Impact of market access and comparative advantage on regional distribution of manufacturing sector

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We discuss the effects of trade costs and comparative technology on industry location by employing the model presented by Martin and Rogers (1995). The model supposes comparative technology differences and different intraregional and interregional trade costs and argues how different factors influence location of industrial value added. By processing the designed model, equations were set up to check whether the conclusions from our mathematical model are credible under panel data at the provincial level of China from 1995 to 2014. We find that location of industrial value added in a region is strongly related to infrastructure and local market size while geographical location of a region is an important determinant for deciding which factor should be handled first.
Keywords: new economic geography, comparative advantage, market access

1. Introduction

Why some regions turn to preferential location for industries and others fail to attract? Many authors try to explain this question by employing different techniques. Marshall (1890) emphasizes on spatial linkages that firm's cluster to economize on the transport of goods, labor market and technological spillover. Monseny *et al.* (2011) for Spanish regions and Ellison *et al.* (2010) for US and UK test Marshall Theory of Agglomeration and find strong evidence for all three factors.

The "NEG" (New Economic Geography) literature has tried to assess this question by considering the framework of increasing returns to scale and imperfect competitive markets, Dixit and Stiglitz (1977) and Krugman (1991) assumes monopolistic competition with economies of scale and iceberg trade costs to explain industrial input-output mechanism by differentiating between core-periphery conditions. Behrens *et al.* (2009) extends Krugman's model to multiple number of regions, where they allow three different factors regional market access, size and competition combining with geographical location of a region to play a radical role in determining regional income and expenditure level and volume of industrial produce, while they ignore regional

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comparative advantage over others.

Regional infrastructure to the market is one of the determinants for the industrial location as Hanson and Song (1998) explore the US-Mexican economic ties and market access (NAFTA) that increas regional market access and economic integration and cause falling trade costs between US and Mexico, further affect the location choice of Mexican manufacturers. Davies and Weinstein (2003) also derive the same conclusion for the OECD regions, that home market effect and regional trade cost stand as substantial forces to attract firms. Most of the researches count interregional trade costs as the main determinant for the market access that further determine industrial location, profits and consumer utility level. The milestone NEG research work of Krugman (1991) "core-periphery model" states, that workers migrate in search of higher nominal wages which in the end are repatriated to their region of origin while higher than threshold value will agglomerate all the labor into a single region. Therefore "core-periphery" analyses are based on interregional trade and its transaction costs that exclude the trade inside a region and ignore non-zero intraregional trade costs that direct industrial value added towards a certain region and demand for labor and produce (Behrens and Thisse, 2007). Martin and Rogers (1995) model is among those which distinguishes between intraregional and interregional trade costs. They find that developed countries will attract more industries by improving interregional transportation facilities, while intraregional improvement of infrastructure favors developing countries. Eventually, we will count on both kinds of trade cost as the determinants of the research problem.

Spatial infrastructure determines regional market access, wages, consumer utility and consequently the level of regional agglomeration that further determines the industrial location. Besides the factors quoted, comparative advantage in technology plays a radical role in spatial economic growth. Gauru and Lecca (2013) present a study to understand the macroeconomic impact of cost of innovation and technology spillover that determine wages and spatial economic growth.[1] Glasson (2001) and Audretsch and Feldman (2004) conclude the same results and point out that educational institutes and R&D laboratory increase spatial innovation which significantly affect their surrounding industries and regions. Florax and Folmer (1992) have extensively distinguished between three approaches, while analyzing the regional impact of technology. First, industrial location decision in terms of proximity to innovative sector flourishes the production and innovation performance (Bania, Calkins and Dalenberg, 1992; Sivitanidou and Sivitinades, 1995). Second, it will cause the forward linkage through more clustering and agglomeration, while strengthening innovative activities in the specified region (Saxenian, 1994; Feldman, 1999). Finally, innovation will explain the regional production and income differences, where knowledge transfer is easier with geographical proximity to specified sector. While, Pavitt (1998) states

[1] For knowledge spillover level and its impact one can refer to Ghosh (2007).

that: “the link between basic research and technological practice is geographically constrained”. Ultimately, He points out the fact of proximity to vertical industries that further leads other of the same kind to locate in the concerned location.

We combine some of the previous research experiences and handle them in a single dynamic platform. First, well established infrastructure creates a suitable trade environment (Chiambaretto *et al*., 2013). Second, market access and its size directly affect intraregional economic growth (Monseny *et al*., 2011; Ellison, Glaeser, and Kerr, 2010). We use Martin and Rogers model (1995) and add some extra feature of intraregional trade costs and comparative advantage of technology between the two regions and try to analyze which factors make a region comparatively more attractive for industries than others. For analyses purpose, we employ one of the world’s fast growing economy, China, and count on provincial data to unveil the puller of industrial value added inside the country in last two decades.

The upcoming text of the paper is organized as follow. We develop our model in the next section. In section 3, we present the implication of empirical analysis on Chinese industrial distribution. The last section accommodates concluding remarks.

2. Theoretical model

New Economic Geography theory has three main forces to explain industrial agglomeration, market access effect, cost of living effect and market crowding effect. The former two are agglomeration forces and the latter is known as dispersion force, while in our model we count on the former two. Therefore, we use the technique of Martin and Rogers (1995) and suppose that there are two regions ℓ_1 and ℓ_2 for comparative analyses, each region composes of two sectors, agriculture A and manufacturing M. Agriculture sector uses labor L to produce while manufacturing sector uses both of the factors labor L and capital K combining with the level of technology in particular region. The level of infrastructure has direct impact on the regional trade costs and production of goods in both regions. Consequently, level of infrastructure and technology is the ultimate source of agglomeration to the location comparatively more advantageous.

2.1. Consumer behavior

For comparative analyses, representative consumer in location ℓ_1 has the utility function $U = C_M^{\mu} C_A^{1-\mu}$, consisting of the consumption C of the agriculture sector and manufacturing sector, where $C_M = (\int_0^{n^w} c_i^{(\sigma-1)/\sigma} di)^{\sigma/(\sigma-1)}$ represents consumption of manufacturing sector at ratio μ. The process of maximization subject to expenditure function $E = p_A c_A + P_M C_M$ determines the level of consumer expenditure in each sector $C_A = (1-\mu) E/p_A$, $c_i = \mu E(p_i^{-\sigma}/P_M^{1-\sigma})$, where c_i under constant elasticity of substitution factor σ represents consumption of manufacturing goods produced by industry i at price $P_M = (\int_0^{n^w} p_i di)^{1/(\sigma-1)}$. Agriculture sector is same in all regions and has no impact on regional economy while the number of producers in manufacturing sector is the direct source of regional growth. Therefore, $n + n^* = n^w$ will represent the total number of firms n^w in region ℓ_1 and ℓ_2 while the superscript "*" represents ℓ_2. One can follow the same process to calculate region ℓ_2's consumer demand and industrial price for the goods produced in ℓ_2.

2.2. Production sector

Suppose agriculture sector produces homogenous goods in both regions which are transported to perfectly competitive markets at same price in both regions. Therefore wages in agriculture sector and revenues equate each other $p_A x_A = a_A w_A$, where a_A the number of labor is used per unit of output x_A while receiving w_A amount of wages that is spent on agriculture produce at price p_A. Because of the perfect competition, price is equal to the marginal costs, therefore agriculture goods play a role of numeraire, therefore through standardization we suppose $a_A = 1$ and $w_A = 1$, that is $p_A x_A = a_A w_A = 1$, ℓ_2 follows the same process and equates the price and wage markets $p_A^* = a_A^* w_A^* = 1$. Consequently, perfect competition equates the labor productivity and wages in agriculture sector for both regions.

Manufacturing sector faces imperfect competition – as explained by Dixit and Stiglitz (1977) – and profit maximization problem $p_M x_j - c_M$, therefore, production of good x produced by industry j needs to pay wages w to labor "a_m" used per unit of production and profits π to capital, as $c(x_j) = wa_m x_j + \pi$. Consumption of goods in a region faces intraregional (D) and interregional (I) iceberg trade costs τ as $x_j = \tau_D c_i + \tau_I c_i^*$ where demand $c_i = p_i^{-\sigma} \mu E / \Delta n^w$ in market $\Delta n^w = \int_0^{n^w} p_i^{1-\sigma} di$ faces domestic price $p_i = \sigma wa_m / (\sigma - 1)$ for domestic production and interregional price $p_i = \sigma wa_m^* / (\sigma - 1)$ for imports to ℓ_1, while $a_m^* = \delta a_m$ is the factor to count on the interregional comparative advantage of technology of ℓ_1 *over* ℓ_2. The difference in regional trade costs and comparative advantage will result in four different prices where the former region pays less transaction cost than the latter region because of the comparative disadvantage of latter region in technology.

$$p_i^{intra} = \tau_D p = \tau_D \qquad p_i^{inter} = \tau_I p = \tau_I .... \tag{1.1, 1.2}$$

$$p_i^{intra *} = \tau_D^* p^* = \tau_D^* \delta \qquad p_i^{inter^*} = \tau_I p^* = \tau_I \delta .... \tag{1.3, 1.4}$$

$$a_m^* = \delta a_m \qquad p_i^* = \sigma w^* a_m^* / (\sigma - 1) = p^* \qquad p^* = \delta p \text{ where } 0 < \delta < 1$$

Equation 1.1 and 1.2 represent consumer prices for the former region while equation 1.3 and 1.4 for latter region, the superscript "intra" represents the intraregional and "inter" represents the interregional final consumer prices.

2.3. The equilibrium condition

The manufacturing sector uses capital as fixed cost that is derived through the sales divided by σ. Therefore, through Mill pricing and demand function we got equation 2.1 and 2.2 to distinguish between core-periphery regions,

$$\pi = \frac{px}{\sigma} = bB\frac{E^w}{n^w},\ \pi^* = \frac{p^*x^*}{\sigma} = bB^*\frac{E^w}{n^w},\ b = \mu/\sigma \ldots. \qquad (2.1, 2.2)$$

Extending the regional market to opponent region will change the market price to $\Delta n^w = \int_0^n p_f^{\text{intra}\,1-\sigma} di + \int_0^{n^*} p_f^{\text{inter}\,*\,1-\sigma} di$ for ℓ_1 good's consumption in intraregional and interregional consumption market while $\Delta^* n^w = \int_0^{n^*} p_f^{\text{intra}\,*\,1-\sigma} di + \int_0^n p_f^{\text{inter}\,1-\sigma} di$ for ℓ_2 good's consumption in both regions. The market size $\Delta = n\varphi_D + n^*\varphi_I\eta$, $\Delta^* = n\varphi_I + n^*\varphi_D^*\eta$ of a region is based on the level of trade freeness $\varphi_D = \tau_D^{1-\sigma}$, $\varphi_D^* = \tau_D^{*\,1-\sigma}$, $\varphi_I = \tau_I^{1-\sigma}$ where φ represents level of market freeness and $\eta = \delta^{1-\sigma}$ is the level of comparative advantage.

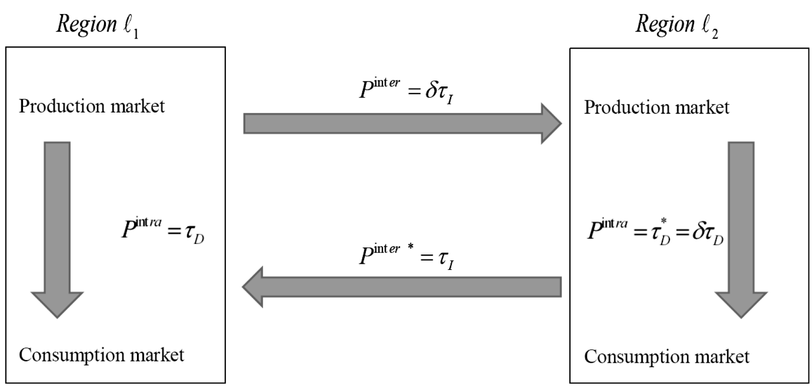

Figure 1. Regional comparative advantage and trade costs

Meanwhile, ℓ_1 faces lower trade costs than ℓ_2 therefore $\varphi_D > \varphi_D^* > \varphi_I$ represents the freeness of trade in the former region than the latter, it is reasonable because more developed regions with better infrastructure that further provide more favorable conditions to intraregional and interregional trade. Meanwhile, ℓ_1 already utilizes the required technology level where they can transport produce at less costs that is evident from market equations 3.1 and 3.2. We standardize the number of firms in this economic system to one, that is $n^w = n + n^* = 1$, then $S_n + S_n^* = 1$ and $S_E + S_E^* = 1$.

$$B = \frac{s_{E\phi_D}}{\Delta} + \frac{(1 - s_E)\phi_I}{\Delta^*} \text{ While } B^* = \frac{(1 - s_E)\eta\phi_D^*}{\Delta^*} + \frac{s_E\eta\phi_I}{\Delta} \ldots. \qquad (3.1, 3.2)$$

The expression of S_n and S_E represents the spatial distribution of manufacturing sector and market size when $S_n = 1$, it means all firms will agglomerate to ℓ_1, viceversa. As an objective of this paper is to find the effect of regional trade costs and comparative advantage of technology on regional distribution of manufacturing sector in a single model. First, we solve the economic system in a steady state $\pi = \pi^*$. Processing steady state of the system will result in number of regional firms S_n (the spatial industrial distribution in ℓ_1). Basically, S_n has two parts, first equation 3.1 and 3.2 represent that both intraregional[1] and interregional trade costs have an impact on the local market. While second part shows the importance of intraregional trade costs in opponent region that is technologically disadvantageous region, which means that ℓ_1 industrial distribution in this model depends on its regional market size and ℓ_2's comparative disadvantage in technology. If $T = (\varphi_D^* \eta - \varphi_I^2)(\varphi_D - \varphi_I \eta)$ and $T > 0$, then

$$s_n = \frac{\eta}{T}[s_E(\varphi_D \varphi_D^* - \varphi_I^2) - \varphi_I^2(\varphi_D^* \eta - \varphi_I)] \ldots \quad (4)$$

Equation 4 reflects the industrial share S_n of region ℓ_1, which is being decided by market size S_E, comparative advantage η, different domestic φ_D *and* φ^*_D and foreign φ_I level of trade freeness. If the regional market size S_E is not large enough as compared to interregional trade freeness φ_I then the regional market has to depend on importing – to satisfy domestic consumers demand for manufacturing produce – from the opponent region that will transpose sign of regional industrial value added S_n to negative. Further, we will discuss the relationships between S_n and the other four research variables one by one to find out the mechanism of ℓ_1 economy. Second order condition of equation 4 will explain the share of each factor included at right side of S_n.

$$\frac{\partial s_n}{\partial s_E} = \frac{\eta}{T}(\varphi_D \varphi_D^* - \varphi_I^2) > 0 \ldots \quad (5)$$

As previous researchers Li *et al*. (2012) and Keith *et al*. (2002)point out, the industrial distribution and regional number of firms are direct function of the market size and possible regional market access. Whilst, equation 4 explains the same concept by pointing towards the importance of comparative advantage while dealing with distribution of manufacturing sector in a two-region model.

Statement 1: If one region improves its market access, ultimately improves its home market endogenously and exogenously by reconsidering trade costs, the region will become more attractive for firms to locate, which further helps the region to extract its market power and size.

Intraregional trade costs for many authors seem meaningless in economic geography, and being neglected, where Martin and Rogers (1995) model stands as an exception by making the distinction between intraregional and interregional

[1] The intraregional trade costs here is the two-different kind of intraregional trade costs which prevail inside the two regions, that is τ_D and τ^*_D.

trade costs, but still failed to count on regional comparative advantage and its role in determining trade costs. To see the market access impact on regional distribution of manufacturing sector, we suppose ℓ_1 has comparative advantage of technology between the two regions. Therefore, combining regional trade costs with comparative advantage we take technology as factor of development to explain spatial distribution of manufacturing sector. The impact of intraregional trade freeness of ℓ_1 *and* ℓ_2 regions is explained in equation 6.1 and 6.2. The right-hand side of both of the equations shows that intraregional trade costs in one region are dependent on the market size in the other region that is further exposed to interregional trade costs and, particularly, to comparative advantage.

$$\frac{\partial s_n}{\partial \varphi_D} = \frac{\varphi_I \eta}{(\varphi_D - \varphi_I \eta)^2} * (1 - s_E) > 0.... \tag{6.1}$$

$$\frac{\partial s_n}{\partial \varphi_D^*} = -\frac{\varphi_I \eta}{(\varphi_D^* \eta - \varphi_I)^2} * s_E < 0 .... \tag{6.2}$$

As we suppose that $\varphi_D > \varphi_D^* > \varphi_I$, therefore $\varphi_D - \varphi_I \eta > 0$, *and* $\varphi_D^* \eta - \varphi_I > 0$.[1] The improvement of trade openness is favorable and less trade costs will attract more firms to the specific region.

Statement 2: When a region improves its intraregional infrastructure level to improve trade, this will result in higher production, ultimately increase their market size and, consequently, decrease the market size in the opponent region. If this improvement is done by less developed region, it will decrease the developing gap.

The impact of traditional trade openness factor φ_I on the regional distribution of manufacturing sector is quoted in equation 6.3, which further includes regional comparative advantage or disadvantage over other regions as an important determinant.

$$\begin{aligned} \frac{\partial s_n}{\partial \varphi_I} = \frac{\eta}{T^2}[2s_E \{ \varphi_I^2 (\varphi_I \eta - \varphi_D) + (\varphi_D \varphi_D^* - \varphi_I^2)(\varphi_D^* \eta^2 + \varphi_D \varphi_I) \} - (\varphi_D^* \eta - \varphi_I) \\ \{ 4\varphi_I^2 \eta + 2s_E \varphi_I^2 - \varphi_D \varphi_D^* \} + \varphi_D \varphi_I^2] \end{aligned} \tag{6.3}$$

Interregional trade between two regions is subject to the market size in both regions $S_E = 1 - S_E$, therefore the symbol of equation 6.3 is dependent on S_E. If $S_E > 1/2$ then $\partial s_n / \partial \varphi_I > 0$, which means that lower trade costs for ℓ_1 to export to ℓ_2 as ℓ_1 has larger market size than ℓ_2, while the opposite is true for ℓ_2 to export to ℓ_1 when $S_E < 1/2$ then $\partial s_n / \partial \varphi_I < 0$.

Statement 3: Trade openness between two regions is directly exposed to the size of regional market that is less beneficial for comparatively smaller markets. Therefore,

[1] To make sure firms can get profits from exporting to another region.

larger market will attract more producers from the opponent region.

As being supposed that ℓ_1 enjoys comparatively better technology which is explained through equation 6 where the size and access to the market play an important role.

$$\frac{\partial s_n}{\partial \eta} = s_E[\varphi_I \eta - \varphi_D^* (\varphi_D^2 - \varphi_I^2 \eta^2)(\varphi_D - \eta)] + 2\varphi_D^* \varphi_I \eta [\varphi_I(\varphi_D + \eta) - \varphi_I \eta(\varphi_I + \eta)$$
$$- \eta(\varphi_D + \varphi_D^* \eta)] - \varphi_D(s_E - \varphi_I)(\varphi_D^{*2} \eta^2 - \varphi_I^2) < 0 \quad (7)$$

While $\frac{\partial \eta}{\partial \delta} = (1 - \sigma)\delta^{-\sigma} > 0$, that is $\frac{\partial s_n}{\partial \delta} > 0$

Improvement in technological level is beneficial for both regions as equation 6 shows $\frac{\partial s_n}{\partial \delta} > 0$, but comparatively backward regions enjoy more than developed regions which is evident in the last part of the equation, where market size and interregional trade openness decide the power of intraregional trade openness. While equation 7 is the ultimate source of agglomeration in our model, comparatively well-established region has more power to attract firms towards the specific region.

Statement 4: Comparative advantage in technology proves the power of agglomeration, higher comparative advantage tends attract to more producers, consequently, leads to higher development gap between the two regions.

3. Empirical settings and data

Research analyses are conducted at the provincial level of China from 1995 to 2014, where the main source of data is *Chinese Statistical Bureau*. We follow the generalized regression model. Where manufacturing value added is strongly correlated to regional market and intraregional trade costs, while, interregional trade costs are strongly correlated to regional technology. Our econometric model includes all the necessary variable to explain Chinese industrial distribution in last two decades.

Market price of regional industrial value added represents regional advancement in industrial share (*K*) (Chow, 1993; 2010), that is further determined by the regional market size(*MSz*) measured through the regional gross domestic product, intraregional trade costs (*IntraTC*) as the cost borne on the transportation of passenger and freight volume, interregional trade costs (*InterTC*) as the flow of foreign direct investment and comparative advantage (*CAd*) as the average ratio of per unit of labor productivity in each region, (Ciccone, 2002; Zhang and Zhang, 2003; McCann and Shefer, 2004). Each variable is averaged for each regions' annual outcome that helps us to check all the regions in a single platform and find the regional comparative advantage over others.

$$K_{gt} = \beta_0 + \beta_1 MSz_{gt} + \beta_2 CAd_{gt} + \beta_3 InterTC_{gt} + \beta_4 IntraTC_{gt} + e_{gt} \quad (8)$$

According to the *China Statistical Yearbook*, we classify the mainland China into seven parts as mentioned in Table 1 that helps us to observe the industrial distribution in China. Most of the border regions are less productive and lack proper infrastructure, except for the regions which have ports in water, while Northeastern and Northwestern regions are distant regions therefore show insignificant results for most variables.

Table 1
Regional distribution of China.

Region	Provinces
Center	Hubei, Hunan, Henan, Jianxi
East	Anhui, Fujian, Jiangsu, Shanghai, Shandong, Zhejiang,
North	Beijing, Tianjin, Hebei, Shanxi, Inner-Mongolia
South	Guangdong, Guangxi, Hainan
Southwest	Sichuan, Yunnan, Guizhou, Chongqing
Northeast	Heilong Jiang, Liaoning, Jinan
Northwest	Ningxia, Xinjiang, Qinghai, Shan'xi, Gansu

Source: NRDC (Natural Resource Defense Council), for further details see Kang *et al*. (2012).

First, Central provinces of China are close to all parts of the country and have better infrastructure for transportation both inside and outside. Where regional technology or wages negatively affect industrial distribution up to 143% while interregional transaction cost are more beneficial (70%) than intraregional one (18%), as per equation 6.1, 6.2 and 6.3. While market effect is comparatively higher than other factors, as per equation 7. Second, Eastern regions consist of a set of provinces like Fujian, Shandong and Zhajiang etc. which add more to domestic value added production. The Eastern regions include six provinces with well-established intraregional infrastructure resulting in 17% (equation 6.1) effect on industrial production. Comparative technology and interregional trade costs possess almost the same significant effect, whereas market effect on regional industrial value added is much higher than the other regions (276%). Third, North regions include comparatively more developed provinces in China and comparatively more populated than other regions, as evident from its market share (236%) and negatively significant effect from all the other factors, where comparative technology effect on industrial distribution is much higher than other parts of the country. While because of the larger market share, regional technology shows negatively significant result, meaning that further increase in market size will increase the negative impact on industrial production. Fourth, South and Southwest regions include seven provinces that provide almost same results. South owes comparatively higher market effect than the opponent. Therefore, market effect lead both regions to have opposite response to interregional and intraregional trade costs, where because of the larger market share of Southern provinces (up to 145%) focusing on intraregional trade costs will be more beneficial while the latter region because of the comparatively lower market share interregional trade costs will benefit the regional industrial value added. Regional technology significantly affects both regions. Fifth, Northeast and Northwest regions include distant and dry border regions, resulting in limiting regional markets and having bad interregional infrastructure. Comparatively, intraregional trade costs have larger impact on industrial value added than interregional trade costs, while regional technology has different results for both regions as negative effect on Northeast industrial production compaed to the positive affect on Northwest region. While intraregional transaction effect is higher for Northeast (76%) than the Northwest (69%).

By observing the above analyses, we find that market effect plays a significantly positive role for the all the seven regions' industrial value added throughout the country. Regional technology is more concerned to regional market size and regional expenditure as evident from Central, Northern and Northeastern regions, while regional technology shows opposite results to the constant factors. Furthermore, less developed regions comparatively rely more on their intraregional transaction than any other factor to attract producers to the specific regions, while comparatively developed regions are more concerned about their interregional transactions, whereas Northern regions show exceptional results because of the heavily populated provinces. Market size affect is further affected by the proximity to comparatively agglomerated regions.

Table 3 presents macroeconomic results of China for the specified period, which strongly support our model. Regional market (at 221%) affects industrial production more than the other factors. While intraregional trade costs positively affect regional industrial value added as compared to the negative impact of interregional trade costs. Regional technology or regional wage market has positive effect on industrial value added (13%), which means there is still space for the Chinese government to take measures in accordance with wages to increase aggregate share of industrial value added. Ultimately pointing towards the importance of market share, intraregional trade costs and regional technology for the economy of China.

Observing Table 3, first, investment in technology either refreshing or up-gradation will result in higher value added production. Increase in production is the ultimate source of further agglomeration, as derived in equation 7. Second, larger market size with higher technology effect is an incentive for new producers to add more value added to domestic production that will increase the number of consumption preferences for domestic consumers. Therefore, lower market size with higher technology further combined with higher population will lead to more profits to producers Third, being a developing country, China's intraregional transaction costs have higher effects while interregional trade costs show negative significance for the value-added production as derived in equation 6.3, therefore improving intraregional infrastructure is more beneficial for China. Fourth, sophisticated intraregional infrastructure will increase intraregional transaction costs and expand its market size (equation 6.1 and 6.2) and comparatively higher number of transactions will result in greater agglomeration power.

Table 2

Generalized regression for industrial distribution across Chinese regions from 1995 to 2014

Region	Center	East	North	South	Southwest	Northwest	Northeast
MSz	2.140947 (.287356) *	2.765489 (.1024622) *	2.368863 (.1770392) *	1.454354 (.0839593) *	1.34885 (.1577469) *	.4577651 (.1161277) *	.4369391 (.214675) *
CAd	- 1.435096 (.8828371) **	.0039425 (.1123031) ***	-.7632607 (.1699287) *	.9912443 (.4243256) *	.9714682 (.2596577) *	.2322001 (.0663806) *	-.1224958 (.4769336) ***
InterTC	.7003798 (.174558) *	.002214 (.0209503) ***	-.0093017 (.0277309) ***	.0883141 (.0210309) *	.1850768 (.0388763) *	.0075077 (.0158179) ***	.0313649 (.0704416) ***
IntraTC	.1799575 (.1157521) **	.1672521 (.0511079) *	-.3021995 (.0924854) *	.1003722 (.0383487) *	.089857 (.0492795) *	.6906011 (.0447454) *	.7657295 (.0867046) *
Constant	.0172112 (.0219723) ***	-.0213503 (.0042008) *	.0337041 (.0059889) *	-.0314977 (.0106556) *	-.0306712 (.0073523) *	-.008505 (.0022426) *	.0045645 (.010956) ***
No. of provinces	4	6	5	3	4	5	3
No. of obs.	80	120	100	60	80	100	60
Wald chi2(4)	220.85	1766.83	382.81	13980.19	692.28	2835.86	598.30
Log likelihood	284.5811	416.0149	368.3247	261.9177	342.9367	523.2777	249.453

Notes: ***p < 0.01, ** 0.01 ⩽ p < 0.05, * 0.05 ⩽ p < 0. 10, standard errors are included inside the parentheses.

Table 3
Generalized regression for industrial distribution across Chinese regions from 1995 to 2014

Variables	Coefficient
MSz	2.212617 (.0707419) *
CAd	.131022 (.0768181) **
InterTC	-.0457661 (.0141003) *
IntraTC	.080676 (.0345535) *
Constant	-.0084771 (.0023167) *
No. of provinces	30
No. of obs.	600
Wald chi2(4)	5947.19

Notes: ***$p < 0.01$, ** $0.01 \leqslant p < 0.05$, * $0.05 \leqslant p < 0.10$, standard errors are included inside the parentheses.

4. Conclusions

This paper discusses the effect of regional transaction costs, comparative technology and market size on industrial value added. The methodology applied in this paper particularly consider regional technology imbalances and inclusion of intraregional transaction costs which affects regional value added which is ignored in previous models of new economic geography. The designed model is analyzed for the economy of China for last two decades through generalized regression. The regression result proves the specific effect of our key factors on regional value added with some exceptions for remote or over populated regions. Regional infrastructure determines the level of intraregional and interregional transaction which further affects market access. Regional market access importance varies for different regions according to their level of comparative advantage and geographical location of a region. Dry border regions and distance from the center or comparatively developed regions, show comparatively lower effect to interregional transaction, where intraregional transaction effect is comparatively more beneficial for less developed regions, as observed in Table 2. First, volume of industrial value added explains the agglomeration power based on the specified cost function. Second, industrial value added is directly affected by the market size, technology and regional infrastructure (equation 4). If a region has comparatively limited market size than the region nearby then intraregional transaction is more fruitful than interregional while larger market receives higher effect from interregional, because of circular effect larger market is obtained through the better market access, as per equation 6.1 and 6.2. Therefore, we utilize the same idea to find the factors which affect the regional industrial value added via the defined variables.

Our equations of location interest point that geographical location of a region is also important in explaining the regional distribution of production activity, where these factors can lead to core-periphery situation (when the opponent region is comparatively well developed). Intraregional trade cost shows the comparative advantage in favor of our interested region, but improvement in infrastructure should be monitored according to regional location and nearby regions.

Going through the econometric model, we find that regional market size, interregional and intraregional trade possess a positive effect while regional technology shows negative effect on regional value added. Considering these factors according to the location of a region will increase regional value added and attraction for the new producers. Therefore, location of a region is more important to decide the priority of different factors to increase regional production. Macroeconomic analyses of Chinese economy fully support our designed model and point out the importance of comparative advantage and intraregional transactions on regional manufacturing sector.

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