Geographic Integration and Firm Exports: Evidence from China

ABFER 10th Annual Conference

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May 22, 2023

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  - In particular, how does geographic integration achieved through domestic transportation infrastructure affect firm-level export decisions?

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- Domestic distribution of economic activities $\rightarrow$ trade?
  - In particular, how does geographic integration achieved through domestic transportation infrastructure affect firm-level export decisions?
- Credibly identifying the impact of exporter integration domestically on firm trade performance is *important* and *challenging*
  - Extensive policies that promote geographic clustering of exporters
  - Location-specific externalities vs. site-specific characteristics
    - ⋆ Mixed evidence in the literature: domestic integration $\implies$ international integration?

This Paper...

- Builds a comprehensive micro-level dataset of Chinese exporters
- Overcomes the identification challenge using a unique quasi-experiment setting
  - Expansion of the high-speed rail (HSR) in China facilitates geographic integration, by reducing "effective" distance between exporters

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  - Expansion of the high-speed rail (HSR) in China facilitates geographic integration, by reducing "effective" distance between exporters
- Our research question:

How does geographic integration of exporters domestically affect firms' export performance?

New York Times, September 23, 2013

- Speedy Trains Transform China
  - Li Qingfu, the sales manager of an company located in Changsha that exports women's dresses and blouses
  - '... he used to travel twice a year to Guangzhou, the commercial hub of southeastern China...'
  - 'He now goes almost every month on the punctual bullet trains'

'More frequent [trips] ... have allowed me to more quickly pick up on fashion changes in color and style. My orders have increased by 50 percent.'

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  3. Knowledge related to **export product qualities**

Related Literature

- **Impact of domestic economic geography on trade:** Cosar & Demir (2016); Fajgelbaum & Redding (2022); Bakker et al. (2022)
- **Geographic spillovers and firm exports:** Foster & Rosenzweig (1995); Aitken, Hanson & Harrison (1997); Bernard & Jensen (2004); Koeinig et al. (2010); Fernandes & Tang (2014)
- **Information frictions in trade:** Rauch (1999); Allen (2014); Startz (2018); Steinwender (2018)
- **Spatial knowledge transmission:** Marshall (1890); Duranton & Puga (2003); Cristea (2011); Keller & Yeaple (2013); Davis & Dingel (2015)
- **Impact of transportation infrastructure investment:** Ahlfeldt & Feddersen (2017); Bernard et al. (2019); Qin (2017); Lin (2017); Dong et al. (2019); Cosar et al. (2021)

Theory

Set-Up

- Multi-sector Melitz model
  - Each firm z produces a unique variety, competes monopolistically within a sector s
  - Exogenously given productivity φ_z
- To access foreign markets, firms are subject to
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  - Export revenue for firm z in sector s is:

$$r_s^x(z) = \kappa_1 \left(\sum_n R_{sn} P_{sn}^{\sigma-1} \tau_{sn}^{1-\sigma} \right) (\varphi_z \, \varphi_s^x(z))^{\sigma-1}; \quad \sigma > 1$$

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- $\varphi_s^x(z)$ endogenously determined through a stochastic interaction process

Two-Step Export Knowledge Acquisition

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   - Drawn from a Fréchet distribution (Buera and Oberfield, 2020): $F(\omega) = e^{-\lambda_z \omega^{-\theta}}$
   - dispersion parameter $\theta > 1$; scale parameter $\lambda_z > 0$ Microfoundation
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   - Other exporters' insights are subject to a discount

$$\omega_{zz'} = f(d_{zz'})\,\omega_{z'}$$

   - $f(d_{zz'}) < 1$, for all $z \neq z'$, captures **geographic frictions** that discount the quality of interactions; determined by geographic distance & connectivity

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- $\varphi_s^x(z)$ follows a Fréchet distribution with dispersion θ and scale: Expected Value

$$\tilde{\lambda}_s(z) \equiv \lambda_z + \sum_{z' \in \mathcal{Z}_s \setminus z} \lambda_{z'} \left[f(d_{zz'})\right]^{\theta}$$

Model Predictions

$$\mathbb{E}(r_s^x(z)) = \kappa_1 \left(\sum_n R_{sn} P_{sn}^{\sigma-1} \tau_{sn}^{1-\sigma} \right) \left[\varphi_z \left(\underbrace{\lambda_z + \sum_{z' \in \mathcal{Z}_s \setminus z} \lambda_{z'} f(d_{zz'})^{\theta}}_{\tilde{\lambda}_s(z)} \right)^{\frac{1}{\theta}} \right]^{\sigma-1}$$

Proposition:

- All else equal, in response to an exogenous reduction in $d_{zz'}$,
  1. firms already exporting increase volume of export on average; and
  2. share of exporting firms, denoted by Z_s, increases.
- Formally, we have

$$\frac{\partial \, \mathbb{E}(r_s^x(z))}{\partial d_{zz'}} < 0; \quad \frac{\partial Z_s}{\partial d_{zz'}} < 0.$$

$\Longrightarrow$ Reduction in geographic frictions increase export intensively and extensively

Proof Cross-Sectional Prediction

Econometric Specification

- Firm z's export revenue (in log) at time t,

$$y_{zst} = \alpha_{st} + \alpha_z + \beta x_{zst} + \iota_{zt},$$

where

  - $x_{zst} \equiv \log \left(\sum_{z' \in \mathcal{Z}_s} \lambda(z') f(d_{zz'})^{\theta} \right)$: firm z extent of geographic integration (export knowledge acquisition)
  - α_{st}: sector time-varying effects
  - α_z: time-invariant firm-specific productivity term
  - ι_{zt}: unobserved time-varying productivity shock
  - $\beta \equiv (\sigma - 1)/\theta > 0$: RF coefficient of interest

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- Identification challenge: $cov(x_{zst}, \iota_{zt}) \neq 0$
  - Location-specific externalities vs. site-specific characteristics
  - Expansion of the HSR lowers geographic frictions, providing plausibly exogenous shocks to x_{zst}

Model Overview Details

Data and Background

Rapid Rollout of the HSR Network

(a) 2008

(b) 2010

(c) 2013

(d) 2030 (Expected)

Export Data

Export data 2000–2013: China General Administration of Customs

- 341k export firms before HSR connection
- Annual firm-level reports
  - Export revenue and quantity by destination $\times$ product type (HS8)
- Detailed firm characteristics
  - Firm location (prefecture level), firm name, ownership (private vs state-owned), sector (HS2 level)

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$$x_{cst} \equiv \sum_{c' \neq c} \left[\sum_{z' \in \mathcal{Z}_{st_0}(c')} r^{x}_{st_0}(z') \right] \tilde{f}(d_{cc't})$$

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- x_{cst} resembles the market access measure (e.g., Donaldson and Hornbeck, 2016)

Two Alternative Measures

- Measure 1: HSR connection status-weighted export revenue:

$$x_{cst} \equiv \sum_{c' \neq c} \left[\sum_{z' \in \mathcal{Z}_{st_0}(c')} r^x_{st_0}(z') \right] \times \mathbb{I}(\mathbf{HSR}_{cc't})$$

  - where $\mathbb{I}(HSR_{cc't}) = 1$ if there is direct HSR connection, and 0 otherwise.

- Measure 2: travel time-weighted export revenue:

$$x_{cst} \equiv \sum_{c' \neq c} \left[\sum_{z' \in \mathcal{Z}_{st_0}(c')} r^x_{st_0}(z') \right] / \mathbf{T}(\mathbf{Train}_{cc't}),$$

  - where $\mathbf{T}(\mathbf{Train}_{cc't})$ is the travel time by train (traditional if there is no HSR).

Identification Strategy

$$y_{zst} = \alpha_{st} + \alpha_z + \beta x_{cst} + \iota_{zt}$$

- Standard DiD approach: HSR not correlated with location-specific shocks correlated with firm's export decisions Event Study

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- Triple-differences model:
  - Compare export performance of firms *before* and *after* HSR connection (first difference)
  - ... in locations *with a new HSR station* relative to those *without* (second difference)
  - Compare the differential effects in sectors experiencing *more* versus *less* increase in exporter integration (third difference)

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- Identification assumption: parallel trend in export performances for firms located in the same city, producing across different sectors

Empirical Results

Baseline Results

	(1)	(2)	(3)	(4)
Dependent Variable	log(export revenue)		No. exp destinations	
Independent Variable	Measure 1	Measure 2	Measure 1	Measure 2
x_{cst}	0.042***	0.030***	0.202***	0.105***
	(0.007)	(0.006)	(0.038)	(0.037)
Observations	2,032,156	2,032,156	2,032,156	2,032,156
R-squared	0.738	0.738	0.805	0.805

Notes: We control for firm fixed effects, city time-varying effects and sector time-varying effects. The error terms are clustered at the city level. Robust standard errors are in parentheses: *** p<0.01, ** p<0.05, and * p<0.1.

Destination Level Analysis Extensive: Dummy

Export Revenue Decomposition

	(1)	(2)	(3)	(4)
Dependent Variable	log(price)		log(quantity)	
Independent Variable	Measure 1	Measure 2	Measure 1	Measure 2
x_{cst}	-0.045***	-0.035***	0.087***	0.066***
	(0.007)	(0.009)	(0.011)	(0.010)
Observations	2,028,602	2,028,602	2,028,602	2,028,602
R-squared	0.852	0.852	0.798	0.798

Notes: We control for firm fixed effects, city time-varying effects and sector time varying effects. The error terms are clustered at the city level. Robust standard errors are in parentheses: *** p<0.01, ** p<0.05, and * p<0.1.

Adjustment of Exported Products

	(1)	(2)	(3)	(4)
Dependent Variable	$\frac{N_{it}^{Added}+N_{it}^{Dropped}}{\bar{N}_i^{HS\text{-}8}}$		$\ln N_{it}^{HS\text{-}8}$	
Independent Variable	Measure 1	Measure 2	Measure 1	Measure 2
x_{cst}	0.044***	0.026**	0.036***	0.026***
	(0.008)	(0.010)	(0.007)	(0.007)
Observations	1,638,608	1,638,608	2,032,156	2,032,156
R-squared	0.401	0.401	0.806	0.806

Notes: We control for firm fixed effects, city time-varying effects and sector time varying effects. The error terms are clustered at the city level. Robust standard errors are in parentheses: *** $p<0.01$, ** $p<0.05$, and * $p<0.1$.

Robustness Checks

- HSR targeted to enhance connectivity for certain sectors (remove the largest sector within a given city) Table
- Late connections: lagged treatment Table
- Permutation test generates a similar p-value compared to the baseline estimation. Table
- Not controlling for city time-varying effects Table
- Restrict sample to a balanced panel: firms that exported in both 2007 (before the rollout of HSR network) and 2013 (the ending period). Table
- Internet connectivity is not correlated with HSR access. Table
- Restrict sample to prefectures eventually connected to HSR network by 2016 Table
- Clustering the errors at city-sector-year level Table

Economic Channel Investigation

Interpreting the Empirical Results

- So far, the results show that the HSR infrastructure shock improves export performance; stronger effects for exporters more integrated with exporters from the same sector
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- We next explore in more detail the economic mechanism(s) behind the empirical results
  - We provide evidence consistent with geographic integration facilitates knowledge spillovers (acquisition and sharing) in export markets

TFP Improvement or Export Cost Reduction?

- Improved export performance can be driven by:
  - TFP improvement: improved capacity to serve **all** markets
  - Export cost reduction: improved capacity to serve **foreign** markets
    - "Export-specific agglomeration"
- To investigate, we have three tests:
  1. Within a firm, export to a destination grows more when the firm becomes more integrated with other firms exporting to the same destination Details
  2. Connected firms converge on the set of export destinations (not on the set of products) Details
  3. Results robust to controlling for integration with all firms Details
- Evidence consistent with *export-specific* spillover effects, i.e., geographic integration affects export-specific decisions and outcomes

Which Export-Specific Cost?

- Earlier results consistent with geographic integration $\Longrightarrow$ reduction in export-specific cost

Which Export-Specific Cost?

- Earlier results consistent with geographic integration $\implies$ reduction in export-specific cost
- We investigate nature of the cost using a heterogeneity analysis:

$$y_{zst} = \alpha_{st} + \alpha_z + \alpha_{ct} + \beta x_{cst} + \gamma x_{cst} \times \text{Firm Type} + \iota_{zt}$$

- Common characteristics of firm types experiencing greater export performance improvement would provide a hint on the nature of the cost reduction

Knowledge Spillovers in Export Market

- We explore the heterogeneity results along the following dimensions:
  - Firm size: smaller firms respond more Details
  - Product type: firms exporting more complex products respond more Details
  - Location: firms locating in more remote regions respond more Details
  - Destination: firms exporting to less open countries respond more Details
  - Exporter type: firms not in processing trade respond more Details
- Firms facing **greater knowledge acquisition costs** improve their export performance to a larger extent
  - Suggestive evidence that there are export-specific agglomerations arising from knowledge spillovers

Controlling for Other Types of Agglomeration

- Marshall (1920) emphasized three types of agglomeration externalities arising from geographic integration:
  1. Access to knowledge
  2. Access to customers and suppliers
     - ★ Access to upstream suppliers (Bernard, Moxnes & Saito, 2019)
     - ★ Access to international markets, i.e., port Details
  3. Access to labor
     - ★ Access to potential pool of workers (Ellison et al., 2010)
     - ★ Flow of high-skilled workers into skill-intensive sectors (Yu et al., 2019) Details

- Results are robust to controlling for (2) and (3) Customers and suppliers Access to labor 1 Access to labor 2
  - ▶ Suggestive evidence that observed export performance improvement is driven by access to knowledge

Knowledge Acquisition in the Export Markets

- To investigate the nature of knowledge being acquired, we study changes in *product qualities* across firms following the HSR expansion
  - Quality inferred from the demand, following Khandelwal et al. (2013) Details
  - Aggregate to firm-product-year level, and compute long difference

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- Denoted by $\triangle\bar{\lambda}_{zk}$, it can be further decomposed to:

$$\triangle\bar{\lambda}_{zk} = \underbrace{\sum_{n\in\mathcal{N}_t\cap\mathcal{N}_{t-1}} \bar{\theta}_{znk}\left(\ln\lambda_{znkt} - \ln\lambda_{znkt-1}\right)}_{\text{Intensive-Within}} + \underbrace{\sum_{n\in\mathcal{N}_t\cap\mathcal{N}_{t-1}} \left(\theta_{znkt} - \theta_{znkt-1}\right)\left(\bar{\lambda}_{znk} - \bar{\lambda}_{zk}\right)}_{\text{Intensive-Across}} +$$
$$\underbrace{\sum_{n\in\mathcal{N}_t\backslash\mathcal{N}_{t-1}} \theta_{znkt}\left(\ln\lambda_{znkt} - \bar{\lambda}_{zk}\right)}_{\text{Extensive-Entry}} - \underbrace{\sum_{n\in\mathcal{N}_{t-1}\backslash\mathcal{N}_t} \theta_{znkt-1}\left(\ln\lambda_{znkt-1} - \bar{\lambda}_{zk}\right)}_{\text{Extensive-Exit}}$$

Impact of Geographic Integration on Product Quality

- Evidence consistent with export knowledge acquisition ...
  - improving quality for products exported to existing destinations
  - facilitating firms exporting to higher-quality destinations

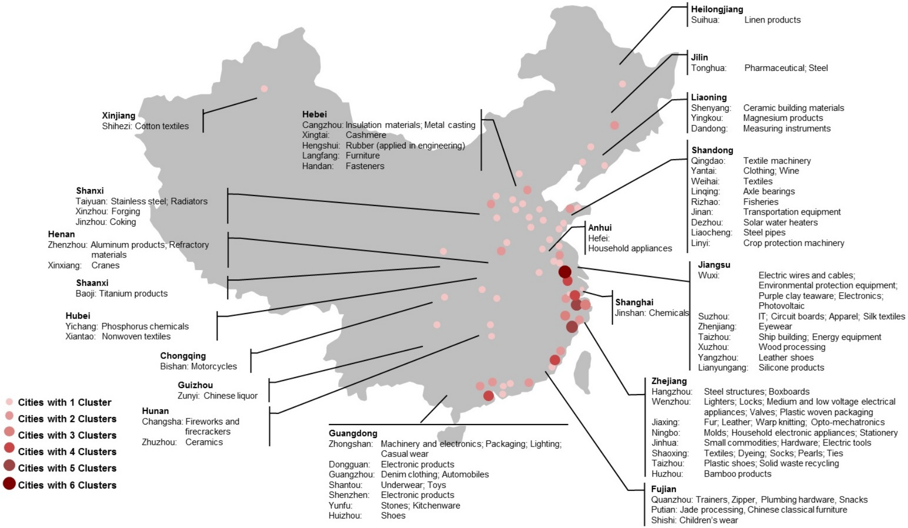
VARIABLES	(1)	(2)	(3)	(4)
	Product quality			
	Measure 1		Measure 2	
Intensive	0.051***	0.042***	0.048***	0.032***
Within	0.044***	0.037***	0.040***	0.026***
Across	0.007**	0.005	0.008**	0.007*
Extensive	0.027***	0.016*	0.027***	0.015***
Entry	0.013***	0.009*	0.014***	0.011***
Exit	-0.015***	-0.007*	-0.013***	-0.005
Average	0.079***	0.058***	0.075***	0.047***
Sector FE	No	Yes	No	Yes
Observations	137,856	137,856	137,856	137,856

Conclusion

- This paper presents new evidence on how geographic integration of exporters is related to firm export performance
- Generate plausibly exogenous variation in extent of integration using a quasi-experiment: the expansion of HSR in China
  - Improved geographic spillovers from HSR-connected cities increase extensive and intensive margins of trade
- Suggestive evidence that export-specific geographic spillovers facilitate knowledge acquisition that improves export product qualities and exports to higher quality destinations
- **Policy implications:**
  - New justifications for policies promoting integration of exporters;
  - Transportation infrastructure investment promotes export by reducing informal trade barriers

Appendix

Export Clusters in China



Back to Motivation

New York Times, September 23, 2013

- Speedy Trains Transform China
  - Li Qingfu, the sales manager of an company located in Changsha that exports women's dresses and blouses
  - '... he used to travel twice a year to Guangzhou, the commercial hub of southeastern China...'
  - 'He now goes almost every month on the punctual bullet trains'

'More frequent access to my client base has allowed me to more quickly pick up on fashion changes in color and style. My orders have increased by 50 percent.'

Back

Related Literature

- **Globalization and economic geography:** Fajgelbaum & Redding (2014); Cosar & Fajgelbaum (2016); Marin et al. (2020); Bakker (2021)
- **Geographic spillovers and firm exports:** Foster & Rosenzweig (1995); Aitken, Hanson & Harrison (1997); Bernard & Jensen (2004); Koeinig et al. (2010)
- **Models of knowledge diffusion:** Perla & Tonetti (2014); Buera & Oberfield (2020); Berkes et al. (2021)
- **Knowledge transmission across locations:** Marshall (1890); Duranton & Puga (2003); Cristea (2011); Keller & Yeaple (2013); Davis & Dingel (2015)
- **Information frictions in trade:** Rauch (1999); Allen (2014); Startz (2018): Steinwender (2018)
- **Impact of transportation infrastructure investment:** Redding & Turner (2015); Cosar & Demir (2016); Bernard et al. (2018); Lin (2017); Dong et al. (2019)

Back

A Heterogeneous Firm Model

- Embed a **knowledge diffusion model** (e.g., Buera and Oberfield, 2020; Berkes et al., 2021) into an **international trade framework with heterogeneous firms** (Melitz, 2003)

- To access foreign markets, firms are subject to
  - fixed cost of export; iceberg trade costs

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  - Knowledge diffused spatially: more effective for exporters more geographically integrated with other exporters

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  - Knowledge diffused spatially: more effective for exporters more geographically integrated with other exporters
- $\downarrow$ in effective distance between exporters $\implies$ $\uparrow$ geographic integration
  - firms already exporting increase volume of export on average
  - a firm responds more if it faces lower productivity or costlier insight collection

Back

Expected Export-Specific Insight

- For tractability, we assume that all insight draws follow a Fréchet distribution:

$$F(\omega) = e^{-\lambda(z)\omega^{-\theta}}, \quad \theta > 1$$

- Thus, we have for own insight draws:

$$\mathbb{E}(\omega) = \Gamma\left(1 - \frac{1}{\theta}\right)(\lambda(z))^{\frac{1}{\theta}}.$$

- Since Fréchet is max stable, $\varphi_s^x(z)$ also follows a Fréchet distribution with scale parameter:

$$\tilde{\lambda}_s(z) \equiv \lambda(z) + \sum_{z' \in \mathcal{Z}_s \backslash z} \lambda(z') \left[f(d_{zz'})\right]^{\theta}$$

- We have:

$$\mathbb{E}(\varphi_s^x(z)) = \Gamma\left(1 - \frac{1}{\theta}\right)(\tilde{\lambda}_s(z))^{\frac{1}{\theta}}.$$

where $\Gamma(\cdot)$ is the gamma function and

$$\tilde{\lambda}_s(z) \equiv \lambda(z) + \sum_{z' \in \mathcal{Z}_s \backslash z} \tilde{\lambda}(z') \left[f(d_{zz'})\right]^{\theta}$$

Back

Expected Export-Specific Knowledge

- Given Fréchet Assumption, we have for own insight draws:

$$\mathbb{E}(\omega) = \Gamma\left(1 - \frac{1}{\theta}\right)(\lambda(z))^{\frac{1}{\theta}}.$$

- For export-specific productivity (max of all insight draws), we have $\varphi_s^x(z)$ also following a Fréchet distribution with dispersion parameter θ and scale parameter:

$$\tilde{\lambda}_s(z) \equiv \lambda(z) + \sum_{z' \in \mathcal{Z}_s \setminus z} \lambda(z')\left[f(d_{zz'})\right]^\theta$$

- We have:

$$\mathbb{E}(\varphi_s^x(z)) = \Gamma\left(1 - \frac{1}{\theta}\right)(\tilde{\lambda}_s(z))^{\frac{1}{\theta}}.$$

where $\Gamma(\cdot)$ is the gamma function and

$$\tilde{\lambda}_s(z) \equiv \lambda(z) + \sum_{z' \in \mathcal{Z}_s \setminus z} \tilde{\lambda}(z')\left[f(d_{zz'})\right]^\theta$$

Back

Model Details

FOC of the expected export profit of a firm w.r.t. $\lambda(z)$:

$$\kappa_2 \frac{\sigma - 1}{\theta} R_s P_s^{\sigma-1} \tau_s^{1-\sigma} \varphi_z^{\sigma-1} \left(\lambda_z^* + \sum_{z' \in \mathcal{Z}_s \backslash z} \lambda_{z'}^* \left[f(d_{zz'}) \right]^{\theta} \right)^{\sigma-\theta-1} - c_s = 0. \quad (1)$$

From (1), we have

$$h(\lambda_z^*) = \kappa_2 \frac{\sigma - 1}{\theta} R_s P_s^{\sigma-1} \tau^{1-\sigma} \varphi_z^{\sigma-1} \left(\lambda_z^* + \sum_{z' \in \mathcal{Z}_s \backslash z} \lambda_{z'}^* \left[f(d_{zz'}) \right]^{\theta} \right)^{\sigma-\theta-1} - c_s = 0.$$

Applying implicit function theorem, we obtain:

$$\frac{\partial \lambda_z^*}{\partial \varphi_z} = - \frac{\partial h(\lambda_z^*)}{\partial \lambda_z^*} \Big/ \frac{\partial h(\lambda_z^*)}{\partial \varphi_z} > 0;$$

and

$$\frac{\partial \lambda_z^*}{\partial c_s} = - \frac{\partial h(\lambda_z^*)}{\partial \tilde{\lambda}_z^*} \Big/ \frac{\partial h(\lambda_z^*)}{\partial c_s} < 0.$$

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Proof of Proposition **??**

The expected export revenue for exporting firms is:

$$\mathbb{E}(r_s^x(z)) = \kappa_1 R_s P_s^{\sigma-1} \left(\frac{\tau}{\varphi_z \left(\tilde{\lambda}_z + \sum_{z' \in \mathcal{Z}_s \setminus z} \tilde{\lambda}_{z'} \left[f(d_{zz'}) \right]^\theta \right)^{\frac{1}{\theta}}} \right)^{1-\sigma},$$

Differentiating with respect to $d_{zz'}$, we obtain

$$\frac{\partial \, \mathbb{E}(r_{sc}^x(z))}{\partial d_{zz'}} = \frac{\partial \, \mathbb{E}(r_{sc}^x(z))}{\partial f(d_{zz'})} \frac{\partial f(d_{zz'})}{\partial d_{zz'}} < 0$$

Firms export if the expected variable profit covers the fixed cost of export. The productivity cutoff is given by:

$$\varphi_s(\lambda_s(z)) = \frac{\tau_s}{P_s \left(\lambda_s(z) \right)^{\frac{1}{\theta}}} \left[\frac{f^x + c_s \tilde{\lambda}_s^*(z)}{\kappa_2 R_s} \right]. \tag{2}$$

where $\varphi_s(\lambda_s(z))$ is the lowest productivity required in sector s to export for a given value of $\lambda_s(z)$. Within a sector s, firms with $\varphi > \varphi_s(\lambda_s(z))$ export.

Proof of Proposition ??

From (2), the share of firms that export as a function of $\lambda_s(z)$ is

$$Z_s(k; \lambda_s(z)) = \int_k^{\infty} g(y)dy,$$

where recall $g(\cdot)$ is the pdf of firm productivity draws. Further, the total share of firms that export is

$$Z_s(a_s) = \int_{a_s}^{\infty} f_s^{\lambda}(j) \int_{\varphi(a_s)}^{\infty} g(y)dydj, \tag{3}$$

where $f_s^{\lambda}(\cdot)$ is the empirical pdf of $\lambda_s(z)$ and a_s is the productivity cutoff given by (2). From (3), it is straightforward to see that $Z_s'(a) < 0$. Therefore, we have

$$\frac{\partial Z_s}{\partial d_{zz'}} < 0.$$

Back

Proof of Proposition **??**

Using results from Proposition **??**, we have

$$\frac{\partial^2 \mathbb{E}(r_s^x(z))}{\partial d_{zz'} \partial \tilde{\lambda}_s^*(z)} > 0;$$

Combining results from Lemma **??**, we have

$$\frac{\partial^2 \mathbb{E}(r_s^x(z))}{\partial d_{zz'} \partial \varphi(z)} = \frac{\partial^2 \mathbb{E}(r_s^x(z))}{\partial d_{zz'} \partial \tilde{\lambda}_s^*(z)} \frac{\partial \tilde{\lambda}_s^*(z)}{\partial \varphi_z} > 0;$$

and

$$\frac{\partial^2 \mathbb{E}(r_s^x(z))}{\partial d_{zz'} \partial c_s} = \frac{\partial^2 \mathbb{E}(r_s^x(z))}{\partial d_{zz'} \partial \tilde{\lambda}_s^*(z)} \frac{\partial \tilde{\lambda}_s^*(z)}{\partial c_s} < 0.$$

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Derivation Details

- Revenue obtained from export is

$$r_s^x(z) = \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} R_s P_s^{\sigma-1} \left(\frac{\tau_s}{\varphi_z \varphi_s^x(z)}\right)^{1-\sigma}.$$

- Taking logs, we get

$$\log r_s^x(z) = const. + \log R_s + (\sigma-1)\log P_s + (1-\sigma)\log \tau_s + (\sigma-1)\log \varphi_z + (\sigma-1)\log \varphi_s^x(z).$$

- $K \equiv \log \varphi_s^x(z)$ follows a log-Fréchet distribution with moment generating function for K given by:

$$M_K(\varphi) = e^{\frac{\varphi}{\theta}\log(\lambda_s(z))} + \Gamma(1-\frac{\varphi}{\theta}).$$

- The expected value is

$$\mathbb{E}(K) = M_K'(0) = \frac{\log \lambda_s(z)}{\theta} + \gamma$$

where γ is the Euler-Mascheroni constant.

Derivation Details

- Taking expectation of the log revenue function, we obtain Details

$$\mathbb{E}\left(\log r_s^x(z)\right) = const + \log R_s + (\sigma - 1)\log P_s + (1-\sigma)\log \tau_s$$
$$+(\sigma - 1)\log \varphi_z + \beta \log \lambda_s(z),$$

where $\beta = (\sigma - 1)/\theta$.

- Assuming it holds for all exporters in each period, we obtain the following estimating equation for $\mathbb{E}\left(\log r_s^x(z)\right)$:

$$y_{zst} = \alpha_{st} + \alpha_z + \beta x_{zst} + \iota_{zt}, \quad (4)$$

where

  - $y_{zst} \equiv \log r_{st}^x(z)$
  - $\alpha_{st} \equiv \log R_{st} + (\sigma - 1)\log P_{st} + (1-\sigma)\log \tau_{st}$
  - $x_{zst} \equiv \log \lambda_{st}(z)$
  - $\iota_{zt} \equiv [(\sigma - 1)\ln \varphi(z;t) - \alpha_z] + [\log r_{st}^x(z) - \mathbb{E}(\log r_{st}^x(z))]$

Back

Cross-Sectional Prediction

Proposition 1

All else equal and conditioning on exporting, firm revenue and profits decrease with its geographic frictions with other exporters in the same sector. Formally, for $\mathbf{d_z} = (\{d_{zz'}\}_{z' \in \mathcal{Z}_s})'$, *we have*

$$\frac{\partial\, \mathbb{E}\left(r_s^x(z)\right)}{\partial\, \mathbf{d_{zz'}}} < \mathbf{0}; \quad \frac{\partial\, \mathbb{E}\left(\pi_s^x(z)\right)}{\partial\, \mathbf{d_{zz'}}} < \mathbf{0}.$$

- Basis for past empirical analyses.
- Cannot separately identify location-specific external economies versus site-specific characteristics

Back

Background

- HSR construction in China started in 2008, rapid expansion until 2016
  - covering 190 cities; total length 10,000km in 2013
  - Spain: 2515km; Japan: 2388km; France: 2036km
- HSR: $> 250 km/hr$ (average 350km/hr)
  - Drastic reduction in travel time: traditional train speed (120-160km/hr)
  - e.g., travel time between Beijing and Shanghai shortened from 13 to 5 hours
- Competitively priced tickets: USD0.07/km (Europe HSR USD0.10-0.20/km; Japan Shinkansen >USD0.20/km)
  - cheaper than discounted air tickets
  - about 3 times the price for traditional trains
- Rapid expansion of ridership: 39% p.a. (13% for air)
  - 672mil in 2013
  - Majority are business travelers

Back

HSR connection criteria

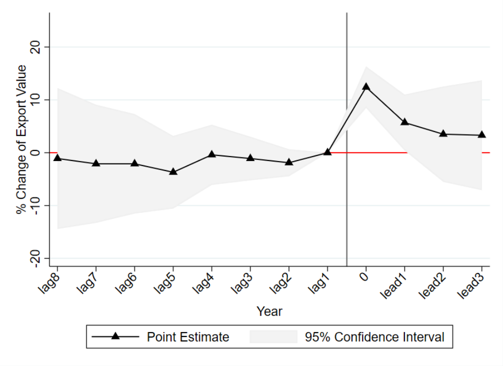
- Not publicly known
- Ridership maximization: connect megacities and cities that will boom
- Reduce spatial inequalities: connect smaller and weaker cities to enhance growth potential
- Zheng and Kahn (2012):
  - No significant differences in GDP growth, wage growth, distance to megacities
  - Cities without HSR connection have higher population growth

Back

Event Study

$$\ln r_{zct} = \sum_{k=\dots,-3,-2,0,1,2,\dots} \beta^k \mathbb{I}(HSR)^k_{ct} + \alpha_z + \gamma_t + \epsilon_{zct}$$

- $\mathbb{I}(HSR)^k_{ct} = 1$ if c is connected in $t-k$
- β^k: relative change in export revenue of treated firms k years after connection



Back

Heterogeneity: Firm Size

- Smaller exporting firms respond more to the HSR driven improvement in access to other exporting firms.

	(1)	(2)
Dependent Variable	log(export revenue)	
Independent Variable	Measure 1	Measure 2
Access to Exporters	0.016*	0.011*
	(0.009)	(0.050)
Access to Exporters×Small	0.060**	0.090***
	(0.024)	(0.027)
Observations	2,032,156	2,032,156
R-squared	0.740	0.740

Back

Heterogeneity: Product Complexity

- Homogeneous products defined using Rauch (1999).
- Firms producing less homogeneous products respond more to the HSR driven improvement in access to other exporting firms.

	(1)	(2)
Dependent Variable	log(export revenue)	
Independent Variable	Measure 1	Measure 2
Access to Exporters	0.043***	0.032***
	(0.008)	(0.006)
Access to Exporters×Simple	-0.022	-0.029*
	(0.020)	(0.015)
Observations	2,023,497	2,023,497
R-squared	0.737	0.737

Back

Heterogeneity: Firms in Core vs. Peripheral Cities

- Export firms located in peripheral cities respond more to the HSR driven improvement in access to other exporting firms.

	(1)	(2)
Dependent Variable	log(export revenue)	
Independent Variable	Measure 1	Measure 2
Access to Exporters	0.053***	0.041***
	(0.010)	(0.008)
Access to Exporters×Core City	-0.026*	-0.025***
	(0.014)	(0.010)
Observations	2,032,156	2,032,156
R-squared	0.738	0.738

Back

Heterogeneity: Openness of Export Destinations

- Less acute information frictions when exporting to more open and easily accessed markets (Lovely et al., 2005)
  - Classify export destinations by openness (trade per dollar GDP, controlling for country size and proximity to economic activity outside of the country)
- Firms exporting to less open destinations respond more to the HSR driven improvement in access to other exporting firms.

	(1)	(2)
Dependent Variable	log(export revenue)	
Independent Variable	Measure 1	Measure 2
Access to Exporters	0.082***	0.064***
	(0.012)	(0.009)
Access to Exporters×Destination Openness	-0.068***	-0.055***
	(0.013)	(0.012)
Observations	1,974,606	1,974,606
R-squared	0.735	0.735

Back

Heterogeneity: Processing Trade

- Firms in ordinary trade respond more to the HSR driven improvement in access to other exporting firms than those in processing trade

	(1)	(2)
Dependent Variable	log(export revenue)	
Independent Variable	Measure 1	Measure 2
Access to Exporters	0.047***	0.033***
	(0.007)	(0.006)
Access to Exporters×Process	-0.399***	-0.288***
	(0.116)	(0.100)
Observations	2,032,156	2,032,156
R-squared	0.739	0.739

Back

Heterogeneity: Ownership Status

- No significant difference between SOEs and privately owned firms

	(1)	(2)
Dependent Variable	log(export revenue)	
Independent Variable	Measure 1	Measure 2
Access to Exporters	0.052***	0.028***
	(0.008)	(0.006)
Access to Exporters × Private	-0.003	-0.025
	(0.012)	(0.015)
Observations	2,032,156	2,032,156
R-squared	0.740	0.740

Back

Controlling for Access to Suppliers, Ports, and Domestic Firms

	(1)	(2)	(3)	(4)
VARIABLES	log(export revenue)		No. exp destinations	
	Measure 1	Measure 2	Measure 1	Measure 2
Access to exporters	0.036***	0.029***	0.171***	0.094**
	(0.009)	(0.010)	(0.049)	(0.043)
Suppliers	0.100***	0.059**	0.201*	0.116
	(0.023)	(0.029)	(0.116)	(0.109)
Port	0.094***	0.029	0.315*	0.116
	(0.029)	(0.018)	(0.164)	(0.079)
Domestic firms (TFP$\geq$75pctl)	-0.091***	-0.075***	-0.002	-0.081
	(0.018)	(0.019)	(0.079)	(0.068)
Domestic firms (TFP$<$75pctl)	0.278***	0.246***	-0.180	0.271
	(0.097)	(0.084)	(0.449)	(0.370)
Observations	2,004,824	2,004,824	2,004,824	2,004,824
R-squared	0.737	0.737	0.804	0.804

Back

Controlling for Labor Supply Responses

	(1)	(2)	(3)	(4)
Dependent Variable	log(export revenue)		No. exp destinations	
Independent Variable	Measure 1	Measure 2	Measure 1	Measure 2
x_{cst}	0.036***	0.024***	0.184***	0.086***
	(0.008)	(0.007)	(0.039)	(0.033)
Skill Intensity×Core City×$1_{\{HSR\}}$	0.574***	0.558***	1.772	1.857
	(0.202)	(0.208)	(1.341)	(1.324)
Observations	2,020,651	2,020,651	2,020,651	2,020,651
R-squared	0.737	0.737	0.805	0.805

Notes: The following prefectures are assigned to the core city group while the rest are in the peripheral city group: Beijing, Shanghai, Tianjin, Chongqing, Shenzhen, Qingdao, Dalian, Suzhou, Xiamen, and Ningbo. We control for firm fixed effects, city time-varying effects, and sector time-varying effects. The error terms are clustered at the city level. Robust standard errors are in parentheses: *** p<0.01, ** p<0.05, and * p<0.1.

Back

Destination Level Analysis

- We consider impact of x_{cst} on firm export revenue to a specific destination n

$$y_{zsnt} = \alpha_{zn} + \alpha_{snt} + \alpha_{ct} + \beta x_{cst} + \iota_{znt},$$

	(1)	(2)
	log(export revenue)	
	Measure 1	Measure 2
x_{cst}	0.012*	0.004***
	(0.006)	(0.000)
Observations	15,717,657	15,717,657
R-squared	0.726	0.726

Robust standard errors clustered by prefectures in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Back

Lagged Treatment

VARIABLES	(1)	(2)	(3)	(4)
	log(export revenue)		No. exp destinations	
Measure 1	0.044***		0.288***	
	(0.013)		(0.101)	
Measure 2		0.027***		0.180**
		(0.008)		(0.074)
Observations	2,032,156	2,032,156	2,032,156	2,032,156
R-squared	0.738	0.738	0.805	0.805

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

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Exclude the Largest Sector

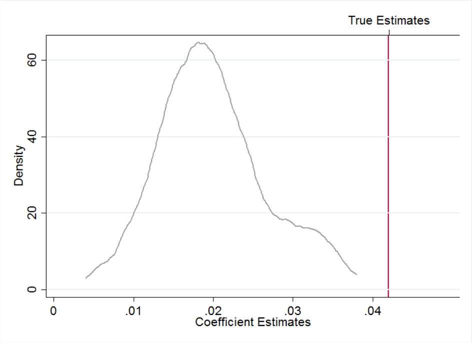
VARIABLES	(1)	(2)	(3)	(4)
	log(export revenue)		No. exp destinations	
Measure 1	0.048***		0.182***	
	(0.008)		(0.040)	
Measure 2		0.030***		0.145***
		(0.007)		(0.036)
Observations	1,740,255	1,740,255	1,740,255	1,740,255
R-squared	0.734	0.734	0.802	0.802

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

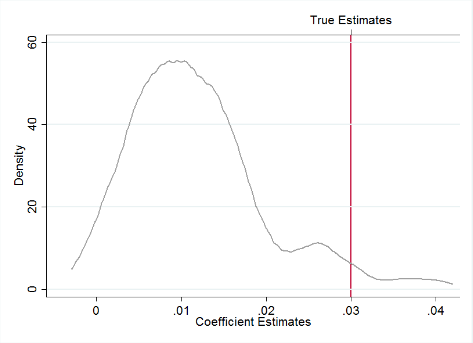
Back

Permutation Test

- The p-values derived from the permutation tests are quantitatively similar to the baseline results.



(a) Measure1



(b) Measure2

Notes: For the first measure, we randomly select a set of city pairs for each year during 2008 and 2013. The number of connected city pairs is specified to be the same as in reality in the corresponding year. For the second measure, we reshuffle the reduction of commuting time between city pairs caused by the HSR network expansion and re-compute the second measure. The distribution of coefficient estimates are based on 200 simulations. The p-values of the estimates are 0 for Measure 1 and 0.02 for Measure 2, both of

No Control of City Time-varying Effects

	(1)	(2)	(3)	(4)
VARIABLES	log(export revenue)		No. exp destinations	
Measure 1	0.026*		0.052	
	(0.013)		(0.063)	
Measure 2		0.033**		0.102
		(0.014)		(0.065)
Observations	2,032,190	2,032,190	2,032,190	2,032,190
R-squared	0.735	0.735	0.802	0.802

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Back

A Balanced Panel of Firms

	(1)	(2)	(3)	(4)
VARIABLES	log(export revenue)		No. exp destinations	
Measure 1	0.047***		0.229***	
	(0.009)		(0.047)	
Measure 2		0.040***		0.170***
		(0.008)		(0.057)
Observations	975,743	975,743	975,743	975,743
R-squared	0.751	0.751	0.842	0.842

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Back

Dropping Cities with no HSR station by 2016

VARIABLES	(1) lnexp	(2) lnexp	(3) N_destination	(4) N_destination
x_{cst}	0.046*** (0.008)	0.032*** (0.006)	0.210*** (0.040)	0.112*** (0.039)
Observations	1,834,222	1,834,222	1,834,222	1,834,222
R-squared	0.740	0.740	0.807	0.807
Firm FEs	Y	Y	Y	Y
CityXyr FEs	Y	Y	Y	Y
SecXyr FEs	97 sectors	97 sectors	97 sectors	97 sectors

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Back

Internet Connectivity

- Internet not positively correlated with HSR connection

VARIABLES	(1) Internet usage	(2) ln(Internet usage)
HSR dummy	1.176	-0.041
	(4.849)	(0.036)
Observations	2,271	2,271
R-squared	0.437	0.993

*** p<0.01, ** p<0.05, * p<0.1

Back

Clustering Standard Errors at City-Sector-Year Level

VARIABLES	(1) lnexp	(2) lnexp	(3) N_destination	(4) N_destination
x_{cst}	0.042***	0.030***	0.202***	0.105**
	(0.007)	(0.007)	(0.034)	(0.044)
Observations	2,032,156	2,032,156	2,032,156	2,032,156
R-squared	0.738	0.738	0.805	0.805
Firm FEs	Y	Y	Y	Y
CityXyr FEs	Y	Y	Y	Y
SecXyr FEs	97 sectors	97 sectors	97 sectors	97 sectors

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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Alternative Mechanisms: Measure Details

1. Changes in access to suppliers, induced by HSR connection

$$\sum_{s'} \psi_{s'}^{s} \sum_{c' \neq c} \left[\sum_{z' \in \mathcal{Z}_{s' t_0}(c')} r_{s' t_0}(z') \right] f(d_{cc' t}),$$

where $\psi_{s}^{s'}$ is the input share from sector s' for a firm in sector s.

2. Changes in access to port, induced by HSR connection
   - Define $\mathbb{C}_z^{port}$ as the set of port locations that exporter z uses
   - Define access to port:

$$\sum_{port(z) \in \mathbb{C}_z^{port}} f(d_{cc' t}),$$

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Alternative Mechanisms: Measure Details

3. Changes in access to production activities, induced by HSR connection
   - Define access to general production activities

$$\sum_{c' \neq c} \left[\sum_{z' \in \mathcal{Z}_{st_0}(c')} VA_{st_0}(z') \right] f(d_{cc't})$$

   - Split the measure (using TFP) into access to the most productive firms and the rests

$$\sum_{c' \neq c} \left[\sum_{z' \in \mathcal{Z}_{st_0}(c')} VA_{st_0}^{\text{top quartile}}(z') \right] f(d_{cc't}) + \sum_{c' \neq c} \left[\sum_{z' \in \mathcal{Z}_{st_0}(c')} VA_{st_0}^{\text{rest}}(z') \right] f(d_{cc't})$$

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Extensive Margin: Export to A Destination or Not

	(1)	(2)
Dependent Variable	Export dummy	Export dummy
Independent Variable	Measure 1	Measure 2
x_{cst}	0.003***	0.025***
	(0.001)	(0.004)
Observations	12,153,853	12,153,853
R-squared	0.710	0.710

Notes: We control for firm×destination fixed effects, city time-varying effects, sector time-varying effects and destination time-varying effects. We cluster the error terms at the city level. Robust standard errors are in parentheses: *** $p<0.01$, ** $p<0.05$, and * $p<0.1$.

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No Significant Effects on FTCs

VARIABLES	(1) lnexp	(2) lnexp
x_{cst}	0.017	0.016
	(0.016)	(0.016)
Observations	491,074	491,074
R-squared	0.712	0.712
Firm FEs	Y	Y
CityXyr FEs	Y	Y
SecXyr FEs	97 sectors	97 sectors

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

- Evidence consistent with export insights to overcome **production**-specific barriers, rather than distribution-specific barriers

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Pairwise Analysis: Quality

- Use destination market GDP/capita to proxy product quality (Khandelwal, 2008)
- No significant impact on average; positive impact to firms in core cities

VARIABLES	(1)	(2)	(3)	(4)
	Quality			
	Measure 1		Measure 2	
x_{cst}	46.764	60.975	-21.911	12.191
	(41.272)	(39.317)	(42.106)	(35.866)
x_{cst}Xcore			166.045**	115.253
			(77.952)	(73.389)
Firm FEs	Y	Y	Y	Y
CityXyr FEs	Y	Y	Y	Y
SecXyr FEs	97 sectors	97 sectors	97 sectors	97 sectors
Observations	2,032,156	2,032,156	2,032,156	2,032,156
R-squared	0.788	0.788	0.788	0.788

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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Trade Fairs Data

meeting_name	showroom	url	meeting_locale	organization	industry	meeting_city	introduction	scope
中国(杭州)茶业博览会秋季展	杭州和平国际会展中心	http://www.onezh.com/web/index_41954.html	杭州和平国际会展中心 浙江省杭州市绍兴路158号 乘车路线 全景地图	主办单位：浙江省商务厅、浙江省供销合作社联合社 承办单位：上海励新展览有限公司 协办单位：中国国际茶文化研究会、中国食品土畜进出口商会、中国茶叶学会	所属行业：食品、饮料、酒	展会城市：浙江|杭州	展会介绍 为参展商提供一个充分展示、宣传的场所； 为参展商提供一个同行业的交流与合作平台； 为参展商提供一个高人气的贸易销售和招商渠道开发平台； 六大茶类的宣传推广及知识普及，倡导健康饮茶和优质生活； 各茶类研究院校、茶器有关开发机构，茶创意文化及新研发产品的展示聚集场所； 茶行业发展趋势，茶企与专家之间的学术性对话。 参展费用 标准展台：双开口：RMB 7800/9㎡ 单开口：RMB 6800/9㎡ 空地面积：RMB 680/㎡ （ 36 ㎡起租 ） 实施细则：参展合同签订后，7日之内支付定金50%的预付款，保留展位； 宣传广告：彩页广告、会刊编印、展讯广告、入场券、手提袋等详见官网报价； 特殊广告：现场气球、拱门、条幅、喷绘、阵地广告及展馆广告位等详见官网报价； 相关资讯 → 中国茶业博览会 （秋季展）在杭州开幕 12/24	展品范围 六大茶类：绿茶、白茶、黄茶、红茶、青茶、黑茶（普洱茶、安化黑茶、六堡茶）； 再生茶类：萃取茶、浓缩茶、果味茶、保健茶、茶饮料、茶食品； 茶具产品：陶瓷、紫砂、茶盘、煮茶器、冲茶具、玻璃器皿、根雕艺术等； 茶叶包装：茶叶盒设计、制作印刷、金属制罐、袋泡茶包装机等； 泡 茶 水：矿泉水、纯净水、瓶装水、直饮水及净水设备等； 茶叶加工：种植、杀青、色选、保鲜、贮藏、检测技术； 茶叶销售：茶秤量、喷码打印、防伪标签等； 茶工艺品、茶家具及茶科技衍生品；

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Controlling for Access to Goods

1. Better access to upstream suppliers (Bernard et al, 2019)
   - Control for changes in access to suppliers, induced by HSR connection

$$\sum_{s'} \psi_{s'}^{s} \sum_{c' \neq c} \left[\sum_{z' \in \mathcal{Z}_{s' t_0}(c')} r_{s' t_0}^{x}(z') \right] \mathbb{I}(HSR_{cc' t}),$$

   where $\psi_s^{s'}$ is the input share from sector s' for a firm in sector s.

2. Changes in domestic shipping cost
   - Control for changes in access to port, induced by HSR connection

$$\sum_{c' \in \mathbb{C}_z^{port}} \mathbb{I}(HSR_{cc' t}),$$

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Controlling for Access to People

1. Better access to workers in other prefectures
   - Control for changes in access to workers across occupations, induced by HSR connection

$$\sum_{c' \neq c} \text{CorrL}_{ic'} \mathbb{I}(HSR_{cc't}),$$

   where $\text{CorrL}_{ic'}$ is the labor correlation between firm i and city c' (Ellison et al., 2010).

2. Reallocation of high-skilled workers across cities
   - After an opening of a HSR station, core cities have an in-flow of high-skilled workers while others have an out-flow (Yu et al., 2019).
   - Core-city exporters in skill-intensive industries may benefit more than the rest.

$$\text{Skill Intensity} \times \text{Core City} \times 1_{\{\text{HSR}\}}$$

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Knowledge Sharing in the Export Markets

- Modify utility function to:

$$U = \left(\int_{\zeta \in \Omega_n} (\lambda_n(\zeta) q_n(\zeta))^{(\sigma-1)/\sigma} d\zeta \right)^{\sigma/(\sigma-1)},$$

where λ denotes quality.

- Taking logs, we get

$$\ln q_{znkt} + \sigma \ln p_{znkt} = \alpha_{nkt} + \varepsilon_{znkt},$$

- Estimated quality can be calculated using

$$\ln \hat{\lambda}_{znkt} = \frac{\hat{\varepsilon}_{znkt}}{\sigma - 1},$$

where σ is obtained (at HS3 level) from Broda, Greenfield, and Weinstein (2006).

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Knowledge Sharing in the Export Markets

- Calculate a weighted-average quality across different destinations for each firm-product pair

$$\bar{\lambda}_{zkt} = \sum_{n \in \mathcal{N}_t} \theta_{znkt} \ln(\lambda_{znkt})$$

where θ_{znkt} denotes the quantity share of firm z for product k

- Compute long difference in average quality between 2007 and 2013

$$\begin{aligned}\triangle \bar{\lambda}_{zk} &= \bar{\lambda}_{zkt} - \bar{\lambda}_{zkt-1} \\ &= \underbrace{\sum_{n \in \mathcal{N}_t \cap \mathcal{N}_{t-1}} \bar{\theta}_{znk} \left(\ln \lambda_{znkt} - \ln \lambda_{znkt-1}\right)}_{\text{Intensive-Within}} + \underbrace{\sum_{n \in \mathcal{N}_t \cap \mathcal{N}_{t-1}} \left(\theta_{znkt} - \theta_{znkt-1}\right)\left(\bar{\lambda}_{znk} - \bar{\lambda}_{zk}\right)}_{\text{Intensive-Across}} + \\ &\quad \underbrace{\sum_{n \in \mathcal{N}_t \setminus \mathcal{N}_{t-1}} \theta_{znkt} \left(\ln \lambda_{znkt} - \bar{\lambda}_{zk}\right)}_{\text{Extensive-Entry}} - \underbrace{\sum_{n \in \mathcal{N}_{t-1} \setminus \mathcal{N}_t} \theta_{znkt-1} \left(\ln \lambda_{znkt-1} - \bar{\lambda}_{zk}\right)}_{\text{Extensive-Exit}}\end{aligned}$$

- We estimate:

$$\triangle \bar{\lambda}_{zk} = \beta \triangle x_{cs} + \alpha_c + \alpha_s + \triangle \iota_{zk}$$

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Export Growths across Destinations

- We examine relative export growth within a firm-year across destinations:

$$y_{zdt} = \alpha_{zd} + \alpha_{zt} + \alpha_{dt} + \beta x_{cdst} + \iota_{zdt}$$

	(1)	(2)	(3)	(4)
Dependent Variable	log(export revenue)		Export dummy	
Independent Variable	Measure 1	Measure 2	Measure 1	Measure 2
x_{csdt}	0.012**	0.003	0.001**	0.001
	(0.005)	(0.005)	(0.001)	(0.000)
Observations	6,397,648	6,397,648	22,849,152	22,849,152
R-squared	0.838	0.838	0.743	0.743

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Connected Firms Converge on the Export Destinations

- Pairwise analysis: changes in similarities in the set of export destinations and product varieties (HS8) following the improved integration from HSR connection Definition

$$\text{angle distance}_{zc't} = \alpha_{zc'} + \alpha_{zt} + \alpha_{c't} + \gamma \mathbb{I}(HSR_{zc't}) + \iota_{zc't},$$

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. variables	Destination similarity			Product similarity		
$\mathbf{I}(HSR_{zc't})$	0.002*	0.003***	0.004***	-0.000	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Firm-Dest-city FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year FE	No	No	Yes	No	No	Yes
Dest-City-Year FE	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	No	No	Yes	No	No
R-squared	0.738	0.741	0.912	0.762	0.770	0.811

Robust standard errors clustered by prefectures in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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Pairwise Similarity

$$\text{angle distance}_{zc't} = \arccos\left(\frac{\sum_d(\pi_{zdt} - \bar{\pi}_{zdt})(\pi_{c'd} - \bar{\pi}_{c'dt})}{\sqrt{\sum_d(\pi_{zdt} - \bar{\pi}_{zdt})^2 \times (\pi_{c'dt} - \bar{\pi}_{c'dt})^2}}\right),$$

where $\pi_{zt} = (\pi_{z1t}, \ldots, \pi_{zDt})$ is a vector summarizing the export share to destinations by firm z and time t

- Product variety is defined analogously

Back to results

Controlling for Integration with General Production

$$x_{cst}^{\text{General}} = \sum_{c' \neq c} \left[\sum_{z' \in \mathcal{Z}_{st_0}(c')} VA_{st_0}(z') \right] \mathbb{I}(HSR_{cc't})$$

- If firm's export decision is driven primarily by spillovers not specific to the export market, adding x_{cst}^{General} would reduce the effects of x_{cst} considerably

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	log(export revenue)				No. exp destinations			
	Measure 1		Measure 2		Measure 1		Measure 2	
x_{cst}	0.042***	0.036***	0.030***	0.029***	0.202***	0.171***	0.105***	0.094**
	(0.007)	(0.009)	(0.006)	(0.010)	(0.038)	(0.049)	(0.037)	(0.043)
x_{cst}^{General}		-0.022*		-0.011		0.009		0.003
		(0.011)		(0.009)		(0.044)		(0.046)
Observations	2,032,156	2,018,616	2,032,156	2,018,616	2,032,156	2,018,616	2,032,156	2,018,616
R-squared	0.737	0.805	0.737	0.805	0.737	0.805	0.737	0.805

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Proximity to Customers and Suppliers: Empirical Results

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	log(export revenue)				No. exp destinations			
	Measure 1		Measure 2		Measure 1		Measure 2	
x_{cst}	0.042***	0.036***	0.030***	0.029***	0.202***	0.171***	0.105***	0.094**
	(0.007)	(0.009)	(0.006)	(0.010)	(0.038)	(0.049)	(0.037)	(0.043)
Access to suppliers		0.100***		0.059**		0.201*		0.116
		(0.023)		(0.029)		(0.116)		(0.109)
Access to port		0.094***		0.029		0.315*		0.116
		(0.029)		(0.018)		(0.164)		(0.079)
Observations	2,032,156	2,004,824	2,032,156	2,004,824	2,032,156	2,004,824	2,032,156	2,004,824
R-squared	0.738	0.737	0.738	0.737	0.805	0.804	0.805	0.804

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Labor Market Pooling: Empirical Results I

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	log(export revenue)				No. exp destinations			
	Measure 1		Measure 2		Measure 1		Measure 2	
x_{cst}	0.042***	0.041***	0.030***	0.029***	0.202***	0.200***	0.105***	0.103***
	(0.007)	(0.007)	(0.006)	(0.006)	(0.038)	(0.038)	(0.037)	(0.037)
Access to labor		0.002		0.963*		-0.018		1.423
		(0.002)		(0.496)		(0.011)		(2.544)
Observations	2,032,156	2,016,197	2,032,156	2,009,924	2,032,156	2,016,197	2,032,156	2,009,924
R-squared	0.738	0.737	0.738	0.737	0.805	0.804	0.805	0.804

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Labor Market Pooling: Empirical Results II

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	log(export revenue)				No. exp destinations			
	Measure 1	Measure 2	Measure 1	Measure 2	Measure 1	Measure 2	Measure 1	Measure 2
x_{cst}	0.042***	0.036***	0.030***	0.024***	0.202***	0.184***	0.105***	0.086***
	(0.007)	(0.008)	(0.006)	(0.007)	(0.038)	(0.039)	(0.037)	(0.033)
Flow of skilled labor		0.574***		0.558***		1.772		1.857
		(0.202)		(0.208)		(1.341)		(1.324)
Observations	2,032,156	2,020,651	2,032,156	2,020,651	2,032,156	2,020,651	2,032,156	2,020,651
R-squared	0.738	0.737	0.738	0.737	0.805	0.805	0.805	0.805

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