Connect and Compete: Transport Infrastructure and Spatial Divergence*

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July 23, 2024

Preliminary and incomplete

Abstract

This paper examines the effects of transportation infrastructure on regional economic development through the lens of product market competition. Using data from China's "National Expressway Network" and the Annual Survey of Industrial Firms (ASIF), we investigate how reductions in domestic trade costs influence the spatial distribution of economic activity. Our findings indicate that while improved market access generally boosts economic output in larger regions, it can negatively impact smaller regions by increasing competition and causing less productive firms to exit. This results in increased Total Factor Productivity (TFP) but reduced manufacturing output and employment in smaller regions. The analysis highlights the critical role of product market competition in regional economic dynamics, providing insights into the mixed empirical evidence on the benefits of transportation infrastructure investments.

Keywords: transportation, divergence, regional inequality

JEL Codes: R12, R41, F12

*I would like to thank my advisors, Carsten Eckel and Claudia Steinwender, as well as Lei Li and Martina Magli for their continued support. I would further like to thank Costas Arkolakis, Holger Breinlich, Gabriele Buontempo, Zhang Chen, Banu Demir, Dave Donaldson, Juliette Fournier, Dorothee Hillrichs, Luca Macedoni, Dennis Novy, Marta Santamaria, and Davide Suverato for helpful comments and suggestions. All mistakes are my own.

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1 Introduction

The pursuit of regional convergence in economic development has prompted substantial investments in transportation infrastructure across various economies. Noteworthy examples include India's "Golden Quadrilateral" initiative, which saw an investment of US$7.5 billion over a span of 13 years according to the National Highways Authority of India. Similarly, China's commitment to regional connectivity is evident through the implementation of the "National Expressway Network," involving a substantial investment of US$120 billion over a 15-year period (Faber 2014). China specifically stated that one of the goals was to "[...] improve the regional integration of the economy and allow growth dynamics to expand from the coastal regions to the interior and western parts of the country" (World Bank 2007).

Yet the influence of reductions in domestic trade costs through transport infrastructure on achieving a more even spatial distribution of economic activity remains unclear. Empirical evidence provides a mixed picture. One the one hand, transportation infrastructure exhibits positive local effects on manufacturing activity and GDP per capita in several countries (Datta 2012; Ghani et al. 2015; Banerjee et al. 2020; Coşar et al. 2021). However, positive average effects can mask considerable regional heterogeneity. Faber (2014) finds that highway connections had a negative impact on GDP growth in small peripheral regions that were connected to large metropolitan areas in China. Further, Baum-Snow et al. (2020) find that the Chinese Highway Network increased economic output in regional primates, but at the expense of smaller prefectures, which, in turn, specialized more in agriculture.

In this paper we integrate product market competition, following the framework of Melitz and Ottaviano (2008) and Ottaviano and Suverato (2024), into a QSE model akin to Redding and Rossi-Hansberg (2017). Consumers have quadratic preferences over differentiated varieties produced in monopolistic competition. Consequently, a choke price emerges, representing the threshold beyond which demand for a variety ceases. The choke price is contingent upon a local price statistic, which diminishes with a reduction in domestic trade costs. This decline in the local price statistic results in a lowered choke price, compelling the exit of the least productive firms from the market.

Firms draw their productivity from a region specific Pareto distribution, where some regions' distribution exhibits a thicker upper tail making them more productive. Consistent with the standard QSE framework, cities with exogenously higher productivity will have a lower price index due to higher local production at lower marginal costs. This is the agglomeration force in the conventional QSE scenario, and a reduction in trade costs will attenuate this force, contributing to a more uniform distribution. At the same time the product market competition mechanism will induce exits of firms in smaller regions unable to compete in the new environment.

Through the lens of a standard Quantitative Spatial Economics (QSE) model, a reduction in domestic trade cost should lead to a more even distribution (Redding and Rossi-Hansberg 2017). In QSE models, the local CES price index acts as an agglomeration force. Better access to a variety of goods in large urban centers makes it attractive for workers to live there, while small and remote regions face higher prices for the same bundle of goods due to costly trade. Consequently, a reduction in trade cost erodes the advantage of larger regions and leads to a more uniform spatial distribution.

However, due to the CES structure of preferences, there is no product market competition that can give rise to domestic import competition (Arkolakis et al. 2018). Despite this, the literature on international trade indicates that import competition can result in adverse manufacturing outcomes in exposed regions (Redding 2022). The observed spatial distribution of winners and losers in the data may be driven by product market competition dynamics (Faber 2014; Baum-Snow et al. 2020). Notably, firms in larger urban centers tend to be more productive, allowing them to charge lower prices (Combes et al. 2012). When trade is costly, firms in peripheral regions enjoy a degree of trade protection. However, a connection between small regions and urban centers diminishes this protection, exposing smaller market firms to competition from their more productive urban counterparts. Following the framework Melitz and Ottaviano (2008), this can lead to the exit of the least productive firms and, in the presence of labor mobility, contribute to spatial divergence.

To provide reduced form evidence that the product market competition channel is relevant in the Chinese setting I combine data from the Annual Survey of Industrial Firms (ASIF) and data on travel time and highway placements from Egger et al. (2023) and Ma and Tang (2024). ASIF covers all firms above a certain size threshold from 1997 to 2007 and enables an examination of how reductions in trade costs impact the primary dimensions of product market competition: increased firm exits and reduced markups. Preliminary results show that increased market access due to the Chinese Expressway System reduced manufacturing output and employment in the smallest regions but increased it in the biggest. I observe that in the smallest regions markups decline and firms a more likely to exit, while at the same time average Total Factor Productivity (TFP) increases, consistent with the theoretical framework outlined above.

Section 2 outlines the theoretical framework, while section 3 describes the data, empirical approach and results. Section 4 concludes.

2 Model

There are $n \in N$ regions in a country each endowed with an exogenous measure of land Λ_n. Manufacturing is a monopolistically competitive sector that uses only labor as input and produces differentiated varieties that are traded from i to n at an iceberg cost $\tau_{ni} = \tau_{in}$ where $\tau_{nn} = 1$. A mass of L workers freely chooses where to locate.

2.1 Workers

Workers consume a bundle of differentiated manufacturing goods C_n and land which they use for living T_n according to the following Cobb-Douglas Preferences

$$U_n = \left(\frac{C_n}{\beta}\right)^{\beta} \left(\frac{T_n}{1-\beta}\right)^{1-\beta} \tag{1}$$

They supply one unit of labor inelastically which earns them a wage w_n. I assume that expenditure on land is redistributed in a lump sum to the workers residing in that location. Therefore, per capita income v_n in each location equals labor income w_n plus per capita expenditure on residential land $(1-\beta)v_n$, namely

$$v_n L_n = w_n L_n + (1-\beta) v_n L_n = \frac{w_n L_n}{\beta}$$

Hence the fraction of income a worker spends on the goods bundle is $\beta v_n = w_n$. Preferences over differentiated varieties take a quadratic form and are

$$C_n = \sum_{i}^{N} \int_0^{M_{ni}} \alpha q_{ni}(\omega) - \frac{\gamma}{2} q_{ni}(\omega)^2 d\omega \tag{2}$$

Taking first order conditions gives the demand function

$$q_{ni}(\omega) = \frac{\alpha}{\gamma} - \frac{\alpha M_n - \gamma Q_n}{\gamma \tilde{P}_n} p_{ni}(\omega) L_n \tag{3}$$

where $\tilde{P}_n = \sum_i \int_0^{M_{ni}} p_{ni}(\omega') d\omega$ is a price statistic and $Q_n = \sum_i \int_0^{M_{ni}} q_{ni}(\omega') d\omega$ is a quantity statistic. $M_n = \sum_i M_{ni}$ is the mass of firms serving market n. Individuals only demand a positive amount of a good if its price is below the choke price $\hat{p}_{ni} = \hat{p}_n$. Hence the $p_{ni}(\omega)$ where $q_{ni}(\omega) = 0$ gives the choke price:

$$\hat{p}_n = \frac{\alpha \tilde{P}_n}{\alpha M_n - \gamma Q_n} \tag{4}$$

In the case that consumers have no love for variety $(\gamma = 0)$ the choke price becomes

$$\hat{p}_n = \frac{\tilde{P}_n}{M_n}$$

which is the average price. This implies that all prices have to be the same for all goods that are consumed with positive quantity, which is an intuitive result of a setting were goods are perfect substitutes and markets competitive.

2.2 Firms

Upon paying a fixed cost of entry and production F firms in i discover their productivity draw ϕ from a distribution $G_i(\phi)$. They then decide whether to produce or freely exit. Since all firms with productivity ϕ behave identically varieties are now indexed with ϕ. Successful entrants maximize profits:

$$\max_{p_{ni}(\phi)} \sum_{n}^{N} p_{ni}(\phi)q_{ni}(\phi) - \frac{\tau_{ni}w_i}{\phi}q_{ni}(\phi)$$

Taking FOCs gives the pricing rule

$$p_{ni}(\phi) = \frac{1}{2}\left(\frac{\alpha\tilde{P}_n}{\alpha M_n - \gamma Q_n} + \frac{\tau_{ni}w_i}{\phi}\right)$$

The cut-off productivity ϕ^*_{ni} of a firm in i to still serve market n is determined by the marginal cost that is equal to the choke price in n

$$\frac{\tau_{ni}w_i}{\phi^*_{ni}} = \frac{\alpha\tilde{P}_n}{\alpha M_n - \gamma Q_n}$$
$$\phi^*_{ni} = \frac{\alpha M_n - \gamma Q_n}{\alpha\tilde{P}_n}\tau_{ni}w_i$$

taking the pricing rule and substituting gives

$$p_{ni}(\phi) = \underbrace{\frac{1}{2}\left(\frac{\phi}{\phi^*_{ni}} + 1\right)}_{\text{markup}} \underbrace{\frac{\tau_{ni}w_i}{\phi}}_{\text{marginal cost}} \tag{5}$$

2.3 Differentiated Sector Equilibrium

There is a subset M_{ni} of entrants J_i in region i productive enough to serve market n

$$M_{ni} = J_i(1 - G_i(\phi^*_{ni})) \tag{6}$$

The conditional cdf of firms from i serving market n is

$$\mu_{ni}(\phi) = \frac{g_i(\phi)}{1 - G_i(\phi^*_{ni}))} \ \text{ if } \phi \geq \phi^*_{ni} \tag{7}$$

where $g_i(\phi)$ is the pdf corresponding to $G_i(\phi)$. The aggregate price statistic $\tilde{P}_n$ becomes

$$\tilde{P}_n = \sum_i M_{ni} \int_{\phi^*_{ni}}^{\infty} p_{ni}(\phi)\mu_{ni}(\phi)d\phi \tag{8}$$

The aggregate quantity statistic Q_n becomes

$$Q_n = \sum_i M_{ni} \int_{\phi^*_{ni}}^{\infty} q_{ni}(\phi)\mu_{ni}(\phi)d\phi \tag{9}$$

Trade flows are

$$T_{ni} = \sum_i M_{ni} \int_{\phi^*_{ni}}^{\infty} p_{ni}(\phi)q_{ni}(\phi)\mu_{ni}(\phi)d\phi \tag{10}$$

Average profits are

$$\bar{\Pi}_i = \sum_n (1 - G_i(\phi^*_{ni})) \int_{\phi^*_{ni}}^{\infty} \pi_{ni}(\phi)\mu_{ni}(\phi)d\phi \tag{11}$$

where potential profits in n are weighted by the probability of being realized $1 - G_i(\phi^*_{ni})$ The free entry condition is

$$w_i F = \sum_n (1 - G_i(\phi^*_{ni})) \int_{\phi^*_{ni}}^{\infty} \pi_{ni}(\phi)\mu_{ni}(\phi)d\phi \tag{12}$$

And the income/spending identity (or goods market clearing condition) is

$$w_i L_i = \sum_n T_{ni} \tag{13}$$

2.4 Parametrization

Let $G_i(\phi)$ be Pareto distributed with $G_i(\phi) = 1 - (b_i/\phi)^\theta$ with shape parameter $\theta > 1$ and city i specific support $[b_i, \infty)$. The conditional cdf of firms in i serving n is

$$\mu_{ni}(\phi) = \theta \frac{(\phi^*_{ni})^\theta}{\phi^{\theta+1}} \tag{14}$$

Using this parametrization the aggregate quantity statistic Q_n becomes

$$Q_n = \frac{\alpha M_n}{2\gamma(\theta+1)} \tag{15}$$

Similarly, $\tilde{P}_n$ is

$$\tilde{P}_n = \frac{2\theta+1}{2\theta+2} \frac{w_n}{\phi^*_{nn}} M_n \tag{16}$$

Where we have used the fact that $\phi^*_{nn} = \phi^*_{ni} \frac{w_n}{\tau_{ni} w_i}$. To derive the free entry condition we first need to derive average profits 11

$$w_i F = \sum_k \left(\frac{b_i}{\phi^*_{ki}} \right)^\theta \frac{\tau_{ki} w_i}{\phi^*_{ki}} \frac{\alpha L_k}{2\gamma(\theta+1)(\theta+2)} \tag{17}$$

The income/spending identity 13 can be derived similarly to the free entry condition and is

$$w_i L_i = \sum_k J_i \left(\frac{b_i}{\phi^*_{ki}} \right)^\theta \frac{\tau_{ni} w_i}{\phi^*_{ni}} \frac{\alpha L_k}{2\gamma(\theta+2)} \tag{18}$$

Setting the two conditions equal yields the equilibrium number of entrants in i

$$J_i = \frac{L_i}{(\theta+1)F} \tag{19}$$

Which, together with the spending identity of importer n (i.e. income in n matching expenditure of n) characterizes the cut-off productivity

$$\phi_{ni}^{*} = \left[\frac{\alpha}{2\gamma(\theta+1)(\theta+2)Fw_n} \sum_k L_k \left(\frac{b_k}{\tau_{nk} w_k} \right)^{\theta} \right]^{\frac{1}{\theta+1}} \tau_{ni} w_i \tag{20}$$

The derivation of trade shares λ_{ni} (i.e. the share that n imports from i) follows from the income/spending identity. Plugging in the cut-off productivity ϕ_{ni}^{*} from 20 in the definition of trade flows 10 from i to n, trade shares are

$$\lambda_{ni} = \frac{L_i b_i^{\theta} (\tau_{ni} w_i)^{-\theta}}{\sum_k L_k b_k^{\theta} (\tau_{nk} w_k)^{-\theta}} \tag{21}$$

Following the results of Ottaviano and Suverato (2024) one can express the ideal price index P_n under Pareto distribution as

$$P_n = \frac{2}{\alpha} \left(\frac{\eta_1 - \eta_2}{1 - \eta_2} \right) \hat{p}_n$$

where

$$\eta_1 = \frac{2\theta+1}{2(\theta+1)}; \quad \eta_2 = \frac{2\theta^2+4\theta+1}{2(\theta+2)(\theta+1)}$$

Rewriting 21 as the own trade share λ_{nn} one can rewrite the cut-off productivity in terms of the own trade share

$$\phi_{nn}^{*} = \left[\frac{\alpha}{2\gamma(\theta+1)(\theta+2)} \frac{L_n b_n^{\theta}}{\lambda_{nn}} \right]^{\frac{1}{\theta+1}}$$

Substituting for the choke price $\hat{p}_n$ with 4 and using the above definition of the domestic productivity cut-off, the ideal price index can be expressed as

$$P_n = \chi \left[\frac{\lambda_{nn}}{L_n b_n^{\theta}} \right]^{\frac{1}{\theta+1}} w_n \tag{22}$$

where $\chi = \frac{2}{\alpha} \left(\frac{\eta_1 - \eta_2}{1-\eta_2} \right) \left(\frac{2\gamma(\theta+1)(\theta+2)}{\alpha} \right)^{\frac{1}{\theta+1}}$ collects constants.

2.5 Land Markets

The expenditure on the exogenous measure of developable land Λ_n is redistributed in a lump sum to the workers residing in that location. The residential land demand T_n times the number of consumers L_n must equal the supply of land Λ_n. We can use this condition to solve for the land rents, which gives

$$r_n = \frac{(1-\beta)v_n L_n}{\Lambda_n} = \frac{1-\beta}{\beta}\frac{w_n L_n}{\Lambda_n}$$

2.6 Spatial Equilibrium

For workers to be indifferent between any two regions indirect utility needs to equalize across space

$$V_n = \frac{\beta w_n}{(P_n)^{\beta}(r_n)^{1-\beta}} = \bar{V}$$

Plugging P_n and r_n into V_n and solving for L_n gives the equilibrium distribution of population shares

$$\frac{L_n}{L} = \frac{\left[\lambda_{nn}^{-\frac{\beta}{\theta+1}} b_n^{\frac{\theta\beta}{\theta+1}} \Lambda_n^{1-\beta}\right]^{\frac{\theta+1}{(\theta+1)-\beta(\theta+2)}}}{\sum_k \left[\lambda_{kk}^{-\frac{\beta}{\theta+1}} b_k^{\frac{\theta\beta}{\theta+1}} \Lambda_k^{1-\beta}\right]^{\frac{\theta+1}{(\theta+1)-\beta(\theta+2)}}} \tag{23}$$

which together with trade shares 21 and the income/spending identity 18 determine the spatial equilibrium.

Figure **??** show a simple two-region simulation of the equilibrium at different trade cost. In line with the intuition outlined in 1, the price index declines with trade cost, but this decline is much stronger for regions that are initially small as they import more of their goods. At the same time, the domestic cut-off productivity rises steeply for small regions as the environment in their market becomes more competitive, while it hardly changes for the big region. This implies that the least productive firms in the small regions exit the market.

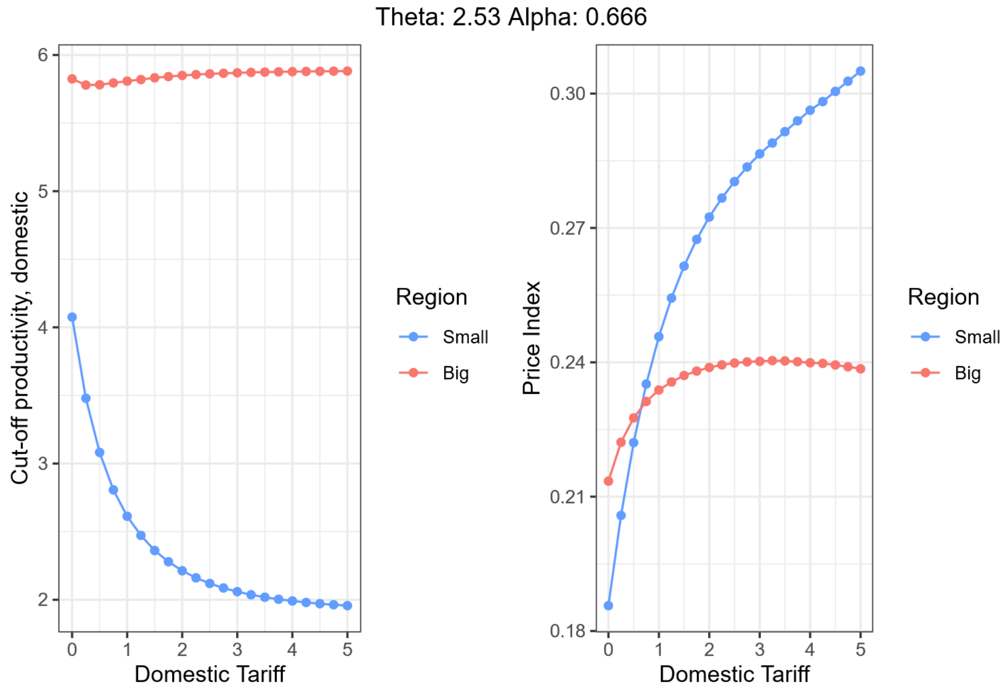

Figure 1: Two Region Simulation of the Model

3 Empirics

3.1 Data

The primary data source is the Annual Survey of Industrial Firms (ASIF) from the Chinese National Bureau of Statistics (NBS) covering the years 1998-2007. The survey covers "all state-owned and above-scale private-owned industrial enterprises", where "above-scale" refers to firms with annual sales greater than or equal to 5 million RMB (about \$ 770,000 at exchange rates in 2021). We follow the steps in Casper et al. (2024) as adapted from Brandt, Van Biesebroeck, Wang, et al. (2017) to track firms over time whose unique firm identifier may have changed due to mergers, acquisitions or restructuring. We also drop firms with missing values in employment, exports and wage bill as well as firms that report negative exports or negative gross output. Following Brandt, Van Biesebroeck, Wang, et al. (2017) we also drop firms with fewer than 8 employees as these fall under a different legal regime. The Chinese Industrial Classification (CIC) changed between 2002 and 2003, to consistently track industries we employ the crosswalk by Brandt, Van Biesebroeck, and Zhang (2012). As part of this change some industries were reclassified as services, hence we also remove these from our sample[1]. We further drop other industrial non-manufacturing industries (e.g. mining or oil refining). The final resulting data set is described in table 1

Table 1: Summary of ASIF data

	Number of Firms	Value Added	Output	Employment	Export	Net value of fixed assets
1998	165110	1.94	6.77	61.96	1.08	4.41
1999	162029	2.16	7.27	58.05	1.15	4.73
2000	162884	2.54	8.57	55.59	1.46	5.18
2001	171243	2.83	9.54	54.41	1.62	5.54
2002	181552	3.3	11.08	55.21	2.01	5.95
2003	196213	4.2	14.23	57.48	2.69	6.61
2004	278984	5.72	20.17	66.16	4.05	7.95
2005	271830	7.22	25.16	68.96	4.77	8.95
2006	301957	9.11	31.65	73.58	6.05	10.57
2007	336763	11.7	40.5	78.74	7.33	12.34

Note: This table shows aggregates of the underlying firm level data by year. This includes all firms in the sample, including non-manufacturing industrial firms. Employment is in million workers. Value added, output, exports and net value of fixed assests are in trillion RMB. All values are in nominal terms.

Lastly, I follow De Loecker and Warzynski (2012) to estimate firm level TFP and markups. Data on travel time between prefectures between 2000 and 2007 comes from Egger et al. (2023) where we follow Baum-Snow et al. (2020) to convert travel time tt_{ijt} into ice-berg trade cost using the ad-hoc formula

$$\tau_{ijt} = 1 + 0.004 \times tt_{ijt}^{0.8}$$

where τ_{ijt} denotes ice-berg trade cost between prefectures i and j at time t.

[1] These are CIC codes 1711, 1712, 1713, 1714, 2220, 3648, 3783, 4183, and 4280.

Figure 2: Highway Network in China, 1999 and 2010

3.2 Empirical Approach

The empirical context is China's Expressway Network, built between 1992 and 2007. As outlined in figure 2, it was a large scale investment in a new network, hence drastically reducing travel times between prefectures. The main goals were to connect all provincial capitals and cities with over 500,000 people through a unified expressway network and to build routes linking key centers to borders in line with the Asian Highway Network (Faber 2014). Originally planned for completion by 2020, the network was finished early by the end of 2007. The Chinese Ministry of Communications divided the construction into two phases: the "kick-off" phase (1992-1997) and "rapid development" (1998-2007). The acceleration in 1998 was due to highway construction being included in the government's stimulus efforts following the Asian financial crisis (World Bank 2007).

To explore correlates between prefecture level outcomes and changes in market access I estimate the following regression model

$$\Delta \log(y_{it}) = \sum_{q=1}^{4} \beta_q \Delta \log(MA_{it}) \times \mathbb{1}_q + X_{it} + \mu_t + \varepsilon_{it} \tag{24}$$

where y_{it} are prefecture level outcomes for prefecture i, q denote its initial size quartile in 1998 and Δ denote first differences between 2000 - 2007. I define market access MA_{it} for prefecture $i \in N$ at time t as

$$MA_{it} = \sum_{j \in N} Q_{j,1998} \times \frac{1}{\tau_{ijt}^{\sigma-1}}$$

where $Q_{j,1998}$ is output in j in 1988 and $\sigma = 4$. X_{it} includes changes in input and output tariffs, high-speed rail connection, and the share of firms in Sepcial Economic Zones. Lastly, μ_t are year fixed effects. Table 2 displays averages over time across initial size quartiles for Market Access and some key outcomes.

Table 2: Outcomes and Market Acess

Quartile	Mrket Access	Markup	TFP	Labor Productivity
4	0.891	1.134	3.123	296
3	0.881	1.145	3.153	228
2	0.864	1.145	3.109	192
1	0.836	1.164	3.436	178.1

Comparison of average MA, Markup, TFP, and Labor Productivity across time for each initial size quartile. Labor Productivity is defined as output per worker. Market Access uses output shares as weights.

Aggregate trends are controlled for as well as changes in foreign trade exposure at the prefecture level. Since output $Q_{j,1998}$ in the definition of MA_{it} is fixed to its level at 1998, subsequent changes come only from changes in the trade cost due to highway construction, not any endogenous output changes. Nevertheless, road placement itself is likely to be

Table 3: Market Access Change and Prefecture Performance

	Output	Employment	Markup	TFP	No. Firms
MA Change (Q1)	-13.117**	-18.992***	-1.999***	2.272	-19.583*
	(6.592)	(6.119)	(0.681)	(3.638)	(9.983)
MA Change (Q2)	-4.283	-6.202**	-0.780**	4.445*	-0.039
	(3.205)	(2.887)	(0.339)	(2.330)	(3.236)
MA Change (Q3)	-2.258	-2.446	-0.072	0.957	-0.230
	(4.938)	(3.425)	(0.492)	(2.280)	(3.545)
MA Change (Q4)	-0.401	13.740***	2.162***	0.336	23.871***
	(3.876)	(4.991)	(0.699)	(2.528)	(6.224)
Num.Obs.	2009	2009	2009	2009	2009
R2	0.137	0.137	0.271	0.041	0.192

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

Standard Errors are clusteres at the prefecture level.

endogenous, and hence the results of regression 24 should be interpreted as correlational only.

To identify causal effects we aim to exploit and IV strategy based on constructing least-cost path spanning tree networks similar to Faber (2014) and Egger et al. (2023). These networks aim to identify changes in market access attributed solely to a network whose placement results from cost optimization. This is currently work in progress.

3.3 Results

Preliminary results are outlined in 3.

The results of estimating 24 show that increased market access due to the Chinese Expressway System reduced manufacturing output and employment in the smallest regions but increased it in the biggest. This is in line with regional divergence, as outlines in Faber (2014) and Baum-Snow et al. (2020). In line with the model outlined in section 2, we observe that in the smallest regions markups decline and firms a more likely to exit, while at the same time average Total Factor Productivity (TFP) increases.

4 Conclusion

The substantial investments in transportation infrastructure by various economies, such as India's "Golden Quadrilateral" and China's "National Expressway Network," aimed to enhance regional economic integration and reduce domestic trade costs. However, the impact of these investments on achieving a more balanced spatial distribution of economic activity is ambiguous, with mixed empirical evidence. While transportation infrastructure generally boosts manufacturing activity and GDP per capita, it can also result in regional disparities, as seen in China where smaller peripheral regions experienced negative growth impacts due to increased competition from larger urban centers.

In this paper, we incorporate product market competition into a Quantitative Spatial Economics (QSE) model to explore these dynamics. We show that reductions in trade costs can lead to a more even distribution of economic activity by lowering local price indices, driving less productive firms out of the market, particularly in smaller regions. This mechanism is supported by data from the Annual Survey of Industrial Firms (ASIF), which reveals that improved market access through the Chinese Expressway System decreased manufacturing output and employment in smaller regions while increasing them in larger ones. This suggests that product market competition plays a crucial role in shaping the spatial distribution of economic activity, with significant implications for regional development policies.

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