Expressway, Market Access, and Industrial Development in China

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Overview

Motivation

Massive and rapid transportation infrastructure development in a large economy is an appealing economic experiment with great impact.

- Fundamental role in fostering regional growth, promoting industrial development and shaping economic geography, by reducing trade cost (*e.g.*, Duranton *et al.*, 2014; Coar and Demir, 2016; Donaldson, 2018)
- Difficult to observe in most developed countries, which may have concluded the massive construction years ago
- China is an idea testing ground

Motivation

Research Significance:

- Research on the impact of transport infrastructure in China has blossomed recently,
  - *e.g.*, on county-level economy (Faber, 2014; Qin, 2017), decentralization (Baum-Snow *et al.*, 2017); urban development and specialization pattern (Baum-Snow *et al.*, 2018)

  However, less attention has been paid to the effect on **manufacturing industrial development** and **regional inequality from the production side**
- Consider the **entire transportation network and market access** (*e.g.*, Donaldson and Hornbeck, 2016), which is essential to fill in the research gap
- Deal with the challenging **Identification** due to the rapid changing economy and infrastructure
  - IV estimation is widely applied, but most IVs in transportation literature are cross-sectional
    - historical road map (*e.g.*, Duranton and Turner, 2012; Baum-Snow *et al.*, 2017)
    - Minimal Spanning Tree map (*e.g.*, Faber, 2014)
  - This paper introduces a novel panel IV to transportation research

Why the National Expressway Network?

- **Superior** to other road infrastructures, in terms of road quality, speed and cities connected
- Mainly used for **freight transportation**, which is more relevant to industrial firms by facilitating the access to upstream industries and downstream consumers
- The expressway network have been quite **complete** by now.
  - it was approved by the China State Council in 1992
  - experienced a rapid development during 2000-2009

Preview of Results

- The construction of national expressways network significantly promotes market access at county-level in China
- Market access growth has a causal impact on the industrial growth, from:
  - **extensive margin**: firm # (+)
  - **intensive margin**: product (+) and capital (+), which explains the changes inside the production function
  - endogenous market access can be addressed by panel IVs, which pass both weak-identification and over-identification tests
- Further, better market access plays a fundamental role in
  - transition of manufacturing industry from labor intensive to capital intensive
  - regional inequality from production side
  - centralization of production at the regional level

Data

Geo–referenced Data:

- Geo-referenced expressway data from the ACASIAN Data Center in 2000-2009
- Geo-referenced county boundary map with 6-digit county codes
- Remote Sensing Data: slope + land use pattern of China

Firm Data:

- The Annual Surveys of Industrial Firms (ASIF) from 2000-2009, conducted by the National Bureau of Statistics of China
  - Keep firms registered at county level and drop relocated firms

County-Level Data:

- Statistical Year book from each province, China City Statistical Yearbook and China County Statistical Yearbook, *e.g.*, county population, land area

Data

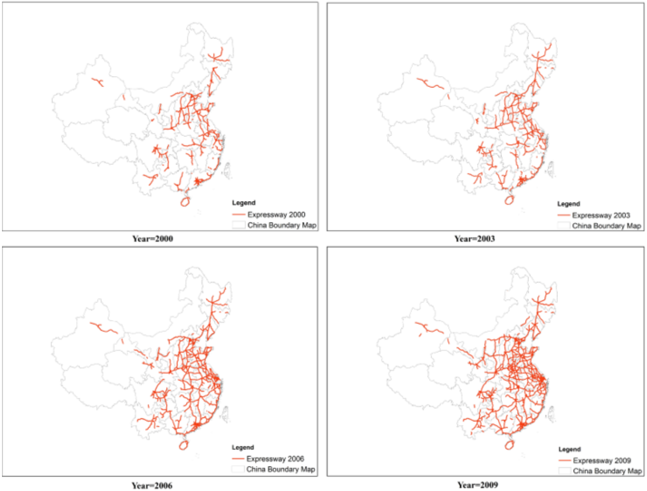

Figure: National Expressway Network in China: 2000-2009

Methodology: Market Access Measurement

Market Access based on China's expressway network:

$$MA_{ct} = \sum_{c' \neq c} {T_{cc't}}^{-\theta} \times pop_{c't}$$

- $t = 2000, 2003, 2006$ or 2009
- θ is the power decay parameter, or the distance elasticity of trade
- Micro-foundation from Donaldson and Hornbeck (2016)

Methodology: Market Access Measurement

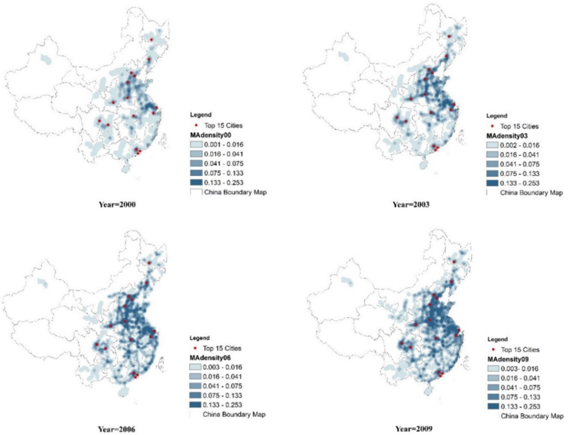

Figure 4: Market Access from 2000-2009

Note: The blue area denotes the density of market access. The darker the color, the higher the market access density. Market access values in each subgraph have been categorized to 5 groups by the same threshold value for the sake of compression.

Methodology: Estimate θ

- The key parameter θ is essential to the MA measurement and is specific to research context
- θ is the distance elasticity of trade, thus estimation of θ requires micro-level domestic trade data, which is rarely available in China, and thus often ignored in extant literature (e.g., Baum-Snow et al., 2018)
- We use micro-level Custom data of freight transportation from counties to ports to estimate θ in China

$$\ln Volume_{cpt} = \alpha - \theta \ln T_{cpt} + \gamma PortSize_{pt} + \delta_c + \eta_t + \epsilon_{cpt}$$

  - t=2000, 2003
  - $Volume_{cpt}$: value of goods shipped from county c to port p at year t
  - T_{cpt}: travel time in minutes
- $\hat{\theta} = 1.1$

Methodology: Empirical Strategy

Estimate the effect of market access on industrial development:

$$\ln Y_{ct} = \alpha + \beta \ln MA_{ct} + \gamma X_{ct} + \delta_c + \eta_{rt} + \epsilon_{ct}$$

- $\ln Y_{ct}$: an outcome related to industrial development of county c at year t, *e.g.*, local industrial GDP, number of firms, firm production, etc.
- $\ln MA_{ct}$: logarithmic market access for county c at year t. However, $\ln MA_{ct}$ could be endogenous, and IV is need.
  - endogenous placement decisions of transport infrastructures
  - reverse causality
  - local unobservables (*e.g.*, agglomeration economies)
- X_{ct}: characteristics about the county and representative firm in that county
- δ_c and η_{rt} are county fixed effects and province-year fixed effects, respectively

Aggregate or average individual firm data to the county level

- keep both stages of 2SLS at the county level
- weight the total number of firms when firm average information is used

Methodology: Construction of IV

Apply **Minimal Spanning Tree (MST)** method to **construct Panel IV**

- Minimal Spanning Tree is a hypothetical network generated based on the knowledge of Graph Theory. To construct a MST network, we need:
- 1_{st}, select target cities that are to be connected by the hypothetical network
- 2_{nd}, construct the least-cost routes that connect all the target cities and form a hypothetical network
  - "cost": calculated from the slope and land use pattern for each 1 km^2 land parcel in China, not in monetary base
  - slope $\uparrow$, restrictive land use $\uparrow \Rightarrow$ cost $\uparrow$

MST is first introduced to economics literature by Faber (2014), however, Faber's (2014) MST method has issues:

- Faber's (2014) IV is only one cross-section, not a panel
- target cities could be endogenous

Methodology: Construction of IV

In this paper, we construct two sets of MST network to instrument expressway:

1. **Pop1990 MST**: following Faber (2014), set cities with population ≥ 1 million in 1990 as target cities, same as the government's proposal in 1992.
2. **Wall-city MST**: use wall-cities data in 1820s (Qing Dynasty) to estimate city size and set target cities.
    - **Inclusionary restriction**: Ancient wall size distribution well predicts city size distribution and population at current time (*e.g.*, Ioannides and Zhang, 2017)
    - **Exclusionary restriction**: Wall cities were built for military purpose of homeland security

How do we get panel IV? $\Rightarrow$ For each MST network, we assume its dynamic expansion following different criteria: (1) importance of cities; (2) least cost routes.

Four panel IVs

	pop1990 MST	wall-city MST
Most important cities first	MA_pop90^{order}	$MA\_wallcity^{order}$
Least cost routes first	MA_pop90^{cost}	$MA\_wallcity^{cost}$

Pop1990 MST IV

MA_$pop90^{order}$:

MA_$pop90^{cost}$:

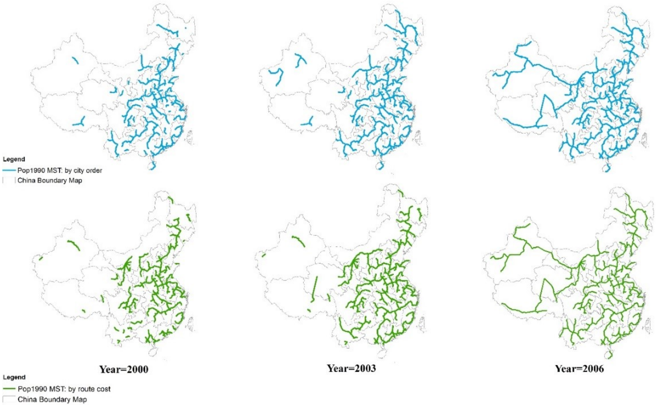

Figure: Pop1990 Minimal Spanning Tree

Wall-city MST IV

$MA\_wallcity^{order}$:

$MA\_wallcity^{cost}$:

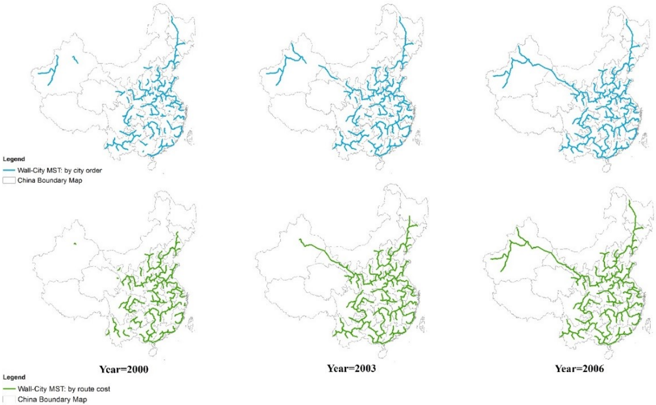

Figure: Wall-city Minimal Spanning Tree

Results: Summary Statistics

Table 1: Summary Statistics

County Characteristics	2000			2003			2006			2009		
Industrial Outcome	**Obs**	**Mean**	**S.d.**	**Obs**	**Mean**	**S.d.**	**Obs**	**Mean**	**S.d.**	**Obs**	**Mean**	**S.d.**
County sum: GDP from Industrial Firm[a] ('000,000)	1,876	624.83	1,700.00	1,892	1,273.00	3,341.00	1,814	1,459.00	3,668.00	1,822	2,272.00	5,298.00
County sum: Firm Number	1,876	43.71	78.97	1,892	60.49	125.00	1,814	73.48	137.90	1,822	69.77	128.50
County mean: Employment	1,876	229.80	102.80	1,892	209.50	82.77	1,814	147.40	58.64	1,822	170.80	75.62
County mean: Product Value ('000,000)	1,876	195.23	108.07	1,892	277.19	141.17	1,814	376.32	214.78	1,822	756.40	429.07
County mean: Capital ('000,000)	1,876	274.54	154.86	1,892	318.21	177.34	1,814	270.52	157.80	1,822	506.40	333.78
County mean: TFP	1,876	1.04	0.14	1,892	1.04	0.16	1,814	1.05	0.17	1,822	1.20	0.27
County-Level Market Access												
MA	1,016	44.15	28.41	1,167	76.17	41.98	1,402	104.96	47.55	1,562	117.30	48.70
MA_pop90^{order}	983	111.70	81.74	1,106	114.70	80.34	1,193	13 4.10	79.44	1,193	135.80	81.23
MA_pop90^{cost}	960	117.40	84.85	1,101	127.20	77.52	1,193	133.20	79.24	1,193	134.80	81.04
$MA\_wallcity^{order}$	865	38.58	20.68	946	52.90	28.01	981	68.05	23.55	981	69.25	24.01
$MA\_wallcity^{cost}$	894	57.29	24.82	963	67.52	22.40	981	67.92	23.42	981	69.11	23.87
Population		**1990**										
Population ('000)	2,224	417.30	318.00									
Estimated Population ('000)	1,780	462.10	111.40									

Note: [a] GDP from industrial firms is calculated from the aggregated value added of all the industrial firms in the county.

Results: First-Stage Regression

- Four MST market access variables as the IVs for the actual market access
- Preliminary tests show IVs are not weak: significantly and positively correlate with MA
- Choose column (3) and (6) in the second-stage: both matter; facilitate an over-identification test

Table 3: First-stage Regression

	(1)	(2)	(3)	(4)	(5)	(6)
D.V.	*lnMA*	*lnMA*	*lnMA*	*lnMA*	*lnMA*	*lnMA*
$lnMA\_pop90^{order}$	0.1333***		0.0833*			
	(0.0318)		(0.0426)			
$lnMA\_pop90^{cost}$		0.0666***	0.0405*			
		(0.0157)	(0.0211)			
$lnMA\_wallcity^{order}$				0.1045***		0.1182***
				(0.0270)		(0.0274)
$lnMA\_wallcity^{cost}$					0.1879**	0.2430***
					(0.0895)	(0.0897)
Observations	7,016	7,016	7,016	7,016	7,016	7,016
R-squared	0.8548	0.8548	0.8551	0.8545	0.8541	0.8550
Other Controls	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES
Province-Year FE	YES	YES	YES	YES	YES	YES

Note: Standard errors are clustered at city-year level and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Regressions are weighted by the number of firms in the county.

Results: Second-Stage Regression

column 1: aggregate level

- industrial GDP (+)

column 2: extensive margin

- firm # (+)

column 3: intensive margin

- total product (+)
- **column 4-6**: within production function
  - capital (+)
  - employment, TFP

Table 4: Second-stage Regression

	(1)	(2)	(3)	(4)	(5)	(6)
D.V.	ln *IndusGDP*	ln *Firm#*	ln *Product*	ln *Emply*	ln *Capital*	ln *TFP*
Data Structure	Aggregated	Aggregated	Mean	Mean	Mean	Mean
	Panel A: Instruments from the Pop1990 MST					
lnMA	0.2831***	0.5055***	0.0907***	0.0206	0.0735***	0.0221**
	(0.0589)	(0.1369)	(0.0253)	(0.0183)	(0.0259)	(0.0109)
R-squared	0.9223	0.7328	0.8627	0.8372	0.8128	0.5785
Weak Identification Test [a]	16.56	11.64	16.60	16.60	16.60	16.60
Underidentification Test [b] P-value	0.000	0.000	0.000	0.000	0.000	0.000
Over-identification Test [c] P-value	0.176	0.747	0.944	0.000	0.102	0.181
	Panel B: Instruments from the Wall-City MST					
lnMA	0.1634***	0.4550***	0.0471**	0.0134	0.0583**	0.0094
	(0.0501)	(0.1314)	(0.0189)	(0.0172)	(0.0238)	(0.0092)
R-squared	0.9413	0.7625	0.8803	0.8387	0.8207	0.5962
Weak Identification Test	20.12	11.13	20.15	20.15	20.15	20.15
Underidentification Test P-value	0.000	0.000	0.000	0.000	0.000	0.000
Over-identification Test P-value	0.930	0.067	0.312	0.496	0.808	0.914
Observations	7,006	7,016	7,016	7,016	7,016	7,016
Other Controls	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES
Province-Year FE	YES	YES	YES	YES	YES	YES

Note: [a] The weak-identification test reports the correspondingly-robust Kleibergen-Paap robust rk Wald F statistic when clustered standard error is applied. The critical value to pass the weak-identification test is 11.59. [b] The null hypothesis for the underidentification LM test is that the equation is underidentified which means the excluded instruments are irrelevant. [c] In the case of clustered standard error, the Hansen J Statistic is report for the Sargan-Hansen test of overidentifying restrictions, of which the null hypothesis is the instruments are uncorrelated with the error term and exclusionary restriction is valid. Standard errors are clustered at city-year level and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Column (1) and (3)-(6) are weighted by the number of firms in the county.

Results: Second-Stage Regression

ln *MA* coefficients in *Panel B* are generally smaller

- Pop1990 IV may correlate with agglomeration economies

Validity of IV:

- Weak-identification test:
  - Critical value 11.59
  - Both sets of IVs pass all 6 weak identification tests
- Over-identification test:
  - Wall-city MST IV passes all 6 over-identification tests
  - Pop1990 MST IV fail to pass test in Column 4

⇒ Wall-city IVs perform better!

Table 4: Second-stage Regression

	(1)	(2)	(3)	(4)	(5)	(6)
D.V.	ln *IndusGDP*	ln *Firm#*	ln *Product*	ln *Emply*	ln *Capital*	ln *TFP*
Data Structure	Aggregated	Aggregated	Mean	Mean	Mean	Mean
	Panel A: Instruments from the Pop1990 MST					
lnMA	0.2831***	0.5055***	0.0907***	0.0206	0.0735***	0.0221**
	(0.0589)	(0.1369)	(0.0253)	(0.0183)	(0.0259)	(0.0109)
R-squared	0.9223	0.7328	0.8627	0.8372	0.8128	0.5785
Weak Identification Test [a]	16.56	11.64	16.60	16.60	16.60	16.60
Underidentification Test [b] P-value	0.000	0.000	0.000	0.000	0.000	0.000
Over-identification Test [c] P-value	0.176	0.747	0.944	0.000	0.102	0.181
	Panel B: Instruments from the Wall-City MST					
lnMA	0.1634***	0.4550***	0.0471**	0.0134	0.0583**	0.0094
	(0.0501)	(0.1314)	(0.0189)	(0.0172)	(0.0238)	(0.0092)
R-squared	0.9413	0.7625	0.8803	0.8387	0.8207	0.5962
Weak Identification Test	20.12	11.13	20.15	20.15	20.15	20.15
Underidentification Test P-value	0.000	0.000	0.000	0.000	0.000	0.000
Over-identification Test P-value	0.930	0.067	0.312	0.496	0.808	0.914
Observations	7,006	7,016	7,016	7,016	7,016	7,016
Other Controls	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES
Province-Year FE	YES	YES	YES	YES	YES	YES

Note: [a] The weak-identification test reports the correspondingly-robust Kleibergen-Paap robust rk Wald F statistic when clustered standard error is applied. The critical value to pass the weak-identification test is 11.59. [b] The null hypothesis for the underidentification LM test is that the equation is underidentified which means the excluded instruments are irrelevant. [c] In the case of clustered standard error, the Hansen J Statistic is report for the Sargan-Hansen test of overidentifying restrictions, of which the null hypothesis is the instruments are uncorrelated with the error term and exclusionary restriction is valid. Standard errors are clustered at city-year level and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Column (1) and (3)-(6) are weighted by the number of firms in the county.

Results: Parameter Sensitivity

The estimated $\hat{\theta}$ is 1.1 and its 95% confidence interval is [1.07, 1.16].

- higher $\theta \Rightarrow$ larger distance elasticity of trade $\Rightarrow$ smaller coefficient

Table A1: Sensitivity Test of the Power-Decay Parameter θ

	(1)	(2)	(3)	(4)	(5)	(6)
D.V.	$\ln IndusGDP$	$\ln Firm\#$	$\ln Product$	$\ln Emply$	$\ln Capital$	$\ln TFP$
Data Structure	Aggregated	Aggregated	Mean	Mean	Mean	Mean
	Panel A: Instruments from the Pop1990 MST					
$lnMA$ (θ = 1.07)	0.2907***	0.5547***	0.0935***	0.0213	0.0759***	0.0227**
	(0.0614)	(0.1598)	(0.0262)	(0.0188)	(0.0269)	(0.0112)
R-squared	0.9205	0.6999	0.8610	0.8370	0.8112	0.5773
$lnMA$ (θ = 1.16)	0.2691***	0.4311***	0.0856***	0.0194	0.0690***	0.0210**
	(0.0545)	(0.1063)	(0.0237)	(0.0174)	(0.0243)	(0.0104)
R-squared	0.9254	0.7762	0.8655	0.8376	0.8155	0.5807
	Panel B: Instruments from the Wall-City MST					
$lnMA$ (θ = 1.07)	0.1681***	0.4876***	0.0486**	0.0139	0.0598**	0.0096
	(0.0516)	(0.1481)	(0.0194)	(0.0177)	(0.0245)	(0.0094)
R-squared	0.9407	0.7429	0.8798	0.8386	0.8199	0.5960
$lnMA$ (θ = 1.16)	0.1546***	0.4070***	0.0440**	0.0125	0.0554**	0.0090
	(0.0475)	(0.1086)	(0.0180)	(0.0164)	(0.0225)	(0.0089)
R-squared	0.9425	0.7884	0.8813	0.8389	0.8221	0.5966
Observations	7,006	7,016	7,016	7,016	7,016	7,016
Other Controls	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES
Province-Year FE	YES	YES	YES	YES	YES	YES

Note: Standard errors are clustered at city-year level and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Column (1) and (3)-(6) are weighted by the number of firms in the county.

Results: Heterogeneous Effect across Industries

Stratify firms to 39 industries according to 2-digit CIC codes; Perform 2SLS (wall-city MST) by strata

- Good market access indeed stimulates the location's development of capital intensive industries
- Emerging industries during 2000-2009 were more capital intensive and more responsive to market access growth

⇒ Shed light on the undergoing industrial transition in China

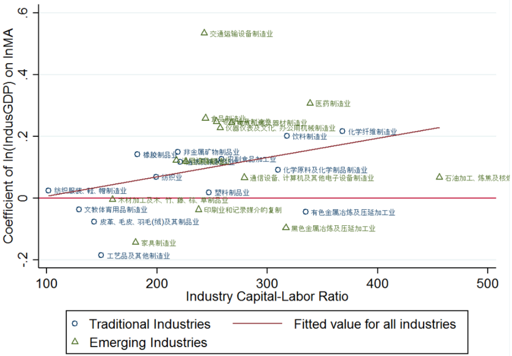

Figure 5: Heterogeneous Response to Market Access across Industries

Note: Each dot (circle or triangle) represents an estimated impact of market access growth on industrial GDP growth for one manufacturing industry.

Results: Heterogeneous Effect across Regions

- Across regions: developed V.S. less-developed regions
  - National expressways' expansion decentralizes manufacturing activities from the south-east to inland areas
    - National expressways bring mobility. Market access does not always help front runners.
  - The first-tier cities (i.e., Beijing, Shanghai, Guangzhou and Shenzhen) are not affected.

Table 5: Market Access and Geographic Heterogeneity

	(1)	(2)	(3)	(4)	(5)	(6)
D.V.	ln *IndusGDP*	ln *Firm#*	ln *Product*	ln *Emply*	ln *Capital*	ln *TFP*
Data Structure	Aggregated	Aggregated	Mean	Mean	Mean	Mean
IV	Wall-City	Wall-City	Wall-City	Wall-City	Wall-City	Wall-City
	Panel A: South-East Coastal Provinces					
lnMA	0.4178***	0.6474***	0.0882*	0.0515	0.1411***	0.0177
	(0.1307)	(0.2133)	(0.0474)	(0.0338)	(0.0520)	(0.0204)
lnMA × South-East Coastal	-0.3686***	-0.6668***	-0.0564	-0.0499	-0.1166**	-0.0101
	(0.1319)	(0.2193)	(0.0496)	(0.0386)	(0.0551)	(0.0216)
R-squared	0.9175	0.6838	0.8732	0.8326	0.7936	0.5905
	Panel B: First-Tier Cities					
lnMA	0.1633***	0.4252***	0.0483**	0.0158	0.0595**	0.0093
	(0.0501)	(0.1284)	(0.0189)	(0.0171)	(0.0239)	(0.0093)
lnMA × First-Tier City	0.1257	1.6106	-0.0437	-0.0121	0.1715	-0.0381*
	(0.2164)	(1.4026)	(0.0664)	(0.0583)	(0.1160)	(0.0197)
R-squared	0.9413	0.7589	0.8801	0.8383	0.8178	0.5967

Results: Heterogeneous Effect across Regions

- Within inland provinces: core V.S. periphery
  - Inland provincial capitals receive some positive heterogeneous effect
  - Benefits to inland urban districts are particularly large; even positive impact on employment
  - ⇒ The Core-Periphery pattern of New Economic Geography theory

	Panel C: Inland Provincial Capitals					
lnMA	0.1310**	0.3553**	0.0496**	0.0132	0.0478*	0.0077
	(0.0512)	(0.1612)	(0.0205)	(0.0182)	(0.0246)	(0.0094)
lnMA × Inland Provincial Capital [a]	0.3258**	0.3941	-0.0261	0.0033	0.1093*	0.0152
	(0.1534)	(0.2856)	(0.0523)	(0.0407)	(0.0571)	(0.0279)
R-squared	0.9385	0.7919	0.8800	0.8387	0.8176	0.5956
	Panel D: Inland Urban Districts					
lnMA	-0.0322	-0.1989	0.0253	-0.0077	0.0151	0.0052
	(0.0424)	(0.1714)	(0.0197)	(0.0183)	(0.0224)	(0.0102)
lnMA × Inland Urban District [b]	1.0675***	1.7607***	0.1308**	0.1298**	0.2560***	0.0214
	(0.2240)	(0.5518)	(0.0578)	(0.0517)	(0.0746)	(0.0235)
R-squared	0.9161	0.6856	0.8796	0.8295	0.8092	0.5973
Other Controls	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES
Province-Year FE	YES	YES	YES	YES	YES	YES

Note: [a] Inland provinces are provinces excluding the south-east coastal provinces and first-tier cities. [b] Inland urban districts are the urban-district counties in inland provinces. Standard errors are clustered at city-year level and are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Column (1) and (3)-(6) are weighted by the number of firms in the county.

Geographic Concentration of Manufacturing Industries

- A related question: does market access lead to geographic concentration of the industries?
- Measurement of concentration: Location Quotient $LQ_{ic} = \frac{Y_{ic}/Y_c}{Y_i/Y}$

Table 6: Market Access and Location Quotient

	(1)	(2)	(3)	(4)	(5)	(6)
D.V.	*lnLQ*	*lnLQ*	*lnLQ*	*lnLQ*	*lnLQ*	*lnLQ*
IV	Wall-City	Wall-City	Wall-City	Wall-City	Wall-City	Wall-City
Sample	All Industries	Manufacturing	Mining and Utilities	Manufacturing	Manufacturing	Manufacturing
lnMA	0.1128***	0.1225***	0.0498	0.1119***	0.0671*	0.1001***
	(0.0331)	(0.0350)	(0.0851)	(0.0355)	(0.0355)	(0.0231)
lnMA × High K/L Industry				0.0228*		
				(0.0127)		
lnMA × Emerging Industry					0.1175***	
					(0.0128)	
lnMA × Inland Provinces						0.0395*
						(0.0237)
Observations	111,733	94,156	17,468	94,156	94,156	115,282
R-squared	0.2322	0.2067	0.5057	0.2064	0.2051	0.2018
Other Controls	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES
Industry-Year FE	YES	YES	YES	YES	YES	YES

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Instrumental variable is the Wall-City IV.

Implications:

- National Expressways expansion brings opportunities for the inland to catch up
- There could be opportunity to "leap forward" instead of following the old labor-intensive development pathway

My Takeaways

- This paper is among the earliest to:
  - document the rapid growing market access at a refiner geographic level (county-level)
  - explicitly estimate the power-decay parameter θ in China's context using detailed trade date.
  - investigate the impact of market access on the performance of industrial firms
  - Propose novel panel IVs for dynamic transport network expansion
- Findings:
  - good market access benefits local industrial (manufacturing) development: intensive margin and extensive margin
  - reduce inequality from production side between coastal and inland regions, but may hurt the inland periphery areas
- Implications: there could be opportunity to leap forward instead of following the old labor-intensive development pathway, because China already has decent markets of tradable capital.

Questions are welcome

Thank You!