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Industrial Restructuring and Spatial Development in Korea, 1983-1993

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1. Introduction

Korean manufacturing, once considered the locomotive for the unprecedented rapid economic development of the country, has been undergoing significant structural changes since the late 1980s. Traditionally, the competitive advantage of Korean manufacturing industry has centered on labor, both quantitatively and qualitatively. However, industrial development strategy relying on labor cost advantages is no longer considered a viable means for sustained economic development during this period of fierce international competition. This might be best illustrated by the decline of the size of manufacturing employment since the late 1980s.

Industrial location has been an important determinant of spatial development in Korea, configuring the geography of economic well-being of the country for the past three decades. Unfortunately, Korean industrialization has exhibited a classic example of polarized development, corresponding to a general pattern of developing economies' spatial economy. Existing major urban centers, as well as selective growth poles, have been major beneficiaries of economic development. Most rural areas and cities in depressed regions have been the source of labor for the growing regions. Thus, regional economic disparities, with few exceptions, have been viewed as synonymous with disparities in industrial location.

Some conditions necessary for reducing spatial disparities in industrial location have been developed since the late 1980s. Most importantly, a number of urban diseconomies have significantly reduced the attractiveness of urban areas as the locus of industrial activities. Rapidly rising land prices and land shortages, housing problems, high wages, severe traffic congestion, and environment regulations have forced urban industries to move beyond city limits, or even to foreign countries. In

contrast, rural regions, with improved transportation and communication accessibility and abundant cheap land, have begun to attract industrial investment. Regional policies provided additional motivation for the dispersion of manufacturing industries by providing assistance and subsidies in various forms. This paper examines the changes in industrial location during the span of 1983 to 1993. Emphasis will be placed on the examination of the premise that recent restructuring has brought about a significant reduction of spatial concentration of industrial location.

2. Industrial Restructuring and Location Change

1) Industrial Restructuring and Space

The history of capitalism has shown a sequence of development patterns based on different modes of production, which is often called the *regime of accumulation*. Industrial restructuring, from this viewpoint, can be understood as a response to structural crisis in capitalist development, whether it was caused by the fluctuation of business cycles or the fundamental limit of capitalism (Bradburry, 1985). Each production system has its own geographical character. The spatial structure of the Fordist accumulation system (or Fordism) is associated with a series of great industrial agglomeration in core industrial regions. The main reason for this spatial concentration is to utilize economies of scale and scope, both internally and externally. The traditional spatial production system has dissolved into a new spatial system since the Fordist system entered into crisis during the late 1960s and early 1970s. A series of new industrial spaces has emerged away from traditional industrial complexes, reshaping the spatial system of production. New manufacturing locations include suburban areas of metropolitan centers, smaller cities and peripheral rural regions. In contrast, traditional industrial centers have experienced a significant loss of production employment (Scott, 1988).

The geographical dispersion of manufacturing industry has been associated with increased capital mobility, plant closure and relocation, and the development of subcontracting networks (Soja, et. al., 1983). Increasingly footloose capital can be free from traditional locational constraints due to technological innovations in transport, communications, and production. Thus, flexible production sectors found in new industrial spaces are relatively independent of the agglomeration economies of old Fordist industrial centers, such as linkages to mass production complexes and labor

skills (Storper, 1990).

Recent empirical studies reveal that deindustrialization theories based on the post-Fordist framework oversimplify ongoing regional transition. Pollard and Storper (1996), in their research on US metropolitan areas, pointed out that the pathway to regional development is multiple; neither the European-style post-Fordist manufacturing sector nor highly specialized urban information economies explains American metropolitan growth in the 1990s. Fielding (1994) found that the overall spatial structure of employment and population distribution in Europe did not show any significant shift in spite of fundamental changes in the production system. In addition, older Fordist manufacturing regions are undergoing a fundamental economic transformation by adopting new production systems to existing industries. Florida (1996) recognized these processes as *regional creative destruction.*

2) Explanations of Location Change

A variety of concepts have been proposed to explain emerging patterns of industrial location, including non-metropolitan industrialization, urban-rural shift, Snowbelt-Sunbelt shift, filtering down, spill-over, and so on. These relatively new (compared to two centuries of industrialization) locational tendencies revealed a significant departure from the classic pattern of urban concentration. There has been a realignment of the core-periphery relationship in production as industrial heartlands lost competitive advantage to the newly growing industrial spaces in formerly peripheral regions.

One widely held belief is that nonmetropolitan industrialization or industrial decentralization is a normal process of industrial development in advanced economies (Lonsdale and Seyler, 1979). Product-cycle theory, assuming a close relationship between industrial location and the stage of economic development, explains spatial decentralization using the filtering down process (Erickson, 1976; Erickson and Leinbach, 1979). Three distinct phases in the development of production processes and resulting locational patterns were identified. In the first phase, when an industrial product is introduced, location is highly concentrated in high technology regions or large urban areas in order to utilize the pool of skilled labor and a variety of external economies in these areas. During the following phase, when the demand for the product increases rapidly, production is transformed into a mass production method. The new locational requirement for these growing industries is low costs sites, typically smaller urban areas. During

the final stage of the product-cycle, the production process becomes standardized and routinized, with less reliance on technology as well as agglomeration economies or economies of scope. Production can be most effectively done by branch plants located in different nonmetropolitan areas that provide advantages in assembly costs.

It was noted that differential settlement size offers different competitive advantage. Thus, the spatial division of labor in manufacturing activities is manifested through regional hierarchies (Moriarty, 1991). Regions at lower levels of the hierarchy have advantages in standardized production whereas those at upper levels have competitive edges in newly growing high technology industries (Norton and Rees, 1979). In addition, there is an order in the spatial filtering process. Within rural regions, areas that are adjacent to metropolitan centers tend to grow faster than non-adjacent rural areas (Haynes and Machunda, 1987). High technology industries also tend to decentralize toward peripheries as they mature and production processes are standardized. This occurs when access to urbanization economies such as specialized inputs, research facilities and skilled labor market are no longer the primary conditions for the location of high technology industries (Barkley, 1988).

Following Keeble, et. al. (1983), there are three major explanatory frameworks for the decentralization of industrial location. The first approach, the production cost explanation, highlights cost difference as the mechanism for locational shifts from urban to rural regions. In general, urban locations have higher operating costs, including wages and salaries, and factory rents. High production costs in urban areas reduce competitiveness, resulting in lower profitability. This decentralizes urban industries to rural settlements. Urban disadvantages in production costs are represented by agglomeration diseconomies. Agglomeration of manufacturing firms and employment in urban areas has a positive impact on productivity, but after a certain level, deglomerative forces come into being due to diseconomies from congestion, rising land costs, lack of space, high wages, labor conflicts, etc (Hakanson and Danielsson, 1985). Therefore, larger metropolitan centers are more prone to losing manufacturing industries. A decline in the strength of relationship between urban hierarchies and manufacturing employment density might reflect the diseconomies of large cities (Moriarty, 1991). The cost advantage explanation of new industrial space is not limited to urban to rural shift, but can be applied at different regional scales. Chinitz (1986) cites the cost pull of the Southern US states as

the main force for the locational shift of US manufacturing. The South has lower labor costs, lower operating costs, lower local taxes, and a higher level of subsidies for capital investment, physical facilities and worker training, compared to the North. Carlino and Mills (1987) also emphasize the importance of the spatial variation of production costs for the regional shift of manufacturing employment.

The second approach, constrained location theory, focuses on the physical constraints of urban location that acts as a ceiling on industrial growth. Firms need to move out to suburban or rural areas or to displace labor for machinery for further extension of production capacity. In either case, urban manufacturing employment decreases. According to Tulpule (1969), growing firms need larger factory site to accommodate new machinery to increase output. Thus, industries requiring more space tend to locate in rural areas where land is readily available at lower costs. Fothergill et al. (1987) examined the relationship between employment change and space availability. They found that regions with higher proportions of old buildings and heavily built-up sites with little room for expansion were associated with larger employment losses. Scott (1982) also considered the lack of space in central cities an important motivation for the industrial dispersion to peripheral areas. Thus, capital intensive firms with horizontal plant layouts tend to locate at peripheral areas, while labor intensive (and competitive) firms concentrate at the center of metropolitan labor markets. The decentralization tendency is stronger when new investment strategies attempt to replace labor with machinery.

The last approach, capitalist restructuring theory, emphasizes capital mobility and flexible production system as the explanation of spatial shift of industrial location. Capital employs a variety of strategies to reorganize the production system over space due to its increased mobility and technical innovation. The range and scope of spatial forms of production organization have greatly increased (Hudson, 1988). An increasingly footloose capital freed from locational constraints more easily makes use of spatial decentralization as an instrument to secure profit. Interregional and international shifts of production facilities are dominated by branch plants, which are specialized for standardized mass production supported by automated technology. In contrast, strategic and control functions such as planning, R&D, administrative and bureaucratic activities are highly centralized in core regions. Therefore, there is a clear spatial division of labor between centers and peripheries, depending on the comparative

advantage of respective regions (Capello, 1994).

The rise of a series of new industrial spaces based on flexible production systems has caught recent attention. Relying on the principle of flexible specialization, firms in new industrial agglomerations are interconnected through dense networks of horizontal and vertical linkages. These new industrial ensembles can arise out of nowhere (such as the Silicon Valley), but more often are found in pre-existing localities with skills and resources for new production system. They include the Third Italy, Los Angeles, New England, the M4 Corridor, etc. In the latter case in which development is based on endogenous resources, new industrial space does not generate totally new urbanization. This might be the main reason for the relatively stable spatial structure of settlement systems, in spite of considerable changes in production systems (Fielding, 1994). To some scholars (Brown et al, 1996; Camagni, 1991; Florida, 1996), theories based on flexible accumulation are overly pessimistic about the prospect of revitalization of old industrial regions. According to their view, restructuring of traditional industrial centers does not mean monotonic decline of old centers or acceleration toward post-Fordist accumulation system. Rather, there is a simultaneous process of regeneration of some old industries in new localities and decline in other traditional sectors.

3) Factors of Industrial Location Change

There are many factors affecting the location of industrial activities across space. The selection of testable variables largely depends on the theory and method upon which research is based, and the availability of data. In addition, it might be possible that a set of variables performing well in one region do not do well in another region. The same notion could be extended to temporal sequence, industrial sectors, and spatial scale. In this section, some locational factors considered important for industrial and spatial restructuring in Korea are discussed. It must be noted that these factors are not comprehensive. For example, various social, behavioral, and political variables are not considered because no such data are readily available at regional level. Instead, the focus is on economic and geographical factors.

Economic variables have been considered the most important factors for the location of manufacturing industries because they are directly related to the costs of production. Three economic factors are considered in this study. First, the availability of low wage labor is one of primary factors for regional as well as global shifts of industrial location (Dicken, 1992;

Haynes and Machunda, 1987; Keeble, 1976). Low regional wage levels are often accompanied by sizable labor reserves, often the result of underemployment i.e., employment in part-time jobs or in occupations in which the worker's skill and ability are not fully used. Thus, even if the unemployment rate is low in a region, the existence of low wage workers means a potential labor supply for high paying firms (Kale and Lonsdale, 1979). Industrial wage rates tend to increase as city size increases (Scott, 1982).

Second, the price and availability of industrial land have been central elements in the constrained location model. According to Fothergill and Gudgin (1982), over one half of the difference in employment change between urban and rural areas is due to the employment expansion of existing plants. They claim that the shift of manufacturing out of large cities is because urban firms have great difficulties in undertaking physical expansion. The importance of low cost industrial land in uncongested areas has been increased by the development of transportation networks and the increased use of the automobile by workers. The significance of land price (as well as availability) as a factor of industrial location will be greater in countries with smaller territory and higher density.

The last economic factor is industrial structure. The demand for labor is strongly affected by the mix of industries. Regions with favorable (thus growth oriented) industrial structures will require a larger labor force than those with unfavorable sectoral composition. Keeble (1976) showed that regional industrial structure, measured by the share of regional employment in rapidly growing industries at the national level, was closely associated with manufacturing employment change. Another important measure of industrial structure, with respect to the demand for employment, is labor intensity (or labor-output ratio). It was noted that capital intensive industries have different locational tendencies from labor intensive industries (Fothergill et al, 1987; Scott, 1982). Therefore, in developing economies such as Korea that exhibit a strong tendency to transform industrial structures from labor intensive toward capital intensive, the structural factor will be strongly associated with employment change.

According to classic location theory, under isotropic assumptions, distance (thus transportation cost) is the single most important factor in determining the optimal location of manufacturing industries. The importance of distance (to market, raw materials, and suppliers) has declined significantly as a result of the development of modern transportation and tele-communication

networks. However, accessibility is still considered the primary reason for the geographical agglomeration of vertically and horizontally interrelated industries in the new flexible production system. One major difference between classic and modern location theory is that the former is focused on the minimization of transportation cost, whereas the latter emphasizes linkages and transactions among manufacturing firms and between manufacturing and business service firms (Scott, 1988).

Agglomeration economies have been recognized as a geographical source of cost reduction. Agglomeration economies, including urbanization and localization economies, can be defined as the savings in costs occurring from the accumulation of industries in a particular region. This enables firms to share external expenses with others. However, there is a limit to the scale of agglomeration economies, with decreases after a certain point (Smith, 1971). During the periods of locational decentralization, various types of negative agglomeration economies have been noted as major causes for the decay of industrial centers. These factors include high land and housing prices, traffic congestion, pollution, high labor costs, and high incidence of crime. These agglomeration diseconomies raise production costs directly and indirectly, thus reducing the economic efficiency of manufacturing firms. This, in turn, encourages the migration of existing industries to less congested areas.

3. Data and Methodology

This paper focuses on the location changes of Korean manufacturing from 1983 to 1993. These ten years is divided into two sub-periods, before and after 1988, a turning point for the growth of Korean manufacturing employment. Manufacturing employment reached its highest level in 1988 and decreased until 1992, increasing slightly in 1993. Therefore, the first five years are an extension of the period of rapid industrialization since the early 1960s, whereas the last five years are considered restructuring period. It is expected that some significant differences in the spatial processes of Korean manufacturing industry can be revealed through the comparison of these two periods. Analyses will be carried out at city and county level, excluding two remote island counties without meaningful industrial activities. There are 187 regional units (52 cities and 135 counties) during the first period and 208 units (73 cities and 135 counties) during the second period. The main data source is the manufacturing survey compiled by the National Statistical Office of Korea. Non-manufacturing data include expressway accessibility, land price and population. The beginning (1983),

mid-point (1988) and the last year (1993) censuses will be used for analysis. The regional shift of industrial location will be examined using the location quotient and regression analysis. Differential performance by different types of regions will be identified. In addition, a set of factors will be introduced and tested to explain locational changes.

4. Results of Analysis

1) Industrial Location

Table 1 and Figure 1 show manufacturing employment changes between industrializing and restructuring periods by urban and rural areas. During 1983 to 1988, urban areas accounted for about two-thirds of manufacturing employment growth. The amount of growth in urban areas was about two-folds that of gains in rural areas. Within urban areas, larger cities with population greater than 100,000 absorbed the majority of growth. But metropolitan cities, in spite of a large absolute increase, experienced the lowest growth rates. Within rural areas, counties adjacent to urban areas accounted for the majority of rural manufacturing employment growth. Of adjacent counties, those near metropolitan centers gained more employment than those near smaller cities.

The restructuring period (1988-1993) reveals dramatic differences from the earlier period. Urban areas recorded a large decrease while rural areas continued to add manufacturing jobs, although at a reduced rate. The loss of urban manufacturing employment was most significant in the largest cities, both in absolute and relative terms, accounting for more than 80 percent of the loss in urban regions. Medium sized cities also lost employment, but not as drastically as in the largest cities. It is notable that the smallest cities gained employment in spite of the general deindustrialization trend of urban economies. On the contrary, all types of rural regions gained manufacturing employment during the restructuring period. Those rural counties adjacent to urban areas gained more employment than nonadjacent counties, accounting for more than two thirds of the growth in total rural manufacturing jobs. The share of nonadjacent rural regions increased during the restructuring period, which is most apparent in growth rates.

Therefore, the most obvious phenomenon during the restructuring period is the deurbanization of industrial employment and resulting rural industrialization. A clear pattern is revealed through the settlement system. During the first period, growth rates were much higher in smaller city groups than in larger ones. During the restructuring period, larger city groups

Table 1. Industrial Location Change by Urban and Rural Region

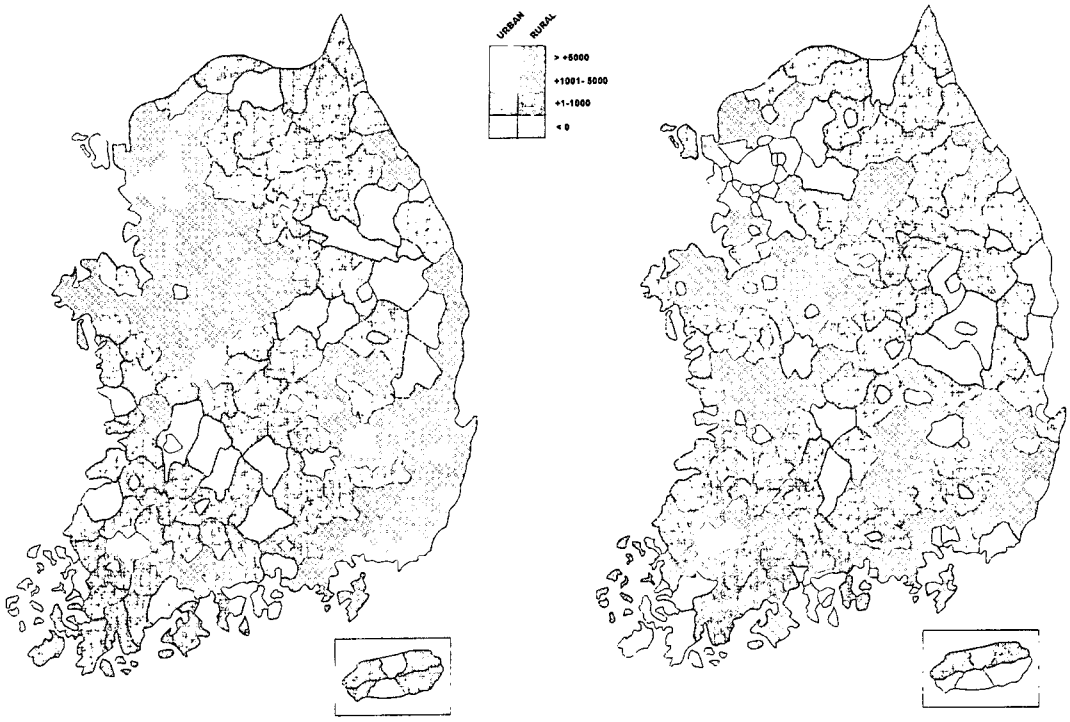
	Location Quotient				Employment Change			
	1983	1988(A)	1988(B)	1993	1983-88	1988-93	1988(C)	1993(D)
Nation	1.00	1.00	1.00	1.00	905,689	-236,441	1.41	0.92
Urban	1.30	1.13	1.14	0.98	599,099	-414,010	1.33	0.84
Metropolitan	1.22	1.01	1.01	0.83	285,748	-338,781	1.24	0.77
Medium	1.60	1.37	1.46	1.26	233,500	-99,840	1.40	0.89
Small	0.94	1.46	0.98	1.16	79,851	24,611	2.34	1.14
Rural	0.47	0.71	0.64	1.07	306,590	177,569	1.82	1.33
Adjacent	0.69	1.00	0.88	1.37	237,400	129,534	1.81	1.29
Metropolitan	0.99	1.31	1.20	1.71	130,351	52,899	1.79	1.26
Nonmetro.	0.50	0.77	0.72	1.18	107,049	76,635	1.82	1.32
Nonadjacent	0.21	0.34	0.28	0.58	69,190	48,035	1.86	1.50

Note: 1) (A): Administrative areas are based on the year 1983
(B): Administrative areas are based on the year 1993
2) (C), (D): 1983 and 1988 = 1.00
3) Metropolitan Cities: Seoul, Pusan, Taegu, Inchon, Kwangju, and Taejon
Medium cities: non-metropolitan cities with population larger than 100,000 in 1983 and 1988
Small cities: non-metropolitan cities with population smaller than 100,000 in 1983 and 1988

experienced negative growth rates, whereas the smallest cities recorded positive growth. In rural areas, nonadjacent counties performed better, followed by counties adjacent to nonmetropolitan cities and metropolitan cities.

The accelerated deurbanization and decentralization of manufacturing employment are much more apparent in location quotients. Urban areas as a whole have witnessed decreases in the location quotients, whereas rural areas have seen increases over the time periods. The decrease in urban areas was most evident in the largest cities. The location quotient of these cities was above average initially, about average at the mid-point, then below average in the final year. The opposite trend is seen in the smallest cities. Medium sized cities are more industrialized than other city groups, but tended to lose dominance over time. In rural regions, all types of counties experienced increases in location quotients throughout the research period. The location quotient for rural areas as a whole was only 36 percent that of urban areas in 1983 but became higher than urban areas in 1993. In fact, rural areas that are adjacent to metropolitan cities became the most highly industrialized in 1993.

An additional comparison of industrial location change during industrializing and restructuring periods is carried out by examining the level of industrialization Table 2. Dramatic changes are revealed in employment growth during



a) 1983-1988 b)1988-1993

Figure 1. Change in Manufacturing Employment

the two time periods. During the industrializing period (1983-88), two types of industrialized regions accounted for more than two thirds of total growth. The vast number of the least industrialized regions, mostly rural counties, accounted for only 4 percent of national growth. These facts suggest that the spatial concentration of industrial location proceeded within established industrial areas during the rapidly industrializing period.

Remarkable changes occurred during restructuring period (1988-93). The most highly and the least industrialized regions moved in opposite direction from moderately industrialized and moderately less industrialized regions. Moderately industrialized areas led deindustrialization, accounting for more than 90 percent of the decrease in national manufacturing employment. The loss is equivalent to more than 20 percent of base employment, or about one-third of the gain from the previous period. The least industrialized regions

Table 2. Industrial Location Change by Industrialization and Core-Periphery

	Location Quotient				Employment Change			
	1983	1988(A)	1988(B)	1993	1983-88	1988-93	1988(C)	1993(D)
Nation	1.00	1.00	1.00	1.00	905,689	-236,441	1.41	0.92
Industrialization								
Industrialized	2.06	1.84	1.87	1.67	621,570	-199,676	1.44	0.90
Highly	2.80	2.49	2.79	2.52	387,937	19,093	1.58	1.02
Moderately	1.67	1.44	1.40	1.15	233,633	-218,769	1.31	0.79
Less indust.	0.52	0.54	0.52	0.57	284,119	-36,765	1.36	0.96
Moderately	0.71	0.68	0.64	0.65	245,186	-67,619	1.33	0.93
Least	0.10	0.16	0.11	0.24	38,933	30,854	1.81	1.63
Core-periphery								
Core	1.29	1.23	1.23	1.14	778,150	-303,344	1.40	0.89
Capital	1.24	1.19	1.19	1.06	492,644	-151,082	1.48	0.90
Southeast	1.36	1.30	1.30	1.26	285,506	-152,262	1.31	0.87
Periphery	0.39	0.44	0.44	0.62	127,539	66,903	1.45	1.16
Southwest	0.43	0.49	0.49	0.68	119,188	57,688	1.47	1.15
Others	0.19	0.20	0.20	0.32	8,351	9,215	1.34	1.28

Note: 1) (C), (D): 1983 and 1988 = 1.00
2) Industrialization is based on the LQ in 1983 and 1988
Highly industrialized regions are those with LQ larger than 2.0
Moderately industrialized regions are those with LQ larger than 1.0
Moderately less-industrialized regions are those with LQ larger than 0.2
Least industrialized regions are those with LQ less than 0.2
3) Capital region: Seoul, Inchon, and Kyonggi Province
Southeast region: Pusan, Taegu, and Kyongsang Provinces
Southwest region: Kwangju, Taejon, and Jolla and Choongchong Provinces
Other region: Kangwon and Cheju Provinces

added more than 60 percent of base employment during the restructuring period. The most highly industrialized regions also experienced a net gain, but the size was negligible compared to industrializing years.

The differential performance by regions of different levels of industrialization was revealed through changes in the location quotients Table 2. Two industrialized regions and moderately less industrialized regions experienced a decline in the LQ. Only the least industrialized areas witnessed an increase in the LQ. As a result, there was a general decline in the disparity in the index between industrialized and less industrialized regions. In 1983, the location quotient of the most highly industrialized group was 28 times larger than that of the least industrialized group. The difference diminished to 11 times in 1993.

The results strongly suggest that the classic core-periphery model is not a valid analytical framework for the explanation and prediction of locational changes in contemporary Korea. The

majority of employment loss has occurred in established areas, while employment has grown in the least favorable regions. It must be emphasized, however, that the most heavily industrialized regions did not lose employment. The decline in the location quotient of this region is due to greater population growth. The ascendance of the least industrialized areas and the status quo of the most highly industrialized areas are somewhat different from advanced economies, in which traditional industrial centers are losing competitiveness and the most peripheral areas have remained largely underdeveloped. These characteristics are also quite different from developing nations in which acute spatial disparities are persistent between cores and peripheries. A third comparison of industrial location change during the two periods focuses on core and peripheral areas Table 2. The core-periphery comparison provides a new dimension with regard to recent industrial location changes in Korea. During the industrializing period, manufacturing employment change shows a typical core-periphery relationship. Core regions accounted for as much as 86 percent of new manufacturing jobs, well above the share of industrialized areas as a whole or that of urban areas. Within core regions, the capital region absorbed more than one half of national employment growth, while the Southeast region accounted for about one third. Peripheral areas attracted only 14 percent of new manufacturing employment during the period. The Southwest region accounted for most of employment growth of peripheral areas. In terms of growth rates, however, there was no significant difference between core and peripheral areas. Even the least industrialized peripheral areas performed as well as the heavily industrialized Southeast region in growth. Therefore, the pattern during the first period can be summarized as universal gains in terms of growth rates, but a clear core-periphery relationship in absolute growth.

There was a radical breakup in the long-lasting core-periphery pattern of manufacturing employment growth during the restructuring period. Core regions lost a considerable number of industrial workers during the restructuring period, exceeding total national decreases. The capital region and the Southeast region lost about the same amount of employment, roughly equivalent to 10 percent of base employment. Peripheral areas recorded a net gain, although absolute growth was reduced to one half that of the previous period. Most of the growth occurred in the Southwest region, but other peripheral areas did much better in relative terms. In fact, these areas added more employment during the restructuring period than the previous

period. Therefore, the relationship between core and periphery was completely reversed during restructuring, which might be comparable to the Snowbelt-Sunbelt shift in the US, though at a smaller scale. Location quotients mirror the regional shift of manufacturing employment growth. In particular, the capital region is not an especially industrialized region when population is considered. The Southeast region has maintained its status as the industrial heartland of Korea. Peripheral areas, while still less industrialized than the nation as a whole, are rapidly catching up to core regions.

2) Regression Analysis

A bivariate regression model integrating intercept and slope dummy variables was applied to test the regional effect on industrial location change. The model and hypotheses can be summarized as follows:

Model: $DLQ = (a + b_2) + (b_1 + b_3) LQt_1 + e$

where: b_2 and b_3 are intercept and slope dummies; t_1 represents initial time point.

Hypotheses: H_1: $b_2 = 0$; H_2: $b_3 = 0$; H_3: $b_2 = b_3 = 0$

The results from the regression model are presented in Table 3, confirming overall differences in the pattern of employment growth between contrasting regional types (urban/rural, industrialized/less industrialized, and core/periphery). First, the large F statistic from the Chow test strongly supports structural differences in growth patterns between the contrasting regions. The null hypothesis ($b_2 = b_3 = 0$) is rejected for both industrializing and restructuring periods. In addition, the F statistic is consistently larger for the second period, suggesting a larger structural difference during the later period. With regard to the intercept dummy, the null hypothesis ($b_2 = 0$) is rejected only for industrialized versus less industrialized regions. This result is presumable because regional categorization is based on the location quotient in the beginning points.

However, the null hypothesis assuming an identical initial level of industrial development between rural and urban areas, and core and periphery, cannot be rejected for any period. With regard to the slope dummy, the null hypothesis ($b_3 = 0$) is rejected in all cases with the exception for core versus periphery during the first period. This implies significant regional differentials in the growth rate of manufacturing employment between two opposite type of regions. Again, the test statistics are consistently larger for the restructuring period, indicating increasing differentials between the regions. In addition, the regression analysis provides evidence of spatial

Table 3. Test of Regional Effect on Location Change

	Urban/Rural	Industrialized/ Less-industrialized	Core/Periphery
1983-1988			
a	0.080 (2.647)**	0.060 (1.455)	0.111 (2.541)*
b_1	0.171 (4.101)**	0.081 (0.715)	-0.225 (-2.548)*
b_2	-0.039 (-0.625)	0.420 (3.390)**	0.090 (1.406)
b_3	-0.343 (-6.877)**	-0.308 (-2.537)*	0.098 (1.058)
Chow F	36.51**	6.18**	3.21*
1988-1993			
a	0.220 (5.325)**	0.127 (2.195)*	0.143 (2.446)*
b_1	0.185 (4.224)**	0.268 (1.874)	0.313 (3.042)**
b_2	0.039 (0.517)	0.686 (4.234)**	0.161 (1.874)
b_3	-0.503 (-8.785)**	-0.612 (-3.976)**	-0.513 (-4.701)**
Chow F	55.60**	10.80**	11.55**

Note : 1) Base model: $DLQ = a + b_1LQt_1 + e$ (1)
Dummy model: $DLQ = a + b_1LQt_1 + b_2D + b_3DLQt_1 + e$ (2)
2) Parentheses are T statistics
3) Chow $F = \{(SSE_1 \; SSE_2)/(K+1)\}/\{SSE_2/(N-2K-2)\} \sim F_{K+1,\ N-2K-2}$
where, SSE_1: Residual sum of square from equation (1)
SSE_2: Residual sum of square from equation (2)
K: Number of restriction (=1)
N: Number of observations
** Significant at .01
* Significant at .05

convergence or catch-up process. The coefficients of intercept dummies are positive in five out of six cases, and those of slope dummies are negative in five out of six cases. This indicates that benchmark regions (urban, industrialized, and core regions) tend to have a higher level of industrialization overall, but that growth of the location quotient of these regions tends to fall more rapidly compared to opposing regions.

A multiple regression model was also run for the two periods in order to test factors that are related to location change Table 4. Identical variables were used for both periods to examine changes in the impact of independent variables. The proposed regression model explains relatively small portions of the variations in the growth rates of

Table 4. Test of the Factors of Employment Change

Dependent variable: growth rates of manufacturing employment

	1983-1988		1988-1993	
Independent variables	Standard : zed Coefficients	t values	Standard : zed Coefficients	t values
CONSTANT	-	5.590**	-	6.097**
WAGE	-0.250 (0.742)	-3.284**	-0.157 (0.874)	-2.522*
CAPITAL	0.325 (0.731)	4.238**	0.211 (0.725)	3.086**
LABOR	-0.097 (0.693)	-1.229	-0.287 (0.714)	-4.168**
LAND	-0.340 (0.852)	-4.786**	-0.173 (0.865)	-2.771**
PDEN	-0.107 (0.841)	-1.490	-0.250 (0.837)	-3.933**
LQ	0.074 (0.864)	1.045	-0.206 (0.822)	-3.212**
ACESS	0.126 (0.902)	1.818	0.141 (0.905)	2.300*
R2	0.230		0.324	
F	7.643**		13.705**	

Note : 1) WAGE = initial regional wage ratio
CAPITAL = growth rate of capital-labor ratio
LABOR = initial labor-capital ratio
LAND = growth rate of land asset to output ratio
PDEN = initial population density
LQ = initial location quotient
ACCESS = dummy variable for rural expressway
2) Parentheses are tolerance values
** Significant at .01
* Significant at .05

regional manufacturing employment for both periods. The relatively low coefficients of determination reflect the omission of other variables significant for industrial location change in Korea. They include variables related to industrial and locational policies, labor relations, labor market, infrastructure, government regulations, behavioral factors, business organization, and so on.

The first independent variable (WAGE) tests the effect of the regional wage ratio. The hypothesis, that a negative association exists between the two variables, can be accepted for both industrializing and restructuring periods. The impact of wage ratio on employment growth was stronger in the period of rapid industrialization than the restructuring period, possibly reflecting the differences in the capacity of labor supply for the two periods. The adjustment of labor inputs to the wage ratio is more flexible when labor supply is abundant than in the context of labor

shortages and strong labor power. Reduced flexibility in the labor market better represents the period of industrial restructuring than industrialization.

The second independent variable (CAPITAL) supports a positive association between capital accumulation and employment growth for both periods. This suggests that capital investment has been an important source for the creation of new manufacturing jobs. The possibility of a labor shedding effect by new capital investment, as a substitute for labor inputs, was insufficient to change the coefficient of the variable to a negative value. This result supports the hypothesis that high rates of capital investment have been a consistent source of industrial development in Korea. The relationship of capital accumulation to employment growth declined during the restructuring period. This might reflect the fact that a larger portion of new capital investment has been expended on such areas as quality or productivity enhancement facilities, including research and development activities that demand fewer labor inputs.

The third independent variable (LABOR) tests the effect of labor intensity on the growth of manufacturing employment. The hypothesis proposing a negative relationship between the two variables can be accepted only for the restructuring period. The coefficient of labor intensity is also negative for the industrializing period, though not significant. This implies that regional industry structure has become a more important determinant of regional industrial growth in recent years. It also indicates that regions that depend heavily on labor intensive industries are more likely to lose employment compared to regions with less labor intensive (or capital intensive) structures, especially during industrial restructuring.

The fourth independent variable (LAND) tests the effect of changes in land prices. The hypothesis stating a negative effect of growth in the ratio of land assets to gross output can be accepted for both periods. The result suggests that regions that witnessed higher growth in the ratio of land assets would have difficulty in attracting new industrial employment. It is apparent that manufacturing industry has been losing its competitive edge to non-manufacturing activities in those areas with a rapid rise in land prices. An increasing share (value) of land assets to total output will enable existing firms to sell factory sites and move out of current locations. On the other hand, a higher ratio of land assets means that firms have to expend more for acquisition of land instead of new machinery. In either case, employment will tend to decrease rather than

increase.

The fifth and sixth independent variables (PDEN and LQ) test the effect of agglomeration economies. The hypothesis of negative urbanization economies can be accepted only for the restructuring period. The coefficient of population density (PDEN) is negative for the industrializing period, but not significant. A highly significant and negative coefficient during the second period indicates that diseconomies of urban agglomeration have increasingly deleterious effects on manufacturing industries in densely populated areas. These diseconomies were apparently less serious in the previous period. The hypothesis regarding the impact of localization economies can be accepted only for the period of industrial restructuring. The coefficient of the location quotient (LQ) has a positive value in the first period, although it is not significant. Industrial location during the industrializing period might take the form of cumulative causation, in which already industrialized areas continued to attract new industrial employment. The highly significant, but negative coefficient for the second period strongly rejects the continuation of the trend of spatial concentration. A negative relationship between the initial level of industrialization and the growth of industrial employment during following years is strong evidence of a new trend of decentralization of industrial location.

The last independent variable (ACCESS) tests the effect of rural transportation accessibility. The hypothesis of a positive relationship between the variable and the growth of regional manufacturing employment can be accepted only for the restructuring period. The coefficient of rural expressway accessibility is positive in the first period, but less significant ($p=0.07$). This result implies that the positive effect of a modern expressway system on manufacturing employment in rural areas has increased over time. The result suggests the existence of a moderate time lag between the construction of new expressways and industrialization in adjacent rural areas. Considering the relatively minor changes in the expressway network during the research period, the increased significance of the variable is the result of the effect of the existing highway system.

5. Conclusion

Industrial restructuring has brought about substantial changes in traditional growth patterns of regional manufacturing employment in Korea. During the industrializing period (1983-88), broadly defined core areas, such as urban areas and their adjacent rural counties, industrialized areas, the capital region and the Southeast region,

attracted the majority of new manufacturing employment. During the industrial restructuring period (1988-93), these more advanced regions were heavily affected by a national trend of deindustrialization, whereas less industrialized and peripheral regions including rural areas, and the Southwest and most remote provinces, emerged as newly industrializing spaces. These new patterns of industrial location might be comparable to those that have taken place in western advanced countries. In addition, the spatial spread of industrial location through regional hierarchical system was very similar to the filtering down process suggested by theorists of regional product-cycle. Gross employment change, location quotients, and simple regression analysis provided ample evidence of the emerging process of decentralization of industrial location.

Multiple regression analysis identified a significant association between the growth of regional manufacturing employment and economic and geographical factors. Throughout the research period, rapid rises in the regional wage ratio and land prices were negatively associated with the growth of manufacturing employment, whereas capital investment had a strong positive impact. These three factors are some of the most important triggers of industrial restructuring in Korea (Kim, 1993; Park, 1994). Factors that became more important in recent years were agglomeration indicators, such as population density and the location quotient, and the labor intensity of regional industries. Accessibility to modern highway networks had positive impact on the location of manufacturing industries, but with some time lag. Also, the emergence of new industrial spaces in former peripheral areas can be explained by cost advantages in these regions, as well as physical constraints in urban location. However, a large portion of variation remained unexplained, reflecting the omission of socio-political variables.

The general implication of industrial restructuring on spatial development seems to be more optimistic in Korea compared to advanced countries. This is because an increasing number of regions that were not the locus of previous industrialization are participating in the new phase of development. Therefore, the overall process of industrial location in Korea revealed similarities to developing economies during the industrializing period, but more closely resembled advanced economies during the restructuring period.

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ABSTRACT

This paper examines spatial aspects of industrial restructuring in Korea during the period of 1983 to 1993. Changes in manufacturing location are analyzed using both descriptive and statistical methods. The results strongly suggest that industrial restructuring has brought about a new locational trend of decentralization toward formerly less industrialized regions away from traditional centers. With reduced disparities between core and peripheral regions, the new process of spatial restructuring provides an opportunity for more balanced territorial development in Korea.