.225)	0.416++ (0.176)	-0.139 (0.172)	0.027 (0.253)	0.032 (0.150)	-0.014 (0.088)
(0,1) District 10-50 km from GQ	-0.055 (0.418)	-0.108 (0.257)	-0.173 (0.214)	-0.133 (0.243)	0.070 (0.382)	0.143 (0.228)	-0.007 (0.122)
C. Old plants (25 years and above)							
(0,1) Nodal district	1.142 (0.809)	1.054 (0.787)	1.198+ (0.651)	-0.036 (0.364)	0.064 (0.359)	0.036 (0.166)	0.278++ (0.126)
(0,1) District 0-10 km from GQ	0.335 (0.273)	0.197 (0.203)	0.342++ (0.172)	-0.013 (0.161)	0.012 (0.207)	0.157 (0.144)	0.048 (0.082)
(0,1) District 10-50 km from GQ	-0.540 (0.415)	-0.553+ (0.288)	-0.239 (0.260)	-0.507++ (0.233)	-0.374 (0.314)	0.150 (0.192)	-0.032 (0.099)

Notes: Long-differenced estimations consider changes in the location and productivity of organized-sector manufacturing activity in 283 Indian districts from 2000 to 2009 from the Annual Survey of Industries (ASI). Explanatory variables are indicators for distance from the GQ network that was upgraded starting in 2001. Estimations consider the effects relative to districts more than 50 km from the GQ network. Column headers list dependent variables. Young plants are those less than four years old. Labor productivity is total output per employee in district, and TFP is weighted average of Sivadasan (2009) approach to Olley-Pakes estimations of establishment-level productivity with repeated cross-section data. Outcome variables are winsorized at their 1% and 99% levels, and entry variables are coded at the 1% level where no entry is observed to maintain a consistent sample. Estimations report standard errors, have 283 observations, control for the level of district activity in 2000, and weight observations by log total district population in 2001. Initial district conditions include variables for national highway access, state highway access, and broad-gauge railroad access and district-level measures from 2000 Census of log total population, age profile, female-male sex ratio, population share in urban areas, population share in scheduled castes or tribes, literacy rates, and an index of within-district infrastructure. Estimations include state fixed effects as well.

Backup A.3: Dynamic effects after GQ completion



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Backup A.4: Young plants require complementary markets

Table 2: Long-differenced estimations of the impact of GQ improvements, comparing 2009 to 2000, interacted with initial conditions

DV - Logged values of	Young					Mature					Old				
	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(12)	(13)	(14)	(15)	(16)
A. Base OLS estimation that excludes nodal districts and measures effects relative to districts 10-50 km from the GQ network															
(0,1) District 0-10 km from GQ	0.701++ (0.290)	0.311+ (0.185)	0.643++ (0.272)	0.409++ (0.179)	0.239++ (0.120)	0.358 (0.333)	-0.139 (0.172)	0.027 (0.253)	0.032 (0.150)	-0.014 (0.088)	0.335 (0.273)	-0.013 (0.161)	0.012 (0.207)	0.157 (0.144)	0.048 (0.082)
B. Panel A with interaction split using median of district distance from nodal cities															
(0,1) District 0-10 km from GQ	0.781+ (0.405)	0.360 (0.262)	0.775++ (0.352)	0.543++ (0.241)	0.444++ (0.180)	0.113 (0.436)	-0.351 (0.242)	-0.107 (0.360)	0.032 (0.226)	0.044 (0.154)	0.291 (0.284)	0.063 (0.203)	0.096 (0.273)	0.235 (0.189)	-0.014 (0.117)
Above median															
(0,1) District 0-10 km from GQ	0.661++ (0.312)	0.288 (0.201)	0.582++ (0.294)	0.344+ (0.183)	0.146 (0.124)	0.473 (0.379)	-0.044 (0.187)	0.087 (0.266)	0.032 (0.155)	-0.037 (0.093)	0.354 (0.320)	-0.047 (0.185)	-0.027 (0.228)	0.123 (0.148)	0.074 (0.088)
Median value and below															
C. Panel A with interaction split using median of district access to banking services (% Households with access to Bank)															
(0,1) District 0-10 km from GQ	0.827++ (0.340)	0.436++ (0.218)	0.741++ (0.340)	0.434++ (0.216)	0.329+++ (0.118)	0.384 (0.315)	-0.018 (0.206)	0.084 (0.260)	-0.037 (0.155)	0.038 (0.097)	0.444 (0.311)	0.068 (0.181)	0.169 (0.222)	0.159 (0.151)	0.114 (0.098)
Above median															
(0,1) District 0-10 km from GQ	0.596 (0.366)	0.208 (0.230)	0.561+ (0.300)	0.387+ (0.197)	0.160 (0.163)	0.337 (0.489)	-0.243 (0.230)	-0.022 (0.349)	0.099 (0.202)	-0.066 (0.118)	0.242 (0.333)	-0.081 (0.203)	-0.121 (0.259)	0.155 (0.179)	-0.012 (0.099)
Median value and below															
D. Interaction split using median of Output market misallocation															
(0,1) District 0-10 km from GQ	0.428 (0.381)	0.007 (0.236)	0.483 (0.345)	0.581+++ (0.221)	0.264+ (0.155)	0.035 (0.480)	-0.373 (0.227)	-0.287 (0.339)	-0.025 (0.208)	-0.110 (0.118)	0.345 (0.325)	-0.204 (0.208)	0.025 (0.256)	0.358++ (0.160)	0.089 (0.098)
Above median															
(0,1) District 0-10 km from GQ	0.905+++ (0.330)	0.542++ (0.209)	0.767+++ (0.295)	0.288 (0.187)	0.221+ (0.131)	0.613+ (0.335)	0.045 (0.187)	0.276 (0.255)	0.075 (0.148)	0.059 (0.092)	0.326 (0.313)	0.139 (0.177)	0.001 (0.226)	-0.000 (0.158)	0.016 (0.095)
Median value and below															
E. Interaction split using median of Input market misallocation															
(0,1) District 0-10 km from GQ	0.522 (0.359)	0.114 (0.211)	0.482 (0.319)	0.480++ (0.212)	0.257++ (0.130)	0.313 (0.424)	-0.118 (0.207)	-0.005 (0.309)	0.016 (0.184)	-0.023 (0.103)	0.450 (0.299)	-0.175 (0.178)	0.05 (0.227)	0.332++ (0.152)	0.123 (0.091)
Above median															
(0,1) District 0-10 km from GQ	0.914++ (0.354)	0.567++ (0.240)	0.852+++ (0.318)	0.322 (0.197)	0.216 (0.156)	0.416 (0.371)	-0.168 (0.210)	0.068 (0.277)	0.053 (0.161)	-0.003 (0.107)	0.182 (0.344)	0.205 (0.210)	-0.04 (0.258)	-0.083 (0.163)	-0.053 (0.103)
Median value and below															

Notes: See Table 1. Long-differenced estimations consider changes in the location and productivity of organized-sector manufacturing activity in 106 non-nodal districts located within 0.50 km of GQ for the time period starting from 2000 to 2009 from the Annual Survey of Industries (ASI). Panel (a) repeats the base estimation for this group. In panels (B)–(E), the base effect is interacted with indicator variables for above or below median values for indicated district traits. Estimation controls for unreported main effects of district traits. District level access to infrastructure, literacy, access to banking, population density is extracted from 2001 census, while distance from nodal cities to district is computed from district edge using India's district level GIS maps. Lastly, initial TFP is plant-level TFP for the year 2000-01 computed following LP-Sivadasan methodology on ASI data. misallocation matrices are computed using the methodology proposed in Duranton et al. (2015a).

Backup A.5: Industry attributes and responsiveness

Table 3: Long-differenced estimations of the impact of GQ improvements, comparing 2009 to 2000, by industry traits

DV - Logged values of	Young					Mature					Old				
	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR	Output	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(12)	(13)	(14)	(15)	(16)
A. Base OLS estimation that excludes nodal districts and measures effects relative to districts 10-50 km from the GQ network															
(0,1) District 0-10 km from GQ	0.701++ (0.290)	0.311+ (0.185)	0.643++ (0.272)	0.409++ (0.179)	0.239++ (0.120)	0.358 (0.333)	-0.139 (0.172)	0.027 (0.253)	0.032 (0.150)	-0.014 (0.088)	0.335 (0.273)	-0.013 (0.161)	0.012 (0.207)	0.157 (0.144)	0.048 (0.082)
B. Panel A split regressions using median of industry GVC intensity															
(0,1) District 0-10 km from GQ	0.950++ (0.388)	0.540++ (0.264)	0.539+ (0.320)	0.103 (0.134)	0.124 (0.119)	0.662+ (0.372)	0.280 (0.220)	0.026 (0.245)	-0.131 (0.140)	0.022 (0.084)	0.585 (0.363)	0.408+ (0.226)	0.134 (0.260)	-0.141 (0.158)	-0.005 (0.111)
Above median industry															
(0,1) District 0-10 km from GQ	0.129 (0.342)	0.182 (0.211)	0.368 (0.319)	0.286 (0.224)	0.155 (0.151)	0.111 (0.301)	-0.219 (0.185)	0.087 (0.276)	0.154 (0.171)	0.026 (0.125)	-0.159 (0.295)	-0.388++ (0.182)	-0.191 (0.246)	0.154 (0.172)	-0.025 (0.102)
Median value and below															
C. Panel A split regressions using median of industry external finance dependence															
(0,1) District 0-10 km from GQ	1.117++ (0.440)	0.668+++ (0.251)	0.745++ (0.348)	0.022 (0.147)	0.076 (0.140)	0.496 (0.381)	0.149 (0.249)	-0.127 (0.278)	-0.110 (0.161)	-0.038 (0.106)	0.529 (0.384)	0.327 (0.239)	0.186 (0.287)	-0.003 (0.147)	0.067 (0.105)
Above median industry															
(0,1) District 0-10 km from GQ	0.335 (0.338)	0.283 (0.210)	0.424 (0.286)	0.242 (0.215)	0.064 (0.134)	0.396 (0.326)	-0.033 (0.194)	0.199 (0.263)	0.142 (0.147)	-0.008 (0.105)	0.032 (0.318)	-0.136 (0.199)	-0.098 (0.249)	-0.013 (0.177)	-0.017 (0.096)
Median value and below															
D. Panel A split regressions using median of industry contractual intensity															
(0,1) District 0-10 km from GQ	0.452 (0.742)	0.279 (0.381)	0.475 (0.508)	0.193 (0.328)	0.114 (0.163)	0.671 (0.627)	0.149 (0.393)	0.425 (0.500)	0.022 (0.188)	0.034 (0.137)	0.419 (0.658)	0.207 (0.399)	0.317 (0.453)	0.089 (0.208)	-0.182 (0.190)
Above median															
(0,1) District 0-10 km from GQ	0.708++ (0.317)	0.383+ (0.196)	0.744++ (0.300)	0.433++ (0.194)	0.315++ (0.128)	0.329 (0.327)	-0.155 (0.185)	0.040 (0.263)	0.035 (0.166)	-0.026 (0.099)	0.299 (0.262)	-0.003 (0.165)	0.002 (0.212)	0.164 (0.149)	0.062 (0.086)
Median value and below															
E. Panel A split regressions using median of industry relationship stickiness															
(0,1) District 0-10 km from GQ	0.543 (0.353)	0.161 (0.198)	0.453 (0.306)	0.425++ (0.208)	0.287++ (0.120)	0.367 (0.333)	-0.167 (0.182)	0.101 (0.267)	0.180 (0.161)	-0.007 (0.102)	0.166 (0.293)	-0.253 (0.163)	0.008 (0.216)	0.237 (0.150)	-0.019 (0.087)
Above median															
(0,1) District 0-10 km from GQ	1.015++ (0.469)	0.866+++ (0.325)	1.077+++ (0.395)	0.100 (0.205)	0.165 (0.145)	0.931++ (0.427)	0.423 (0.304)	0.385 (0.368)	-0.044 (0.146)	0.028 (0.098)	1.198++ (0.571)	0.578++ (0.291)	0.517 (0.414)	0.105 (0.146)	0.097 (0.104)
Median value and below															

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Backup A.6: Plant-level panel estimates

Table 4: Plant-level effects of GQ access: estimation of plant exit/closure and performance outcomes

<i>DV - Logged values of</i>	Sample scheme				
	Exit[0/1]	Output	Avg. plant size (emp.)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)
A. All					
(0,1) District 0-10 km from GQ	-0.114++ (0.054)	0.123+++ (0.040)	0.016 (0.021)	0.113++ (0.045)	0.015 (0.020)
N	18321	10213	10211	10172	9853
R ²	0.022	0.947	0.926	0.912	0.907
B. Young					
(0,1) District 0-10 km from GQ	-0.140++ (0.057)	0.145++ (0.063)	0.071 (0.046)	0.050 (0.061)	0.013 (0.033)
N	6255	3486	3486	3479	3373
R ²	0.026	0.944	0.905	0.910	0.912
C. Mature					
(0,1) District 0-10 km from GQ	-0.100+ (0.056)	0.111+ (0.058)	-0.014 (0.025)	0.145++ (0.057)	0.017 (0.029)
N	9459	5245	5243	5222	5051
R ²	0.019	0.950	0.936	0.911	0.909
D. Old					
(0,1) District 0-10 km from GQ	-0.106++ (0.050)	0.114+ (0.061)	-0.019 (0.044)	0.164++ (0.064)	0.015 (0.052)
N	2607	1482	1482	1471	1429
R ²	0.024	0.939	0.937	0.915	0.878

Note: The table limits the sample to plants from the sample scheme observed in the data in the five before and after the nearest GQ segment being completed. "Exit" is an indicator variable measured as the failure to observe the same plant in the post-GQ period. Table reports OLS coefficient estimates of the effect on plant outcomes due to proximity to the GQ segment. All specifications include an unreported constant term, regressors for completion interacted with an indicator for nodal district and district 10 - 50 km from the nearest GQ segment, and plant and year fixed effects. Sample is restricted to comprise the same set of districts available in the repeated cross-section analysis above. Standard errors are clustered by district. Significance levels are indicated by + < .1, ++ < .05, +++ < .01.

Backup A.7: Heterogeneity by initial plant capabilities

Table 5: Plant heterogeneity and the impact of market access: Sample Scheme

DV - Logged values of	Young					Mature					Old				
	Exit[0/1]	Output	plant size (emp.)	Labor productivity	TFPR	Exit[0/1]	Output	plant size (emp.)	Labor productivity	TFPR	Exit[0/1]	Output	plant size (emp.)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
A. Sample scheme interactions with initial skill intensity															
(0,1) District 0-10 km from GQ	-0.138++	0.098++	0.074++	-0.012	0.024	-0.107+	0.004	0.034	-0.076++	0.016	-0.104+	0.017	0.098+	-0.05	0.002
*above median	(0.066)	(0.043)	(0.031)	(0.043)	(0.022)	(0.061)	(0.037)	(0.022)	(0.037)	(0.017)	(0.054)	(0.043)	(0.056)	(0.041)	(0.027)
(0,1) District 0-10 km from GQ	-0.139+++	-0.045	-0.06	0.041	-0.017	-0.095+	0.011	-0.044++	0.096++	-0.005	-0.110++	-0.118++	-0.066+	-0.001	-0.019
*below median	(0.053)	(0.042)	(0.039)	(0.035)	(0.022)	(0.054)	(0.039)	(0.021)	(0.037)	(0.016)	(0.053)	(0.053)	(0.040)	(0.045)	(0.036)
B. Sample scheme interactions with initial capital intensity															
(0,1) District 0-10 km from GQ	-0.170+++	0.132+++	0.036	0.103+++	0.059+++	-0.100+	0.081++	0.038+	0.025	0.055+++	-0.098+	-0.007	0.05	-0.024	0.024
*above median	(0.063)	(0.035)	(0.027)	(0.036)	(0.022)	(0.055)	(0.034)	(0.020)	(0.033)	(0.018)	(0.056)	(0.051)	(0.056)	(0.044)	(0.041)
(0,1) District 0-10 km from GQ	-0.112++	-0.091++	-0.04	-0.064	-0.061+++	-0.101+	-0.069+	-0.041+	-0.02	0.044+++	-0.110++	-0.085+	-0.017	-0.013	-0.038
*below median	(0.056)	(0.041)	(0.030)	(0.041)	(0.021)	(0.059)	(0.037)	(0.021)	(0.033)	(0.016)	(0.051)	(0.045)	(0.028)	(0.038)	(0.033)
C. Sample scheme interactions with initial TFPR															
(0,1) District 0-10 km from GQ	-0.148++	0.027	0.044	-0.013	-0.012	-0.092	0.005	0.02	-0.029	-0.016	-0.099++	-0.023	0.066	-0.006	-0.053
*above median	(0.058)	(0.040)	(0.035)	(0.037)	(0.025)	(0.059)	(0.030)	(0.019)	(0.032)	(0.018)	(0.049)	(0.036)	(0.055)	(0.045)	(0.036)
(0,1) District 0-10 km from GQ	-0.147++	0.028	-0.044	0.065	0.019	-0.114++	0.015	-0.017	0.034	0.03	-0.110++	-0.087	-0.033	-0.045	0.051
*below median	(0.061)	(0.041)	(0.032)	(0.043)	(0.021)	(0.055)	(0.043)	(0.019)	(0.036)	(0.020)	(0.055)	(0.062)	(0.038)	(0.048)	(0.036)
D. Sample scheme interactions with initial labor productivity															
(0,1) District 0-10 km from GQ	-0.126++	0.028	0.092+++	-0.087+	-0.03	-0.104+	-0.018	0.039+	-0.097+++	-0.011	-0.093+	-0.032	0.062	-0.039	0.008
*above median	(0.061)	(0.048)	(0.032)	(0.047)	(0.025)	(0.060)	(0.038)	(0.021)	(0.033)	(0.015)	(0.049)	(0.050)	(0.054)	(0.050)	(0.025)
(0,1) District 0-10 km from GQ	-0.152+++	0.029	-0.069++	0.108+++	0.038+	-0.096+	0.039	-0.047++	0.120+++	0.026	-0.110+	-0.043	-0.034	0.003	-0.017
*below median	(0.057)	(0.040)	(0.035)	(0.038)	(0.023)	(0.053)	(0.037)	(0.021)	(0.033)	(0.018)	(0.058)	(0.051)	(0.035)	(0.047)	(0.045)

Notes: See Table 4. Estimations in the base effect presented in Table 4 is interacted with indicator variables for above or below median values for indicated plant traits.

Backup A.8: Expanded distance-band robustness

Table A.2: Long-differenced estimations of the impact of GQ improvements, comparing 2009 to 2000 (Expanded spatial bands)

<i>DV - Change in logged values of manufacturing trait listed in column header:</i>	Output	Employment	Plant count	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Young plants (0-5 years)							
(0,1) District 0-10 km from GQ	0.931++ (0.368)	0.410 (0.314)	0.273 (0.264)	0.450+ (0.245)	0.849++ (0.332)	0.405++ (0.202)	0.202 (0.135)
(0,1) District 10-50 km from GQ	0.297 (0.535)	0.051 (0.394)	0.147 (0.284)	-0.057 (0.321)	0.171 (0.462)	0.231 (0.302)	0.081 (0.138)
(0,1) District 50-125 km from GQ	0.406 (0.399)	0.265 (0.311)	0.376 (0.251)	0.307 (0.266)	0.393 (0.353)	0.133 (0.231)	-0.063 (0.120)
(0,1) District 125-200 km from GQ	0.281 (0.408)	0.156 (0.331)	0.189 (0.255)	0.117 (0.291)	0.222 (0.372)	-0.170 (0.226)	-0.051 (0.125)
B. Mature plants (6-24 years)							
(0,1) District 0-10 km from GQ	0.804+ (0.420)	0.434 (0.288)	0.566++ (0.233)	0.013 (0.231)	0.359 (0.322)	0.225 (0.211)	0.078 (0.108)
(0,1) District 10-50 km from GQ	0.400 (0.495)	0.116 (0.312)	-0.018 (0.252)	0.026 (0.292)	0.410 (0.441)	0.344 (0.282)	0.085 (0.142)
(0,1) District 50-125 km from GQ	0.716+ (0.382)	0.380 (0.246)	0.246 (0.218)	0.334 (0.209)	0.541+ (0.306)	0.299 (0.233)	0.075 (0.126)
(0,1) District 125-200 km from GQ	0.634+ (0.367)	0.279 (0.257)	0.210 (0.242)	0.127 (0.223)	0.469 (0.304)	0.284 (0.219)	0.195 (0.122)
C. Old plants (25 years and above)							
(0,1) District 0-10 km from GQ	0.368 (0.328)	0.068 (0.256)	0.203 (0.223)	-0.041 (0.183)	0.173 (0.235)	0.360++ (0.181)	0.062 (0.110)
(0,1) District 10-50 km from GQ	-0.509 (0.465)	-0.688++ (0.333)	-0.386 (0.294)	-0.532++ (0.254)	-0.208 (0.347)	0.363 (0.220)	-0.019 (0.132)
(0,1) District 50-125 km from GQ	-0.062 (0.342)	-0.254 (0.253)	-0.302 (0.217)	0.051 (0.196)	0.239 (0.258)	0.259 (0.199)	-0.028 (0.136)
(0,1) District 125-200 km from GQ	0.164 (0.339)	-0.141 (0.267)	-0.125 (0.233)	-0.134 (0.193)	0.255 (0.262)	0.376++ (0.187)	0.077 (0.129)

Notes: See Table 1

Backup A.9: New construction versus upgrades

Table A.3a: Long-differenced estimations comparing the impact of GQ improvements for young plants only

<i>DV - Change in logged values of manufacturing trait listed in column header:</i>	Output	Employment	Plant count	Avg. plant size (emp.)	Avg. plant size (output)	Labor productivity	TFPR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Within GQ improvements: New construction versus upgrades							
(0,1) District 0-10 km from GQ*	0.464	0.194	0.078	0.139	0.230	0.267	0.099
(0,1) New construction district	(0.407)	(0.312)	(0.230)	(0.254)	(0.344)	(0.194)	(0.117)
(0,1) District 0-10 km from GQ*	0.894++	0.332	0.095	0.454++	0.990+++	0.518++	0.346++
(0,1) Road upgrade district	(0.353)	(0.306)	(0.281)	(0.220)	(0.331)	(0.221)	(0.155)
B. GQ improvements versus the planned but not upgraded NS-EW network							
Panel B.1: Effects for districts based upon distance from the GQ network:							
(0,1) District 0-10 km from GQ	0.710++	0.263	0.079	0.290	0.652++	0.453++	0.242+
	(0.290)	(0.233)	(0.206)	(0.189)	(0.283)	(0.185)	(0.127)
(0,1) District 10-50 km from GQ	0.139	-0.043	-0.016	-0.171	0.005	0.241	0.125
	(0.460)	(0.318)	(0.227)	(0.263)	(0.395)	(0.273)	(0.120)
Panel B.2: Effects for districts based upon distance from the NS-EW network:							
(0,1) District 0-10 km from NS-EW	0.378	0.184	0.105	0.095	0.250	0.201	0.029
	(0.263)	(0.209)	(0.176)	(0.173)	(0.230)	(0.145)	(0.095)
(0,1) District 10-50 km from NS-EW	-0.249	-0.249	-0.185	-0.196	-0.135	0.184	0.012
	(0.352)	(0.255)	(0.214)	(0.221)	(0.320)	(0.199)	(0.114)

Notes: See Table 1. Panel B long-differenced estimations compare results from proximity to the GQ network to the NS-EW highway network that was planned for the upgrade at the same time as the GQ project but was then delayed. The regressions control for the initial district conditions listed in Table 2 and state fixed effects.

Backup A.10: Cumulative effects of GQ completion



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