Regional Manufacturing Change: A Model and Empirical Studies

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I. Introduction

The dynamic character of industrial location is not fully explained by classical location theory. The traditional theoretical basis of industrial location assumes the behavior of an economic man and an oversimplified economic environment, making for a static and ahistorial conceptualization. The aim of much recent work in industrial location has been to replace the static concept of traditional analysis with dynamic and process oriented models (Hakanson, 1974; Hamilton, 1974; 1978). A behavioral paradigm provides the mainstream of this approach and has attracted much attention and support in recent years. Generally, behavioral industrial location studies concern themselves with the way in which firm attributes—organization, ownership, size and decision making procedures—influence the locational behavior of firms (Keeble, 1977). However, this approach itself is not exempt from criticism. Massey argued that the behavioral approach demonstrates well the failure to solve the fundamental problems which stimulated its development (Massey, 1979:63). Neither the theories based on the traditional economic view nor the behavioral approach alone can fully explain the dynamic aspects of industrial location.

Few research efforts thus far have attempted to interpret locational changes within a synthetic framework. Successful development of a conceptual model based on a synthesis of different approaches would be potentially valuable. The behavioral approach, helpful in understanding firm spatial behavior, can be incorporated into a conceptual framework with emphasis on an economic point of view. The behavioral approach does not necessarily deviate from the conceptual framework based on economic factors; rather it may be seen as complementary to the economic framework.

1. Objectives of the Study

The purposes of this study are: 1) to describe a model of regional manufacturing change by synthesizing different theoretical approaches in industrial location dynamics; and 2) to conduct a partial test of the model based on regional manufacturing change and locational preference of firms in both a developed and a developing country.

Since the processes of change and the resulting manufacturing patterns have been identified primarily from studies conducted in developed economies, some questions must be raised concerning the applicability of such results to developing economies. What is the nature and extent of manufacturing locational change in developing countries? What are the differences and similarities in the processes of change and why? These questions need to be answered to understand the order existing in the world space economy.

In this study the focus is on a peripheral region in a developed economy (the State of Georgia, U.S.A.) and on a developing economy (the Republic of Korea). General patterns and processes of locational change are compared based on two considerations: 1) Georgia can be regarded as part of a developed economy while Korea is an example of a developing economy; and 2) Georgia and Korea can each be regarded as peripheral regions in the space economy of the United States and East Asia, respectively.(1) Complexities in the comparison are expected because Georgia is politically a subnational administrative unit and thus differs organizationally from Korea. These complexities are elaborated in the case studies reported in this research.

2. Some Definitions

Locational change in manufacturing, narrowly defined, means the relocation of productive activity. In a broader sense, locational change must include differential rates of productive expansion among regions. Locational change in a broad context, therefore, relates not only to change in the location of firms and factories but also to change in the spatial pattern of employment (Walker and Collins, 1975:1). Therefore, firm births, deaths, and relocations, as well as the differential growth of existing firms and their change in organizational status, including change of ownership, are all related to locational changes.

The following definitions of locational change, spatial entities, and processes of locational change are employed in this study.

1) Locational change in manufacturing refers to any change in spatial pattern of manufacturing activities as a result of firm births, firm deaths, relocation of firms, differential growth of existing firms, and orgianzational change of firms.

2) Several spatial entities are defined as follows:

a) The metropolitan core represents the central portion of the central city where economic activity historically concentrated and refers to

(1) Japan can be regarded as the core in East Asian space economy. See Berry et al. (1976:300-316).

downtown;

b) A regional core represents the most developed and industrialized area within a specific region. Regional periphery refers to the remainder of the region.

3) Processes of locational change are defined as follows(2):

a) Decentralization is locational change in manufacturing outward from the core within a metropolitan core-periphery structure;

b) Dispersion is locational change in manufacturing from a metropolitan area to nonmetropolitan areas;

c) Diffusion is locational change in manufacturing within a given metropolitan system and the change presumably occurs downward in the urban hierarchy.

II. Model of Regional Locational Change in Manufacturing

Locational change in manufacturing is a process in which behavioral and economic considerations are integrated in time and space. Analysis of this complex process requires an understanding of the relationship between the entire economic system and a firm's locational behavior(Massey, 1979: 57-72). The underlying relationship between locational behavior and the economic system can be depicted as Figure 1.

The economic system is divided into public and private sectors. These two sectors in the economic system directly or indirectly affect locational behavior of firms. Public sector activities such as infrastructure improvement and private sector conditions such as inertia and scale economies impact on economic variables in space. Underlying firm preference is affected by locational changes in economic conditions as well as by personal economic factors such as hometown location and amenity issues. Individual location

(2) Similar definitions are employed in other studies. The definition of dispersion in this study is slightly different from the others. See Cohen and Berry (1975); Fisher and Park (1980:100).

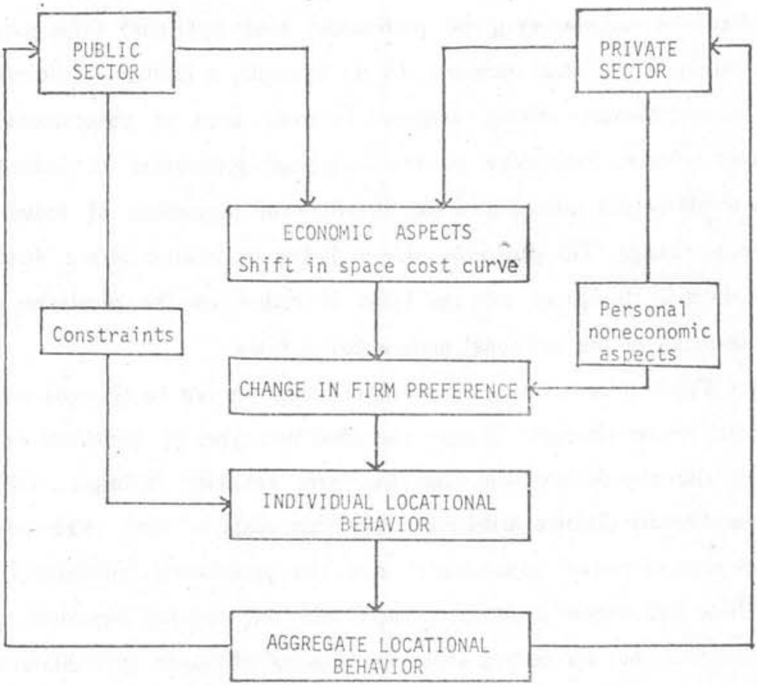

Fig. 1. Underlying Relationship Between Locational Behavior and the Economic System.

behavior is directly related to this underlying firm preference. The locational behavior of firms, however, cannot be fully explained by the firm's spatial preference because the set of constraints imposed by the public sector provide the rules by which industrial locators must abide. Infrastructure inadequacy, zoning, and government directed locations are some examples of the constraints on individual locational behavior. The sum of individual locational behaviors shapes the aggregate pattern of manufacturing location, which is then the basis for reshaping the economic system. This feedback continues over time and thus Figure 1 implies a temporal dimension in locational behavior.

As reflected in the diagram, the set of direct public sector effects (constraints) on individual locational behavior is no less important in explaining aggregate locational behavior than is the force of underlying firm spatial preference. This fact does not, however, detract from the importance of revealing and understanding the preferences that industrial firms possess for location in the space economy. If, for example, a locational constraint such as exclusionary zoning, imposed by some level of government, is suddenly relaxed, knowledge of the locational preferences of industrial firms would permit inference of the direction and magnitude of industrial locational change. The constraint side of industrial location is not directly entertained in this paper, and the focus is rather on the revelation and understanding of the locational preferences of firms.

From Figure 1 it is clear that locational behavior can be changed as the economic system changes. Ellinger identified two types of locational behavior: locationally decisive and indecisive firm behavior (Ellinger, 1977). The locationally decisive firms are "those that adapt to their environment in a process of mutual adjustments" and the locationally indecisive firms are "those that choose a location based not on long-run locational cost considerations, but for certain short-run benefits" (Ellinger, 1977:295-296). Locationally decisive firm behavior may evolve over time in a region (Ellinger, 1977). Along a similar line Averitt suggested that a center firm system can develop over time (Averitt, 1968;1979). In Averitt's scheme, the "center firms" are large in economic size and tend toward vertical integration, geographic dispersion, product diversification, and managerial decentralization. "Periphery firms," on the contrary, are smaller, less well integrated, geographically confined, relatively specialized, and generally dominated by one person or a family (Averitt, 1979:77-79). The evolution of locational behavior and firm system development in a region over time are not separate phenomena in the economic system. They are related to changes in the economic environment and are the result of interactions between firms and the economic system (Figure 1).

Within this conceptual framework an intrametropolitan manufacturing change model has been recently developed and empirically tested (Park, 1981; Wheeler and Park, 1981). In the intrametropolitan manufacturing change model, the growth pattern within a metropolitan area shows a wave-like expansion, which is a continuous approximation of a very discrete process.(3) This model of intrametropolitan locational change includes the processes of decentralization, dispersion, and diffusion and the patterns of locational change along a metropolitan core-periphery structure. Shifts in factor cost advantages and technological change in production affect the process of locational change in maufacturing. Firm spatial behavior, as in the evolution of locationally decisive firms and the center firm system, is also an important factor for locational change in maufacturing. The model further suggests that external economies and the source of innovation and incubation are not locationally static but are dynamic within the core-periphery framework of the metropolitan area.

This metropolitan manufacturing change model can be a useful starting point in the development of a regional manufacturing change model because later phases of metropolitan manufacturing change involve some aspects of interregional change, such as diffusion and nonmetropolitan industrialization. It is assumed that there exists a manufacturing core and periphery in a regional/national space economy. The intrametropolitan locational change is applied to each region's major metropolitan area even though the phase in the locational change of each metropolitan area is different at a given time. The integration of intrametropolitan locational change in a nation, therefore, reveals basic patterns of manufacturing change at the regional level (Figure 2).

Industrial change can also be related to several existing regional economic theories(Weinstein and Firestine 1978:44-67). The usefulness of the product life cycle concept in particular has been recognized in the American experience (Erickson, 1976 a;1976b;1981; Erickson and Leinback, 1979; Norton and Rees, 1979; Park and Wheeler, 1982; Rees, 1979; and Thomas,

(3) Six phases of intrametropolitan locational change have been identified: 1) initial stage; 2) metropolitan core concentration; 3) metropolitan core dominance; 4) inner city dominance; 5) suburban dominance; and 6) nonmetropolitan industrialization.

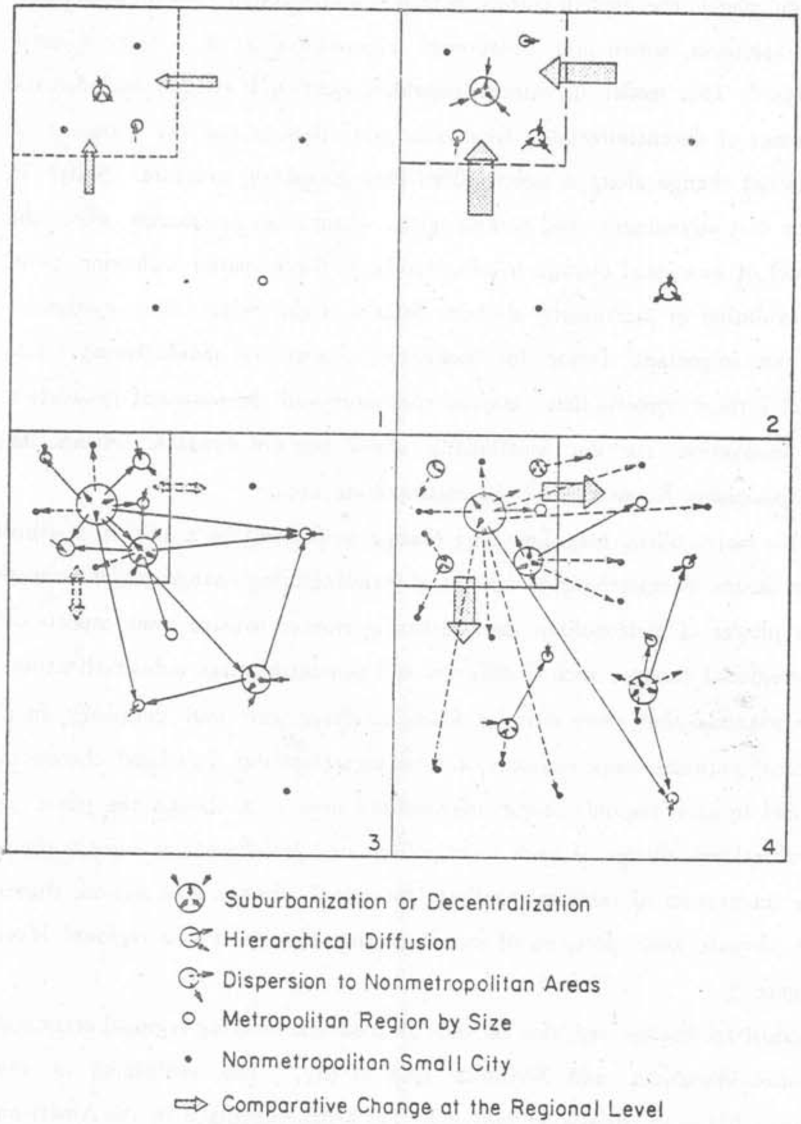

Fig. 2. Processes of Regional Manufacturing Change.

1981). Locational change at the regional level, however, is too complex to be explained by this concept alone. Manufacturing change at the regional level can be explained by synthesizing the intrametropolitan locational change model and regional economic theory. Four phases of locational change at the regional level are developed based on a synthesis of the intrametropolitan locational change model, the product life cycle concept, and behavioral aspects. These are: 1) initial industrial development; 2) core regional concentration; 3) filtering down process—hierarchical diffusion; and 4) regional industrial dispersion—nonmetropolitan industrialization.

1. Phase 1: Initial Industial Development

The first stage in the evolution of manufacturing at the regional level is characterized by the beginning of industrial development in the coreland of the national space economy (Figure 2-1). Infrastructure, labor, and markets in major urban areas in the core region are the important factors for initial attraction of industry. This initial phase can also be related to the early phase of the product cycle. Scientific and engineering skills are critical human inputs in the initial stage of the product cycle. Manufacturing activities concentrate in larger urban areas of the core region in the early phase of industrial growth because of higher levels of innovation and skills in these areas.

2. Phase 2: Core Region Concentration

With the expansion of market areas and agglomeration economies the major metropolitan areas in the core area experience high growth rates in manufacturing (Figure 2-2). Within this area, however, manufacturing activities begin to decentralize because of a shift in factor cost advantages. Suburbanization of manufacturing activities characterize large metropolitan areas. Toward the end of this phase a few center firms may develop in the core region. Larger urban areas then begin to link with smaller urban areas through the establishment of branch plants or other investments by the center firms. Most firms, however, still remain as periphery firm systems and display locationally indecisive firm behavior. Therefore, most firms concentrate their investment in the core region because of their constraints in decision space within which it might be expected to make investments and location decisions. Manufacturing concentration in the core region also can be attributed to technological development in the transportation system, growth in market size, and external economies within the area.

3. Phase 3: Hierarchical Diffusion

The highest order urban areas in the core region begion to experience a relative decline in their manufacturing base through the hierarchical diffusion to lower order centers in the regional economy and by dispersion of manufacturing to adjacent nonmetropolitan areas (Figure 2-3). This diffusion and dispersion process is related to firm system development. With technological development and emergence of larger industrial organizations, the center firm system becomes dominant in this stage. As the industrial organizations grow, the firm's decision space becomes broader (Taylor, 1975). Furthermore, with standardization of product a firm can establish new branch plants in urban areas of the peripheral region where cheap labor is available. Urban areas in the peripheral region begin to industrialize because of advantages in certain resources or because cheap labor becomes more important as a pull factor on manufacturing activities in a national or regional space. Certain smaller centers in the periphery, i.e., attractive locations in terms of power, transportation, or resource base, will grow through diffusion of manufacturing from the larger centers. Urban systems in the core region can be easily integrated by the hierarchical diffusion of manufacturing. The growth rate of the core region, however, begins to decrease early in this phase, and relative decline of manufacturing will occur later. In contrast, metropolitan areas in the periphery are gaining their manufacturing base through hierarchical diffusion of manufacturing from the core region, and the periphery as a whole begins to increase its share of manufacturing. Major urban centers in the periphery of the national space economy experience suburbanization of manufacturing.

4. Phase 4: Regional Industrial Dispersion—Nonmetropolitan Industrialization

In the last stage, the major metropolitan areas experience absolute decline in their manufacturing base through dispersion of manufacturing to nonmetropolitan areas (Figure 2-4). Primarily, development of efficient transportation in the periphery, agglomeration diseconomies in the core regions, and factor cost advantages in the peripheral region are important factors in explaining the decline. Another important factor in manufacturing change is the corporate organization's behavior. Uncertainties in firm's environments increase as an industrial system becomes more complex and interdependencies among organizations are increased (Ullrich and Wicland, 1980). Under these uncertainties, growth of organization in economic size, rather than maximum profit, is emphasized and accordingly organization's industrial investment expands spatially (Erickson, 1981; Hakanson, 1979). Center firm system and locationally decisive firm behavior are more important in regional manufacturing change than before.

In the beginning of this phase, the national urban system may be integrated through the hierarchical diffusion of manufacturing. However, later, manufacturing change will be characterized not by hierarchical diffusion but by filtering down from metropolitan areas to nonmetropolitan areas. Small towns and cities in the nonmetropolitan region, especially in the periphery, experience rapid growth of manufacturing by dispersion and filtering down from metropolitan areas. There are a number of reasons for this dispersion of industry. Technological change and standardization of manufacturing processes have a great impact on nonmetropolitan industrialization. (Park and Wheeler, 1983; 1984, in press; Rees, 1979; and Wood, 1978). Zero growth in the core region, with concurrent high growth rates in the periphery of the national space economy, is the reverse of the conventional center-periphery concept. Research and development activities and development of new product may also be conducted in the peripheral region. Factor equalization in the national space economy and other factors such as as business climate become more important in this phase (Fisher and Hanink, 1982). External economies and an industrial seedbed also emerge in the periphery. Corporate organization becomes more important in integrating the national urban system. Small cities and towns in the nonmetropolitan area, in the later parts of this phase, will grow together with specialization of each city or town (Hage, 1979).

The above four phases are a simplified discussion of very complex processes, and each phase may not be as discrete as implied by this discussion. This model, however, implies that differences in regional manufacturing change in two different areas (i.e., developed versus developing areas) are a reflection of a temporal lag in the stage of regional manufacturing change (H_1). Even though this model primarily considers a national space economy, the model can be applied to regional space economy. Assuming that a regional core and periphery can be identified within a specific area such as the state of Georgia, the four phase model can then also be applied at the state level. In this case, dispersion from the national core to the state is a separate issue. Based on the regional locational change model, it can be hypothesized that manufacturing growth and change at the regional scale reflects a core-periphery relationship (H_2). These spatial settings should affect firm spatial behavior. Therefore, consensual underlying spatial preference dimensions exist regardless of particular individual differences in firm spatial preference by type and size of firms and according to the level of economic development. It is hypothesized that these underlying spatial preference dimensions of firms are related to the actual locational change dimensions (H_3).

III. Empirical Evidence

Every feature of the model cannot be examined in the case studies. Instead, specific hypotheses derived from the model are tested. The hypotheses are:

H_1 Differences in manufacturing change at a given time in Georgia and Korea are a reflection of a temporal lag in the phase of regional manufacturing growth and change.

H_2 Manufacturing growth and change at the regional scale reflect a core-periphery relationship.

H_3 Consensual underlying spatial preference dimensions of firms reflects actual locational change in manufacturing and the stage of regional manufacturing growth and change.

Study areas selected are Georgia and Korea. The data for the case studies are of two primary types: first, regional manufacturing employment and, second, firm behavioral data. To examine manufacturing change, county units (the 159 counties in Georgia and 138 counties in Korea) were used. In Georgia, temporal coverage is for the period from 1860 to 1978 inclusive. Some inconsistency over the time period exists, however, because of variations in data availability. Major data sources used for the Georgia case study are *The United States Manufacturing Census* and *Georgia Manufacturing Directory* (Georgia Department of Industry and Trade, 1958;1963; 1969;and 1978~1979). In the case study of Korea, data by county units are not available before 1958. Employment data in the *Korea Manufacturing Census* for the period of 1958 to 1977 were utilized (Korea National Bureau of Statistics, 1963;1968;1973;1977; Korea Development and Industrial Bank, 1958).

Behavioral data for this study were obtained from surveys of individual firms conducted in Atlanta and Seoul.[4] Identical questions were asked in both mail questionnaires, except those concerning regional preferences. Of the 73 questionnaires sent to Georgia parent companies and 197 to Korean parent companies, 29 and 74 were returned, respectively. Of those sent to individual plants, responses were received from 118 of 391 questionnaires

(4) The surveys were conducted during the winter, 1980. A cover letter was addressed to each individual plant manager or president of the parent company.

sent in Atlanta and from 180 of 673 questionnaires sent in Seoul. The overall response rate was 29.3 percent. The mailed questionnaire consisted of three parts: 1) general information; 2) preferences for various location factors; and 3) regional preferences for industrial location.

1. Regional Manufacturing Change in Georgia and Korea

In earlier studies, locational change at the metropolitan level has been analyzed and related successfully to the conceptual model of intrametropolitan locational change (Park, 1981; Wheeler and Park, 1981). At the metropolitan level, the metropolitan core-periphery framework of locational change has been explored in both the conceptual model and empirical case studies. In this paper the focus was given to the examination of the general pattern and process of locational change at a regional scale.

The general trend of location change was examined by employing entropy measurements. Entropy, in information theory, is a measure of the degree of disorder or uncertainty in a system. The entropy measure of information theory has been suggested as a useful index of industrial concentration/dispersion (Theil, 1967; Finkelstein and Fiedberg, 1967; and Horwitz and Horwitz, 1968). There have been several applications of entropy measures in this type of analysis (Horwitz, 1970; Horwitz and Horwitz, 1968; Garrison and Paulson, 1973; and Griffin and Semple, 1971). Shannon's expression of entropy as a descriptive measure is (Shannon, 1948):

$$H=-\sum_{i}^{n} q_i \log_2 q_i \qquad (1)$$

where H=entropy value

q=a set of nonnegative numbers which sum to unity ($\sum_{i}^{n} q_i=1.0$)

n=number of subgroups

Thus, when H is zero, complete concentration in one region is implied, while when system entropy is maximized ($H=\log_2 N$), total dispersion occurs with complete equality in the manufacturing share of counties.

For the purpose of this study, q_i is interpreted as the ith county's relative ability to attract manufacturing activities and H then becomes a measure of regional concentration of manufacturing. Although we do not have the true value of q_i, we can estimate it from employment data as:

$q_i = y_i / Y$

where Y=total manufacturing employment in a system

y_i=a county's (i) manufacturing employment

An important property of equation (1) is that values derived from it can be used as a measure of between and within region dispersion or concentration. Theil describes a way to measure between group entropy and within group entropy that can be applied to the spatial-temporal dispersion of industry.(5) Theil's argument can be stated as follows for the purpose of this study.(6) If we group counties into R economic regions, S_1, S_2, …, S_R, where each county belongs to exactly one economic region, equation (1) can be decomposed as follows:

$$H = -\sum_{i}^{n} q_i \log_2 q_i$$

$$= -\sum_{r=1}^{R} \sum_{i \in S_r} q_i \log_2 q_i$$

$$= -\sum_{r=1}^{R} (Q_r \log_2 Q_r + \sum_{i \in S_r} q_i \log_2 \frac{q_i}{Q_r})$$

$$= -\sum_{r=1}^{R} Q_r \log_2 Q_r - \sum_{r=1}^{R} Q_r (\sum_{i \in S_i} \frac{q_i}{Q_r} \log_2 \frac{q_i}{Q_r}) \quad (2)$$

where $Q_r = \sum_{i \in S_r} q_i$ such that $\sum_{r=1}^{R} Q_r = 1.0$.

The first term on the right of equation (2) represents between economic region dispersion and takes a maximum value of $\log_2 R$ when all Q's are

(5) See H. Theil (1967). The term "dispersion" in entropy measures does not refer to the process of locational change defined before. Dispersion in the entropy measure simply means spread toward a more uniform distribution.

(6) This part is a revised and corrected one from the study of J.M. Griffin and R.K. Semple (1971).

equal. The second term to the right of equation (2) represents weighted within region dispersion. Within region dispersion takes a maximum value when all counties have equal employment proportion. Therefore, equation (2) indicates that total entropy is the sum of between region entropy and within region entropy. Between region entropy measures interregional manufacturing change among economic development regions, while within region entropy measures intraregional manufacturing change within economic development regions. Total entropy, then, is an overall dispersion trend within Georgia and Korea resulting from the mix of interregional and intraregional change.

By measuring the entropy value in equation (2) over time, the extent of dispersion of manufacturing activities can be described. Further, between region and within region dispersions over time can be compared. These measures were applied to Georgia and Korea using county units as subgroups and economic development regions as groups, respectively.

① Manufacturing Change in Georgia

The total entropy values showed a general decrease until the early twentieth century and a continuous increase in values after the 1930s (Table 1). This change in the total entropy suggests a spatial concentration of industry through the early twentieth century, followed by spatial dispersion continuing through 1978.

As total entropy is the sum of between region and within region entropy, the total entropy value may not directly represent the interregional locational change in manufacturing. In this particular case, the increase in the total entropy value derives from the increase in within region entropy. To understand interregional manufacturing change, therefore, between region entropy should be examined.

Between region entropy attained its highest value in 1900. The higher values of between region entropy in this early period can be attributable to the dispersed pattern of manufacturing in the earlier industrialized period. From the 1930s to the 1960s, the value was relatively low and

Table 1. Summary Table of Absolute Entropy in Georgia

Year	Total Entropy (H)*	Between Region**	Within Region
1860	5.709	3.800	1.908
1880	5.488	3.716	1.772
1900	5.688	3.872	1.817
1919	5.530	3.783	1.746
1929	5.781	3.855	1.926
1939	5.415	3.640	1.775
1947	5.596	3.695	1.901
1958	5.640	3.671	1.970
1963	5.744	3.682	2.062
1968	5.813	3.692	2.122
1973	6.019	3.787	2.232
1978	6.088	3.785	2.303

Source: Calculated by the author.
* 157 subregions (counties).
**18 economic development regions.

there was no marked change in the value of between region entropy. This finding suggests that Georgia experienced a regional concentration of manufacturing up to the 1960s. Since 1968, between region entropy has been increasing, and dispersion of manufacturing since then has characterized industry at the region level.

The entropy measure at the intraregional scale (within region entropy), in contrast with the between region entropy, represents a continuous increase since 1939 and suggests a trend toward a uniform distribution within economic development regions. This trend is attributable to suburbanization (decentralization) of manufacturing in metropolitan areas.

The examination of the distribution of manufacturing in Georgia from 1860 to 1978 reveals that the regional concentration and later dispersion of industrial activity identified by the entropy measure is linked to the regional core-periphery relationship within the Georgia space economy, assuming that the northwestern central region is the regional core in Georgia (Figure 3).[7] Thus, the results of entropy measures generally

(7) Manufacturing distribution patterns are mapped only for 1929 and 1978.

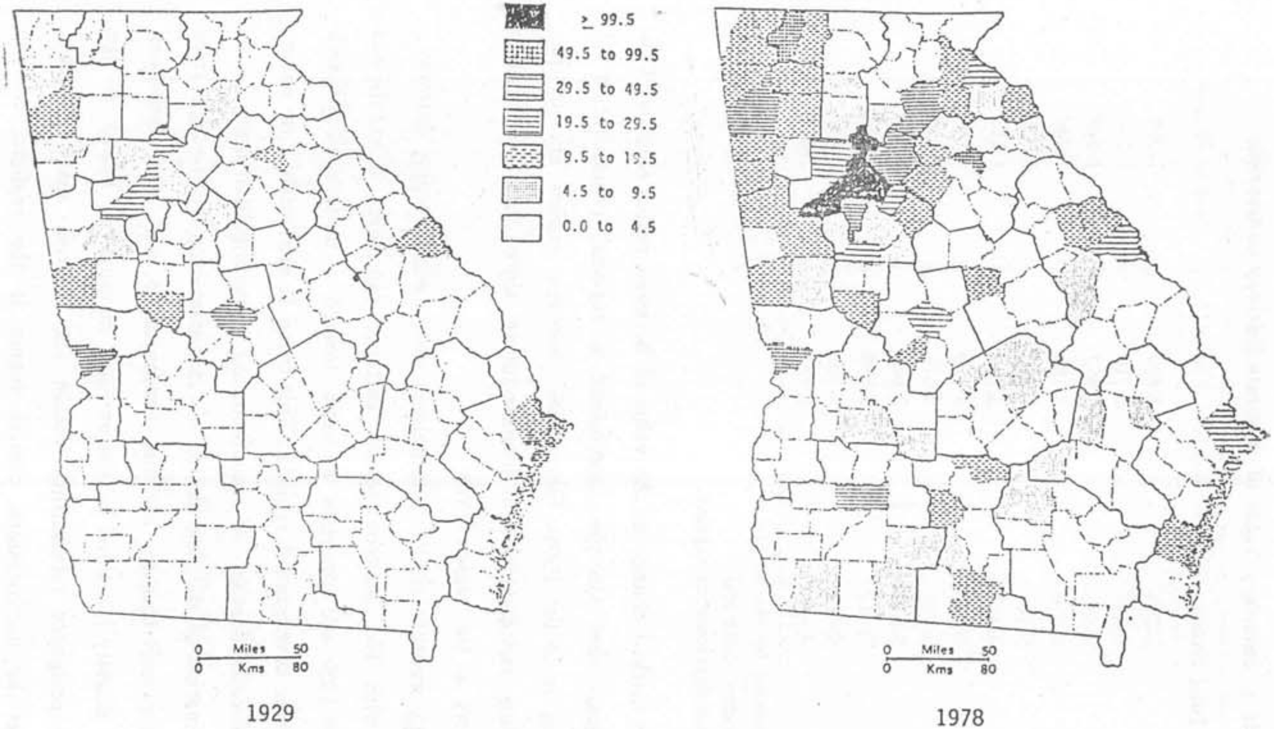

Fig. 3. Manufacturing Employment Density (per square mile) of Georgia by County in 1929 and 1978.

Source: Calculated by the author from the U.S. Manufacturing Census and Georgia Manufacturing Directory data.

Table 2. Summary Table of Absolute Entropy in Korea

Year	Total Entropy (H)*	Between Region**	Within Region
1958	4.605	3.044	1.561
1963	4.238	2.834	1.404
1968	4.047	2.685	1.362
1973	4.064	2.473	1.591
1977	4.128	2.346	1.782

Source: Calculated by the author.
* 140 subregions (counties).
**17 economic development regions.

support acceptance of the regional core-periphery hypothesis.

② Mannfacturing Change in Korea

Total entropy measure in Korea decreased until the 1960s and increased slightly in the 1970s, representing a strong concentration of manufacturing during the 1950s and the 1960s with a slight dispersion during the 1970s (Table 2). The slight increase in the total entropy value during the 1970s, however, is not attributable to locational change at the regional level. The between region entropy measure has decreased continuously during the last two decades. This decrease can be related to a strong concentration of manufacturing at the regional scale. The increase in total entropy in the 1970s is related entirely to the rapid increase in the within region entropy measure. The interpretation of the entropy measure between regions and within regions suggests that there has been not only an increasing disparity between economic development regions but also a spread of manufacturing within the economic development regions of Korea. Therefore, continuous regional manufacturing concentration has been the dominant pattern of locational change at the regional level in Korea during the last two decades.

This dominant trend of locational change in manufacturing at the regional scale in Korea can be related to the regional core-periphery framework. A distinguishing characteristic of manufacturing distribution in Korea is the bipolar concentration zones of the northwest region (Seoul and Gyeong-gi Province) and the southeast coastal region (Figure 4). [8] The

(8) Manufacturing distribution patterns are mapped only for 1958 and 1977.

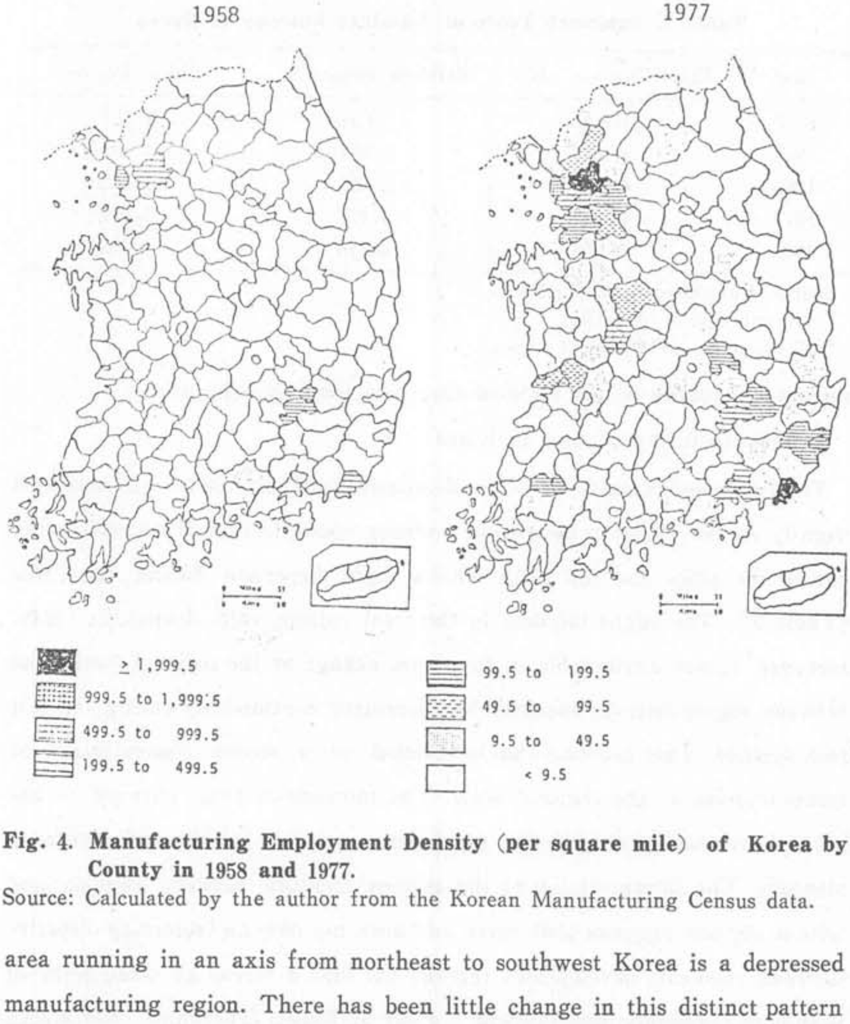

Fig. 4. Manufacturing Employment Density (per square mile) of Korea by County in 1958 and 1977.
Source: Calculated by the author from the Korean Manufacturing Census data.

area running in an axis from northeast to southwest Korea is a depressed manufacturing region. There has been little change in this distinct pattern during the last three decades. However, a continuous concentration of manufacturing in the two regions represents a dominant trend in manufacturing change during the last two decades. The disparity between the regions along the northwest to southeast axis and the regions along the axis from the northeast to the southwest existed even more than fifty years ago. (Hying, 1976). The disparity still exists in Korea, and the gap in fact has increased during the last two decades. Considering this spatial distribution of manufacturing activities in Korea, the results of the entropy

Table 3. Relative Entropy (H_r) in Georgia

Year	H_r*	Year	H_r*
1860	.783	1947	.767
1880	.752	1958	.773
1900	.780	1963	.787
1919	.758	1968	.797
1929	.793	1973	.825
1939	.742	1978	.835

Source: Calculated by the author
*$H_r=H/\log_2 157$.

Table 4. Relative Entropy (H_r) in Korea

Year	H_r*	Year	H_r*
1958	.646	1973	.570
1963	.594	1977	.579
1968	.568		

Source: Calculated by the author.
*$H_r=H/\log_2 140$.

measure provide support for acceptance of the core-periphery relationship hypothesis in Korea.

③ Comparison between Georgia and Korea

Comparisons between Georgia and Korea are useful in understanding locational change in manufacturing at the regional scale. Based on the relative entropy measure,(9) the locational pattern of manufacturing activities in Georgia is far more dispersed than that of Korea. During the last two decades Georgia's relative entropy was about .80, while Korea's was about .60 (Tables 3 and 4). The difference in the degree of dispersion in manufacturing may be attributable to: 1) historical considerations and a lag in the stage of industrial development in Korea, and 2) complexities resulting from the comparison of different political organization.

Historically, southern plants in the United States have been more oriented

(9) The relative entropy of the system can be measured as: $H_r=H/\log_{2n}$ where H_r is a relative entropy which varies from "0" (complete manufacturing concentration) to "1" (complete manufacturing dispersion).

toward smaller towns than has been true nationally (Lonsdale and Browning, 1971). The high value of relative entropy in Georgia, even around the end of the nineteenth century, reflects this feature. On the other hand, Korean manufacturing is still in the regional concentration stage, and preference is given to a regional core location. The share of manufacturing employment of the core region (Seoul metropolitan area) has continuously increased during the last two decades, and now the core region has 48.3 percent of the nation's manufacturing employment. The regional core in Georgia (the Atlanta metropolitan area) marked its highest percentage in the 1960s (32 percent), but now has only 27.2 percent of Georgia's manufacturing employment. The regional manufacturing concentration stage in Georgia is over, and presently Georgia is experiencing manufacturing dispersion from the northeastern central region. The differences in intraregional entropy measures further suggest that Georgia has experienced a continuous suburbanization trend since 1939, while Korea had a large within region concentration up to the 1960s and only recently has become involved in suburbanization.

Another possible reason for the differences in the degree of dispersion in manufacturing between Georgia and Korea involves the complexities resulting from the comparison of different political organizations. Georgia is a segment of the United States' periphery, and the regional periphery of Georgia has benefited from the dispersion of manufacturing from the U.S. national core. For example, branch plant investments of New York parent companies are important sources of manufacturing growth in nonmetropolitan Georgia. (Park and Wheeler, 1983). The constraints of international investment in East Asia is more restrictive than those of interstate investment in the United States. Therefore, the actual dispersion of manufacturing from the regional core-periphery setting in Georgia is possibly overestimated even though the underlying trend cannot be reversed. On the other hand, extensive Korean government commitments to industrial district development in the areas along the Seoul-Busan axis have probably accentuated regional manufacturing concentration during the last two decades. A similar level of impact of government policy and control in Georgia cannot be found. These complexities in making a comparison may exaggerate the differences in the degree of manufacturing dispersion at the regional scale. The underlying differences in the degree of dispersion, however, exist regardless of these complexities.

Considering Georgia as a peripheral region of the United States, recent processes of manufacturing change in Georgia can be characterized as filtering down from metropolitan areas to nonmetropolitan areas (phase four of regional manufacturing change). A recent study on branch plant investment from New York parent companies supports this process (Park and Wheeler, 1983). If Georgia is regarded as a closed unit and only Georgia based firms are considered, manufacturing change in Georgia is not yet in phase four; nonmetropolitan industrialization. Recent evidence of dispersion in industrial investments by Atlanta parent companies, however, suggests that manufacturing change in Georgia will soon be into the fourth phase. In Korea, a regional manufacturing concentration with an extensive suburbanization from larger metropolitan areas has been a dominant process of manufacturing change. Branch plant investments by larger corporate organizations, however, have had an almost negligible impact on manufacturing growth in peripheral regions of Korea. The evidence suggests that regional manufacturing change in Korea is probably in the end of the second phase: core region concentration. From this brief examination of locational dynamics in Georgia and Korea, industrial development in Korea seems to be at an earlier phase than that in Georgia, thereby supporting acceptance of the temporal lag hypothesis. Further examination of spatial preference of firms in both Georgia and Korea will clarify these discussions.

2. Firm Spatial Preference and Locational Change in Manufacturing

The firms surveyed were asked to rank six subregions based on their

Table 5. Frequencies of the Highest Preference in the Subregions by Firm Type in the Atlanta and Seoul Metropolitan Areas

	Multiplant Firms (MPF)		Single Plant Firms (SPF)	
	Atlanta	Seoul	Atlanta	Seoul
Downtown (DT)	*0 (0.0)	*1 (1.7)	*1 (1.1)	*2 (1.2)
Inner City (IC)	0 (0.0)	4 (6.7)	2 (2.1)	26 (15.4)
Near Suburb (NS)	8 (34.8)	32 (53.3)	44 (46.8)	198 (63.9)
Far Suburb (FS)	4 (17.4)	10 (16.7)	24 (25.5)	23 (13.6)
Other Metropolitan Areas (OM)	2 (8.7)	10 (16.7)	11 (11.7)	4 (2.4)
Nonmetropolitan Areas (NM)	9 (39.1)	3 (5.0)	10 (10.6)	6 (3.6)
χ^2 test	$\chi^2=16.319$, $df=4$, $p<.01$		$\chi^2=31.385$, $df=5$, $p<.001$	

Source: Compiled and calculated from the questionnaire survey by the author.
*Aggregated as one region (parentheses are in percentages of the total).
Altanta MPF vs. Atlanta SPF: $\chi^2=10.662$, $df=4$, $p<.05$ (DT, IC, and NS are aggregated); Seoul MPF vs. Seoul SPF: $\chi^2=18.117$, $df=5$, $p<.01$(DT and IC are aggregated).

assessed importance for future plant location or relocation. The six subregions are four subregions (downtown, inner city, near suburbs, and far suburbs) of the Atlanta and Seoul metropolitan areas, other metropolitan areas, and nonmetropolitan areas. The examination of preference by six subregions reveals that significant differences in spatial preference exist by type of organization and by level of regional/national economic development (Table 5). The difference in spatial preference, however, can ultimately be accounted for by two consensus spatial preference dimensions in multidimensional scaling (MDS), the first a metrorpolitan core-peripherry relationship and the second a broader regional/national core-periphery environment.

The specific model employed in this study is Carroll and Chang's MDPREF model (Chang and Carroll, 1969). This model simultaneously provides information about the psychological dimensions underlying the mapped relationships and the extent and nature of differences among subjects. The first dimension, plotted on the horizontal axis, is readily interpreted in all cases as representing a metropolitan core-periphery framework (Figure 5). (10)

(10) For detail informations for an interpretation and applications of MDPREF model, see Green and Rao(1972); Wheeler (1976;1981).

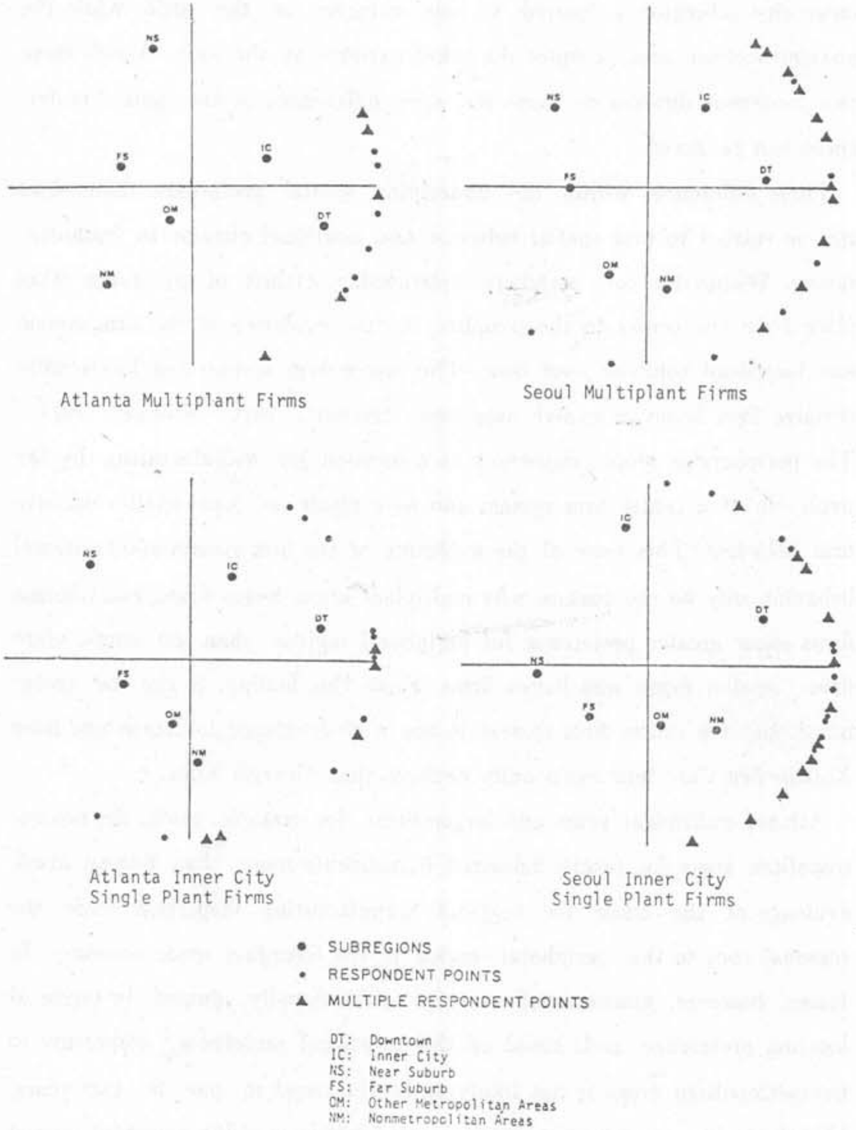

Fig. 5. Spatical Preference: Multidimensional Scaling.

The dominant pattern along the horizontal axis reveals a distinction between central city and suburban areas. The second dimension, plotted on the vertical axis, can be interpreted in all cases on a core-periphery basis at the regional/national scale (Figure 5). Generally, the near suburban or inner city subregion is located in one extreme on the scale while the nonmetropolitan area occupies the other extreme on the scale. Within these two consensus dimensions, however, some differences in firm spatial preferences can be noted.

These differences within the underlying spatial preference dimensions can be related to firm spatial behavior and locational change in manufacturing. Within the core-periphery relationship a shift of preference takes place from the center to the periphery by the evolution of the firm system and locational behavior over time. The center firm system and locationally decisive firm behavior evolve over time (Averitt, 1979; Ellinger, 1977). The periphery is more important as a location for manufacturing by the evolution of a center firm system and as a result of locationally decisive firm behavior. This view of the evolution of the firm system and locational behavior may be the reasons why multiplant firms, larger firms, and Georgia firms show greater preference for peripheral regions than do single plant firms, smaller firms, and Korea firms. From this finding, it can be recognized that the center firm system is not well developed in Korea and most Korean firms are less locationally decisive than Georgia firms.

Atlanta multiplant firms and larger firms, for example, prefer the nonmetropolitan areas for future industrial investments more than Korean firms, evidence of the trend for regional manufacturing dispersion from the regional core to the peripheral region in the Georgian space economy. In Korea, however, nonmetropolitan areas are virtually ignored in terms of location preference, and, based on this locational preference, dispersion to nonmetropolitan areas is not likely to be the trend in one or two years. Manufacturing concentration in the center region is still a dominant process of manufacturing locational change at the national scale in Korea.

The differences between Georgia and Korea can be clarified by the examination of scaling of economic development regions in the two areas. The firms surveyed were asked to rate each economic development region from 1 (best place) to 7 (worst place) for manufacturing plant location or relocation. The examination of the scaled values is quite useful in relating spatial preference to industrial location.

Northern Georgia is regarded as an adequate place for a branch plant or new plant location by Atlanta multiplant firms. This area includes the Atlanta metropolitan area and surrounding nonmetropolitan areas. The surrounding nonmetropolitan areas are rated about equal in comparison to the Atlanta economic development region. Southern Georgia is perceived as an inadequate place for manufacturing investment by Atlanta multiplant firms. Most of the single plant firms regard the Atlanta Economic Development District as a good place for industrial investment, and the southeastern region of the Atlanta Economic Development District is rated as an adequate place for plant location. The southern part of Georgia is also not preferred by Atlanta single plant firms. Atlanta multiplant firms consider more areas as medium or adequate places for plant location than do the Atlanta single plant firms, reflecting the fact that they consider broader nonmetropolitan areas for manufaturing investment than do single plant firms.

Seoul multiplant firms regarded the Seoul and Busan Economic Development Districts as good places for branch plant or new plant location. They consider the area in the axis from the northwest to the southeast, with the Seoul-Busan express highway connections, as an adequate place for industrial investment. The northeast is not favored and most of the southwest region is regarded as somewhat adequate for investment by Seoul multiplant firms. Most single plant firms regard the Seoul Economic Development District as the best location and the Busan Economic Development District as a good selection for manufacturing investment. The northeast region and most of the southwest region are regarded as poor for industrial investment by Seoul single plant firms. The area considered as an adequate choice for plant location by Seoul single plant firms is therefore limited spatially.

In this context, the difference between multiplant firms and single plant firms in Seoul is similar to those in Atlanta. This difference suggests again that multiplant firms consider a broader area in which to make the location decision, are closer to the center firm system, and reflect more locationally decisive firm behavior than do single plant firms. The difference between the highest mean scaling and the lowest mean scaling is greater in Korea than in Georgia, suggesting that a preference disparity between the core and the periphery is greater in Korea than in the Georgian space economy.[11] This difference between Georgia and Korea is fundamental to an understanding of the dispersion in the Georgian space economy and he regional concentration on the Korean space economy.

If the mean scaled values are correlated with manufacturing employment in each economic development district,[12] two general trends appear: 1) the correlation is higher in Korea than in Georgia; and 2) the correlation is higher for single plant firms than multiplant firms (Table 6). A higher correlation means that the more industrialized an area is, the more preference is given to the area. The correlation values, therefore, imply that the Seoul firms and single plant firms contribute more to the concentration of

Table 6. Correlation Coefficients between Mean Scale Value and Manufacturing Employment of the Economic Development Districts

Mean scale of Atlanta MPF vs. Mean scale of Atlanta SPF:	.799
Mean scale of Atlanta MPF vs. log of ME:	−.552
Mean scale of Atlanta SPF vs. log of ME:	−.658
Mean scale of Seoul MPF vs. Mean scale of Seoul SPF:	.966
Mean scale of Seoul MPF vs. log. of ME:	−.910
Mean scale of Seoul SPF vs. log of ME:	−.916

Source: Calculated by the author.
MPF: Multiplant firms.
SPF: Single plant firms.
ME: Manufacturing employment.

(11) The difference between the highest and the lowest mean scaling is about 5.0 in Korea and about 2.3 in Georgia.

(12) The scaled value is assumed as an interval scale for this purpose. Logarithm transformation of manufacturing employment of each economic development district in 1978 is used.

manufacturing in the industrialized region such as a large metropolitan area or regional core than Atlanta firms and multiplant firms, respectively. Atlanta firms, especially multiplant firms, consider under-developed areas for their industrial investment more than Seoul firms do. This difference can be related to the evolution of the firm system and firm spatial behavior. Even though the city of Seoul has a longer history and is much larger than the city of Atlanta in terms of population, manufacturing growth in Seoul is at an earlier stage than that of Atlanta. The center firm system has not evolved as fully in Korea, and Seoul firms are more likely to exhibit locationally indecisive firm behavior than do Atlanta firms because of the latter's earlier stage in regional manufacturing growth.

IV. Concluding Remarks

The conceptual model suggests that industrial location has a changing character. It is dynamic along certain concensus spatial dimension, i.e., the metropolitan core-periphery relationship and a regional core-periphery framework. As the conceptual model is not a precise mathematical expression, it is susceptible to interpretive bias in the evaluation of the model. Nevertheless, the patterns and processes of locational change recognized in Georgia and Korea are generally well fitted to the conceptual model. The basic framework of the regional core-periphery concept is identified by both actual locational change and firm spatial preference. Within this framework the phase of locational change currently operating in Korea is earlier than that of Georgia, representing a relative lag in regional manufacturing growth and change. Considering the results of locational change at the Seoul metropolitan area (Park, 1981), Korea seems to be at the end of phase two: regional manufacturing concentration. Georgia, as a distinct unit region, is undergoing phase three. However, if we consider Georgia as one segment of the periphery of the United States, the current manufacturing change in Georgia is the result of the beginning of phase four (nonmetropolitan industrialization) in the United States as a whole. Metropolitan areas in Georgia previously benefited from the hierarchical diffusion from the major metropolitan areas in the Manufacturing Belt, but now nonmetropolitan areas in Georgia are undergoing a growth by filtering down on the metropolitan to nonmetropolitan dimension (Park and Wheeler, 1983).

The relative lag between Georgia and Korea, as expected from the conceptual model, seems to be related to the level of regional/national economic development, the evolution of the center firm system, and the development of locationally decisive firm behavior. Spatial preference of firms demonstrates the lag more clearly, supporting the concept of an interrelationship among industrial change, firm spatial preference, and locational behavior as discussed in the conceptual model.

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