Title	Regional externalities and agglomeration of manufacturing in East Asia
Sub Title	
Author	Miyagi, Akira
Publisher	Keio Economic Society, Keio University
Publication year	2006
Jtitle	Keio economic studies Vol.43, No.1 (2006.) ,p.61- 84
JaLC DOI	
Abstract	There are two types of agglomeration, localization and urbanization, which generate different effects on the growth of each region-industry: Previous studies indicated that their influence on each region-industry varies according to their location and characteristics; this resembles the production cycle. We employed the methodology used in the previous studies to analyze the growth of the manufacturing industries in East Asian countries that include some aspect of agglomeration. The evidence indicated that localization has a negative effect on industries in every region. Urbanization generally has a positive effect, although the effect varies in each region according to the development level.
Notes	
Genre	Journal Article
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=AA00260492-20060001-0061

KEIO ECONOMIC STUDIES **43**(1), 61–84 (2006)

REGIONAL EXTERNALITIES AND AGGLOMERATION OF MANUFACTURING IN EAST ASIA

Akira MIYAGI

Graduate School of Economics, Keio University, Tokyo, Japan

First version received October 2005; final version accepted September 2006

Abstract: There are two types of agglomeration, localization and urbanization, which generate different effects on the growth of each region-industry: Previous studies indicated that their influence on each region-industry varies according to their location and characteristics; this resembles the production cycle. We employed the methodology used in the previous studies to analyze the growth of the manufacturing industries in East Asian countries that include some aspect of agglomeration. The evidence indicated that localization has a negative effect on industries in every region. Urbanization generally has a positive effect, although the effect varies in each region according to the development level.

Keywords: localization, urbanization, core and periphery, interaction of industries
JEL Classification: O14, O53, R11

1. INTRODUCTION

Since the introduction of the concept of externality by Marshall (1920), scholars have often insisted that it is crucial in economic geography because of its geographical limit. Externality functions only in a few limited areas. These are areas in which many firms and industries agglomerate or collectively gather and form a cluster comprising networks of information, a mutual demand and supply relation, and a common pool of inputs. Firms within this network increase their productivity by various means such as technology spillover, forward and backward linkage, and the reduction of initial costs. This productivity growth generates a greater agglomeration of firms that prefer a more profitable environment, thereby leading to further productivity growth and additional agglomeration. Finally, most economic activities are concentrated in a limited number of areas that generate regionally restricted externality and agglomeration.

Acknowledgements. The author is thankful to Professor Fukunari Kimura (Keio University) for his kind advice and to the anonymous referees for their helpful comments. All the errors in this paper are the responsibility of the author alone.
E-mail: akira_miyagi@par.odn.ne.jp

It has been observed that regional externality is mutually affected by agglomeration through a network within a cluster. Further, agglomeration is categorized into two types according to the manner of each cluster's formation. In the first type, the cluster is specialized into a single industry. In the second, the cluster comprises diversified industries. The former type of agglomeration is referred to as localization; the latter, urbanization.

In the case of localization, firms of the same industry agglomerate into particular regions and form a "production area." In such regions a regional externality prevails within the industry and realizes more effective production than that achieved by industries outside the area. Some examples are Detroit for automobiles and Silicon Valley for electronics.

In the case of urbanization, firms belonging to various industries gather into a particular location, or "industrial core." In this "core," the inter-industry network enables firms within it to achieve a more productive environment. Some examples are the northeastern megalopolis in the United States and the Ruhr area in Germany.

Both types of agglomeration the concern to the detailed process of the generation of regional externality by the means of the abovementioned network. In other words, different generation processes of the externality cause different types of agglomeration. This fact gives rise to two questions: (1) Does this difference in the types of agglomeration lead to a the different outcome of region-industry growth? and (2) Which generation process of the externality contributes more to the growth of each industry?

Previous studies have attempted to discover which pattern of agglomeration is more effective for the growth of each industry. One of the most important studies is Glaeser, Kallal, Scheinkman, and Shleifer (1992), which was the first attempt to prove the relationship between agglomeration and externality. According to that study, urbanization is positively correlated to the growth of each industry in every region, while localization is not. Another important study is that of Henderson, Kuncoro, and Turner (1995), which pointed out that the outcome varied with the type of the industry. In mature industries, only localization had a positive effect, while in newly established industries, both localization and urbanization had a positive effect. In this study, the authors also insisted that mature industries tended to locate in small rural cities, while new industries were likely to be in large metropolises.

These outcomes provide some implications regarding the relationship between the location and growth of industries: the pattern of agglomeration affects the growth of the industries. Moreover, this effect varies according to the circumstance of the industry. In particular, Henderson et al. (1995), that insisted that the location pattern and type of the industry produce to some effects, revealed the existence of some implicit connection with the "production cycle" in by Vernon (1966) who focused on the growth of industries in various countries.

With regard to the production pattern, the recent manufacturing trend in East Asian countries presents an interesting point of view. As is commonly known, East Asia has become one of the centers of manufacturing and other economic activities along with

North America and Western Europe. Within East Asia, Japan has played an important role as the industrial core. Furthermore, within Japan, the central region including Tokyo, Nagoya, and Osaka (the so-called Pacific Belt) is regarded as the core of the Japanese economy. Therefore, there exists a kind of hierarchic system wherein the Japanese core region functions as the core of all Asian regions and the others–the Japanese peripheral region, NIEs (Korea, Taiwan, Singapore, and Hong Kong), ASEAN[1] (Indonesia, Malaysia, Thailand, and the Philippines), and the Chinese coastal region (around Beijing, Shanghai, and Guangzhou)—as the "periphery" that follows the core region[2].

However, the recent expansion of globalization has modified this hierarchic system to a certain extent. While the share of the Japanese core region inside the Japanese economy is shrinking, that of Japan within East Asia is also decreasing. On the contrary, the ASEAN and Chinese coastal regions are regarded as new places of agglomeration that attract various firms from other countries, particularly Japan.

There might have been some kinds of externality that must have made the Japanese central region the core and the other regions new places of agglomeration. Are these phenomena brought about by localization or by urbanization? Are industries in each region affected by the concentration of the same industry or other industries? Analyzing these aspects is the main motivation of this study.

In this study, some regression analyses were undertaken for the manufacturing industries in these countries/regions in order to discover how each type of agglomeration affects the growth of industries. The findings are as follows: localization has a negative effect on the growth of most industries irrespective of the industry and region. Urbanization has a positive effect on all industries. However, the regression sign for urbanization varies by the industry location-positively in the ASEAN, China (and NIEs with weaker tendency) and negatively in Japan. These results indicate that the effect of regional externalities varies by the level of economic development of the regions in which each industry is located.

The contents of this paper are as follows. Section 2 discusses the previous studies on regional externality and presents its definition. Section 3 introduces the regression formula and variables used for the analysis. Section 4 reveals the outcome of the regression analysis and discerns what kind of externalities affect the growth of industries in each region. Section 5, the final section, includes a conclusion and the implications for further analyses.

2. LITERATURE

The concept of regional externality and its relation to agglomeration has been already explained in the previous section. Here, in order to establish our standpoint, we

[1] Singapore is one of the members of ASEAN, but is included in the NIEs because of the difference in economic development. Refer also to Footnote 10.

[2] For a detailed analysis of the core of Asian manufacturing, please refer to Fujita and Hisatake (1999).

want to clarify how much previous studies have revealed about the relationship between agglomeration and regional externalities.

Economic geographers have pursued the effect of externality through agglomeration since Hoover (1948), who introduced the terms "localization" and "urbanization." Early works, such as that of Henderson (1988), had conducted some static analyses, which explored the relationship between the agglomeration patterns and the size of cities or location of industries (but not for growth)[3].

At the same time, dynamic externality came to draw attention due to the rise of a new economic growth theory. The pioneers of the endogenous growth theory, Romer (1986) and Lucas (1988), mentioned that technological activities have a type of externality that induces sustained growth through spillover. They (especially Lucas (1988)) insisted that this externality occurred intensively in cities or surrounding areas.

Inspired by the insights of growth theorists and based on former analyses of economic geographers, an analysis was conducted in Glaeser et al. (1992) to estimate the effect of (dynamic) externality on the growth of cities and industries. At the beginning of this study, theories on externality were classified into three types: Marshall-Arrow-Romer (MAR), Porter, and Jacobs.

MAR externality, named after the theories of Marshall (1890), Arrow (1962), and Romer (1986), is generated by "knowledge spillovers between firms in an industry" (p.1127). Since such spillovers occur within a narrow region, the concentration of firms in particular region is needed for the growth of the industry to which the firms belong. Porter externality is based on Porter's study (1990) on the competitiveness of industries. He insists that the geographical concentration of firms is the key to industrial growth. Thus, this externality is similar to that of MAR, but is different in terms of competitiveness—while MAR supports monopolistic competition in order to stimulate creative destruction, Porter insists that competition is necessary for industrial growth[4].

Jacobs externality reflects the idea and analysis in Jacobs (1969), who investigated the economic history of various cities. She insisted that innovations were often formulated through the interactions of industries in a large city, so the increase in the diversity of industries helped the growth of cities. She also claimed that competition was necessary for the growth. Jacobs presented an interesting example. In the nineteenth century, Manchester was a large industrial city that specialized in the textile industries and was praised for its effective production circumstances. At the same time, Birmingham was a smaller city containing various sectors and criticized for its ineffective and confused urban system. However, Birmingham, with diversified industries, was the city that steadily grew, while Manchester gradually declined.

To investigate the effect of these externalities, Glaeser et al. (1992) conducted a regression analysis of the six largest industries (both manufacturing and non-manufacturing) in 170 U.S. cities during 1956 and 1987. The result predicted that the

[3] Analyses on regional externalities can be classified by their theoretical concepts—internal or external and static or dynamic. For further discussion, refer to Junius (1999).

[4] Porter externality is as interesting as the other two externalities; however, as this study focuses on industrial interaction and not on competition, we had to abandon the analysis of this externality.

growth of the city-industry was positively correlated with the diversity of industries and the competition within the city but not with the concentration of large industries in each city. Hence, Glaeser et al. concluded that Jacobs externality was capable of affecting each city-industry to a greater extent while the MAR externality was not (the effect of the Porter externality is unclear).

Henderson et al. (1995) conducted a supplemental analysis. They extended Henderson (1988) to the dynamic analysis of Glaeser et al. (1992), and linked three types of externalities in Glaeser et al. (1992) to the terminology of economic geographers–the MAR externality to localization and the Jacobs externality to urbanization. Henderson et al. limited the range of their sample to a few manufacturing industries: a number of "mature" industries and "new high-tech industries"[5]. They then analyzed on the growth of these industries in 224 U.S. cities. With regard to the mature industries, they found some evidence for localization (MAR externality) but not for urbanization (Jacobs externality). Further, with regard to the high-tech industries, they found evidence for both localization and urbanization.

Some additional studies have been conducted in accordance with the concept and framework of these papers. Among the noteworthy ones are Mano and Otsuka (2000), Henderson, Lee, and Lee (2001), and Tomiura (2003)[6].

The main objective of Mano and Otsuka (2000) and Henderson et al. (2001) was different dispersion of location; Tomiura (2003) studied the impact of import increase and vertical integration. However, all of them include aspects of economic geography to a large extent and adopt the methodology of Glaeser et al. (1992) and Henderson et al. (1995). Each of them supports the effects of localization or urbanization on the growth of region-industries, while mentioning that the effects vary or even disappear based on characteristics and circumstances. For example, Mano and Otsuka (2000) insists that urbanization stimulated some industries in Japan during the high-growth period in the 1960s but that in later periods, neither of the regional externalities had any effect on the industrial growth. Tomiura (2003) reveals a different outcome: during the financially prosperous periods of the 1980s, there were no externalities that helped industrial growth; but during the deep depression of the 1990s, urbanization began to stimulate growth despite the drive of the pressure of import penetration. Henderson et al. (2001) presented almost the same result as Henderson et al. (1995): in Korea as well as the United States, regional externalities functioned differently in the industries according to their maturity and location.

[5] Henderson et al. listed five industries (e. g., machinery and primary metals) as "mature" and three other industries (electronic components, medical equipment, and computers) as "high-tech." However, there exist no clear criteria for distinguishing both types of industries.

[6] For other noteworthy studies, refer to Hanson (1998), who studied Mexico, and Gao (2004), who deals with China.

3. ANALYTICAL METHOD

Based on the methods and results of earlier literatures and in order to extend our analysis of the relationship between regional externality and industrial growth, it is necessary to explain the analytical method that was employed and the definition and the characteristics of the data that were used for the analysis. The following is the methodology we adopted.

3.1. Equations and variables

The growth account or the total factor productivity, which is often used in growth theory or industrial organization, is the most commonly used to evaluate the effect of (dynamic) externalities or the growth of output not generated by the mere increase of input. However, this method requires a huge amount of data and involves complicated data processing and difficult regression problems. Moreover, the building of reliable data on capital stock for each industry in each region is difficult to the extent that the estimated outcome of the total factor productivity is seldom reliable. Therefore, we intend to adopt the peculiar but simple method introduced by Glaeser et al. (1992), which is adopted by most of the other studies in this field[7].

Suppose that an industry at time t produces its product Y_t by using labor input L_t and technological parameter A_t. The parameter A_t reflects the overall technological circumstances that the industry is capable of using at time t and is subject to the influence of the regional externality. As is evident, omitting capital input from the production function simplifies the analytical process at the expense of accurate calculation of technological growth.

The production function can be precisely expressed as follows:

$$Y_t = A_t \cdot F(L_t)\,, \tag{1}$$

where $F(L_t)$ is a labor-output function that has a characteristic of decreasing returns. Let w_t be designated as the wage rate. Then, the profit of the industry is expressed in the following manner:

$$\pi_t = A_t \cdot F(L_t) - w_t L_t\,. \tag{2}$$

In order to maximize profits, let us differentiate the above equation with respect to labor input:

$$A_t \cdot F'(L_t) = w_t\,.$$

By taking the logarithm for both sides of the equation, this equation is converted into the style of the growth equation

$$\log\left(\frac{A_{t+1}}{A_t}\right) = \log\left(\frac{w_{t+1}}{w_t}\right) - \log\left(\frac{F'(L_{t+1})}{F'(L_t)}\right). \tag{3}$$

A_t denotes the technological parameter defined as the combination of the initial condition, regional externalities (localization and urbanization), and remaining conditions that will be mentioned later.

[7] Hanson (1998) and Mano and Otsuka (2000) also contributed to this methodology.

(4) $\log\left(\frac{A_{t+1}}{A_t}\right) = g(\textit{initial condition, localization, urbanization, and others}) + e_t$.

Let $F(L)$ be $F(L_t) = L_t^{1-\alpha}$, $0 < \alpha < 1$. Then, its differential is$F'(L_t) = (1-\alpha)L^{-\alpha}$. This implies that $\log\left(\frac{F'(L_{t+1})}{F'(L_t)}\right) = -\alpha \log\left(\frac{L_{t+1}}{L_t}\right)$.

Finally, by substituting the above equation and (4) with (3) and rearranging, we arrive at the following:

$$(5) \qquad \alpha \cdot \log\left(\frac{L_{t+1}}{L_t}\right) = -\log\left(\frac{w_{t+1}}{w_t}\right) + g(\textit{initial condition, localization, urbanization, others}) + e_t .$$

Equation (5) will be used for the regression analysis. As mentioned earlier, this might not be an accurate method to measure technological growth, but it enables us to conveniently determine the direction and degree of externalities.

The regression equation is derived from (5) in the following manner for the industry i in region r at time $t \in [T \leq t \leq T']$ (where T is the initial and T' is the final):

$$(6) \qquad \log\left(\frac{L_{riT'}}{L_{riT}}\right) = \beta_0 + \beta_1 \cdot L_{riT} + \beta_2 \cdot w_{riT} + \beta_3 \cdot \log\left(\frac{w_{riT'}}{w_{riT}}\right) + \beta_4 \cdot SHARE + \beta_5 \cdot DIV + \beta_6 \cdot SERVICE + \gamma_r \cdot (regional\_dummy)_r .$$

The dependent and independent variables to be used for regression equation (6) can be explained as follows.

The dependent variable is a logarithm of the increasing rate of the number of workers from the initial T to the final T' (not the annual increase but the total increase during the entire term). As mentioned earlier, it is an imperfect but useful parameter that can function as a substitute for the growth of an industry, caused by regional externality through productivity improvement.

L_{rit} in the second term implies that the right-hand side of equation (6) represents the number of workers for the ith industry in region r at time t at the initial T, and w_{rit} in the third term represents the wage rate for that industry. These two variables denote the initial condition. The fourth term represents the logarithm of the increase in the nominal wage rate, measured in U.S. dollars. The next subsection presents the calculation of the wage rate.

In the fifth term, SHARE refers to the relative share of workers (L) who belong to the industry i in each region r at time t, compared to the rate for all of Japan (expressed as J), and is defined mathematically as $\frac{L_{irT}/L_{rT}}{L_{iJT}/L_{JT}}$. This value corresponds to the localization. The greater this value, the denser is the concentration of industry in that region as compared with that in Japan as a whole. There are two reasons for comparing our database with the overall data of Japan. First, it is difficult to build a reliable database of workers for all Asian regions. Second, as mentioned in the introduction, the basic concept of this study is that Japan is the core of East Asia. Therefore, we attempt to express the conditions of industries in comparison with the general trend represented by all of Japan.

In the sixth term, DIV stands for the degree of diversification of workers in each region relative to that in the whole of Japan. The degree itself is calculated as the inverse of Hirschman-Herfindahl Index (HHI), or

$$D_{ir} = \frac{1}{HHI} = \frac{1}{\sum_{I \neq i} (L_{Ir}/L_r)^2}$$

This implies (the inverse of) the squared sum of the labor share for every industry in region r[8]. This variable is related to the urbanization or diversification of the industrial structure in each region. An increase in the value of this index is indicative of a greater diversity in the structure of the region (compared with Japan as a whole), and each industry receives more opportunities to interact with other industries.

In the seventh term, SERVICE is introduced as the other factor that influences regional externality. It stands for the ratio of the number of workers in tertiary industries (commerce, service, finance, etc., expressed as S) to that in all manufacturing industries (M) in region r and is defined as $\frac{L_{rST}}{L_{rMT}}$[9].

Since only considers study samples from the manufacturing sector are discussed in this paper, some parameters that reflect the other sectors are needed.

The regional dummies correspond to the broader classification of the regions defined in subsection 3.3 and are used as either constant dummies (as in equation (6)) or slope dummies (expressed in subsection 4.3).

3.2. *Data source*

The data are mainly collected from the industrial censuses implemented in each country. In the case of countries where continuous and systematic data are not easily obtained, the data from the *Industrial Statistic Database*, published by the United Nations Industrial Development Organization (UNIDO), are used as a substitute. Refer to Appendix A for a detailed description of the source.

In this study we define "workers" as individuals engaged in each industry (not only salaried individuals but also family workers and self-employed individuals). The wage rate is calculated by dividing the entire wage payment by the number of individuals employed, and then converting it to U.S. dollars. The wage payment is counted nominally, and the nominal exchange rate in each year is used for conversion.

The basic span of analysis is from 1986 to 2001 (refer to Appendix A for the exception). In 1986, the sharp appreciation of the yen after the Plaza Agreement forced many Japanese firms to relocate their factories to other regions such as ASEAN countries and Chinese coastal regions. In addition, the latest data for Asian countries can be acquired for the period around 2001. Thus, this span is appropriate to observe the recent trend of agglomeration and dispersion in East Asia.

[8] Industry i itself is excluded to avoid duplication with SHARE.

[9] This variable is introduced from Mano and Otsuka (2000). The naming of the factor SERVICE is also attributed to them.

3.3. *Regions and industries*

The definition of "regions" in East Asia is presented in Table 1. Japan is divided into seven regions (three as the "core" and four as the "periphery") and China is divided into five (three as the "coastal core" and two as the "inland periphery"). However, in the case of other countries, the entire country is treated as one region. One of the reasons for the division of Japan and China is that these two countries are so large in terms of population and economic power that it is inappropriate to consider them as one region and compare them with other Asian countries. The other reason is that the role of each area in these countries is different—while the Japanese Pacific Belt and the Chinese coastal region are considered to be the core, the remainder is considered as the periphery. Hence, it is recommended that they be divided according to their role.

Table 1. Definition of "regions" and their categorization

Category	Name	Including
JCORE	Kanto	Ibaragi, Tochigi, Gunma, Saitama, Chiba, Tokyo, Kanagawa, Yamanashi
	Tokai	Gifu, Shizuoka, Aichi, Mie
	Kinki	Shiga, Kyoto, Osaka, Hyogo, Nara, Wakayama
JPERI	Hokkaido-Tohoku	Hokkaido, Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima
	Hokushinetsu	Niigata, Toyama, Ishikawa, Fukui, Nagano
	Chugoku-Shikoku	Tottori, Shimane, Okayama, Hiroshima, Yamaguchi, Tokushima, Kagawa, Ehime, Kochi
	Kyushu	Fukushima, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima, Okinawa
NIEs	Korea	
	Taiwan	
	Hongkong	
	Singapore	
ASEAN	Indonesia	
	Malaysia	
	Thailand	
	Philippines	
CCORE	China coastal, North	Beijing, Tianjin, Hebei, Liaoning, Shandong
	China coastal, Central	Shanghai, Jiangsu, Zhejiang
	China coastal, South	Fujian, Guangdong, Guangxi, (Hainan)
CPERI	China Midland	Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Hubei, Hunan
	China West	Sichuan, (Chongqing,) Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Ningxia, Xinjiang

Table 2. Definition of "industries" and industry groups

Category	Name	Including
Machines	Fabricated metals	
	Machinery	general machinery, special machinery
	Electrics	general electrics, computers, electronics
	Transportation	motor vehicles
	Precisions	optical instruments, measurement instruments
Material	Chemical	chemical materials, artificial textile
	Petroleum	petroleum refinement, cokes
	Rubber	
	Plastics	
	Nonmetal	
	Metals	steel, non-ferrous minerals
Light	Foods	foods, beverages, tobacco
	Textile	
	Apparel	
	Papers	
	Printing	
	Others	

The regions are broadly categorized into six groups—Japanese core (JCORE), Japanese periphery (JPERI), NIEs, ASEAN[10], Chinese core (CCORE), and Chinese periphery (CPERI). This categorization is related to the regional dummies mentioned in subsection 3.1. Thus far, twenty regions and six regional groups can be used for this analysis.

According to Fujita and Hisatake (1998), the manufacturing industries of these regions are classified into seventeen categories, which are further categorized into three groups (machines, material, and light). A more detailed categorization would not be very appropriate because the classification systems of each country are different. Refer to Table 2 for details. A total of 338 region-industry samples were employed for the regression[11].

3.4. General trend

Prior to undertaking the regression analysis, it is appropriate to observe the overall trend of the variables and the dependent variable for East Asian countries.

The general trend in the number of workers in the manufacturing industry in each region (and regional group) is listed in Table 3, and the summary statistics of the

[10] Due to the difference in economic development and industrialization, Singapore is included in NIEs, not in ASEAN. For the same reason, other ASEAN members (Brunei, Cambodia, Laos, Myanmar (Burma), and Vietnam) are excluded from the samples in this study.

[11] The petroleum industries in Hong Kong and Indonesia are not included in the sample because they lack data for the beginning of the period (1986).

variables—the maximum, the minimum, the mean, and the standard deviation—are presented in Table 4.

Table 3. Total number of manufacturing workers in each region and their growth rates

	Total number of workers in manufacturing (unit: persons)				Annual average growth rate (unite: percent)		
Regions	1986	1991	1996	2001	1986–91	1991–96	1996–01
JCORE							
Kanto	3,315,794	3,335,157	2,879,927	2,502,804	0.58	−13.65	−13.09
Tokai	1,884,518	1,997,047	1,818,322	1,672,453	5.97	−8.95	−8.02
Kinki	1,919,337	2,163,671	1,916,340	1,462,200	12.73	−11.43	−23.70
JPERI							
Hokkaido-Tohoku	1,033,291	1,167,777	1,053,683	915,537	13.02	−9.77	−13.11
Hokushinetsu	901,738	957,260	871,254	766,276	6.16	−8.98	−12.05
Chugoku-Shikoku	1,049,527	1,094,847	974,175	835,398	4.32	−11.02	−14.25
Kyushu	788,296	866,524	803,396	711,552	9.92	−7.29	−11.43
NIEs							
Korea	2,738,353	2,918,008	2,897,667	2,647,995	6.56	−0.70	−8.62
Taiwan	2,755,184	2,666,638	2,525,236	2,419,712	−3.21	−5.30	−4.18
Singapore	246,682	358,723	368,055	345,141	45.42	2.60	−6.23
Hong Kong	884,000	603,900	302,200	182,800	−31.69	−49.96	−39.51
ASEAN							
Indonesia	1,691,435	2,993,967	4,214,967	4,385,923	77.01	40.78	4.06
Malaysia	476,260	844,733	1,389,545	1,574,797	77.37	64.50	13.33
Thailand	907,403	1,596,930	2,413,300	2,299,200	75.99	51.12	−4.73
Philippines	618,400	1,108,500	903,400	1,086,000	79.25	−18.50	20.21
CCORE							
China coastal, north (Beijing)	11,495,486	13,117,493	13,292,172	8,298,173	14.11	1.33	−37.57
China coastal, central (Shanghai)	11,162,202	8,450,117	8,170,237	3,283,046	−24.30	−3.31	−59.82
China coastal, south (Guangzhou)	4,177,747	4,816,089	5,868,267	2,184,392	15.28	21.85	−62.78
CPERI							
China Midland	14,545,657	18,124,293	17,421,302	10,361,976	24.60	−3.88	−40.52
China West	6,780,598	9,943,410	8,178,236	5,972,412	46.65	−17.75	−26.97

Table 4. Summary statistics for the dependent and the variables

	Mean	Std. Dev.	Minimum	Maximum
Dependent				
log(L01/L86)	0.0543	0.8196	−3.1998	3.7027
Variables				
L86	299317	613898	180	4656162
W86	9008	9786	35	41893
log(W01/W86)	0.8340	0.4931	−1.0600	3.1931
SHARE*	1.0810	0.8283	0.0533	5.9774
DIV*	0.8218	0.2035	0.3566	1.6446
SERVICE	2.1973	1.1159	0.7410	4.4517

*: comparative value to the whole Japan

The first four columns in Table 3 show the number of individuals engaged in manufacturing in each region. From these columns, we can observe a kind of hierarchical system within East Asia and the changes in this system, which are explained in Section 1. In 1986, Japan had a considerably greater worker population than other Asian countries (with the exception of China, due to its large population). However, in 2001, the advantage that Japanese and Chinese regions enjoyed over other regions in terms of the number of workers had diminished. For example, Kanto in the Japanese core region (JCORE), with approximately 3.3 million workers, had the highest worker population in East Area, with the exception of China. However, in 2001, its worker population reduced to approximately 2.5 million, and it no longer held the position of having the largest number of workers.

The fifth to seventh columns of Table 3 show the annual average of the increase in the number of workers in each region. In the Japanese regions, the number of manufacturing workers grew moderately by 4 to 13 percent during 1986–1991; thereafter, however, this number reduced steadily. During 1996–2001, the rates of reduction in the number of workers were over 10 percent in most Japanese regions. This trend does not vary significantly in the NIEs. On the contrary, the growth rates in the ASEAN countries were almost positive throughout the analytical period. The growth rates themselves have been reducing (they were around 70 percent during 1986–1991 and did not exceed 20 percent during 1996–2001); however, it is notable that these countries showed positive growth in the number of workers. However, the growth rates in the number of workers in Chinese regions is peculiar; during 1986–1996, this number was increasing in most regions, but after this period, it began to decrease tremendously by 25 to 60 percent. This trend appears to contradict the commonly perceived image of China as a continually growing manufacturing country.

The trend of the major variables and the dependent variables—SHARE, DIV, and the log of the growth of workers—is presented in Table 5. In order to avoid complicated

Table 5. Value of the major variables and the dependent variable by regional and industrial groups

	(A) SHARE			(B) DIV			(C) log(labor growth)		
	Machine	Material	Light	Machine	Material	Light	Machine	Material	Light
JCORE	1.06	1.06	0.92	0.96	0.96	0.94	−1.34	−1.36	−2.34
	(0.41)	(0.24)	(0.33)	(0.13)	(0.10)	(0.09)	(1.04)	(1.24)	(2.98)
JPERI	0.83	0.92	1.19	0.83	0.85	0.89	−0.63	−1.11	−2.30
	(0.47)	(0.44)	(0.48)	(0.14)	(0.14)	(0.17)	(1.35)	(1.80)	(3.45)
NIES	0.77	1.22	1.28	0.79	0.78	0.81	3.62	−0.95	−1.47
	(0.50)	(1.21)	(1.23)	(0.30)	(0.23)	(0.28)	(7.10)	(3.74)	(3.14)
ASEAN	0.36	1.17	1.58	0.60	0.64	0.73	4.94	4.43	2.81
	(0.23)	(0.88)	(1.19)	(0.18)	(0.14)	(0.22)	(9.07)	(10.46)	(7.34)
CCORE	0.69	1.51	1.21	0.79	0.84	0.90	−0.35	−3.67	−2.99
	(0.39)	(0.82)	(1.16)	(0.16)	(0.10)	(0.21)	(7.09)	(7.31)	(5.86)
CPERI	0.72	1.60	1.07	0.84	0.90	0.92	−2.54	−4.04	−4.72
	(0.45)	(0.89)	(0.90)	(0.15)	(0.06)	(0.12)	(5.63)	(6.43)	(3.96)

Note: Figures in parentheses represent the standard error.

descriptions, these values are represented by the averages within the regional and industrial groups explained in the previous subsection. The left part of Table 5 corresponds to the value of SHARE in 1986. A kind of international and internal division of labor can be affirmed from this table. We can observe that there is a concentration of machines in JCORE, the only regional group whose value of SHARE exceeds 1.00. On the other hand, material and light industries tend to be spread out over the other regions. For example, the value of SHARE for light industries in JCORE was 0.92, the lowest among the six regional groups, while its value in the ASEAN countries was 1.58. The value of DIV, shown in the central part of Table 5, does not vary by industry in each region (due to the characteristics of HHI). Despite this, from this table, it can be observed that DIV has a higher value for Japan and China and a lower value for the ASEAN countries (around 0.94 in JCORE and under 0.75 in ASEAN), which shows that this variable has a relative tendency. The right part of Table 5 indicates the trend of the dependent variable and the logarithm of labor growth in each region-industry. Similar to Table 3, we can observe a drastic increase in the number of workers in the ASEAN countries (2.81 and above), a unanimous and rapid decrease in China (−2.54 and below in most industries), and a moderate decrease in most industries in Japan and the NIEs (from −0.95 to −2.30).

4. REGRESSION RESULTS

4.1. *General result*

Table 6 presents the outcome of the basic regression (ordinal least squares) based on equation (6) in the previous section, with constant dummies for each regional group to eliminate regionally specific factors. The first column of Table 6 presents the result of the regression using all the available data of every industry and region.

The second coefficient of this column represents the initial workers (L86) and is found to be insignificant. Therefore, the initial size of the region-industry does not guarantee an initial advantage for the growth, at least within the framework of this study. The coefficient for the initial wage rate (W86) is positive and highly significant.

Table 6. Results of the basic regression analysis with constant dummies

	Dependent : log(labor in 2001/labor in 1986) for each industry			
	All	Machines	Material	Light
Variable	(1)	(2)	(3)	(4)
Constant	0.085	0.187	0.539	−0.594*
	(0.257)	(0.443)	(0.579)	(0.335)
L86	$8.68 * 10^{-8}$	$1.77 * 10^{-7}$	$3.11 * 10^{-8}$	$2.10 * 10^{-7}$**
	$(7.22 * 10^{-8})$	$(1.36 * 10^{-7})$	$(1.73 * 10^{-7})$	$(9.05 * 10^{-8})$
W86	$3.29 * 10^{-5}$***	$2.43 * 10^{-5}$	$-4.37 * 10^{-6}$	$5.16 * 10^{-5}$***
	$(8.18 * 10^{-6})$	$(1.83 * 10^{-5})$	$(1.63 * 10^{-5})$	$(1.60 * 10^{-5})$
log(W01/W86)	−0.286***	−0.644***	−0.441**	0.021
	(0.104)	(0.216)	(0.215)	(0.136)
SHARE	−0.318***	−0.699***	−0.145	−0.362***
	(0.048)	(0.177)	(0.087)	(0.066)
DIV	0.514**	0.880**	0.390	0.565*
	(0.212)	(0.355)	(0.473)	(0.287)
SERVICE	0.079	0.151	0.005	0.073
	(0.059)	(0.105)	(0.115)	(0.081)
JCORE	−1.322***	−1.093**	−0.698	−1.129***
	(0.236)	(0.473)	(0.517)	(0.373)
JPERI	−1.123***	−0.923**	−0.537	−0.923**
	(0.234)	(0.444)	(0.504)	(0.362)
NIEs	−0.444***	0.017	−0.473	−0.366*
	(0.155)	(0.305)	(0.295)	(0.219)
ASEAN	0.770***	0.776**	0.574	1.163***
	(0.219)	(0.385)	(0.418)	(0.306)
CCORE	−0.040	0.139	0.001	−0.070
	(0.135)	(0.255)	(0.255)	(0.179)
R^2	0.5027	0.6528	0.4046	0.6096
Sample	338	100	118	120

Note: Figures in parenthesis indicate the standard error.
***: Significance at the 1% level
**: Significance at the 5% level
*: Significance at the 10% level

At the same time, the coefficient for the increase of wages (log(W01/W86)) is found to be negative and significant. The sign for log(W01/W86) satisfactorily reflects the commonly believed notion that with a higher wage rate, the competitiveness of the industry becomes weaker and the number of workers decreases. However, there must be some additional explanation for the positive sign of W86 that contradicts this notion.

The coefficient for SHARE, or the degree of localization, is found to be negative and highly significant. This implies that the denser the agglomerates of an industry into one region, the smaller the size of the industry becomes in terms of employment. In other words, localization does not contribute to the growth of each region-industry, at least in this analysis of all East Asian regions and industries.

The coefficient for DIV, the degree of urbanization, is positive and adequately significant. This outcome predicts that the greater the growth of urbanization or the more diversified the components of the industries in each region become, the greater is the growth of each industry.

The negative sign for SHARE and positive sign for DIV predicts that urbanization generally stimulates the growth of region-industries in term of employment, while localization works inversely. This outcome is similar to that of Glaeser et al. (1992) who insisted that urbanization had positive effect on the growth of cities, while localization had a negative effect. On this study, since the unit of analysis is not cities but wider regions, the comparison cannot be easily made; however, the similarity of the outcomes provides us some insights for the consideration of the effects of regional externalities.

The coefficient for SERVICE, or the presence of tertiary industries relative to that of the manufacturing industries, is found to be insignificant. Although the sign itself is positive, it is unable to explain the impact and importance of this variable, at least based on the dataset and framework of this study.

The regional dummies show a symmetric result. The dummies for JCORE, JPERI, and NIEs are found to be significantly negative, while those for ASEAN are significantly positive. The coefficients for China, both coastal (CCORE) and inland (represented by the constant) are insignificant. This might reflect the overall trend of manufacturing workers in each region that is shown in Table 10.

4.2. *Outcomes by industry groups*

In the first regression, all the available data were used, regardless of the type of industry and region. However, the prevalence of the tendency cannot be guaranteed for all types of industries. Therefore, we attempted to conduct additional regression in order to clarify the industry-specific aspect of externalities.

The second to fourth columns in Table 6 present the outcome of the ordinal least squares regression with samples from each industrial group referred to in subsection 3.3: machines in column (2), materials in column (3), and light industries in column (4). Their significance tends to be weaker (particularly for materials), but the outcomes for these groups (columns (2) to (4)) do not vary greatly from those of the first regression with all samples (column (1)). It is noteworthy that the sign and significance for SHARE

are almost unchanged. Hence, we can assert that localization discourages the growth of every industry group. The same can be said of the results for DIV and SERVICE.

4.3. Different sign of externality by regions

4.3. Until now, it has been assumed that regional externalities have an equal effect on all regions. However, as mentioned in the latter half of section 2, the correspondence to each externality might change on account of the period or the circumstances faced by the

Table 7. Results of the regression with regional dummies for localization

	Dependent : log(labor in 2001/labor in 1986) for each industry			
	All	Machines	Material	Light
Variable	(1)	(2)	(3)	(4)
Constant	0.194	1.063**	0.262	−0.295
	(0.261)	(0.473)	(0.582)	(0.363)
L86	$-1.22 * 10^{-7}$	$2.35 * 10^{-7}$	$-3.44 * 10^{-7}$*	$1.59 * 10^{-7}$
	$(9.12 * 10^{-8})$	$(2.16 * 10^{-7})$	$(1.99 * 10^{-7})$	$(1.73 * 10^{-7})$
W86	$-1.05 * 10^{-5}$	$-4.21 * 10^{-5}$***	$-2.19 * 10^{-5}$*	$-1.08 * 10^{-5}$
	$(6.66 * 10^{-6})$	$(1.55 * 10^{-5})$	$(1.22 * 10^{-5})$	$(1.30 * 10^{-5})$
log(W01/W86)	−0.469***	−1.042***	−0.701***	−0.176
	(0.103)	(0.225)	(0.211)	(0.142)
SHARE	0.061	−1.216**	0.283	−0.276
	(0.117)	(0.521)	(0.176)	(0.234)
SHARE*JCORE	−0.749***	0.399	−0.733**	−0.332
	(0.174)	(0.519)	(0.324)	(0.318)
SHARE*JPERI	−0.856***	0.292	−0.854***	−0.353
	(0.156)	(0.535)	(0.321)	(0.263)
SHARE*NIEs	−0.489***	0.383	−0.495***	−0.216
	(0.118)	(0.464)	(0.174)	(0.221)
SHARE*ASEAN	−0.202	0.601	−0.412*	0.219
	(0.129)	(0.636)	(0.218)	(0.228)
SHARE*CCORE	−0.050	0.291	−0.015	−0.034
	(0.099)	(0.338)	(0.144)	(0.145)
DIV	0.259	0.802*	0.442	0.315
	(0.227)	(0.412)	(0.493)	(0.331)
SERVICE	0.250***	0.193**	0.228**	0.233***
	(0.048)	(0.083)	(0.097)	(0.070)
R^2	0.4147	0.5625	0.3973	0.4670
Sample	338	100	118	120

Note: Figures in parenthesis indicate the standard error.
***: Significance at the 1% level
**: Significance at the 5% level
*: Significance at the 10% level

industry or region. In order to verify whether or not externalities have different effects on different regions, we will apply slope dummies, instead of the constant dummies used in equation (6). As well as subsection 4.1, CPERI is related to the root variables.

Table 7 expresses the case with different coefficients regarding localization for each region (group). The first column, which deals with the case for all industries, predicts that the coefficients for localization are significantly negative for Japan (both core and

Table 8. Results of the regression with regional dummies for urbanization

	Dependent : log(labor in 2001/labor in 1986) for each industry			
	All	Machines	Material	Light
Variable	(1)	(2)	(3)	(4)
Constant	−0.118	0.365	0.263	−0.295
	(0.264)	(0.478)	(0.571)	(0.363)
L86	$7.15 * 10^{-8}$	$1.96 * 10^{-7}$	$-3.76 * 10^{-8}$	$1.59 * 10^{-7}$
	$(7.83 * 10^{-8})$	$(1.40 * 10^{-7})$	$(1.77 * 10^{-7})$	$(1.73 * 10^{-7})$
W86	$2.08 * 10^{-5}$**	$9.04 * 10^{-6}$	$-8.36 * 10^{-6}$	$-1.08 * 10^{-5}$
	$(8.13 * 10^{-6})$	$(1.82 * 10^{-5})$	$(1.59 * 10^{-5})$	$(1.30 * 10^{-5})$
log(W01/W86)	−0.372***	−0.770***	−0.483	−0.176
	(0.105)	(0.217)	(0.213)	(0.142)
SHARE	−0.336***	−0.742***	−0.143	−0.276
	(0.050)	(0.177)	(0.088)	(0.234)
DIV	0.808***	0.779*	0.699	−0.332
	(0.279)	(0.457)	(0.572)	(0.318)
DIV*JCORE	−1.290***	−0.817	−0.740	−0.353
	(0.259)	(0.516)	(0.547)	(0.263)
DIV*JPERI	−1.287***	−0.937*	−0.668	−0.216
	(0.265)	(0.515)	(0.559)	(0.221)
DIV*NIEs	−0.469**	0.186	−0.530	0.219
	(0.183)	(0.364)	(0.329)	(0.228)
DIV*ASEAN	0.731***	0.888	0.714	−0.034
	(0.267)	(0.502)	(0.508)	(0.145)
DIV*CCORE	0.001	0.252	0.040	0.315
	(0.159)	(0.315)	(0.290)	(0.331)
SERVICE	0.163	0.206**	0.057	0.233***
	(0.056)	(0.093)	(0.108)	(0.070)
R^2	0.4598	0.6326	0.3920	0.4670
Sample	338	100	118	120

Note: Figures in parenthesis indicate the standard error.
***: Significance at the 1% level
**: Significance at the 5% level
*: Significance at the 10% level

periphery) and NIEs and are insignificant for other regions. This indicates the existence of a strong discouraging force against localization in relatively developed regions, and no particular tendency in less developed areas. The other characteristics of the outcome do not vary from Table 6, with the exception of the coefficient for SERVICE, which becomes significantly positive. The second to fourth columns present the results for each industry group (as in Table 6). The tendency does not vary with the general case in the first column, except for machines that predict a positive but insignificant value for all slope dummies. In general, localization has a negative or no effect on the industrial growth for all regions.

Table 8 presents cases with different coefficients for urbanization by region (group). Here, we find an interesting phenomenon: DIV, which is now related to the Chinese periphery, shows a significantly positive sign. This observation is applicable with respect to ASEAN and the Chinese core; however, the coefficients in Japan are significantly negative. The coefficients for NIEs are also negative (-0.469); however, in addition to the basic coefficient (DIV, whose value is 0.808), the total effect of urbanization in NIEs is weak, but significantly positive ($+0.339$). The other columns in Table 8, representing each industry group, do not show different outcomes in general.

These findings lead us to predict that urbanization has different effects on different regions. It has a positive effect in less developed regions. However, in relatively developed areas it has a converse effect.

Similar results are acquired from Table 9, which deals with the case of the different coefficients of SERVICE, or the effect of the tertiary sector according to regions. As shown in the first column (for all industries), the coefficients for Japan (JCORE and JPERI) are significantly negative (from -0.769 to -0.904) and have absolute values that are more than that of the base variable ($+0.985$), which is significantly positive. On the other hand, those for ASEAN and China are significantly positive or insignificant. The slope dummy for NIEs is significantly negative (-0.445), but it does not exceed the positive value of the base variable. Overall, the impact of the tertiary industry on the employment growth is negative in Japan, ambiguous in NIEs and ASEAN, and strongly positive in the Chinese periphery. It is well known that, in the early stage of economic development, both the secondary and tertiary sectors grow steadily. However, after the economy matures, the secondary sector begins to shrink, while the tertiary sector continues to grow. The outcome of this table might be correlated with this feature of economic development. The tendency does not vary in the analyses for each industrial group presented in the second to fourth columns, except for the light industries represented in column (2).

4.4. Analyses with and without China

Due to the particular trend of Chinese manufacturing shown in section 3.4, it is necessary to conduct an additional analysis in order to ensure the reliability of the previous outcomes.

Table 10 presents the results of the least squares regression without the Chinese samples, covering all industries. Compared with the early analysis in Table 6 to 9, there

Table 9. Results of the regression with regional dummies for SERVICE

	Dependent : log(labor in 2001/labor in 1986) for each industry			
	All	Machines	Material	Light
Variable	(1)	(2)	(3)	(4)
Constant	−0.368	0.003	0.276	−0.556
	(0.273)	(0.473)	(0.607)	(0.369)
L86	$1.29 * 10^{-7}$*	$2.52 * 10^{-7}$**	$-1.42 * 10^{-9}$	$2.13 * 10^{-7}$*
	$(7.20 * 10^{-8})$	$(1.25 * 10^{-7})$	$(1.71 * 10^{-7})$	$(1.10 * 10^{-7})$
W86	$2.57 * 10^{-5}$***	$1.41 * 10^{-5}$	$-8.37 * 10^{-6}$	$2.61 * 10^{-5}$
	$(8.13 * 10^{-6})$	$(1.61 * 10^{-5})$	$(1.48 * 10^{-5})$	$(1.57 * 10^{-5})$
log(W01/W86)	−0.401***	−0.780***	−0.580***	−0.067
	(0.100)	(0.197)	(0.206)	(0.144)
SHARE	−0.318***	−0.774***	−0.133	−0.378***
	(0.049)	(0.168)	(0.088)	(0.073)
DIV	0.461**	0.878**	0.323	0.567
	(0.216)	(0.351)	(0.490)	(0.420)
SERVICE	0.685***	0.469	0.456	−0.884
	(0.198)	(0.350)	(0.379)	(0.420)
SERVICE*JCORE	−0.904***	−0.587*	−0.562	−0.822*
	(0.183)	(0.341)	(0.371)	(0.414)
SERVICE*JPERI	−0.746***	−0.457	−0.475	−0.341
	(0.179)	(0.323)	(0.355)	(0.271)
SERVICE*NIEs	−0.455***	−0.012	−0.395	1.104***
	(0.154)	(0.283)	(0.297)	(0.376)
SERVICE*ASEAN	−0.248	−0.028	−0.205	−0.042
	(0.168)	(0.294)	(0.323)	(0.212)
SERVICE*CCORE	0.025	0.237	0.074	0.162**
	(0.144)	(0.261)	(0.274)	(0.081)
R^2	0.4856	0.6664	0.3764	0.5328
Sample	338	100	118	120

Note: Figures in parenthesis indicate the standard error.
***: Significance at the 1% level
**: Significance at the 5% level
*: Significance at the 10% level

exist no specific differences in general. However, the significance and the value of each coefficient have increased. Therefore, it can be asserted that the general tendency of regional externality is not affected by the peculiar trend of the Chinese samples.

Table 11 presents the outcome of the regression for the Chinese samples. An interesting phenomenon can be observed from this table. The dummies related to the coastal area show a significantly negative coefficient. The Chinese coastal areas are known

Table 10. Results of the regression without Chinese samples

Variable	Dependent: log(labor in 2001/labor in 1986) for each industry (1)	(2)	(3)	(4)
Constant	1.001***	0.381	0.034	−0.369
	(0.313)	(0.317)	(0.304)	(0.315)
L86	$7.08 * 10^{-7}$	$1.98 * 10^{-7}$	$5.00 * 10^{-7}$	$7.22 * 10^{-7}$
	$(4.78 * 10^{-7})$	$(5.52 * 10^{-7})$	$(5.08 * 10^{-7})$	$(4.96 * 10^{-7})$
W86	$3.04 * 10^{-5}$***	$-1.54 * 10^{-5}$**	$1.77 * 10^{-5}$**	$2.42 * 10^{-5}$***
	$(8.35 * 10^{-6})$	$(7.64 * 10^{-6})$	$(8.70 * 10^{-6})$	$(8.31 * 10^{-6})$
log(W01/W86)	−0.452***	−0.660***	−0.549***	−0.611***
	(0.122)	(0.132)	(0.126)	(0.117)
SHARE	−0.439***	−0.200**	−0.452***	−0.438***
	(0.057)	(0.083)	(0.060)	(0.058)
SHARE*JCORE		−0.569***		
		(0.178)		
SHARE*JPERI		−0.636***		
		(0.134)		
SHARE*NIEs		−0.240**		
		(0.103)		
DIV	0.555**	0.360	1.609***	0.630**
	(0.245)	(0.275)	(0.322)	(0.249)
DIV*JCORE			−2.037***	
			(0.290)	
DIV*JPERI			−1.996***	
			(0.248)	
DIV*NIEs			−1.095***	
			(0.242)	
SERVICE	0.085	0.230	0.167***	0.467***
	(0.064)	(0.060)	(0.063)	(0.059)
SERVICE*JCORE				−0.682***
				(0.091)
SERVICE*JPERI				−0.502***
				(0.054)
SERVICE*NIEs				−0.137**
				(0.067)
JCORE	−2.120***			
	(0.245)			
JPERI	−1.872***			
	(0.193)			
NIEs	−1.127***			
	(0.183)			
R^2	0.5325	0.4534	0.5301	0.5625
Sample	253	253	253	253

Note: Figures in parenthesis indicate the standard error.
***: Significance at the 1% level
**: Significance at the 5% level
*: Significance at the 10% level

to be one of the fastest growing regions in the Chinese economy; hence, this outcome with all negative coefficients for regional externality appears to be implausible. One of the most convincing explanations is that Chinese manufacturing firms, particularly state-owned firms, are required to enforce severe restructuring; therefore, they maintain a low level of labor input (particularly in late 1990s). Thus, any kind of regional externalities cannot contribute to the growth of workers. The use of other indices (output growth or total factor productivity) as the dependent would lead to different results with respect to regional externalities.

Table 11. Results of the regression with only Chinese samples

	Dependent: log(labor in 2001/labor in 1986) for each industry			
Variable	(1)	(2)	(3)	(4)
Constant	−1.060***	−1.123***	−1.359***	−1.438***
	(0.309)	(0.334)	(0.325)	(0.323)
L86	$-6.70 * 10^{-8}$	$-6.97 * 10^{-8}$	$-6.66 * 10^{-8}$	$-6.07 * 10^{-8}$
	$(4.60 * 10^{-8})$	$(4.94 * 10^{-8})$	$(4.68 * 10^{-8})$	$(4.59 * 10^{-8})$
W86	0.005***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
log(W01/W86)	0.101	−0.023	0.083	0.103
	(0.118)	(0.121)	(0.120)	(0.119)
SHARE	0.031	0.158**	0.027	0.023
	(0.056)	(0.067)	(0.057)	(0.056)
SHARE*CCORE		−0.205***		
		(0.049)		
DIV	0.394	0.388	0.718*	0.423
	(0.374)	(0.402)	(0.395)	(0.375)
DIV*CCORE			−0.429***	
			(0.082)	
SERVICE	−0.668**	−0.575*	−0.629	−0.313
	(0.280)	(0.298)	(0.283)	(0.271)
SERVICE*CCORE				−0.416***
				(0.075)
CCORE	−0.403***			
	(0.072)			
R^2	0.5163	0.4468	0.4999	0.4706
Sample	85	85	85	85

Note: Figures in parenthesis indicate the standard error.
***: Significance at the 1% level
**: Significance at the 5% level
*: Significance at the 10% level

5. CONCLUSION

On the basis of the regression analyses conducted in the previous section, certain tendencies with respect to each kind of regional externality were observed. In most cases, localization is negatively correlated to the growth of the industry. The coefficients for urbanization vary according to the regions in which the industry locates—positively in the less developed regions and negatively in the more developed regions. The effect of the tertiary sector exhibits the same trend. In conclusion, we wish to infer the reason behind the variance of these coefficients.

The negative coefficient for localization implies that industries grow less in places with a high density of firms that belong to the same industry. Instead, they tend to grow more when there are fewer incumbent firms with the same business. This is a contradiction of the concept of clusters and other aspects of agglomeration by the same industry; however, if the industry has already grown well and faces offsetting negative forces such as congestion and increasing prices of inputs, this outcome appears plausible[12].

The positive coefficient for urbanization implies that the industries tend to grow more in places in which various other industries are also locating. In combination with the negative correlation of localization, it can be asserted that industries in less developed regions are likely to grow more. The argument of fragmentation in East Asia (particularly in the ASEAN countries) aids this assumption.

The case of negative localization and urbanization is difficult to interpret. In this case, industries are likely to shrink both in the "place of production" and in the "industrial core." One of the most persuading explanations is that manufacturing in developed regions will not increase its labor input and, hence neither type of externality contributes to the growth (in terms of labor). The other suitable explanation is that if the total number of workers for manufacturing is decreasing in a region, no industry in that region can avoid the effects of this decrease. This indicates the occurrence of dispersion, contrary to agglomeration, at that place; therefore, any variable reflecting the idea of agglomeration cannot function in such a region.

These outcomes predict that the two patterns of regional externality have different effects on each region-industry—a negative effect through localization and a generally positive effect by urbanization—which is consistent with Glaeser et al. (1992). They also insist that the effect of urbanization on each industry differs by the level of economic development of the region. This outcome is similar to that of Henderson et al. (1995), who discussed the relationship between the location and maturity of industries and their regional externalities. Altogether, the evidence shows that the influence of regional externalities varies by the stage of the development of the manufacturing in

[12] Simple regression equations were introduced in this study to make the comparison feasible. Instead, we had to abandon parameters such as the degree of congestion, infrastructure, and distance to the economic center. Many Asian manufacturing industries are dependent on export and foreign direct investment, but it was impossible to include them in this study because of the difficulty of conducting a dataset for them (especially with regard to the stock data of foreign direct investment).

each region or country. These results are important evidence that indicates the relationship between the agglomeration of industries and their economic development, and this study would be a useful tool for advancing of development economics and economic geography.

APPENDIX A: DATA SOURCES

The data for manufacturing in Japan, Korea, Taiwan, Singapore, Malaysia, and Indonesia are taken from the industrial censuses published in each country. The following is a list of the censuses for these countries (with some notes pertaining to the sample span).

Japan: *Census of Manufactures*, 1986–2001.

Korea: *Report on Mining and Manufacturing Survey*, 1986–2001.

Taiwan: *The Report on Industry, Commerce and Service Census Taiwan-Fukien Area, the Republic of China*, 1986, 1991, 1996, 2001 (published every 5 years).

Singapore: *Reports on the Census of Manufacturing Activities*, 1986–2001.

Malaysia: *Annual Survey of Manufacturing Industries*, 1985–2000 (since data in 2001 were not available, the sample span was slightly modified).

Indonesia: *Large and Medium Manufacturing Statistics*, 1986–2001.

Due to the unavailability of continual and reliable information (particularly for Thailand), the data for Hong Kong, Thailand, and the Philippines are taken from the *Industrial Statistic Database* published by UNIDO. Some of the data are adopted from the estimation of Kawabata (2001) that is also based on UNIDO's database. The sample span of those countries is as follows: Hong Kong, 1986–2001; Thailand, 1986–2000; and the Philippines, 1985–1999.

The data for China require complicated estimation. In recent years, the dataset for the Chinese economy has been better; however, it still has some problem areas such as the reliability of data and inconsistency of data among different datasets. For example, the number of workers in each industry in each province can be easily acquired for state-owned sectors but not for all firms, including the private sector. Some of the earliest data for regional employment in industries are obtained from the Second Industrial Census held in 1985; however, this outcome is not reflected in the later development of the dataset.

In order to solve these problems, several estimations of the regional employment for Chinese industries were made in the following manner. The number of workers across all Chinese manufacturing industries was acquired from the recent issues of the *Statistic Yearbook of China*, of 1986–2001. On the other hand, we calculated the ratio of the workers in each industry in each province to the national employment in all manufacturing industries based on the Industrial Census of 1985 or the *Yearbook of Labor Statistics of China* (for later years). The results were used for the substitution of the number of all manufacturing workers in China with the calculated ratio of regional workers. The wage rate was calculated from the data of the regional state-owned sector, considering that it might reflect the average tendency for all sectors.

REFERENCES

Arrow, K. (1962). 'The Economic Implication of Learning by Doing.' *Review of Economic Studies*, 29, 155–73.

Fujita, M., Hisatake, M. (1999). 'Nippon to Higashi-Ajia ni okeru chiiki keizai shisutemu no henyo' (Development of a Regional Economic System in Japan and East Asia). *Tsusan Kenkyu Rebyu*, 13, 40–101.

Glaeser, E. L., Kallal, H. D., Scheinkman, J. A., Shleifer, A. (1992). 'Growth in Cities.' *Journal of Political Economy*, 100, 1126–52

Gao, T. (2004). 'Regional Industrial Growth: Evidence from Chinese Industries.' *Regional Science and Urban Economics*, 34, 101–24.

Hanson, G. H. (1998). 'Regional Adjustment to Trade Liberalization.' *Regional Science and Urban Economics*, 29, 419–444.

Henderson, V. (1988). *Urban Development: Theory, Fact, and Illusion*. New York: Oxford Univ. Press.

Henderson, V., Kuncoro, A., Turner, M. (1995). 'Industrial Development in Cities.' *Journal of Political Economy*, 103, 1067–90.

Henderson, V., Lee, T., Lee, Y. J. (2001). 'Scale Externalities in Korea.' *Journal of Urban Economics*, 49, 479–504.

Hoover, E. M. (1948). *Location of Economic Activities*. New York: McGraw-Hill.

Jacobs, J. (1969). *The Economy of Cities*. New York: Random House.

Junius, K. (1999). *The Economic Geography of Production, Trade, and Development*. Tubingen: Mohr Siebeck (Kieler Studien: 300).

Kawabata, K. (2001). 'Kogyo Hatten' (Industrial Development) in Watanabe T. eds. Higashi-Ajia Choki Keizai Tokei (Long-term Economic Statistics of East Asia), Vol. 5. Tokyo: Keiso Shobo.

Mano, Y., Otsuka, K. (2000). 'Agglomeration Economics and Geographical Concentration of Industries: A Case Study of Manufacturing Sectors in Postwar Japan.' *Journal of the Japanese and International Economies*, 14, 189–203.

Marshall, A. (1890). *Principles of Economics*. London: Macmillan.

Lucas, R. E. (1988). 'On the Mechanics of Economic Development.' *Journal of Monetary Economics*, 22, 3–42.

Porter, M. E. (1990). *The Competitive Advantage of Nations*. New York: Free Press.

Romer, P. (1986). 'Increasing Returns and Long-Run Growth.' *Journal of Political Economy*, 94, 1002–37.

Tomiura, E. (2003). 'Changing Economic Geography and Vertical Linkages in Japan.' *Journal of the Japanese and International Economies*, 17, 561–581.

Vernon, R. (1966). 'International Investment and International Trade in the Product Cycle.' *Quarterly Journal of Economics*, 80, 190–207