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Agglomeration versus Fragmentation: A Comparison of East Asia and Europe

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Abstract

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Keywords: Agglomeration; Fragmentation; East Asia; Europe
JEL classification: N64; N65; R11; R12

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Agglomeration versus Fragmentation:
A Comparison of East Asia and Europe

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1. Introduction

It is well known that there is a clear contrast in intra-regional disparities in location advantages such as factor prices between East Asia and Europe. Such a contrast can be utilized to clarify the different ways in which changes in some economic variables affect other economic variables in connection with differences in location advantages within a region. In other words, the East Asian and European regions work as natural models with large and small intra-regional disparities in location advantages, respectively. A comparative analysis of East Asia and Europe highlights the fact that the consequences of changes in economic variables in a region with smaller disparities are not necessarily the same as those in a region with larger disparities, which provides clues to avoiding unexpected policy effects.

One consequence of the contrasting intra-regional disparities in location advantages shows up in differences in the mechanics of intermediate goods trade between East Asia and Europe. In the 1990s, it was possible to observe active intra-industry trade in machinery parts and components in both East Asia and Europe. However, the mechanics of this trade differs between the two regions (Kimura et al., 2007). East Asian countries are engaged in vertical intra-industry trade within the region, which is a two-way trade based on either product quality differentials or differences in production stages and is motivated by differences in location advantages such as factor prices among countries. In Europe, on the other hand, horizontal intra-industry trade, i.e., the exchange of horizontally differentiated products, is prevalent. As demonstrated theoretically in Helpman and Krugman (1985, p.173), a set of countries with smaller differences in location advantages, such as income per capita, is more likely to engage in this kind of intra-industry trade.

The contrasting intra-regional disparities may also have resulted in the difference in industrial distribution between East Asia and Europe. In East Asia, international production and distribution networks, which exploit differences in location advantages among countries within the networks, have developed dramatically in machinery industries, particularly in the electric machinery industry, since the 1990s (Kimura, 2006). As the network-forming firms have geographically diversified across East Asia, a certain scale of the electric machinery industry has come to exist in each of the countries in the region. In Europe, on the other hand, as is summarized in Overman et al. (2003), industrial location has come to be agglomerated in particular countries as European integration proceeds. In particular, Midelfart-Knarvik et al. (2000) show that electrical apparatus is one of the industries that became increasingly concentrated during the period 1970-1997.

Furthermore, different tendencies in industrial distribution may lead to differences in spatial interdependence in production among countries within a region. That is, the scale of industry in a country is related to that of neighboring countries in a different manner in East Asia and Europe. Spatial interdependence has an important implication for economic development. In a region with positive spatial interdependence, countries can achieve simultaneous economic development by the compartmentalization of production processes, i.e. upstream or downstream processes. In a region with negative spatial interdependence, on the other hand, there seems to be almost no leeway for a particular industry to experience simultaneous expansion except by compartmentalization of different *industries*. Consequently, policy treatment for simultaneous economic development may differ according to the form of the spatial interdependence existing at the regional level.

The aim of this paper is to conduct an empirical investigation of the differences in international spatial interdependence in the electric machinery industry in East Asia and Europe. We focus on the electric machinery industry because, as mentioned above, this industry appears to show the sharpest contrast in industrial distribution between the two regions. It is expected that a dispersed industrial distribution in East Asia will be contrasted with a concentrated distribution in Europe. We first take an overview of the industrial distribution in each region. To this end, a number of indices measuring industrial concentration are calculated. Following this, in order to detect expected differences in spatial interdependence between the two regions, this paper explores the spatial relationships in production/employment in the electric machinery industry among the countries in each of the regions by utilizing a spatial econometric technique. Specifically, applying a spatial lag model separately for the two regions, we compare the estimated coefficients for the spatial weighting matrix. Our empirical evidence for the differences in the intra-regional spatial interrelationships will provide new facts on the contrast between the East Asian and European regions.

It is worth noting that our paper is related to studies that analyze international trade and foreign direct investment (FDI) by using spatial econometrics. A number of recent studies apply the method of spatial econometrics to the estimation of a gravity equation, which is well known as one of the most successful tools for the quantitative analysis of bilateral trade patterns (Behrens et al., 2007; Porojan, 2001; Sevela, 2002). For example, Porojan (2001) estimates the gravity equation by using spatial econometrics techniques and finds substantial differences in both the magnitude and statistical significance of the estimates for the usual gravity variables. Among the studies on FDI (Coughlin and Segev, 2000; Baltagi et al., 2007; Blonigen et al., 2007), Blonigen et al. (2007) estimate a spatial lag model and attempt an empirical differentiation of the FDI types (pure HFDI, export-platform, pure VFDI, and complex VFDI) of US outbound FDI. In contrast to these papers, we examine spatial interdependence in production by employing a spatial lag model.

The remainder of this paper is organized as follows: Section 2 provides a brief overview of distribution patterns in the electric machinery industry in East Asia and Europe. Section 3 summarizes the spatial relationships among countries within a region from the perspective of the extent of intra-regional disparities in location advantages. In Section 4, we explain the empirical method employed to investigate spatial interdependence and present the results, followed by conclusions in the final section.

2. Overview of Industrial Distribution

We begin by outlining time-series changes in the distribution of the electric machinery industry in East Asia and Europe. We first take a look at changes in the value-added of the electric machinery industry, and then formally examine its intra-regional concentration by employing a number of indices.

2.1. Changes in Value-added

In this subsection, we investigate changes in the value-added of the electric machinery industry in East Asia and Europe, comparing the industrial distribution patterns in the two regions. The value-added data for the electric machinery industry, which includes ISIC 383, Rev.2 or ISIC 3110-3230, Rev.3, are obtained from UNIDO's *The International Yearbook of Industrial Statistics*. The data are deflated by the GDP deflator obtained from the World Bank's World Development Indicators Online for the respective countries.

Figure 1 shows the changes in (the log of) value-added in the electric machinery industry for East Asian countries from 1980 to 2000. The East Asian countries of interest in this paper are the nine economies of China, Hong Kong, Indonesia, Japan, the Republic of Korea, Malaysia, the Philippines, Singapore, and Thailand. As is clear from the figure, we can observe a steady increase in production in the electric machinery industry across East Asia. As of 1980, the value-added of the electric machinery industry in Japan was much higher than in the other eight countries, indicating Japan's dominant presence in the region at the time. Following that, except for the period of the Asian financial and currency crisis of 1997-98, the value-added of the electric machinery industry increased continually in most of the eight countries. In particular, the value-added of the electric machinery industry in China and the Rep. of Korea increased rapidly and approached the level of Japan. Such simultaneous development may be attributed to the development of international production networks.

== Figure 1 ==

Figure 2 shows the changes in (the log of) value-added in the electric machinery industry for European countries, whose patterns look quite different from those of the East Asian countries. The European countries of interest are the nine economies known as the “Core EU countries,” namely, Austria, Denmark, France, Germany, Italy, Norway, Portugal, Spain, and the United Kingdom. Although we can observe a rapid expansion in the electric machinery industry for the East Asian region as a whole, value-added in most of the European countries remained relatively stable over the two decades in question. In particular, Germany has continued to enjoy the highest level of value-added in the electric machinery industry, in contrast to Denmark, Norway, and Portugal. The intra-regional distribution of the electric machinery industry seems to have been almost unchanged in Europe during our sample period.

== Figure 2 ==

2.2. Spatial Concentration Indices

To examine industrial concentration and dispersion more closely, this subsection explores well-known spatial concentration indices. Specifically, given the limitations of the data, we examine the changes in the Isard, Herfindhal, and Theil indices for the electric machinery industry in East Asia and Europe.[1] These three indices are defined as follows:

$$Isard_i = \frac{1}{2}\sum_{r=1}^{R}\left|\lambda_r^i - \lambda_r\right|, \quad Herfindhal_i = \frac{1}{R}\sum_{r=1}^{R}\lambda_r\left(\frac{\lambda_r^i}{\lambda_r}\right)^2, \quad Theil_i = \sum_{r=1}^{R}\lambda_r^i\left(\ln\lambda_r^i - \ln\lambda_r\right),$$

where

$$\lambda_r^i = \frac{x_r^i}{\sum_i x_r^i} \quad \text{and} \quad \lambda_r = \frac{\sum_r x_r^i}{\sum_r \sum_i x_r^i}.$$

[1] For other concentration indices and their statistical properties, see Combes et al. (2008, Chapter 10).

The time subscript is omitted for brevity. *R* is the number of countries, i.e., nine for both East Asia and Europe in this paper. In order to avoid bias due to the incomplete adjustment of prices, we use employment in industry *i* in country *r* for x^i_r. The data source for the employment in the whole manufacturing industry and electric machinery industry is the same as that for value-added. A larger value of index indicates a higher concentration in the industry, though the possible range of values differs from index to index. By calculating these indices for East Asia and Europe separately, we only examine the time-series changes for each region, but do not compare the levels in the two regions.

The changes in the three indices for East Asia are depicted in Figure 3, and those for Europe in Figure 4. There are three noteworthy points. First, in both figures, the Isard and Theil indices evolve in a similar way and fluctuate greatly in comparison with the Herfindhal index. Second, the electric machinery industry has been less likely to concentrate in certain countries in East Asia since the middle of the 1980s. This again is consistent with our expectation that the development of international production networks leads to a dispersed industrial distribution in East Asia. Third, compared to the case of East Asia, trends in the spatial concentration of the electric machinery industry in Europe are ambiguous. While the Herfindhal index shows a stable trend with a slight increase, the other two indices evolve in a quite unstable manner. Nevertheless, if we examine the values of the indices for the period 1980 to 2000, it may be possible to conclude that the activities of the electric machinery industry were likely to concentrate in certain countries within Europe.

== Figures 3&4 ==

3. Agglomeration versus Fragmentation

This section briefly summarizes the different ways in which industrial size among countries within a region is interrelated with intra-regional disparities in location advantages. First, we consider the case in which a region with large differences in location advantages faces no trade costs of any kind. In general, it is obvious that large intra-regional disparities in location advantages play a critical role in dispersing industrial distribution. If production processes can be geographically fragmented, each production process will be located in a country which has location advantages for carrying out that process. This phenomenon is called ‘fragmentation,’ one pioneer work being that of Jones and Kierzkowski (1990). Since each production process is linked with the others through an input-output relation, a production expansion in one process leads to increased production in the relevant processes elsewhere. In this sense, under fragmentation, the industrial production of each of the countries is positively related with that of the others.

Let us now suppose a case where trade costs, more specifically, costs for linking remotely located production processes, are incurred by firms. In this case, production processes are not necessarily fragmented or distributed in a dispersed manner according to location advantages. Some parts of the production processes are possibly concentrated in certain countries in order to save trade costs. If fragmentation of production processes is to be more profitable than concentration, given the differences in location advantages among countries within the region, trade costs must be sufficiently low. If geographical remoteness is the major source of trade costs, the closer countries are to each other geographically, the more likely fragmentation is to occur, and thus the more likely their production processes will be positively related with one another. In sum, production processes show a positive spatial relationship among countries in a region with large differences in location advantages.

Let us next examine the case where countries are located in a region with small differences in location advantages. In particular, we consider the extreme case where countries are completely symmetrical in terms of location advantages. Furthermore, we restrict the size of the region to a sufficiently small area. The new economic geography (NEG)[2] model then suggests that a single agglomeration exists within the region for an industry if trade costs among countries are sufficiently low. Meanwhile, production in that industry ceases to exist in all of the other countries. As a result, in a region limited to a sufficiently small area, no positive spatial relationships emerge among countries unless there are intra-regional disparities in location advantages. However, as noted in the hierarchical urban system, some agglomerations may co-exist in the case of a region covering a sufficiently large area. Thus, if our sample European countries cover a large area, the co-existence of multiple agglomerations might lead to a negative spatial correlation among countries within the region.

In the previous section, we noted the dispersed distribution of the electric machinery industry in East Asia, which appears to stem from the development of international fragmentation. Such a development of fragmentation, driven by the large intra-regional disparities in location advantages, will yield a positive spatial correlation among countries in East Asia. On the other hand, the observed concentrated distribution of the electric machinery industry in Europe can be attributed to the relatively small

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[2] See, for example, Fujita el al. (1999, 2002) and Baldwin et al. (2003).

differences in location advantages among countries in Europe. Since the core EU countries are limited to a small area and trade costs among those countries are sufficiently low, the small disparities in location advantages will not lead to any positive spatial interrelationships within the region. Such differing patterns in spatial interdependence between East Asia and Europe are formally examined in the next section.

4. Empirical Analysis

This section describes the spatial econometric technique employed to incorporate the spatial relationships among countries within a region for the electric machinery industry and presents estimation and simulation results.

4.1. Empirical Method

In this subsection, we explain our empirical method for investigating the spatial interrelationships in the electric machinery industry in East Asia and Europe. We estimate the spatial lag model for the two regions, which enables us to carry out an empirical examination of the spatial relationships without losing a degree of freedom.

Our spatial lag model is as follows. Let Y^i_t denote the log of the value-added/employment of the electric machinery industry in country *i* in year *t*. Countries of interest in our analysis are the nine East Asian economies and the nine European economies, and the sample period ranges from 1980 to 2000, as in Section 2. Our spatial lag equation is given by:

$$\mathbf{Y} = \rho\mathbf{WY} + \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon},$$

where **Y** is an N×1 vector of observations on the dependent variable. **X** is an N×K matrix of observations on the exogenous variables that may affect the scale of the electric machinery industry's activities in a country of interest. Logs of GDP per capita and electricity production per capita are introduced as proxies for primary factors of production, i.e., wages and electricity supply. The market potential variable is expected to embody a country's potential market size. Specifically, we use a log of the Harris market potential index, which is defined as the sum of the inverse-distance-weighted, i.e., proximity-weighted, GDPs of all the countries in the world. The development of infrastructure is partly captured by introducing telephone lines per 100 people. We also introduce year dummy variables in order to control to some extent for changes in intra-regional trade costs other than time-invariant distance-related costs (i.e. **W**). **ε** is a vector of disturbances.

The spatial lag weighting matrix **W** is an N×N block-diagonal matrix, which is constructed as follows:

$$\mathbf{W}_t = \begin{bmatrix} 0 & d_t^{1,2} & \cdots & d_t^{1,I} \\ d_t^{2,1} & 0 & \ddots & \vdots \\ \vdots & \ddots & 0 & d_t^{I-1,I} \\ d_t^{I,1} & \cdots & d_t^{I,I-1} & 0 \end{bmatrix}, \quad \mathbf{W} = \begin{bmatrix} W_{1980} & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & W_{2000} \end{bmatrix},$$

where d^{ij}_t is the inverse of the distance between countries *i* and *j* in year *t*. As distances are time-invariant, it will generally be the case that $W_{1980} = W_{1981} = \ldots = W_{2000}$. As is common, **W** is row-standardized. The *i*-th entry of the spatially lagged dependent variable **WY** can then be interpreted as a proximity-weighted average of value-added/employment of the machinery industry in other $j \neq i$ countries in a region.

As is well known, ordinary least squares (OLS) estimates are biased as well as inconsistent for the parameters of the spatial model. Rewriting the above equation as:

$$\mathbf{Y} = \mathbf{Z}\rho + \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon},$$

where **Z** = **WY**, we can express our OLS estimate γ_{OLS} for ρ as:

$$\gamma_{OLS} = \rho + [\mathbf{Z'MZ}]^{-1}\,\mathbf{Z'M}\boldsymbol{\varepsilon},$$

where $\mathbf{M} = \mathbf{I} - \mathbf{X}(\mathbf{X'X})^{-1}\mathbf{X'}$. As the expected value of the second term is not equal to zero, the OLS estimate is biased. Furthermore, while the probability limit of $N^{-1}(\mathbf{Z'MZ})$ can be a finite and nonsingular matrix, that of $N^{-1}(\mathbf{Z'M}\boldsymbol{\varepsilon})$ is not equal to zero, except in the trivial case where ρ = 0. Thus, the OLS estimate is not only biased but also inconsistent. To obtain consistent estimators, we estimate the spatial lag equation by the maximum likelihood (ML) method, following the traditional literature in spatial econometrics.[3] Given the estimates by the ML method, three familiar asymptotic tests are conducted in order to examine the existence of spatial dependence: the Wald test, the likelihood ratio test (LR test), and the Lagrange multiplier test (LM test).

Our particular interest is in the estimates for ρ, the East Asian and European values of which are to be compared. ρ will indicate the strength and sign of the spatial relationships among countries within a region for the electric machinery industry. A significantly positive/negative sign for ρ implies that the electric machinery industry's activities in a country are positively/negatively correlated with those in neighboring countries. For the East Asian region, in which international production networks have developed in the electric machinery industry, production processes in each country will be interrelated with those in neighboring countries. In Europe, on the other hand, production locations in the electric machinery industry have been locked into a limited

[3] For details on ML estimation of the spatial lag model, see Anselin (1988, Ch.6).

number of countries. In particular, if our nine sample countries cover only a small area, agglomeration is formed in only one country within the region. In such a circumstance, once agglomeration is formed within a certain country, the industry's activities would not be yielded to neighboring countries. Therefore, we expect the sign of ρ to be positive and significant for East Asia, but insignificant for Europe.

Our data sources are as follows. Data for value-added and employment in the electric machinery industry are obtained from UNIDO's *The International Yearbook of Industrial Statistics*.[4] The value-added/employment data are modified, as in the last section. Data for distances are drawn from the CEPII's website.[5] Data for all explanatory variables are obtained from the World Bank's World Development Indicators Online. The basic statistics for variables used in the spatial lag regression are reported in Table 1. Naturally, the mean values of all explanatory variables are larger in Europe than in East Asia.

== Table 1 ==

4.2. Empirical Results

The spatial lag equation is estimated separately for the East Asian region and the European region. We also estimate the equations without **WY** or **X**. Table 2 reports the estimates for East Asia.

== Table 2 ==

First, as expected, the coefficients for **WY** are significantly positive for the East Asian sample. Except for the LM test in column (V), the three kinds of tests, i.e., the Wald, LR, and LM tests, reject the null hypothesis of no spatial dependence. A positive sign for the coefficient ρ indicates that the production in the electric machinery industry in a country is positively correlated with that of its neighboring countries in East Asia. Such a positive spatial interrelationship would be a consequence of large differences in location advantages among countries in the region. That is, given the large disparities, international fragmentation of production in the electric machinery industry expands among neighboring countries. Such fragmentation across neighboring countries yields

[4] Note that data covering several years are not available for several countries. If data on either item, i.e. value-added or employment, are available, the data for the missing item is estimated by using the available item's growth rate. Or, if the data for the previous year and the following year are available, we replace a missing datum with the average value of both periods.

[5] http://www.cepii.fr/anglaisgraph/bdd/distances.htm.

positive spatial interrelationships in production within East Asia.

Second, the estimates for the other regressors are as follows. The coefficients for GDP per capita, which is employed as a proxy for wage, are significantly negative, though they are insignificant in the value-added equations. The coefficients for electricity production per capita are positively significant in both equations. Contrary to our expectation, however, the estimated coefficients for market potential and telephone lines are significantly negative. The negative signs for telephone lines seem to be due to a multicolinearity issue. Indeed, there is high correlation (86%!) between telephone lines and GDP per capita in the East Asian sample. The negative signs for market potential are somehow puzzling, but might be due to its correlation with any location advantages on the supply side which are not fully captured in our estimation. In this regard, while location advantages, such as factor prices, on the supply side are considered to be crucial elements in the development of international fragmentation, no studies stress the importance of those, such as market potential, on the demand side.

The results for the European sample are reported in Table 3. As is consistent with our expectation, in Europe, the coefficients for **WY** are insignificantly estimated, and all the three kinds of tests result in the null hypothesis of no spatial dependence not being rejected.[6] Such an insignificant result implies that our sample countries cover only a small area. The relatively large scale of production in Germany may function as a huge single agglomeration among the core EU countries. The coefficients for the other regressors are estimated to be significant with reasonable signs, except for electricity production per capita: Those for GDP per capita are estimated to be negative, while those for market potential and telephone lines are estimated to be positive. Of particular note is that the scale of production and employment in the electric machinery industry in a country is positively affected by its market potential in Europe, in stark contrast to the results for the East Asian sample. The previous studies in the NEG show that the better market access a county/country has, the larger benefits it can enjoy from agglomeration (see, for example, Hanson, 2005; Redding and Venables, 2004). Within a region such as Europe, in which industrial concentration prevails, a certain country with great market potential attracts a large number of firms, resulting in increased production and demand for labor.

[6] For the European sample, the insignificant estimates for **WY** are quite robust. For example, changing the range of the sample in terms of years or countries (adding some other EU countries such as Greece or Finland) does not affect the result. Enlarging the geographical scope (e.g., adding Eastern European countries) might, however, change the result because the spatial interrelationships within a region with a *large* area are expected to be different from those within a region limited to a small area such as the European sample in this paper.

== Table 3==

5. Concluding Remarks

There is a clear contrast in intra-regional disparities in location advantages such as factor prices between East Asia and Europe. Such a contrast yields various kinds of differences between them with regard to industrial activities. First, we found dispersed and concentrated distributions in the electric machinery industry in East Asia and Europe, respectively. Second, this paper has conducted an empirical investigation of the differences in spatial relationships among countries in East Asia and Europe by applying the spatial lag model to each of the two regions. As a result of the empirical analysis, we found that, while the scale of the electric machinery industry in a country is positively correlated with that of neighboring countries in East Asia, there is no spatial correlation in Europe. The result of no correlation implies that the analysis in this paper is dedicated to the spatial relationship within a region limited to a small area of Europe. In future work, it would be invaluable to study whether the relationship turns out to be negative in the case of a larger area including Eastern European countries.

Lastly, our findings provide us with the following implication for economic development. In the case of the East Asian region, it indicates the importance for economic development of a strengthening of location advantages in each of the countries in order to attract and specialize in a particular production stage. For the European region, on the other hand, several countries are unlikely to experience simultaneous expansion of a particular industry, but an individual country could achieve economic development by waiting for a rise in congestion costs in a leading country for a particular industry (e.g. in the case of the electric machinery industry in Germany) or by compartmentalization of differing industries. In either case, however, the core EU countries would not necessarily be able to retain the whole production process within single countries. Some parts of the process might be relocated to Eastern European or others countries to take advantage of cheaper labor. Thus, Europe is headed for some difficult maneuvering in facilitating even economic development over the whole region.

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Table 1. Basic Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
East Asia					
Y (Value-added)	189	22.38	1.50	20.01	25.79
Y (Employment)	189	12.23	1.43	9.99	15.26
GDP per capita	189	8.48	1.19	6.31	10.61
Market potential	189	33.30	8.03	22.00	43.05
Electric production per capita	189	7.20	1.25	4.00	9.02
Telphone lines per 100 *persons*	189	1.94	1.75	-1.52	4.08
Europe					
Y (Value-added)	231	22.32	1.44	19.79	25.20
Y (Employment)	231	11.39	1.41	8.92	13.85
GDP per capita	231	10.00	0.38	9.00	11.44
Market potential	231	33.87	8.06	22.97	43.74
Electric production per capita	231	8.69	0.64	7.25	10.34
Telphone lines per 100 *persons*	231	3.69	0.34	2.32	4.27

Table 2. Estimation Results: East Asia

	Value Added			Employment		
	(I)	(II)	(III)	(IV)	(V)	(VI)
WY		0.451***	0.498***		0.236*	0.337***
		[0.104]	[0.096]		[0.125]	[0.112]
GDP per capita	0.168		0.224	-0.590***		-0.597***
	[0.200]		[0.161]	[0.204]		[0.155]
Market potential	-0.475		-0.529**	-0.566*		-0.616***
	[0.324]		[0.240]	[0.289]		[0.232]
Electric production per capita	1.525***		1.472***	1.734***		1.726***
	[0.276]		[0.238]	[0.260]		[0.230]
Telphone lines per 100 *persons*	-0.798***		-0.798***	-0.719***		-0.728***
	[0.250]		[0.204]	[0.236]		[0.197]
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Wald test		18.68***	26.71***		3.57*	9.10***
LR test		13.58***	18.29***		3.22*	7.64***
LM test		9.73***	13.41***		2.35	5.83**
Observations	189	189	189	189	189	189
R-sq	0.3174			0.3617		
Log likelihood		-330	-299		-330	-289

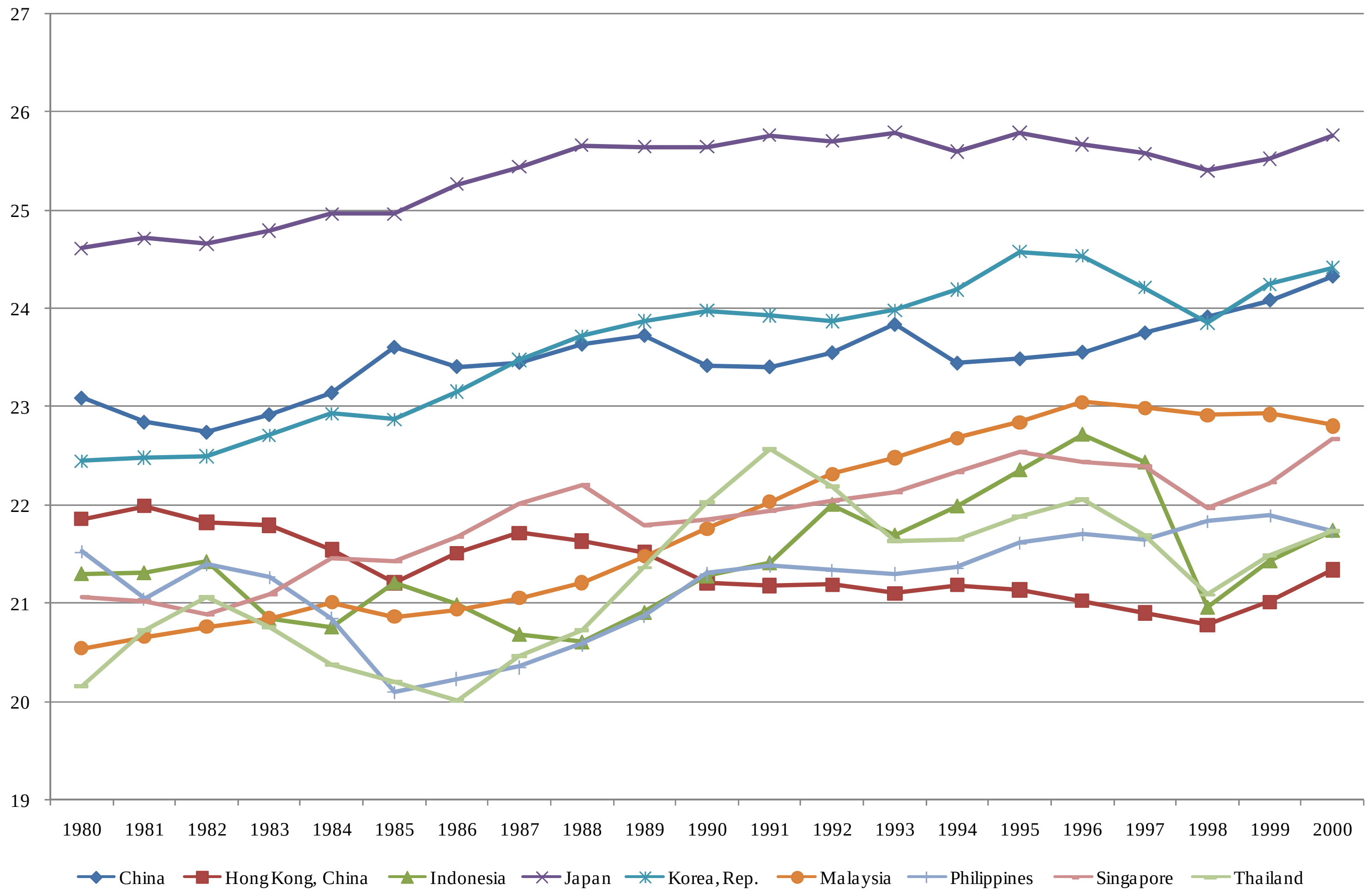
Notes: Standard errors are in parentheses. ***, **, and * show 1%, 5%, and 10% significance, respectively. **Y** is an N×1 vector of observations on the dependent variable (a log of value-added/employment). The spatial lag weighting matrix **W** is an N×N block-diagonal matrix. The *i*-th entry of the spatially lagged independent variable **WY** can be interpreted as a proximity-weighted average of value-added/employment of the machinery industry in other $j \neq i$ countries in a region. **W** is row-standardized. Sample countries are China, Hong Kong, Indonesia, Japan, Republic of Korea, Malaysia, the Philippines, Singapore, and Thailand.

Table 3. Estimation Results: Europe

	Value Added			Employment		
	(I)	(II)	(III)	(IV)	(V)	(VI)
WY		0.138	-0.005		0.234	0.125
		[0.156]	[0.166]		[0.145]	[0.156]
GDP per capita	-1.175***		-1.176***	-2.030***		-2.014***
	[0.246]		[0.302]	[0.221]		[0.283]
Market potential	3.119***		3.120***	3.124***		3.102***
	[0.256]		[0.354]	[0.232]		[0.331]
Electric production per capita	0.331*		0.331*	0.405**		0.415**
	[0.188]		[0.197]	[0.176]		[0.184]
Telphone lines per 100 *persons*	0.844*		0.845**	1.182***		1.164***
	[0.434]		[0.420]	[0.401]		[0.392]
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Wald test		0.78	0.00		2.61	0.64
LR test		0.73	0.00		2.28	0.60
LM test		0.45	0.00		1.43	0.36
Observations	231	231	231	231	231	231
R-sq	0.2814			0.3451		
Log likelihood		-410	-374		-406	-358

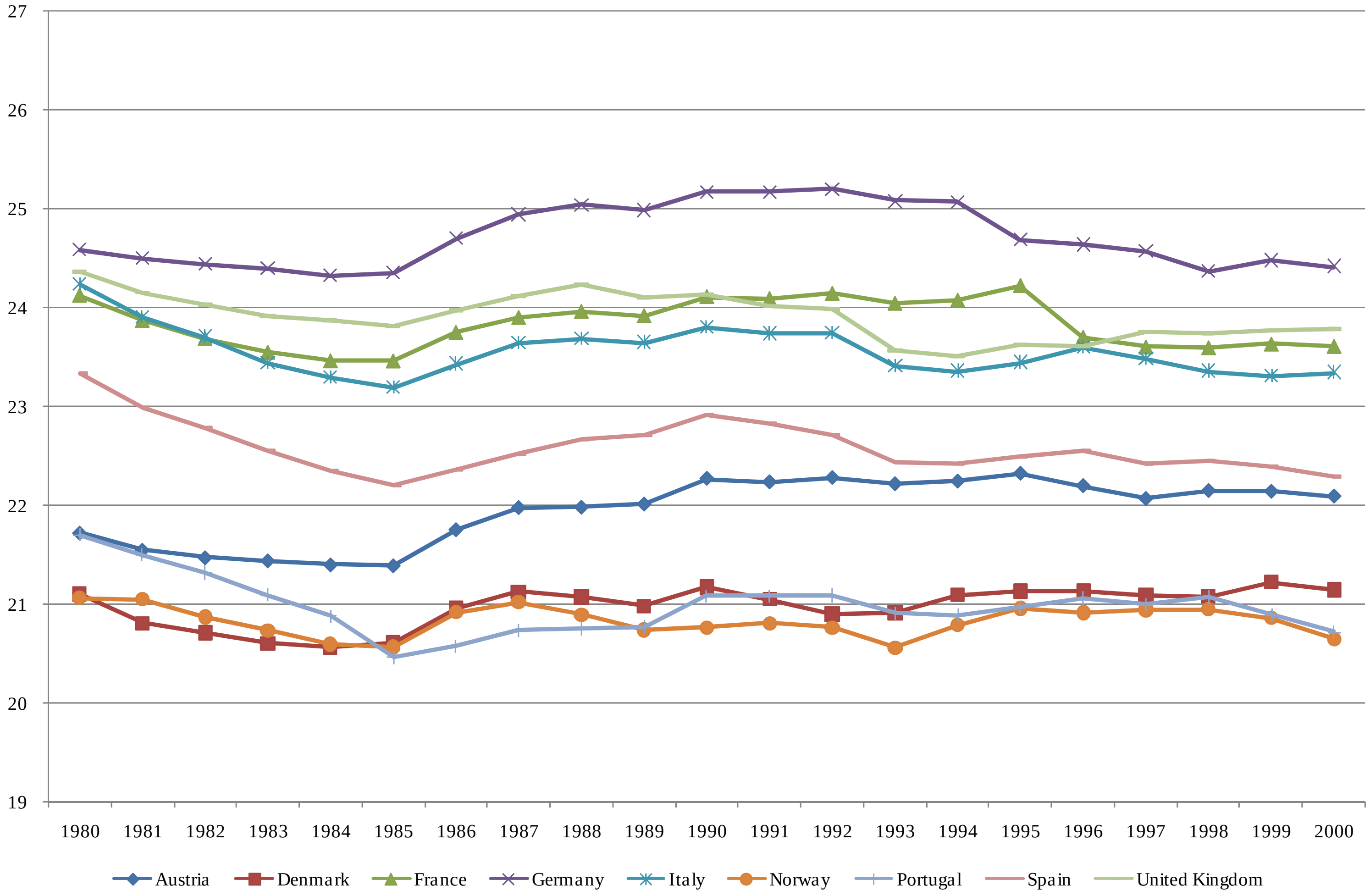
Notes: Standard errors are in parentheses. ***, **, and * show 1%, 5%, and 10% significant, respectively. **Y** is an N×1 vector of observations on the dependent variable (a log of value-added/employment). The spatial lag weighting matrix **W** is an N×N block-diagonal matrix. The *i*-th entry of the spatially lagged independent variable **WY** can be interpreted as a proximity-weighted average of value-added/employment of machinery industry in other $j \neq i$ countries in a region. **W** is row-standardized. Sample countries are Austria, Denmark, France, Germany, Italy, Norway, Portugal, Spain, and United Kingdom.

Figure 1. Changes in Value-added in the Electric Machinery Industry: East Asia



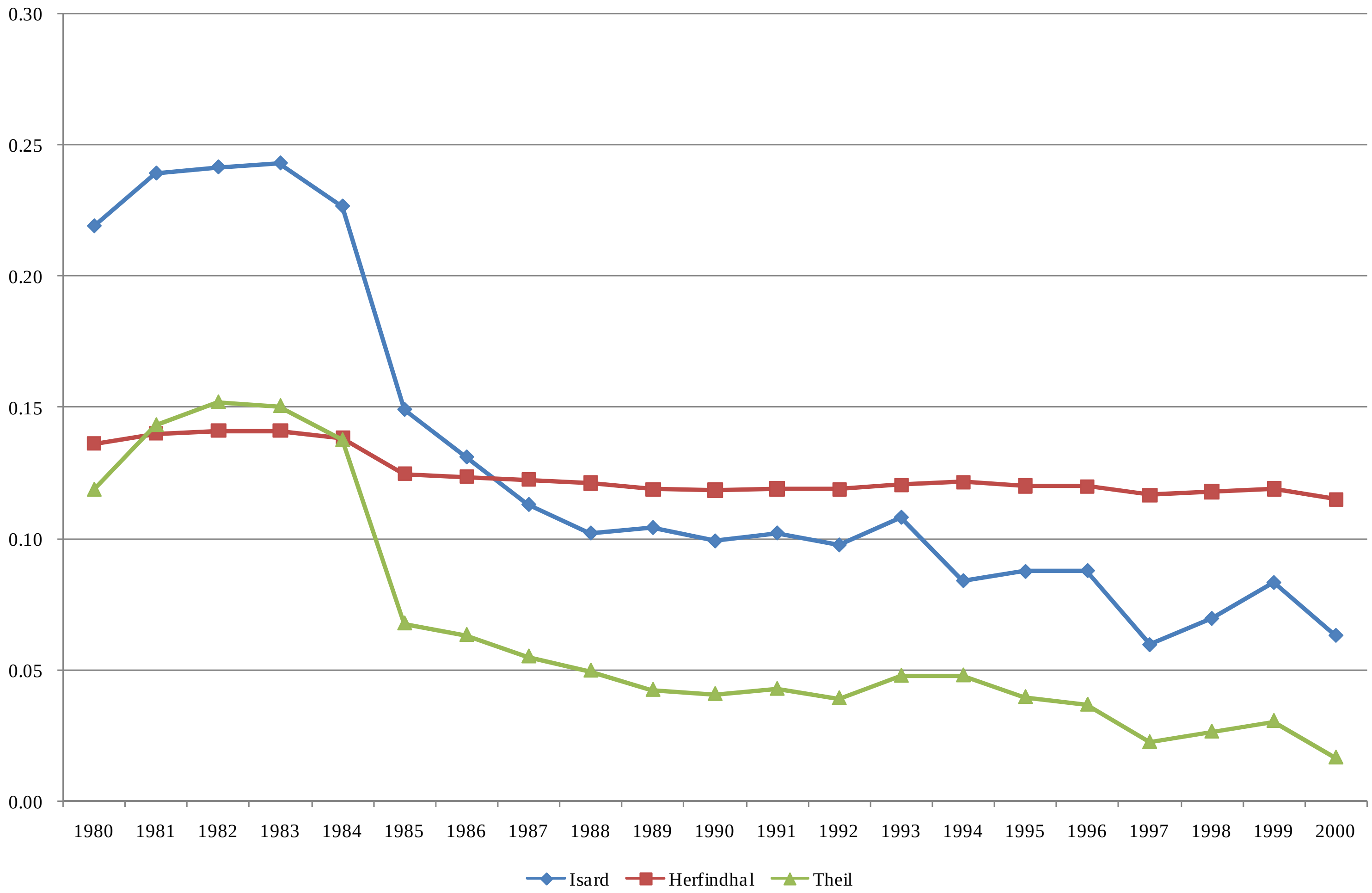
Source: *The International Yearbook of Industrial Statistics* (UNIDO).

Figure 2. Changes in Value-added of Electric Machinery Industry: Europe



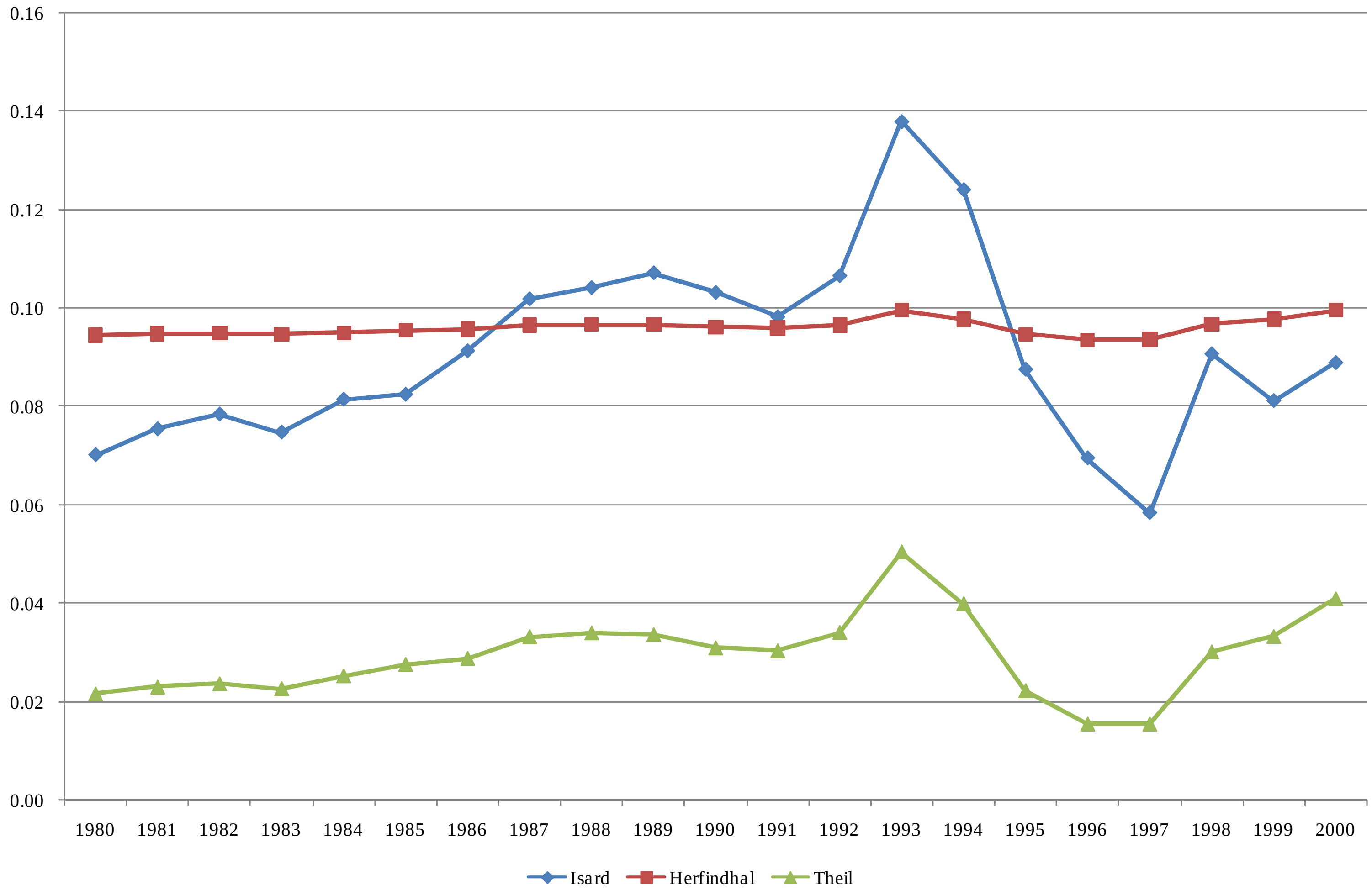
Source: *The International Yearbook of Industrial Statistics* (UNIDO)

Figure 3. Spatial Concentration in the Electric Machinery Industry: East Asia



Source: *The International Yearbook of Industrial Statistics* (UNIDO)

Figure 4. Spatial Concentration in Electric Machinery Industry: Europe



Source: *The International Yearbook of Industrial Statistics* (UNIDO)