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SPATIAL EVOLUTION AND AGGLOMERATIVE FORCES OF CHINA[1]

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Abstract

As the biggest developing and transitional country in the world, China has undergone large and lasting spatial agglomeration since market reform. This paper traces dynamic evolution of spatial agglomeration over the past three decades; the result shows regional disparity, caused by spatial agglomeration, worsened dramatically at the threshold of the new century. By using Theil decomposed technique, the index shows interregional inequality plays as the primary role. And then investigates driving forces for agglomeration based on broad theories, the estimates provide strong support for all three sources of Marshall's theory.

Keywords: Spatial Evolution, Agglomerative Forces, China

JEL: C12, O18, R11

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1. Introduction

The economic activity of spatial agglomeration and regional disparity is of great interest to economists for a long time. From classic location theory to new economic geography, theoretical researches investigate the driving force and inherent mechanism of *why spatial agglomeration forms* and *how has it evolved*. Empirical researches are launched to examine the theories, but most of existing studies focus on developed countries; there is still very little empirical work of developing countries relatively. As the biggest developing and transitional country in the world, China has undergone large and lasting changes in economic geography since market reform in 1978. Accompanied by accelerating interregional factor mobility, spatial agglomeration and regional disparity are main characteristics of economic transformation. In China, inequality gap between coastal region and hinterland has increased by an ever-widening margin. Three most densest belts—Yangtze River Delta, Pearl Delta and Bohai rim area—have gathered more than 90% of country's total industrial clusters with less than 15% of land area. This phenomenon has attracted much concern of whole society, but the ability to understand it scientifically and manage it in practice has remained limited.

Marshall's theory about how the attributes of agglomeration may help to inform the regional planning. Marshall explains the economies of agglomeration as the benefit that firms obtain by locating near each other, and attributes three sources of the benefit: (1) input-output linkage, which can save shipping cost of intermediate inputs for production; (2) labor market pooling, gives more accessibility that manufacturer to a variety of skilled labors; (3) knowledge spillover effect, the ease of communication and exchange new technology in a cluster can improve local productivity. Besides Marshall's theory, it is widely acknowledged that some region possess natural advantage for agglomeration just by location (Ellison and Glaeser, 1999; Kerr and Kominers, 2014). New economic geography theory explains agglomeration force by "home market effect", self-enforcing by accumulative cause and effect (Krugman, 1991). Modern location theory provides a new explanation of agglomeration by "core consumption opportunities", which can reduce searching cost of consumers (Fujita and Thisse, 2002).

There are certainly examples of specialized industry agglomeration, such as Silicon Valley, the

world famous hi-tech industry cluster; and Wall Street, financial district of lower Manhattan, New York city. In China, there are many specialized industry agglomeration, such as petroleum refining industry cluster in Xinjiang, textile and apparel industry cluster in Zhejiang, PC manufacturing industry cluster in Dongguan and etc. Most of the early studies of spatial agglomeration focus on specialized industry, and assess the sources of agglomeration on Marshall's theory. Some studies focus on input-output linkage for agglomeration (Diamond, Charles and Simon, 1990; Holmes, 1999). For example, to assess the input-output linkage effect, Thomas J. Holmes (1999) finds firms with high input-output linkage purchase more, and attributes spatial agglomeration to the fact that enable a large variety of local suppliers. In recent years, the study launches to the field of co-agglomeration. Ellison, Glaeser and Kerr (2010) measure indices of US and UK manufacturing clusters and assess three sources of agglomeration based on Marshall's theory. The study provides sufficient evidence that three sources of agglomeration of Marshall's theory are supported, with input-output linkage particularly important. Whether this finding can be extended to developing countries? Some studies focus on the labor market pooling (Costa and Kahn, 2000; Philippe et al., 2005; Fu, Shihe and Ross, 2010). For example, Costa and Kahn (2000) finds both skilled workers and manufacturers face much more risk with specialized industry structure, which induces large inflow of labors to metropolitan area for better matching opportunities during the past half century. And some studies focus on the knowledge spillover effect (Scherer, 1984; Audretsch and Feldman, 1996; Jaffe et al., 2000; Natarajan and Sivadasanz, 2009). In Comparison with existing studies, this paper exploits spatial evolution and sources of spatial agglomeration of China, which extend existing research perspective. Besides it, we assess agglomeration evolution of whole economic system including primary industry, secondary industry and tertiary industry—12 categories of 59 sub industries, which extend existing research field.

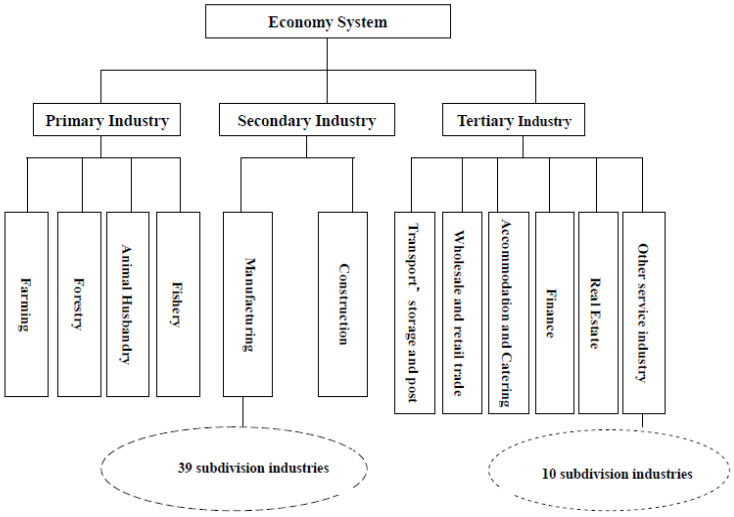
Based on stylized facts description and econometric regression, this paper provides empirical evidences of two aspects: (1) tracing dynamic evolution of spatial agglomeration of China since market reform; (2) assessing the relative important sources for spatial concentration based on broad theories. This paper is organized as follows: section 2 describes stylized facts of spatial agglomeration evolution of China from 1985 to 2012. Section 3 constructs regression model based on theories to assess the relative important sources for spatial agglomeration, and then gives

descriptive statistics on national and regional levels for regression. Section 4 presents empirical results and takes further discussion. Section 5 concludes.

2. Stylized Facts of Spatial Evolution of China

In this section, we compute spatial concentration using provincial level data from *National Bureau of Statistics of China (NBSC)*. In China, territory can be divided into three regions—eastern area, central area and western area. There are totally 34 provincial level administrative regions, including 23 provinces, 5 autonomous regions, 4 municipalities and 2 special administrative regions[2]. Taking completeness and consistency into consideration, we choose 28 provinces[3]. The field of the paper contains primary industry, secondary industry and tertiary industry, 12 categories of 59 sub industries, as is shown in Figure1.

Figure1. The Economy System of China



Note: According to *China Statistical Yearbook*

[2]In 1986, the seventh Five-Year Guideline of China divided the whole country into three regions—eastern region, central region and western region. Eastern region is consisted of 11 provinces: Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan. Central region is consisted of 8 provinces: Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Hunan. Western region is consisted of 12 provinces: Sichuan, Chongqing, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Guangxi and Neimenggu.

[3]During analysis period, the main adjustments of administrative districts in China includes: establishment of Hainan province in 1988, establishment of Chongqing municipality in 1997 (located in the east of Sichuan province before), Hongkong and Macro return to China in 1997 and 1999 respectively. We eliminate Hainan province and merge Chongqing into Sichuan province. For data is incomplete in Tibet area, Tibet is also excluded.

Spatial concentration is an outcome of a process of agglomeration force and dispersion force. We use ratio of geographic unit GDP to measure spatial concentration degree, as in Equation (1).

$$Con_{i,t} = \frac{GDP_{i,t} / ARE_{i,t}}{\sum_{i=1}^{m} GDP_{i,t} / \sum_{i=1}^{m} ARE_{i,t}} \quad (1)$$

Where $GDP_{i,t}$ represents GDP in province i at time t,

$ARE_{i,t}$ represents square kilometer in province i at time t, i represents province, $i = 1, 2, \cdots\cdots, m$.

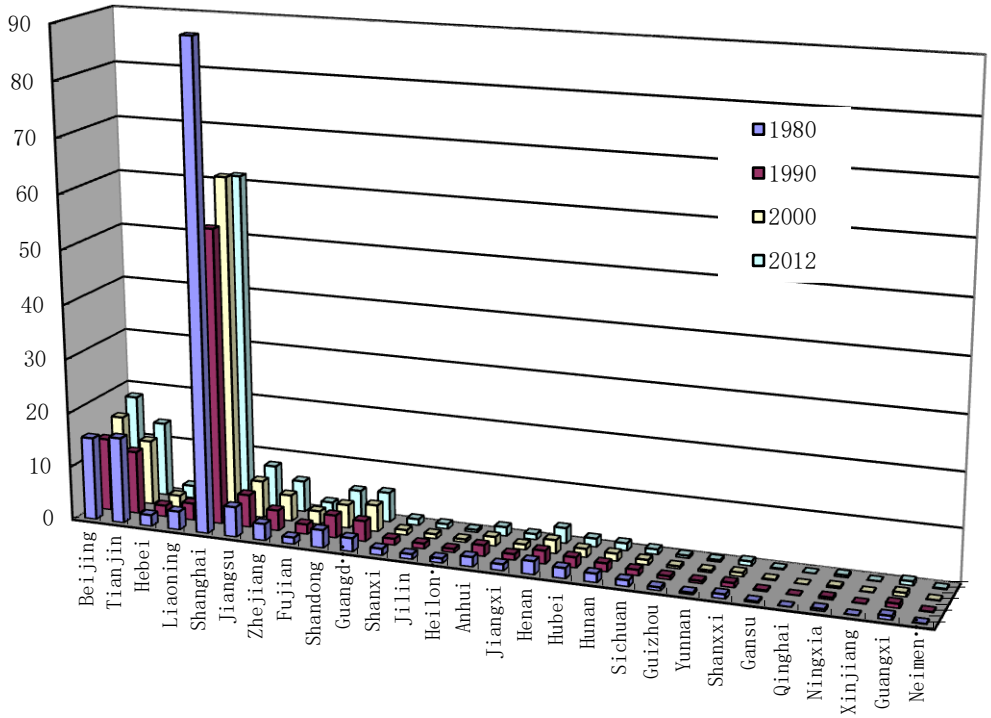
Table 1 presents spatial concentration degree and changes of China from 1980 to 2012. The concentration index shows that coastal region (in the east) and hinterland (in the central and west) started off with very significant spatial disparity. The concentration degree of eastern area has increased sharply by 13.05% during 1990s. On the contrary, the index of central and western area has decreased relatively by -12.48% and -15.74% respectively. Spatial disparity is the result of uneven growth caused by spatial agglomeration. How to achieve coordinated and sustainable development has become one of main concerns for Chinese government. And several policies were launched since then, such as "*strategy for the development of western region*" (2000), "*strategy for the rise of central area*" (2004), "*strategy for revitalizing manufacturing industrial base of northeast area*" (2009). Preferential policies on tax exemption and infrastructure construction have been made to promote the growth of lagging regions and to narrow the inequality gap. After more than 10 years of implementation, it merits looking back to see how public policies affected spatial inequality in China.

Table 1. Geographic Concentration and Changes in China

Region	Year	1980	1990	2000	2012	Change Range（%）		
		A	B	C	D	B→A	C→B	D→C
Eastern Region	Beijing	15.346	13.457	15.981	18.234	-12.31	18.76	14.10
	Tianjin	15.943	11.660	12.007	13.740	-26.86	2.98	14.43
	Hebei	2.115	2.106	2.230	2.337	-0.43	5.89	4.79
	Liaoning	3.456	3.182	2.631	2.395	-7.93	-17.32	-8.97
	Shanghai	89.088	54.367	62.440	61.507	-38.97	14.85	-1.49
	Jiangsu	5.629	6.072	6.898	8.005	7.87	13.60	16.05
	Zhejiang	3.129	3.831	4.894	5.771	22.44	27.75	17.91
	Fujian	1.268	1.852	2.512	2.379	46.06	35.64	-5.28
	Shandong	3.353	4.223	4.384	5.265	25.95	3.81	20.09
	Guangdong	2.520	3.833	4.968	5.544	52.10	29.61	11.60
	Mean	**14.18**	**10.46**	**11.89**	**12.52**	**5.59**	**13.05**	**5.24**
Central Region	Shanxi	1.252	1.204	0.974	1.166	-3.83	-19.10	19.71
	Jilin	0.953	1.001	0.864	0.902	5.04	-13.69	4.40
	Heilongjiang	0.880	0.693	0.575	0.497	-21.25	-17.03	-13.57
	Anhui	1.829	2.078	1.725	1.688	13.61	-16.99	-2.14
	Jiangxi	1.206	1.132	0.995	1.054	-6.14	-12.10	5.93
	Henan	2.485	2.468	2.510	2.876	-0.68	1.70	14.58
	Hubei	1.942	1.956	1.582	1.589	0.72	-19.12	0.44
	Hunan	1.639	1.550	1.391	1.390	-5.43	-10.26	-0.07
	Mean	**1.410**	**1.362**	**1.192**	**1.395**	**-3.40**	**-12.48**	**5.14**
Western Region	Sichuan	1.175	1.085	0.948	0.967	-7.66	-12.63	2.00
	Guizhou	0.620	0.652	0.486	0.498	5.16	-25.46	2.47
	Yunnan	0.387	0.506	0.424	0.385	30.75	-16.21	-9.20
	Shaanxi	0.834	0.865	0.726	0.848	3.72	-16.07	16.80
	Gansu	0.295	0.236	0.192	0.190	-20.00	-18.64	-1.04
	Qinghai	0.045	0.043	0.030	0.035	-4.44	-30.23	16.67
	Ningxia	0.438	0.433	0.371	0.431	-1.14	-14.32	16.17
	Xinjiang	0.060	0.072	0.071	0.070	20.00	-1.39	-1.41
	Guangxi	0.743	0.835	0.727	0.803	12.38	-12.93	10.45
	Neimenggu	0.105	0.119	0.108	0.165	13.33	-9.24	52.78
	Mean	**0.470**	**0.485**	**0.408**	**0.439**	**3.06**	**-15.74**	72.16

Data: CHINA COMPENDIUM OF STATISTICS

Figure 2. Provincial-level Concentration and Changes of China



We use decomposed Theil index technique, proposed by Anand (1983), to distinguish intraregional and interregional inequality, the formula is as in Eq. (2). This index is widely used for empirical analysis of global inequality (e.g., UNDP, 1999; World Bank, 2001; Sala-i-Matin, 2008), and is proper for regional inequality analysis. When the index is negative, it suggests an equalizing trend exist among regions.

$$Theil(T) = Theil(within) + Theil(between)$$

(2)

$$= \sum_i (\frac{Y_i}{Y}) \cdot T_i + \sum_i (\frac{Y_i}{Y}) \cdot \log(\frac{Y_i/Y}{n_i/n})$$

$$= \sum_i (\frac{Y_i}{Y}) \cdot \sum_j (\frac{Y_{ij}}{Y_i}) \log(\frac{Y_{ij}/Y}{n_{ij}/n}) + \sum_i (\frac{Y_i}{Y}) \cdot \log(\frac{Y_i/Y}{n_i/n})$$

Where Y and n represent GDP and population of the whole sample respectively,

Y_i and n_i represent GDP and population in region i of whole sample respectively,

Y_{ij} and n_{ij} represent GDP and population in province j of region i respectively.

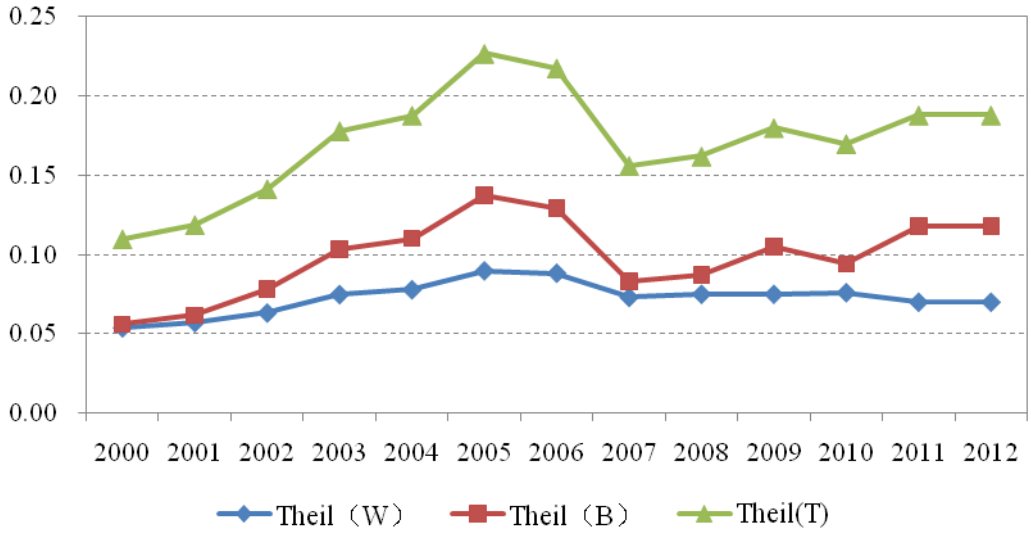
The changes of spatial inequality of China are reported in Table 2. And as is shown in Figure 3, a continuous and rapid increase of inequality is noticeable from 2000 to 2005. The year of 2005 is an important turning point—spatial inequality has fallen significantly, which marks the drop in disparity between coastal area and hinterland of China. And it is noteworthy that interregional inequality raise significantly for second round since 2011. By decomposed index, interregional inequality plays as the primary role to the total, intraregional inequality as a subordinate role.

Table 2. Inequality Changes of China: 2000—2012

Index / Year	Intraregional	Interregional	Total
2000	0.054	0.056	0.110
2005	0.090	0.137	0.227
2010	0.076	0.094	0.170
2012	0.070	0.118	0.188

Data: CHINA STATISTICAL YEARBOOK

Figure 3. Inequality decomposition of China



3. Empirical Methodology and Statistical Description

A. Empirical Methodology

To identify the driving force for spatial agglomeration in China, we build regression model

based on Marshall's theory. In the theory, spatial agglomeration may help to obtain benefit by reducing cost of three sources: goods, labor and skill.

1. Input-output Linkage

Input-output linkage of industries can save shipping cost of intermediate inputs for production. Local specialization is the result of relative industries co-agglomeration. To assess the importance of input-output linkage, we use Krugman's index as in Eq. (3). This index measures specialization degree of geographic unit, which reflects local input-output linkage degree.

$$Spec_{i,t} = \sum_{j=1}^{n} \left[\left| S_{ijt} - S_{jt} \right| \sum_{j=1}^{n} E_{ijt} \right] \Big/ \sum_{j=1}^{n} E_{ijt} \tag{3}$$

Where S_{jt} represents the ratio of GDP in sector j to total at time t,

S_{ijt} represents the ratio of GDP in province i sector j to total at time t,

E_{ijt} represents GDP in sector j of province i at time t,

i represents province， j represents sector.

Specialization degree is an important variable for agglomeration. The result in table 3 shows that specialization degree of coastal region is much higher than that of the hinterland. This preliminary observation demonstrates the positive relationship between spatial agglomeration and local specialization. We will assess the relative importance of this factor by regression analysis.

Table 3. Geographic Specialization and Changes in China

Region \ Year	1980	1990	2000	2012	Change Range（%）		
	A	B	C	D	B→A	C→B	D→C
Eastern Region	0.317	0.233	0.240	0.253	-26.46	3.09	5.24
Central Region	0.271	0.190	0.227	0.184	-29.94	19.35	-18.81
Western Region	0.272	0.206	0.254	0.179	-24.16	23.17	-29.42

Data: *CHINA STATISTICAL YEARBOOK, CHINA INDUSTRY ECONOMY STATISTICAL YEARBOOK, CHINA STATISTICAL YEARBOOK OF TERTIARY INDUSTRY*

2. Labor Market Pooling

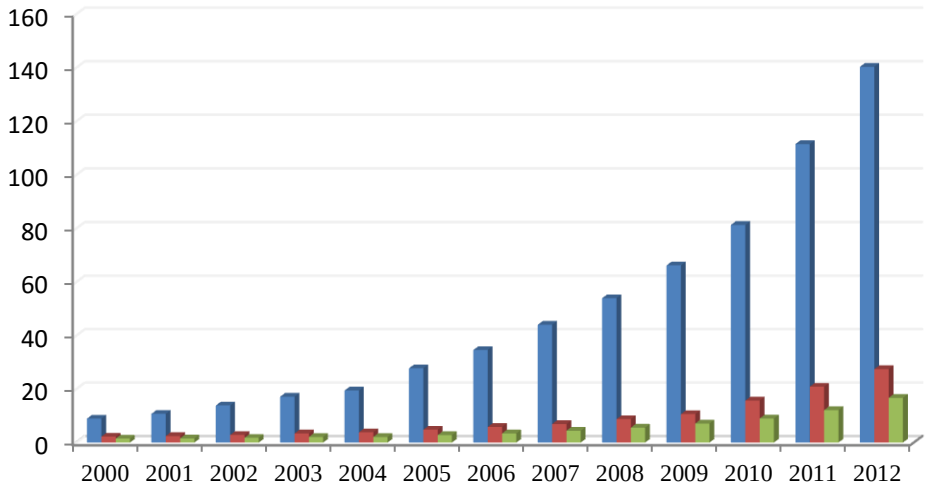
The second driving force for spatial agglomeration is large labor market pooling, which can save searching cost by giving more accessibility to different skilled labors. Existing literature find two mechanisms of labor pooling: risk and matching. Both skilled workers and manufacturers face the risk of specialization especially in the rapidly changing of industrial structure. It is another reason for the large and lasting migration towards coasts and cities since 1980s. We measure the labor market pooling by labor employed number on provincial-level data from 1980 to 2012.

3. Knowledge Spillover Effect

The third driving force for spatial agglomeration is knowledge spillover effect. It happens when knowledge exchanged and learned by engineers and skilled workers nearby. Theoretical studies about it were launched since 1980s. Lucas (1988) explains how human capital accumulation improves economic development through learning-by-doing. Grossman and Helpman (1991) views innovation as a process of generating horizontally differentiated products. Although theoretical research has made much effort on it, empirical studies are still controversial, for there's no direct variable for knowledge spillover effect. Some studies choose the number of patent or the number of new product as proxy variable. We measure it by the number of patent applications accepted, which reflects the ability of exchanging and learning skill.

As is shown in Figure 4, the number of patents of eastern area is 1.4 million in 2012, much higher than that of central (0.274 million) and western area (0.167 million).

Figure 4. Comparison of the number of patents



B. Statistical Description

In China, regional heterogeneity is an obvious phenomenon between coastal area and hinterland. To reveal the complex changes and driving force among regions, we examine both national and regional sample. We build the basic regression model on Marshall's theory as in Eq. (4).

$$\ln(CON_{i,t}) = \delta_0 + \delta_1 \cdot \ln(I - OLinkage_{i,t}) + \delta_2 \cdot \ln(Labor_{i,t}) + \delta_3 \cdot \ln(Tech_{i,t}) + u_{i,t} \quad (4)$$

Where $CON_{i,t}$ is a measure of agglomeration of region i at time t;

$I - OLinkage_{i,t}$ is local specialization of region i at time t;

$Labor_{i,t}$ is the size of labor force of region i at time t;

$Tech_{i,t}$ is the number of patent of region i at time t;

$u_{i,t}$ is a disturbance term.

To broadly assess the forces of agglomeration, we take "home market effect" of new economic geography theory, and "core consumption opportunity" of modern location theory into analysis framework. There's no direct variable for knowledge spillover effect, we use the number of patent as a proxy variable. But is it sufficient to explain this effect? Human capital accumulation can reflect the ability of exchanging and learning skill. We measure the level of human capital accumulation by percentage of people with high school degree to the total. The sample of this paper covers transitional period of China from planning economy to market economy. Although market reform substantially stimulates interregional factor mobility, locality separatist force, such as household registration and capital control by local government, is still very strong in China. To broadly assess the relative importance of these factors, we take them into basic regression model as control variables. The adjusted regression model is as Eq. (5).

$$\ln(CON_{i,t}) = \delta_0 + \delta_1 \cdot \ln(I - OLinkage_{i,t}) + \delta_2 \cdot \ln(Labor_{i,t}) + \delta_3 \cdot \ln(Tech_{i,t})$$

$$+\delta_4 \cdot \ln(PopDen_{i,t}) + \delta_5 \cdot \ln(HumCap_{i,t}) + \delta_6 \cdot \ln(Ins_{i,t}) + \alpha_i + u_{i,t} \qquad (5)$$

Where $PopDen_{i,t}$ is the population of region i at time t;

$HumCap_{i,t}$ is a measure of human capital level of region i at time t;

$Ins_{i,t}$ is market degree index of region i at time t

Table 4 reports statistical description of variables. Dependent variable (concentration degree) in the eastern region is much higher than that of the hinterland. Standard deviation index shows that divergence among provinces of eastern region is the largest. Independent variables (I-O linkage, Labor force, Patent number) and control variables (Human capital, Population density, Market degree) of eastern region are also higher than that of the hinterland. What exact roles they play for in determining spatial agglomeration will be examined below.

Table 4. Descriptive Statistics for Regression

Variable	Observation	Mean	Median	S.D.	Observation	Mean	Median	S.D.
	National level				Eastern Region			
Concentration	784	4.43	132	13.51	280	11.74	4.76	19.84
I-O Linkage	784	0.23	0.21	0.11	280	0.27	0.22	0.17
Labor Force	784	2.17	1.85	1.47	280	2.44	2.13	1.60
Patent Number	784	1.14	0.24	3.28	280	2.43	0.62	5.13
Human Capital	784	0.55	0.24	0.65	280	0.85	0.51	0.97
Population Density	784	4.38	3.70	2.65	280	5.38	4.75	2.83
Market Degree	784	3.56	3.09	2.47	280	4.87	4.29	2.71
	Central Region				Western Region			
Concentration	224	1.53	1.45	0.63	280	0.47	0.41	0.33
I-O Linkage	224	0.24	0.22	0.07	280	0.23	0.23	0.09
Labor Force	224	1.92	2.01	0.36	280	1.63	1.76	0.32
Patent Number	224	0.59	0.25	1.00	280	0.29	0.10	0.71
Human Capital	224	0.47	0.23	0.43	280	0.36	0.18	0.42
Population Density	224	5.03	4.54	2.01	280	3.20	2.50	2.68
Market Degree	224	3.22	2.87	2.07	280	2.53	2.02	1.86

Note: The concentration degree is measured by equation (1). Specialization is measured by equation (3). The unit of labor force is 10 million. Human capital level is measured by percentage of people with high school degree to the total. The unit of population density is 10 million. Market degree is provided by *Chinese Economic Research Institute*.

4. Regression Result and Discussion

We use balanced panel data of 28 provinces from 1980 to 2012 to reflect characteristics of both cross section and longitudinal section based on three types of models: pooled model, fixed effect

model and random effect model.

A. Regression for National Agglomeration

Table 5 reports OLS coefficient estimates of variables for national agglomeration. The regression results of basic model are reported in column (1) - (3).The regression results of adjusted model are reported in column (4) - (6).

Table 5. Regression for National Agglomeration, OLS Estimation

	Basic Model			**Adjusted Model**		
	Pooled	FE	RE	Pooled	FE	RE
	(1)	(2)	(3)	(4)	(5)	(6)
Explanatory Variable						
I-O Linkage	0.310**	0.566***	0.287***	0.241***	0.276***	0.219**
	(2.41)	(3.86)	(2.78)	(3.19)	(6.83)	(2.65)
Labor Force	0.351***	0.356***	0.441***	0.219**	0.219***	0.175*
	(3.41)	(3.86)	(5.20)	(2.47)	(5.77)	(1.77)
Patent Number	0.316***	0.303***	0.243***	0.284***	0.223***	0.298***
	(3.23)	(3.65)	(3.05)	(3.73)	(5.95)	(3.80)
Control Variable						
Human Capital				0.243***	0.243***	0.223***
				(4.79)	(6.99)	(4.22)
Population Density				0.158**	0.160***	0.122
				(2.57)	(3.05)	(1.69)
Market Degree				0.783***	0.784***	0.741***
				(4.51)	(6.10)	(4.02)
Statistical characteristics						
Adjusted R-squared	0.57	0.62	0.51	0.58	0.65	0.54
F-Statistics	792.73	231.89	905.16	2309.68	1315.52	1907.51
Observation	784	784	784	784	784	784

Note: t value of coefficient estimate is in bracket. * denotes significant at 10%, ** denotes significant at 5%, and *** denotes significant at 1%.

In Table 5, the positive estimates of explanatory variables(I-O linkage, Labor force, Patent number) verify three sources of Marshall's theory of agglomeration. Firstly, positive estimate of local specialization shows input-output linkage of industries facilitates economic agglomeration in China. Secondly, positive estimate of labor force approves big labor market pooling helps to reduce the matching risk between manufacturer and skilled labor, which induces to agglomeration. Thirdly, positive estimate of patent number verifies knowledge spillover effect truly helps to facilitate agglomeration.

Taking natural advantage into consideration, the results of fixed effect model shows that *Input-output Linkage* is the strongest explanatory variable, with a coefficient estimate of 0.566, followed by are *Labor market pooling* (0.356) and *knowledge spillover effect* (0.303). This result provides the evidence that Marshall's theory can be extended to developing countries.

Taking control variables (Human capital, Population density, Market degree) into basic model, the estimates of variables on adjusted model in column (4)–(6) shows that marketization is the most important contributor to agglomeration in China. And the positive estimate of population density verifies that "home market effect" stimulates agglomeration by accumulative cause and effect. Considering the number of patent may not be sufficient to explain knowledge spillover effect, we also estimate the level of human capital accumulation. The positive coefficient further confirms knowledge spillover effect is a contributor to spatial agglomeration.

B. Regression for Regional Agglomeration

Regional heterogeneity among coastal region and hinterland is obvious in China. To compare different sources for regional agglomeration, we continue to make further discussion on regional sample. Table 6 reports OLS coefficient estimates of variables for regional agglomeration.

Table 6. Regression for Regional Agglomeration, OLS Estimation

	Eastern Region		**Central Region**		**Western Region**	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Explanatory Variable						
I-O Linkage	1.672	1.57	-0.279***	-4.29	-0.224*	-1.79
Labor Force	0.081***	6.87	-0.336***	-3.55	-0.670***	-4.47
Patent Number	0.162***	14.70	0.198*	2.03	0.481***	3.26
Control Variable						
Population Density	0.179*	1.86	0.056***	4.34	0.034***	5.05
Human Capital	0.667*	1.87	0.306***	4.34	-0.072	-0.74
Market Degree	0.884***	2.36	0.201***	6.18	0.012***	11.28
Statistical characteristics						
Adjusted R-squared	0.69		0.57		0.44	
F-Statistics	911.42		1454.34		1124.49	
Observation	280		224		280	

Note: * denotes significant at 10%, ** denotes significant at 5%, and *** denotes significant at 1%.

In Table 6, the estimate coefficient of input-output linkage is positive in eastern region (1.672)

and negative in central (-0.279) and western area (-0.224). It reveals that specialization production helps to attract upstream and downstream industries gather towards eastern region, on the contrary, attributes the outflow of relevant industries in central and western region. The negative estimate coefficient of labor force in central and western region is coincided with the phenomenon that people have large and lasting migrated to the coast since 1980s, which causes the recession of hinterland. The coefficient of human capital accumulation is much higher in eastern region (0.667), knowledge spillover effect contributes a lot for local agglomeration; but plays as an obstruction (-0.072) in the western area. Marketization facilitates agglomeration of both coastal area (0.884) and hinterland (0.201, 0.012).

5. Conclusions

Unlike the existing literature on agglomeration forces, which focus on manufacturing industry of developed countries, this paper extends the research perspective on whole economic system including 12 categories of 59 sub industries of China—the biggest and transitional country in the world.

Based on stylized facts description and econometric regression, this paper provides empirical evidences of two aspects: (1) tracing dynamic evolution of spatial agglomeration since market reform; (2) assessing the relative important sources for spatial concentration based on broad theories.

The main findings are as follows. First, spatial disparity worsened dramatically in 1990s. The average concentration degree of coastal provinces increased sharply by 13.05%, and decreased by -12.48% and -15.74% of hinterlands. Second, by Theil decomposed technique, the result shows that interregional inequality plays as the primary role to the total, intraregional inequality as a subordinate role. Third, this paper provides strong support for three sources of Marshall's theory of agglomeration, and also provides evidences for "home market effect" of new economic geography theory, and "core consumption opportunity" of modern location theory. Finally, taking regional heterogeneity into consideration, the result shows that specialization production helps to attract co-agglomeration in the coastal region, on the contrary, causes outflow in the hinterland. Labor market pooling and human capital accumulation play as contributor to agglomeration in the coastal area,

but as obstruction in the hinterland.

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