

The Railway on the *Silk Road*

The Effect of China-Europe Railway Express on Manufacturing Geography

Shuang-he Shang Min Wang

Peking University

October 27th 2023, Hong Kong
Annual International Conference on the Chinese Economy

Motivation

The distance to the coast matters for economic development.

- ▶ Ocean shipping carries over 80% of the volume of global trade (UNCTAD, 2022)
- ▶ Populations and economic activities agglomerate in coastal regions.
- ▶ Land-locked countries/regions suffer from
 - ▶ high transportation costs and uncertainty in transportation time (Arvis et al., 2007) ;
 - ▶ the loss of 30 pp of trade and 1.5 pp of GDP growth (Gallup et al., 1999; Limao and Venables, 2001; MacKellar et al., 2002; Rappaport and Sachs, 2003) .

Transportation networks are built to address this problem.

- ▶ **Market Integration Effect** (Faber, 2014; Coşar and Demir, 2016; Donaldson and Hornbeck, 2016; Baum-Snow et al., 2017; Donaldson, 2018; Baum-Snow et al., 2020; Brinkman and Lin, 2022)
- ▶ In this study, we focus on the “Time Saving Effect” of railways (Hummels, 2007; Djankov et al., 2010; Harrigan, 2010; Hummels and Schaur, 2013) .

This Study

- ▶ We study how the China-Europe Railway Express (CERE) reshapes manufacturing geography in China.
 1. Links Chinese cities and European countries directly through railways.
 2. Saves transport time from over 1 month by ship to about 14 days by rail.
 3. Chinese cities joined the CERE program in a staggered way.
- ▶ Previous studies found that CERE opening increases local export (Zhou and Zhang, 2021; Liu et al., 2022) and firm innovation (Wang and Bu, 2019) .
- ▶ What we do in this study
 - ▶ Explore which industries' exports to Europe are mostly promoted by CERE.
 - ▶ Examine the impacts of CERE opening on firms' extensive margin decisions, i.e., firm entry and interregional firm-to-firm equity investments.

Preview of Results

The impact of CERE on export is heterogeneous between industries.

- ▶ The export to Europe in industries that are **time-sensitive** and of **high unit value** are more likely to increase in response to CERE.
- ▶ We call those industries *sensitive industries*.

Opening CERE increases the firm entry into those *sensitive* industries.

- ▶ The number of firm entries **7.9 pp** ↑
- ▶ The amount of paid-in capital for new firm entries **20.8 pp** ↑

Opening CERE affects hinterlands more than coastlands

- ▶ The firm entry effects are **larger in the inland provinces** than those in the coastal provinces.
- ▶ Opening CERE increases firm-to-firm equity investment from coastal provinces to inland provinces **12.09 pp** ↑.

CERE Reshapes the Manufacturing Geography

The economic development of inland China

- ▶ Inland provinces host 56.9% of the country's population (Population Census, 2020)
- ▶ Infrastructure investment in the hinterlands has been encouraged by preferential policies, but the economic efficiency was below expectations. (Chen et al., 2019)
- ▶ One critical constraint for inland development is the high transportation cost limits market access.

Who will fill China's exports as the production cost rises in the coastlands? (Autor et al., 2020; Hanson, 2020)

- ▶ Some firms are seeking to relocate elsewhere, which creates opportunities for the hinterlands. (Qu and Cai, 2013; Ruan and Zhang, 2014; Wei et al., 2017)

The opening of CERE may redefine manufacturing geography in China, providing new perspectives to rethink China's comparative advantages and global specialization.

Background of CERE

Before 2011

- ▶ Sino-Europe seaborne transportation time: 1-1.5 months
- ▶ Eurasian Continental Bridge existed, but there was no routinely managed Sino-Europe railway line.
- ▶ Railway transportation accounted for 0.9% of the value of China's exports to Europe in 2010.

The first pioneering special train started operating in March 2011.

- ▶ Chongqing City Government activated the existing Continental Bridge to transport HP's laptops to Europe in 2011.
- ▶ First line: Chongqing, China → Duisburg, Germany; 14 days
- ▶ Since then, more laptop manufacturers have moved from the coastlands to Chongqing, which became the largest laptop manufacturing district in the world.

Background of CERE

After the success of Chongqing, more and more cities joined the CERE program.



By 2021, 75 cities had joined the CERE program.

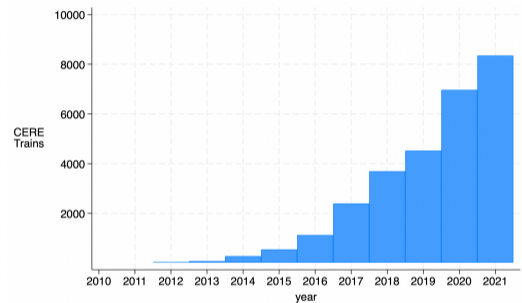


Figure 1: Number of CERE trains sent by Chinese cities

Chinese cities in total sent over 28,000 CERE trains to Europe.

CERE Lines

中欧班列线路示意图



Transportation Modes in Sino-Europe Trade

Table 1: Three Main Transport Modes in Sino-Europe Trade

Transport Mode	Seaborne	Air	Railway
Cost of 20-foot container (USD)	1,994	136,000*	7,506
Average Time (Days)	30	4	14
Value Share (2010)	76.91%	16.61%	0.09%
Value Share (2018)	71.09%	18.11%	3.29%

Notes of Table 1 Resource: The cost and time of Sino-Europe seaborne and railway (CERE) transport come from (Jiang et al., 2018). The cost of Sino-Europe air transport is hard to calculate under various situations, and therefore we did a rough calculation.

The value share of products exported to EU via CERE railways has increased to about **7%** of the total 2708 billion RMB in 2020 (Jiang et al., 2021).

Data

Enterprise Registration Database in China

- ▶ Population firm registration dataset including the ownership, industry code, paid-in capital, investors and their share, registration date, and exit date of all Chinese firms.
- ▶ During 2008-2021, 5,883,220 new manufacturing firms were established.
- ▶ We aggregate the firm-level data into county-industry panel data.
 - ▶ The data include 2,848 counties, and 28 manufacturing industry sectors.
 - ▶ Variables include the measures of firm entry (in terms of **number** and **paid-in capital**).
- ▶ We also aggregate **firm-to-firm equity investments** for further discussion.

Data

Province Exports to Europe

- ▶ A provincial-level aggregate trade data including the export value of all transportation modes, and all HS 6-digit products from 2008-2018.
- ▶ Following Brandt et al.(2017), we match the customs code and manufacturing industries.
- ▶ Finally, we get a province-industry panel dataset of export to Europe.

Empirical Strategy & Results

1. Estimate the effects of opening CERE on export to European countries for each industry using an OLS model.
2. Estimate the effects of opening CERE on manufacturing geography using a DDD model.

Industrial Heterogeneity of CERE on Export to Europe

$$Export_{pit} = \beta_0 + \sum \beta_i \cdot Open_{pt} \cdot IndFE_i + X_{2008,pi} \cdot f(t) + \gamma_{pt} + \delta_{it} + \varepsilon_{pit}$$

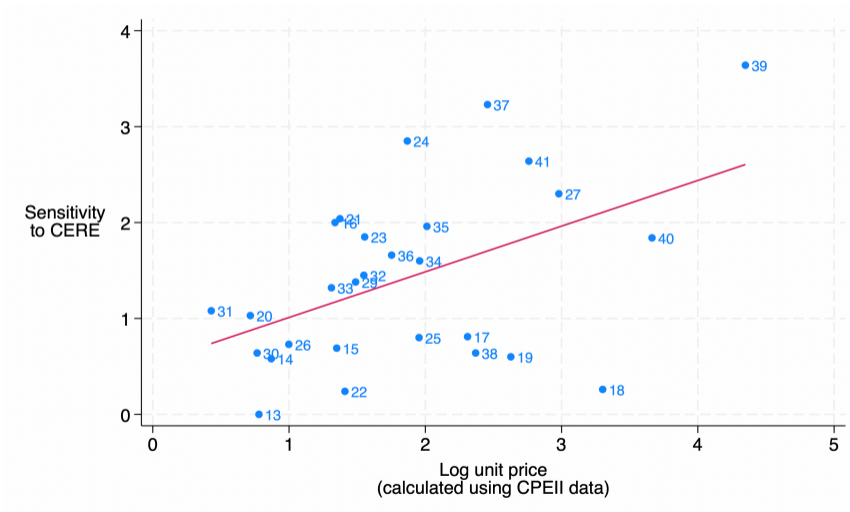
- ▶ $Export_{pit}$: Value of export to Europe, by industry
- ▶ Variables of interest:
 - ▶ $Open_{pt}$: whether the province p joined the CERE program in year t .
 - ▶ $IndFE_i$: 28 industry dummies.
 - ▶ β_i measures the percentage changes in industry i 's exports to Europe brought by CERE.
- ▶ Other controls:
 - ▶ $X_{2008,pi}$: predetermined variables in year 2008. $f(t)$: year dummies.
 - ▶ γ_{pt} : province-year fixed effect; δ_{it} : industry-year fixed effects.

Sensitivity Estimation

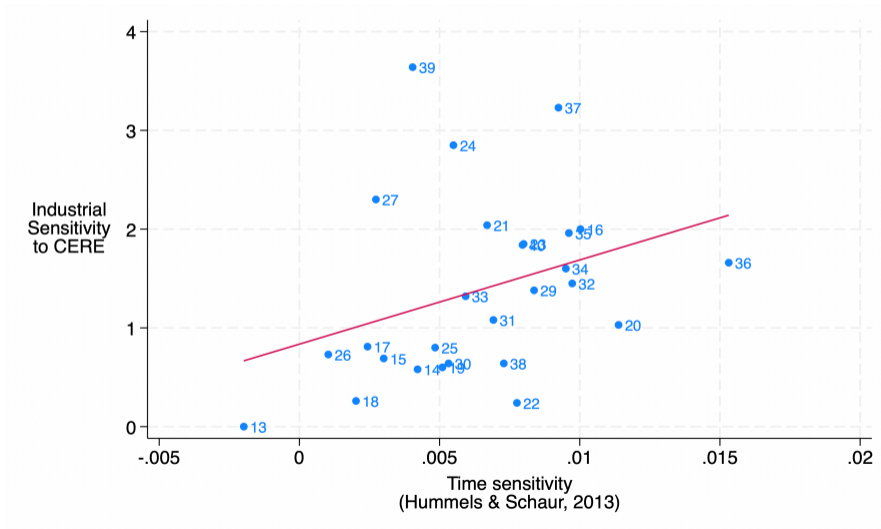
Least sensitive industries	$\hat{\beta}_i$	Most sensitive industries	$\hat{\beta}_i$
agricultural products processing	0.00	computer,cellphones and electronics	3.64
paper products	0.24	other transportation equipment	3.23
clothing	0.26	leisure products	2.85
food	0.58	other Manufacturing	2.64
leather/fur products and footwear	0.60	pharmacy	2.30
nonmetallic mineral products	0.64	furniture	2.04
electrical machinery and equipment	0.64	tobacco	2.00
beverage	0.69	special machinery and equipment	1.96

Figure 2: The estimated sensitivity, $\hat{\beta}_i$ in the previous equation

Sensitivity to CERE and Unit Price



Sensitivity to CERE and Time Sensitivity



Empirical Strategy (DDD)

$$Y_{cit} = \beta_0 + \alpha \cdot Open_{ct}^d \cdot Ind_i + \lambda \cdot X_{2008,ci} \cdot f(t) + \gamma_{ct} + \theta_{ci} + \eta_{pit} + \epsilon_{cit}$$

- ▶ Triple-Difference Setting with county c , year t , industry i , (province p)
- ▶ Y_{cit} : measures of firm entry, by county-industry-year
- ▶ Variable of interest:
 - ▶ $Open_{ct}^d$: whether the county is near the CERE station in year t (within an 80 km radius of CERE station)
 - ▶ Ind_i : whether the industry is **sensitive** to CERE (estimated in the previous regression above the median value)
 - ▶ α measures the average impact of opening CERE on local firm entry in sensitive industries.
- ▶ Other controls
 - ▶ $X_{2008,ci}$: predetermined variables in year 2008. $f(t)$: year dummies.
 - ▶ γ_{ct} county-year FE; δ_{ci} : county-industry FE;
 - ▶ η_{pit} : province-industry-year FE controlling for potential industrial policies

DDD Results

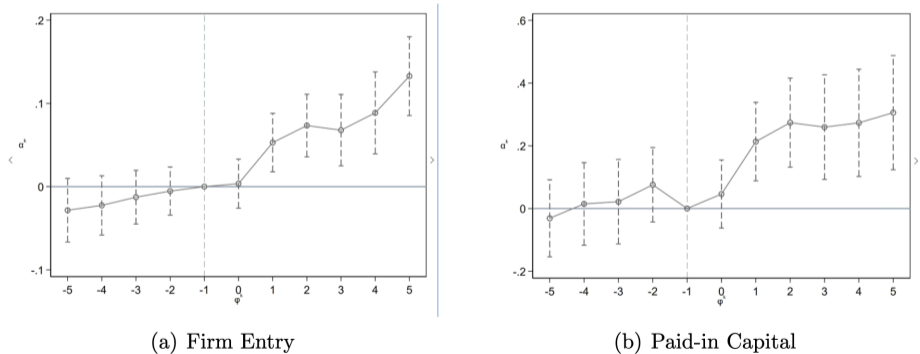
Table 12: Results of DDD

Outcome	Firm Entry			Paid-in Capital		
	All	Inland	Coastal	All	Inland	Coastal
Sample						
DDD(80km)	0.0787*** (0.0143)	0.0925*** (0.0166)	0.0590** (0.0243)	0.2077*** (0.0445)	0.2492*** (0.0621)	0.1491** (0.0582)
Observations	1,148,574	805,098	343,476	1,148,574	805,098	343,476
R-squared	0.820	0.758	0.857	0.661	0.617	0.685
CntyYearFE	YES	YES	YES	YES	YES	YES
CntyIndFE	YES	YES	YES	YES	YES	YES
ProvinceYearIndFE	YES	YES	YES	YES	YES	YES

Notes of Table 12 The standard errors clustering to counties are in parentheses, and *, **, *** represent the significance levels of 10%, 5%, and 1%, respectively. The outcome variables in county c industry i year t including firm entry and paid-in investment, are calculated from the Firm Registration Data from 2008-2021. All outcome variables are transformed into IHS

Event Study Results

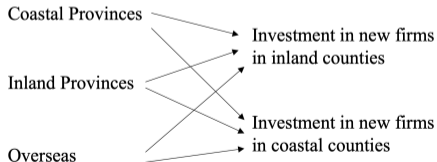
Figure 9: Parallel trend test



Notes to Figure 9: The figures show estimates of event study estimation of equation 5, regressing the outcome variables on DDD term. The outcome variables in county c industry i year t including firm entry

Inter-region Investment

- ▶ Previous regressions show that opening CERE increases the new firm entry in the manufacturing sectors whose exports are responsive to CERE.
- ▶ Who invests in these new firms?
- ▶ The firm registration data provides information about every firm's parent firms (if they have at least one), which is **firm-to-firm equity investment**.
- ▶ We classify these investments into several subgroups



- ▶ We are interested in firm-to-firm equity investment **across regions**.

Inter-region Investment

Table 17: The Results on Inter-regional Investment

Investment flow	Coastal → Inland	Overseas → Inland	Inland → Coastal	Overseas → Coastal
CERE DDD	0.1209*** (0.0252)	-0.0146 (0.0162)	0.0379 (0.0257)	0.0879* (0.0480)
Observations	805,098	805,098	343,476	343,476
R-squared	0.238	0.242	0.210	0.421
CntyYearFE	YES	YES	YES	YES
CntyIndFE	YES	YES	YES	YES
ProvinceYearIndFE	YES	YES	YES	YES

Notes of Table 17: This table reports the impact of CERE on the direction of investment. The standard errors clustering to counties are in parentheses, and *, **, *** represent the significance levels of 10%, 5%, and 1%, respectively.

CERE Reshapes the Manufacturing Geography

- ▶ Considering transportation time, railways could affect world trade and reshape the manufacturing geography.
- ▶ The impact of opening CERE on export is heterogeneous across industries.
 - ▶ The change in industrial structure caused by CERE could also lead to a reduction in pollution. (Zhang & Wang, 2023)
- ▶ CERE promotes the development of inland provinces.
- ▶ Under the Belt & Road Initiatives, similar projects also save transportation time.
 - ▶ China-Pakistan Economic Corridor, China-Asia Railway Express, etc.
 - ▶ Such projects could potentially create development opportunities for remote areas, land port cities, and countries along the route.
 - ▶ More attention should be paid to the change in global economic geography.