

Connective Financing

CHINESE INFRASTRUCTURE PROJECTS AND THE DIFFUSION OF ECONOMIC
ACTIVITY IN DEVELOPING COUNTRIES

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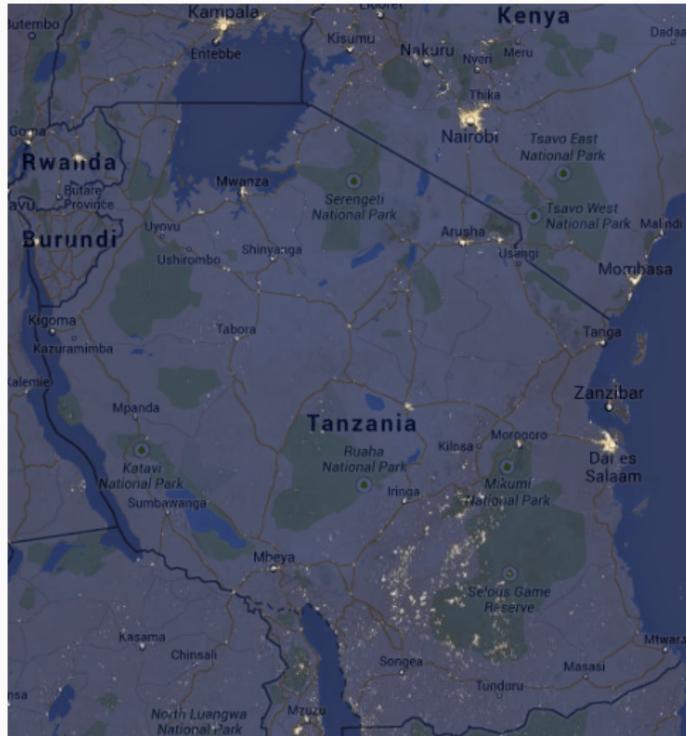
WORK IN PROGRESS

12th China Economics Summer Institute

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Why spatial concentration?



Congestion and transport investments

Developing countries display large primacy, especially in economic activity:

- Dar es Salaam was home to 8% of the Tanzanian population and 53% of manufacturing value-added in 2002.
- **Internal transport costs are 4-5 larger than in US** (Atkin and Donaldson, 2015) and isolate secondary cities (Storeygard 2016).
- **African cities are congested, crowded and unproductive.** Less than 16 percent of their land mass are roads (World Bank 2018).
- **Congestion is a dispersion force** (Krugman & Livas Elizondo 1996).

Evidence suggests that transport infrastructure **disperses economic activity** in developing countries: e.g. see Bird & Straub (2014) on Brazil, Baum-Snow et al. (2017) on China, or Bayes (2017) on Bangladesh.

Why China?

China as the pernicious partner

- “rogue aid”
- “debt trap diplomacy”
- “white elephants”

China as the promising alternative

- “no strings attached”
- “record time”
- Xi Jinping “connectivity is the foundation of development”

China focuses on transport and economic infrastructure, replacing and surpassing Western investments in this sector. [▶▶ Trends.](#) [▶▶ SSA policy.](#)

What's known?

- Chinese financed projects are subject to regional and ethnic favoritism in Africa (Dreher et al. 2019). Worsen perceptions of local corruption (Isaksson & Kotsadam 2018).
- Positive effects of projects on local activity in SSA (Dreher et al. 2019).
- Uneven impact of BRI investments in calibrations (Lall & Lebrand 2019).

What's new?

- **Spatial concentration in light intensity** as a **proxy for economic activity**.
- Exploit **domestic overcapacity in China** as a **global aid supply shock**.
- Chinese projects help to **decentralize economic activity** in developing countries. **Effect driven by poor, coastal and urban regions.**

Should “connective financing” decrease spatial concentration?

Infrastructure investments

- reduce trade costs and make migration easier (Krugman 1996)
- lower inter-region price differences/volatility (Cirera & Arndt 2008)
- lower cost of firm entry (Shiferaw et al. 2015, Ghani et al. 2016)
- lower cost of inputs/consumption (Bayes 2007, Parada 2016)
- raise land values (Donaldson & Hornbeck 2016)

In theory impact of transport infrastructure on concentration is non-linear (bell-shaped) in trade costs (e.g. Krugman & Venables, 1995, Puga, 1999).

Within-region concentration: **industrial activity and population in cities tends to decentralize as countries develop and roads are being built** (Henderson & Kuncoro 1996, Baum-Snow 2007, Baum-Snow et al. 2017).

Data

Chinese financing in the 60s: TAZARA railway



Chinese financing today: Addis Ababa light rail



China provides \$403 million loan to Ethiopia for light rail line

Project ID:
1471

Project Description:

On March 30, 2011, it was reported that both India and China will help Ethiopia construct the Addis Ababa light rail line. India pledged 300 million USD for the construction, and the China EXIM Bank signed a loan agreement with Ethiopia on June 22, 2011. In an Ethiopian 2012 budget report, there was a loan signed between the government and China EXIM Bank for a railway project(s) whose signing date suggests it is the project referred to above. The loan is worth 403 million USD at the rate of Libor 6 months (0.507%) plus 2.6% with a 3 year grace period and 23 year maturity. The rail network is part of the country's Growth and Transformation Plan that sets a target construction of 2,395-km worth of rail track; this rail line will be 36.5 km long, but there are hopes that this sort of project would expand to the rest of the country. Construction is being done by the Chinese company, China Rail Engineering Corporation (CCECC), and has been started as of April 2013 with about 25% of work complete.

Project Details

| | | | |
|---|---|--|---|
| Donor China | Recipient Ethiopia | Year 2011 | Amount (Listed) USD 403,000,000 |
| Amount (2014 USD) USD 447,324,892 | Flow Loan (excluding debt rescheduling) | | Flow Type ODA-like |
| Intent Development | CRS Sector Name Transport and Storage | Recommended for Research? TRUE | |
| Umbrella 0 | | | |

Related Content on AidData.org

Learn more about China's development finance
aiddata.org/china



Download the whole dataset

AidData's Global Chinese Official Finance Dataset, 2000-2014, Version 1.0

How did we collect this information?

Learn more about AidData's Tracking Underreported Flows (TUFF) Methodology

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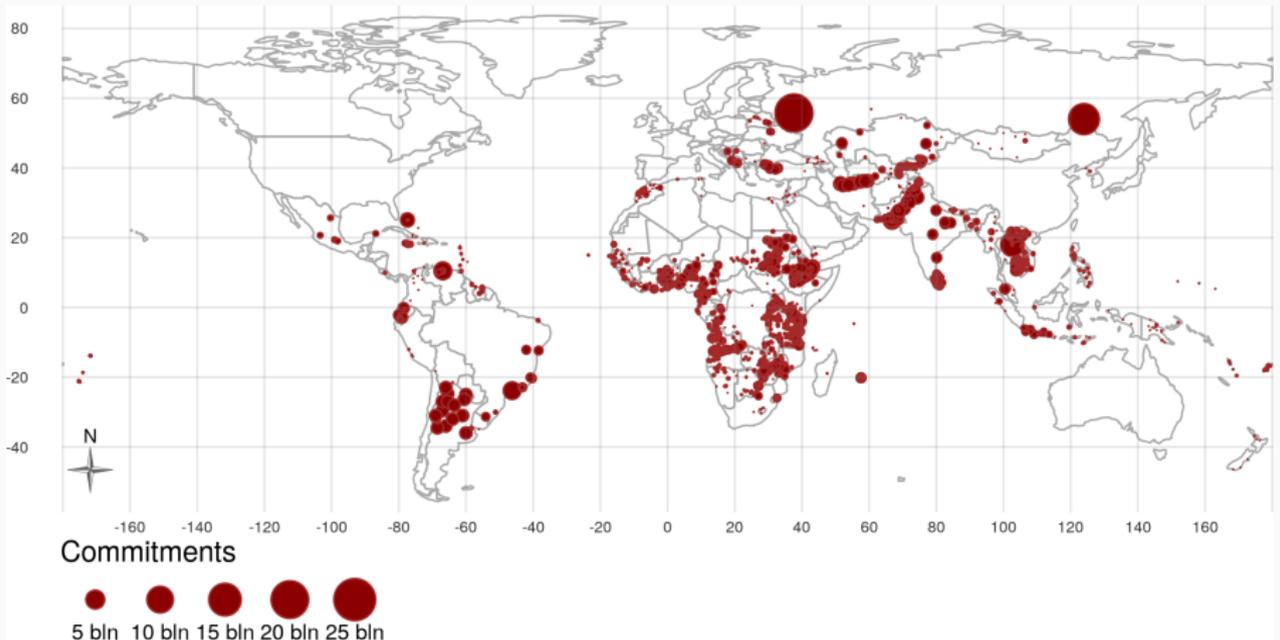
AidData first released data on Chinese Official Finance in 2017. Collected using the Tracking Underreported Financial Flows (TUFF) method, which uses

- documents from Chinese ministries and embassies,
- aid and debt info management systems in recipient countries,
- case study and field research by scholars and NGOs, and
- English, Chinese and local-language news reports.

For this paper, we **geocoded the locations of all projects that have at least reached the implementation stage** (www.aiddata.org/china).

3,485 projects worth 2014 US\$273.6b at 6,184 sites in 138 countries. About 25% of total value are transport projects. [Flows.](#) [Status.](#) [Sectors.](#)

Project locations and values (2000–2014)



Dispersion in nighttime light intensity (similar to Henderson et al. 2018)

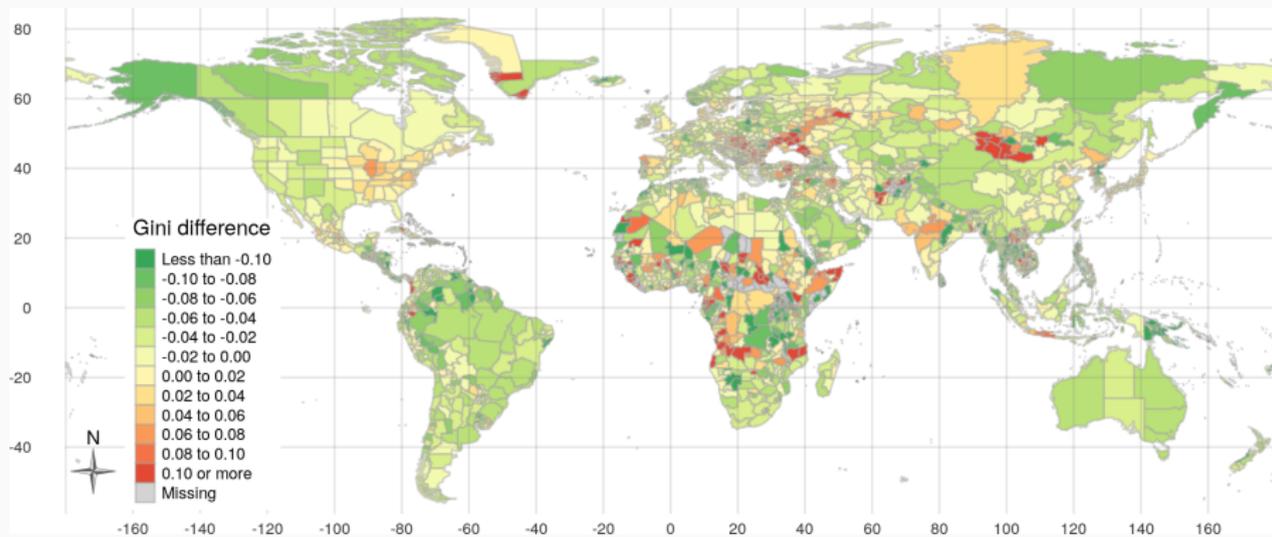
- Divide the entire world into a grid of 6 arc minute cells and intersect the grid with the global administrative boundaries.
- Compute the sum of light (s_i), the land area in km^2 (a_i), and the light intensity in the cell ($x_i = s_i/a_i$).
- Calculate the spatial Gini coefficient in region r as

$$G_r = \frac{\sum_i w_i^n \sum_j^n w_j |x_i - x_j|}{2 \sum_i^n w_i \sum_i^n w_i x_i}$$

where $w_i = a_i / \sum_i^n a_i$ is an area weight and n is the number of lit cells.

The index captures the **overall concentration of economic activity**, i.e. the product of the distributions of population and income per capita.

Long differences in spatial inequalities (2000–2013)



Empirical strategy

How to identify the effects of Chinese projects?

China needs lots of material to build all its homes, trains and tunnels. Even so, it produces more than it can use. (Economist, 09/09/17)

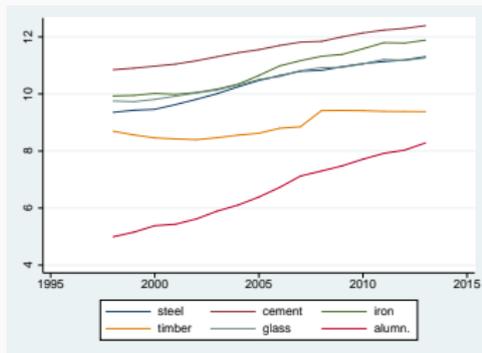
[Mr Xi] hopes to create new markets for Chinese companies, such as high-speed rail firms, and to export some of his country's vast excess capacity in cement, steel and other metals. (Economist, 05/17/17)

Nearby, along a newly laid road, another Chinese factory was providing cement for tunnel construction. Nearly everything for the Laos project is made in China. Almost all the labor force is Chinese. (NY Times, 05/13/17)

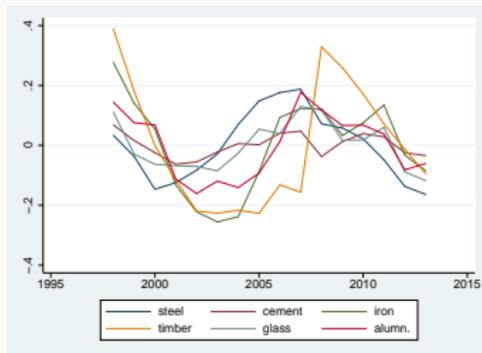
Chinese workers welding steel in Laos



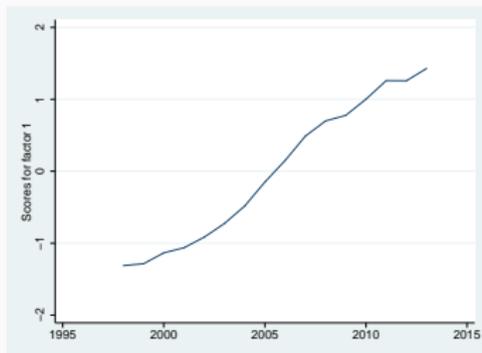
Variation in overcapacity



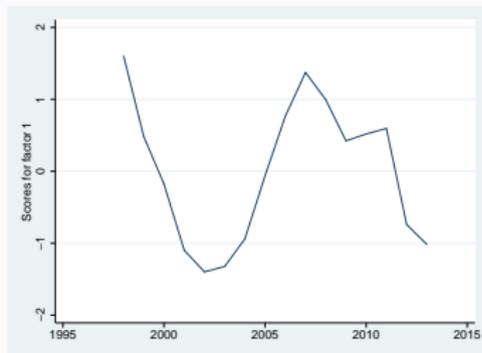
(A) Log levels



(B) Detrended



(C) Principal factor of A



(D) Principal factor of B

Identification strategy I: The instrument

Supply-shock instrument (similar to Nunn and Qian, 2014)

- Variation across time: Proxy for potential aid inputs
 - China's production of steel, cement, iron, timber, glass and aluminum.
- Variation across regions: Exposure to Chinese aid
 - "Probability of receiving aid", i.e. $\bar{p}_{ir} = \sum_t^T \mathbb{I}(\text{ChnProj}_{irt} > 0) / T$

Similar to differences-in-differences

- Exploit **differential effect of Chinese aid inputs** on aid to regions with **high compared to low exposure to Chinese aid**
- Works if differences in spatial inequality in high (low) exposure regions is **not affected differently** by China's input production

Identification strategy II: Parallel pre-trends



Identification strategy III: The 2SLS system

Equation(s) of interest:

$$G_{irt} = \beta \text{ChnProj}_{i,t-2} + \mathbf{x}'_{irt} \boldsymbol{\gamma} + \mu_{ir} + \lambda_{it} + \varepsilon_{irt} \quad (1)$$

$$\text{ChnProj}_{i,t-2} = \delta (F_{t-3} \times \bar{\rho}_{ir}) + \mathbf{x}'_{irt} \boldsymbol{\pi} + \omega_{ir} + \phi_{i,t-2} + v_{ir,t-2} \quad (2)$$

where

- $\text{ChnProj}_{i,t-2}$ is a dummy for a Chinese project (one for 3 yrs after assumed “completion”)
- F_{t-3} is the principal factor of the *detrended* time series of six aid inputs
- $\bar{\rho}_{ir}$ is the probability of receiving Chinese aid
- \mathbf{x}_{irt} is a vector of controls (e.g. population density)
- ω_{ir} and μ_{ir} are region FEs (removing $\bar{\rho}_{ir}$)
- $\phi_{i,t-2}$ and λ_{it} are country-year FEs (partialling out all common trends)

Main results

Chinese projects and economic concentration

| | <i>Different levels of analysis</i> | | | |
|--|-------------------------------------|------------------------|---------------------|---------------------|
| | Within ADM2 (1) | Within ADM1 (2) | Between ADM2 (3) | Between ADM1 (4) |
| <i>Panel a) OLS estimates</i> | | | | |
| $ChnProj_{i,t-2}$ | -0.0030 (0.0034) | -0.0080** (0.0035) | -0.0024 (0.0053) | -0.0022 (0.0040) |
| <i>Panel b) Reduced-form estimates</i> | | | | |
| $F_{t-3} \times \bar{\rho}_{ir}$ | -0.0409** (0.0199) | -0.0435*** (0.0149) | -0.0390 (0.0291) | -0.0247 (0.0163) |
| Observations | 356,046 | 29,810 | 23,693 | 1,784 |
| Regions | 32,603 | 2,668 | 2,140 | 158 |
| Countries | 129 | 158 | 126 | 158 |

Notes: All specifications include the log of population density. Columns (1) to (3) include region fixed effects and country-year fixed effects. Column (4) includes country fixed effects.

Cluster-robust standard errors (country) are in parentheses.

Chinese projects and economic concentration

| | <i>Different levels of analysis</i> | | | |
|-------------------------------|---------------------------------------|------------------------|-----------------------|-----------------------|
| | Within ADM2 (1) | Within ADM1 (2) | Between ADM2 (3) | Between ADM1 (4) |
| | <i>Panel c) 2SLS estimates</i> | | | |
| $ChnProj_{i,t-2}$ | -0.0397* (0.0202) | -0.0462*** (0.0143) | -0.0438 (0.0326) | -0.0510 (0.0340) |
| | <i>Panel d) First-stage estimates</i> | | | |
| $F_{t-3} \times \bar{p}_{ir}$ | 1.0314*** (0.1899) | 0.9429*** (0.1322) | 0.8911*** (0.1386) | 0.4848*** (0.1033) |
| First-stage F-stat | 29.50 | 50.84 | 41.35 | 22.02 |
| Observations | 356,046 | 29,810 | 23,693 | 1,784 |
| Regions | 32,603 | 2,668 | 2,140 | 158 |
| Countries | 129 | 158 | 126 | 158 |

Notes: All specifications include the log of population density. Columns (1) to (3) include region fixed effects and country-year fixed effects. Column (4) includes country fixed effects. Cluster-robust standard errors (country) are in parentheses.

Measuring Chinese investments in different ways

| | <i>Variations on project types and their measurement</i> | | | | | |
|---------------------------------------|--|------------------------|-----------------------|------------------------|-----------------------|------------------------|
| | Baseline (1) | US\$ Amounts (2) | Proj. Count (3) | Completed (4) | Economic (5) | Construction (6) |
| <i>Panel a) 2SLS estimates</i> | | | | | | |
| $ChnProj_{i,t-2}$ | -0.0462*** (0.0143) | -0.0028*** (0.0009) | -0.0141** (0.0062) | -0.0735*** (0.0244) | -0.0297** (0.0131) | -0.0401*** (0.0124) |
| Construction phase | | | | | | -0.0082** (0.0041) |
| <i>Panel b) First-stage estimates</i> | | | | | | |
| $F_{t-3} \times \bar{p}_{ir}$ | 0.9429*** (0.1322) | 15.5508*** (2.4026) | 3.0832*** (0.7703) | 0.5922*** (0.0996) | 0.7753*** (0.0963) | 1.0924*** (0.1547) |
| Construction phase | | | | | | -0.2141*** (0.0228) |
| First-stage F-stat | 50.84 | 41.89 | 16.02 | 35.35 | 64.85 | 49.85 |
| Observations | 29,810 | 29,810 | 29,810 | 29,810 | 29,810 | 29,810 |
| Regions | 2,668 | 2,668 | 2,668 | 2,668 | 2,668 | 2,668 |
| Countries | 158 | 158 | 158 | 158 | 158 | 158 |

Notes: All specifications include the log of population density, region fixed effects and country-year fixed effects. Cluster-robust standard errors (country) are in parentheses.

Accounting for other “China shocks”

| | <i>Adding controls for other China-related shocks</i> | | | |
|--|---|------------------------|------------------------|------------------------|
| | FDI (1) | Exports (2) | Imports (3) | All (4) |
| | <i>Panel a) 2SLS estimates</i> | | | |
| $ChnProj_{i,t-2}$ | -0.0428*** (0.0140) | -0.0379*** (0.0140) | -0.0462*** (0.0143) | -0.0392*** (0.0139) |
| | <i>Panel b) First-stage estimates</i> | | | |
| $F_{t-3} \times \bar{\rho}_{ir}$ | 0.9315*** (0.1317) | 0.9197*** (0.1320) | 0.9428*** (0.1321) | 0.9201*** (0.1316) |
| Other China shock \times Distance to coast | ✓ | ✓ | | ✓ |
| Other China shock \times Urbanization | ✓ | ✓ | | ✓ |
| Other China shock \times Large mines | | | ✓ | ✓ |
| First-stage F-stat | 50.01 | 48.53 | 50.95 | 48.87 |
| Observations | 29,810 | 28,930 | 29,810 | 28,930 |
| Regions | 2,668 | 2,615 | 2,668 | 2,615 |
| Countries | 158 | 146 | 158 | 146 |

Notes: All specifications include the log of population density, region fixed effects and country-year fixed effects. Cluster-robust standard errors (country) are in parentheses.

Extensions and robustness

Who benefits from Chinese transport projects?

- No evidence in favor of an effect on overall light intensity but **reallocation of activity to less developed places.** ▶ Regressions.
- More **urbanized regions which are closer to the coast but poor experience greater decentralization** of activity. ▶ Regressions.
- Effects **representative of Africa, Asia and poorer developing countries** with fast growing populations. ▶ Regressions.

Comparison with geocoded World Bank aid

- Use IBRD's equity-to-loans ratio as an IV for geocoded WB aid locations
- Find no comparable effects of WB aid (overall or transport sector) but instrument is weak and LATE differs ▶ Regressions.

Identification and measurement

- **Effects similar to main results with different IVs:** level factors, overproduction, H-P filtered factors, using all factors separately etc., passes placebo test with US steel production [▶▶ Regressions.](#)
- Christian and Barrett (2019) test satisfied: **instrument does not affect some subgroups more than others** [▶▶ Plots.](#)
- Effects not contingent on type of inequality measure. [▶▶ Regressions.](#)

Timing and persistence

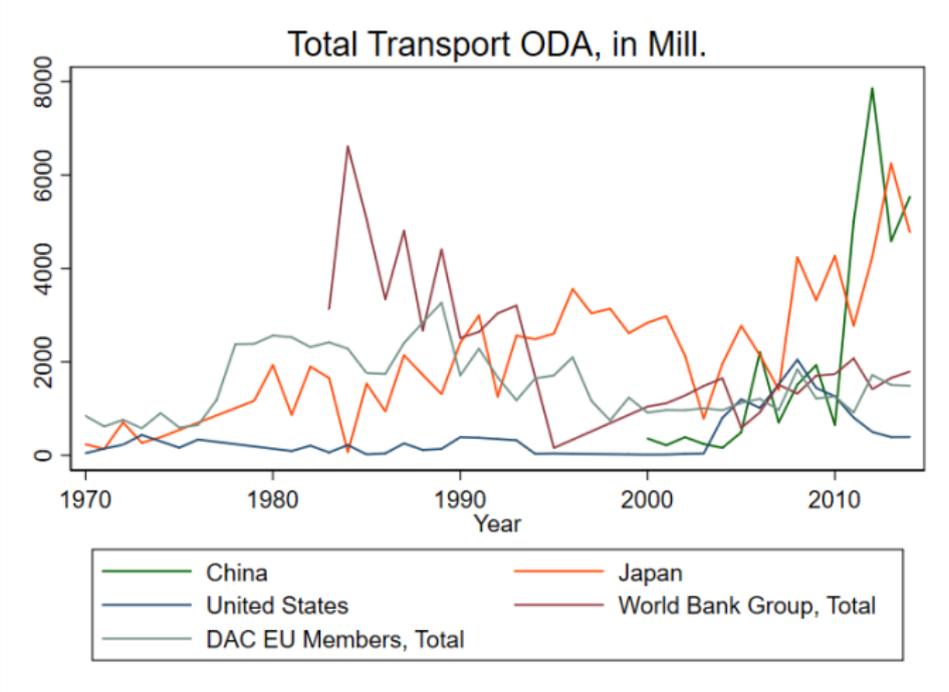
- Meaningful effects when using different dummies (1 to 5 yrs) [▶▶ Regressions.](#)
- Similar results with lagged dependent variable [▶▶ Regressions.](#)

Conclusion

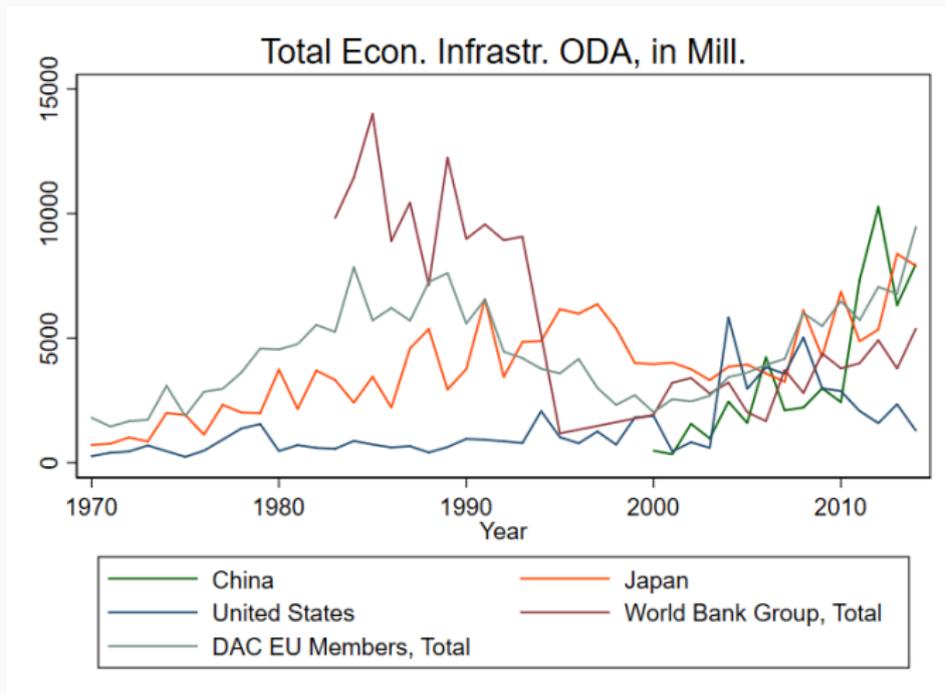
- Decentralized economic activity in cities is a feature of more advanced economies. China underwent a such a decentralization at home.
- Document remarkable pattern: Chinese projects **reduce the concentration of economic activity in regions with better access to world markets, higher road density and higher urbanization.**
- “Connective infrastructure” produces significant positive spillovers. Large effects in Africa, Asia and poor developing countries.
- **LATE is driven by big infrastructure projects** requiring large amounts of physical inputs.
- Broader impact of Chinese projects on wages and social structure is a more complex question.

Appendix

Transport infrastructure trends, ODA only



Economic infrastructure trends, ODA only

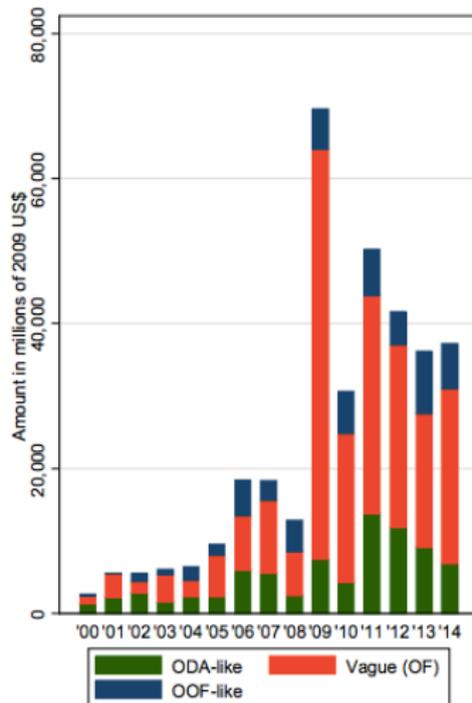
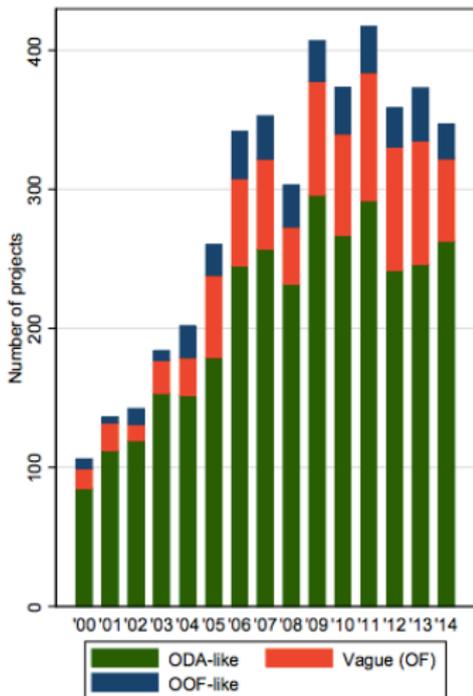


◀ Go back.

*China stands for pushing forward infrastructure and industrial development in Africa in a coordinated way, with a **focus on intensive operation and economies of scale**. It will prioritize support for the **construction of infrastructure facilities for special economic zones, industrial parks, science and technology parks**, etc., to provide favorable conditions for Africa's industrial development and China-Africa industrial capacity cooperation. It will **facilitate cross-border and cross-regional connectivity in infrastructure** to help accelerate the process of African integration.*

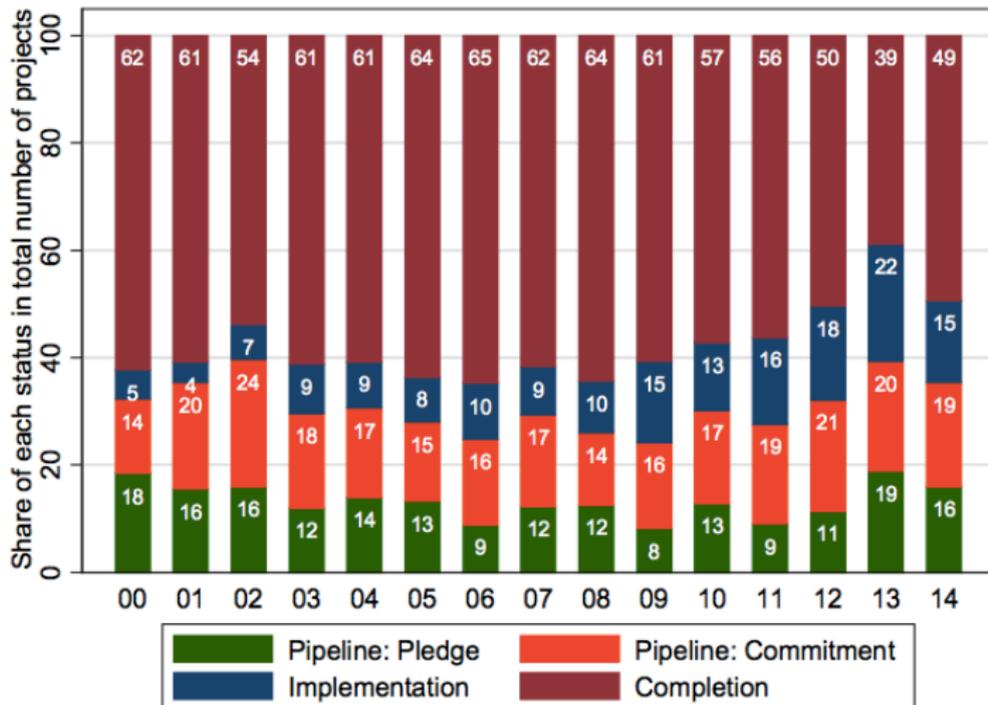
◀ Go back.

Projects and values

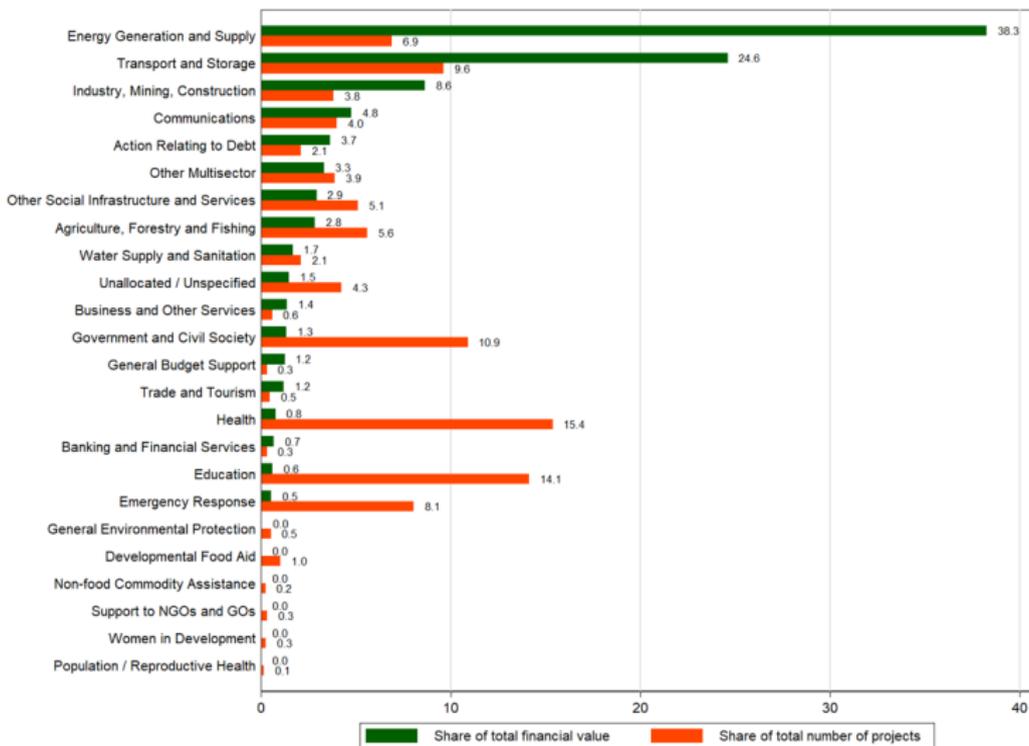


◀ Go back.

Project status



Project sectors



Extension: Light intensity and quintile shares

| | Light | Quintile shares | | | | |
|--------------------|---------------------|----------------------|---------------------|---------------------|---------------------|-----------------------|
| | density | 0-20% | 20-40% | 40-60% | 60-80% | 80-100% |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $ChnProj_{i,t-2}$ | -0.0596 (0.1019) | 0.0074** (0.0031) | 0.0093* (0.0050) | 0.0156* (0.0079) | 0.0209* (0.0125) | -0.0532** (0.0223) |
| First-stage F-Stat | 52.02 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 |
| Observations | 26959 | 26358 | 26358 | 26358 | 26358 | 26358 |
| Regions | 2333 | 2424 | 2424 | 2424 | 2424 | 2424 |
| Countries | 129 | 146 | 146 | 146 | 146 | 146 |

Notes: All specifications include the log of population density, region fixed effects and country-year fixed effects. Cluster-robust standard errors (country) are in parentheses.

◀ Go back.

Extension: Sample splits

| | <i>Splitting at the median of ...</i> | | | | | | |
|-----------------------|--|-----------------------|------------------------|-----------------------------|------------------------|-------------------------|----------------------------|
| | City Access (1) | Urbanization (2) | Road Density (3) | Distance to Coast (4) | Ruggedness (5) | Light density (6) | Light per capita (7) |
| | <i>Panel a) Below median, 2SLS estimates</i> | | | | | | |
| $ChnProj_{i,t-2}$ | -0.0991** (0.0469) | 0.0231 (0.0236) | -0.0163 (0.0264) | -0.0823*** (0.0299) | -0.0705*** (0.0244) | -0.0016 (0.0250) | -0.0486** (0.0193) |
| | <i>Panel b) Above median, 2SLS estimates</i> | | | | | | |
| $ChnProj_{i,t-2}$ | 0.0100 (0.0221) | -0.1029** (0.0452) | -0.0663** (0.0322) | -0.0110 (0.0217) | -0.0162 (0.0277) | -0.0350 (0.0222) | -0.0278 (0.0195) |
| a) Observations | 14,552 | 15,014 | 15,080 | 14,318 | 14,503 | 14,339 | 14,021 |
| a) First-stage F-stat | 12.09 | 35.65 | 22.70 | 33.44 | 38.03 | 18.81 | 23.84 |
| b) Observations | 14,970 | 14,359 | 14,444 | 15,338 | 15,058 | 14,854 | 15,367 |
| b) First-stage F-stat | 42.44 | 12.03 | 16.42 | 17.30 | 6.58 | 14.18 | 15.18 |

Notes: All specifications include the log of population density, region fixed effects and country-year fixed effects. Cluster-robust standard errors (country) are in parentheses.

Extension: Regional decomposition

| | <i>Regional subsets and related alterations</i> | | | | | |
|----------------------------------|---|---------------------------|------------------------|-----------------------|-----------------------|------------------------|
| | Africa (1) | Africa Everproject (2) | Africa Cold War (3) | Asia (4) | Americas (5) | Developing (6) |
| | <i>Panel a) 2SLS estimates</i> | | | | | |
| $ChnProj_{i,t-2}$ | -0.0539** (0.0206) | -0.0539** (0.0264) | -0.0323 (0.1443) | -0.0489** (0.0232) | 0.0317* (0.0164) | -0.0560*** (0.0206) |
| | <i>Panel b) First-stage estimates</i> | | | | | |
| $F_{t-3} \times \bar{\rho}_{ir}$ | 0.9656*** (0.2061) | 0.8996*** (0.1946) | 0.2728** (0.1249) | 0.8348*** (0.1730) | 1.5857*** (0.2191) | 0.8241*** (0.1496) |
| First-stage F-Stat | 21.96 | 21.36 | 4.77 | 23.29 | 52.39 | 30.36 |
| Observations | 9,019 | 4,744 | 8,273 | 9,931 | 5,976 | 10,370 |
| Regions | 791 | 409 | 789 | 868 | 528 | 1,073 |
| Countries | 56 | 48 | 56 | 45 | 37 | 69 |

Notes: All specifications include the log of population density, region fixed effects and country-year fixed effects. Cluster-robust standard errors (country) are in parentheses.

Different instruments

| | <i>Altering the instrument for Chinese projects</i> | | | |
|----------------------------------|---|-----------------------|------------------------|---------------------|
| | Levels IV | Overproduction IV | HP Filter IV | US Steel Placebo IV |
| | (1) | (2) | (3) | (4) |
| | <i>Panel a) 2SLS estimates</i> | | | |
| $ChnProj_{i,t-2}$ | -0.0483*** (0.0122) | -0.0380** (0.0166) | -0.0425*** (0.0155) | 0.0835 (0.2951) |
| | <i>Panel b) First-stage estimates</i> | | | |
| $F_{t-3} \times \bar{\rho}_{ir}$ | 1.3423*** (0.1494) | 0.7368*** (0.1344) | 0.8003*** (0.1274) | -0.0045 (0.0087) |
| First-stage F-stat | 80.76 | 30.07 | 39.44 | 0.27 |
| Observations | 29,810 | 29,810 | 29,810 | 29,810 |
| Regions | 2,668 | 2,668 | 2,668 | 2,668 |
| Countries | 158 | 158 | 158 | 158 |

Notes: All specifications include the log of population density, region fixed effects and country-year fixed effects. Cluster-robust standard errors (country) are in parentheses.

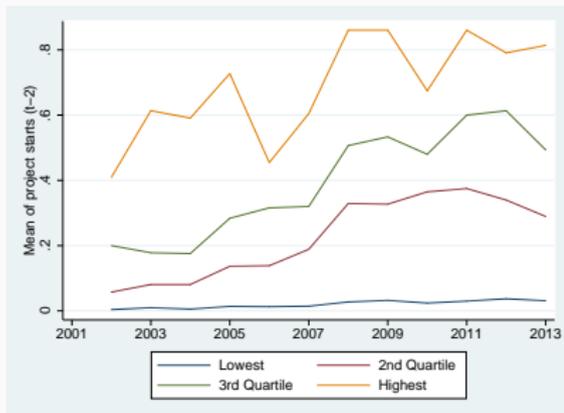
Alternate concentration measures (2SLS at ADM1 and AMD2)

| | <i>Alternate measures of spatial concentration</i> | | | |
|---------------------------------------|--|----------------------------|-----------------------|---------------------------|
| | Unweighted Gini (1) | Bias-corrected Gini (2) | Theil (3) | Coef. of Variation (4) |
| <i>Panel a) 2SLS estimates</i> | | | | |
| $ChnProj_{i,t-2}$ | -0.0668** (0.0296) | -0.0804** (0.0314) | -0.0987** (0.0450) | -0.2261** (0.0882) |
| <i>Panel b) First-stage estimates</i> | | | | |
| $F_{t-3} \times \bar{\rho}_{ir}$ | 0.9429*** (0.1322) | 0.8919*** (0.1501) | 0.9429*** (0.1322) | 0.9429*** (0.1322) |
| First-stage F-stat | 20.40 | 9.19 | 20.40 | 20.40 |
| Observations | 29,810 | 22,796 | 29,810 | 29,808 |
| Regions | 2,668 | 2,132 | 2,668 | 2,668 |
| Countries | 158 | 130 | 158 | 158 |

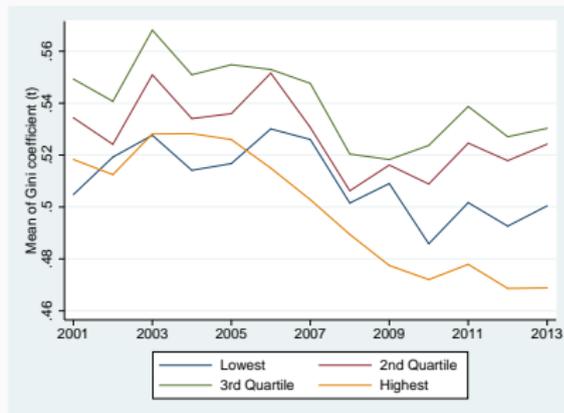
Notes: All specifications include the log of population density, region fixed effects and country-year fixed effects. Cluster-robust standard errors (country) are in parentheses.

| | First-order admin | | Second-order admin | |
|---------------------------------------|-----------------------|-----------------------|---------------------|---------------------|
| | All | Trans. | All | Trans. |
| | (1) | (2) | (3) | (4) |
| <i>Panel a) IV estimates</i> | | | | |
| $WBAid_{i,t-2}$ | -0.0756 (0.0566) | -0.0293 (0.0192) | -0.0430 (0.0313) | -0.0641 (0.0658) |
| <i>Panel b) First-stage estimates</i> | | | | |
| $IBRD_{t-3} \times \bar{\rho}_{ir}$ | 0.0278*** (0.0087) | 0.0672*** (0.0190) | 0.0166 (0.0154) | 0.0478 (0.0428) |
| Kleibergen-Paap F-stat | 3.09 | 12.58 | 3.66 | 1.25 |
| Observations | 29,915 | 29,915 | 356,382 | 356,382 |

Parallel trends



(A) Chinese Projects



(B) Spatial Ginis

◀ Go back.

Short and medium-term effects

| | <i>Project dummy one for X years</i> | | | | |
|----------------------------------|---------------------------------------|------------------------|------------------------|------------------------|------------------------|
| | One | Two | Three | Four | Five |
| | (1) | (2) | (3) | (4) | (5) |
| | <i>Panel a) 2SLS estimates</i> | | | | |
| $ChnProj_{i,t-2}$ | -0.0980*** (0.0344) | -0.0612*** (0.0190) | -0.0462*** (0.0143) | -0.0401*** (0.0124) | -0.0369*** (0.0116) |
| | <i>Panel b) First-stage estimates</i> | | | | |
| $F_{t-3} \times \bar{\rho}_{ir}$ | 0.4442*** (0.0709) | 0.7109*** (0.1062) | 0.9429*** (0.1322) | 1.0842*** (0.1633) | 1.1797*** (0.1825) |
| First-stage F-stat | 39.23 | 44.84 | 50.84 | 44.09 | 41.79 |
| Observations | 29,810 | 29,810 | 29,810 | 29,810 | 29,810 |
| Regions | 2,668 | 2,668 | 2,668 | 2,668 | 2,668 |
| Countries | 158 | 158 | 158 | 158 | 158 |

Notes: All specifications include the log of population density, region fixed effects and country-year fixed effects. Cluster-robust standard errors (country) are in parentheses.

Short and medium-term effects

| | <i>Project dummy one for X years</i> | | | | |
|---------------------------------------|--------------------------------------|------------------------|------------------------|------------------------|------------------------|
| | One (1) | Two (2) | Three (3) | Four (4) | Five (5) |
| <i>Panel a) 2SLS estimates</i> | | | | | |
| $ChnProj_{i,t-2}$ | -0.0986*** (0.0319) | -0.0619*** (0.0178) | -0.0467*** (0.0139) | -0.0406*** (0.0122) | -0.0373*** (0.0115) |
| $G_{ir,t-1}$ | 0.1391*** (0.0198) | 0.1392*** (0.0201) | 0.1399*** (0.0203) | 0.1397*** (0.0204) | 0.1400*** (0.0204) |
| <i>Panel b) First-stage estimates</i> | | | | | |
| $F_{t-3} \times \bar{\rho}_{ir}$ | 0.4459*** (0.0728) | 0.7106*** (0.1086) | 0.9412*** (0.1343) | 1.0825*** (0.1656) | 1.1800*** (0.1850) |
| $G_{ir,t-1}$ | -0.0186 (0.0208) | -0.0270 (0.0216) | -0.0214 (0.0182) | -0.0284 (0.0184) | -0.0238 (0.0186) |
| First-stage F-stat | 37.48 | 42.82 | 49.11 | 42.73 | 40.70 |
| Observations | 29,465 | 29,465 | 29,465 | 29,465 | 29,465 |

Notes: All specifications include the log of population density, region fixed effects and country-year fixed effects. Cluster-robust standard errors (country) are in parentheses.