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Decentralization of Urban Industries and Urban Scale Economies in Korea

도시산업의 분산과 도시 규모경제

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Contents

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Ⅰ. Introduction

In the early stages of economic development, spatial polarization of economic activities has frequently been observed in many developing countries, whereas decentralization has normally prevailed in the later stages of development. South Korea, as a typical example, had experienced excessive concentration, pursuing economic development in the 1960's and the 1970's. On the other hand, South Korea has also witnessed a marked decentralization and de-concentration in terms of the spatial pattern of manufacturing employment in the 1980's and the 1990's. In this regard, tracing the phase of decentralization and de-concentration of Korean manufacturing industries away from the traditional major metropolitan areas in Korea would yield some fruitful implications to regional economic policies for developing countries.

South Korea's total manufacturing employment had experienced a sizable expansion from 2.2 million to 2.8 million during the period 1983-93. In sharp contrast, the three traditional metropolitan cities, Seoul, Busan and Daegu, which had long been the dominant manufacturing centers, had lost their dominance (see <Table 1>). Not only did their share in the nation's total manufacturing employment decline from 44.0 percent to 26.7 percent during this period, but also satellite cities(small and medium sized cities located in the metropolitan areas surrounding a major metropolitan city) and adjacent rural areas surrounding the three metropolitan cities gained the most in terms of manufacturing employment.

The spatial distribution of manufacturing employment classified at the two-digit level also shows that the most dramatic increases took place in both satellite cities and rural areas. In contrast, the three metropolitan cities, Seoul, Busan and Daegu, lost their employment shares in all of the modern industries; the heavy industries, the transportation industries, and the high-tech industries.

The main objective of this paper is to estimate and compare the extent of agglomeration economies, localization versus urbanization economies, in two-digit level manufacturing industries in South Korea. Our panel data set comprises of 23 two-digit level manufacturing industries covering more than 50 South Korean cities. Fixed effect model is relied on considering city characteristics and time trends.

The remainder of the paper proceeds as follows: We begin by discussing types and nature of agglomeration economies: urbanization economies and localization economies in section 2. The next section deals with how to specify the model to analyze agglomeration economies of industry base. Then we empirically estimate and compare the extent of localization and urbanization economies on an industry-by-industry basis, and give explanations for the main characteristics of each industry in section 4. The concluding section summarizes typical phenomenon of agglomeration economies across industries and, based on these results, presents policy implications for each industry in section 5.

II. Literature Review on Agglomeration Economies

The pattern of urban scale externalities has long been studied in the profession of urban and regional economics.[1] One is localization economies where the scale economies of industries locally affects an individual firm's productivity, and the other is urbanization economies where the scale economies of overall urban economic activity affects an individual firm's productivity. Localization economies with clusters of the same industry represent usually scale economies arising from intra-industry specialization, local labor market economies that reduce search costs for firms seeking workers with specific training, and also scale economies in supplying public infrastructure tailored to the local needs of a specific industry. Information spillovers across plants increase with local scale, increasing efficiency as plants can make better-informed decisions.

On the other hand, urbanization economies represent benefits of operating in a large urban environment with correspondingly large overall labor and diversified service sectors to interact with the manufacturing sector. Thus, localization economies are external to firms but internal to an industry, while urbanization economies are external to firms and industries but internal to the city.

Localization economies are frequently called as Marshall – Arrow - Romer(MAR) externality. According to Henderson, Kuncoro and Turner (1995), cities mainly depended on a particular industry tend to specialize in that one export industry or closely connected set of economic activities. This kind of specialization provides scale economies while conserving on urban congestion, land rent costs, and other disamenities. Therefore, standardized manufacturing activities tend to be found disproportionately in smaller specialized areas. On the other hand, urbanization economies, often called as Jacobs externality, focus on diversity. Diversity usually takes place in a large city. Such service activities as high fashion apparel, up-scale publishing and exportable service activities(financial market, advertising, research and development, media services, etc.), tend to be found disproportionately ubiquitously in large metro areas.

Following this line of reasoning, if

1) For an excellent discussion, see Henderson(1983, 1986, 1988) and Gerking(1994).

externalities arising from localization are more dominant than those from urbanization, industries would be decentralized rather than concentrated in urban cities. In other words, when localization economies are stronger than urbanization economies, one can say that decentralization efforts are realized. On the contrary, if urbanization externalities play more significant roles, industries are likely to be concentrated. If urbanization economies are more effective, centralization is still progressing.

Although many researchers have studied the extent and nature of agglomeration economies,[2] there have been relatively few studies that analyzed urbanization and localization economies explicitly on a industry-by-industry basis. Nakamura(1985) was the first who disaggregated urban agglomeration economies into localization economies and urbanization economies explicitly. He found that both economies were significant overall in 19 Japanese manufacturing industries in 1979, but with considerable variation across industries. Light manufacturing industries received more productive advantages from urbanization economies, while heavy industries benefited more from localization economies. Henderson(1986) estimated the nature and extent of these agglomeration economies in the US and Brazilian manufacturing industries in 1972. He concluded that localization economies were prevalent in general, but there were almost no evidence of urbanization economies.

Lee and Zang(1998) showed that localization economies had been dominant features of Korean manufacturing industries in the cross-sectional results of 1983, 1988 and 1993, whereas these industries did not benefit much from locating in large cities. Information spillovers across plants increase with local scale, increasing efficiency as plants can make better-informed decisions. Besides information flows, local external economies of scale arise from increased diversity of economic activity, increased efficiency in labor markets(search activity), and greater opportunity for intra-industry specialization. Using panel estimation technique, Henderson, Lee and Lee(2001) estimated localization and urbanization economies in Korean manufacturing industries for 1983, 1988 and 1993, and also found significant urbanization economies only in the high-tech industry.

Being in line with Henderson, Lee and Lee (2001), we use the panel estimation method to analyze the effects of urban agglomeration economies on productivity and output of 23 Korean manufacturing industries in 1983, 1988, 1991, 1992 and 1993. While Henderson, Lee and Lee(2001) used aggregated data only, our data set, disaggregated to the 23 two-digit SIC

2) To name a few, see Segal(1976), Moomaw(1988), Sveikauskas(1975), and Sveikauskas, Gowdy and Funk(1988).

manufacturing industries, make it possible for us to focus effectively on analyzing the relation of each industry's agglomeration economies with spatial pattern of employment and de-concentration. The estimation approach can provide some implications about efficacy of Korean government's efforts for decentralization.

III. Model Specification and Data

This study focuses on estimating the degree of externality in manufacturing industries in Korea, distinguishing localization(or MAR) economies from urbanization(or Jacobs) economies. The basic specification for comparing localization versus urbanization economies should assume constant return to scale in firm's own technology as in Henderson, Lee and Lee(2001). We use a real value-added function of the form:

$$Xij(t) = A \times Sij(t) \times f(kij(t)) \qquad <1>$$

where X_{ij}(t) is real value-added per worker in city *i,* industry *j* and time *t* and k_{ij}(t) is capital stock per production worker. f(·) represents firm/industry technology, and S_{ij}(t) is a vector of shift factors, such as measures of spillover externalities, time dummies and city dummies. Capital stock for each industry in a locality has been constructed based on perpetual inventory methods by the Census Bureau in the Statistical Office of Korea.

For a proxy for measuring localization economies, we adopt the size of own employment of an industry in a given city. For urbanization economies, we use an innovative way of measuring urban concentration used in Henderson, Lee and Lee(2001), rather than the traditional way of using total city population. The diversity index we use, indicated by $g_s(t)$, is a simplified version of Ellison and Glaeser (1997) index of concentration. It measures the degree of concentration of employment within a city by the deviation in city production pattern from the national pattern. For city *i* in time *t*, the index of specialization, or lack of diversity is defined to be

$$g_s^{\,i}(t) = \sum_{j=1}^{J}\left[\frac{E_{ij}(t)}{E_i(t)} - \frac{N_j(t)}{N(t)}\right]^2 \qquad <2>$$

where E_j(t) represents employment in industry *j* in time *t*, N(t) is national population in *t*, and there exist *J* industries(in our case, *J* = 23). The minimum value of specialization index is zero when, in a city, each industry's share of local manufacturing employment simply mimics its national population share, so that the city is completely non-specialized because its industrial composition copies the nation. The maximum value of $g_s(t)$ approaches two for a city completely specialized in industry *k* where national employment is concentrated in another industry. As $g_s(t)$ increases, diversity falls and there is greater specialization.

The data come from the Mining and Manufacturing Census provided by the National Statistical Office of Korea, giving economic information for 23 manufacturing industries across Korean cities in 1983, 1988, 1991, 1992 and 1993. The data set is based on establishment surveys on firms that employ five or more. The Census data is similar to U.S. published sources and contain capital stock measures, which were generated by perpetual inventory method from the benchmark figures based on wealth surveys conducted in ten years. There were 50 cities in 1983, which expanded to 73 cities in 1988, and to as many as 75 cities by 1991. A city is an administrative section in Korea, populated with more than 50,000 residents. The data on city population are from the Census of Population in the Urban Yearbook.

In the Census data, typically and in Korea, purchased services are not measured. U.S. survey evidence suggests service outsourcing by firms increases with city size(Abraham and Taylor. 1996). In that case, *ceteris paribus,* firms in small cities would appear less productive since they would employ more workers(producing services internally, which are outsourced in bigger cities) for same value-added(given that unrecorded outsourced services can't be netted out from production). To avoid this problem, assuming service workers are generally non-production workers, we measure labor inputs only by production workers. So we are focusing on the material side of production - the physical output with the corresponding labor input - and ignoring the sales, advertising, research, accounting aspects of firm activity as in Henderson, Lee and Lee(2001).

We need to specify functional form and appropriate error structure to estimate Equation (1). We use a first-order Taylor series expansion (Cobb-Douglas) for own firm technology. We would assume city and/or time fixed effects for each industry. The key estimating equation is

$$ln(Xin(t)) = an + bn*ln(kin(t)) + cn*ln(Ein(t)) + dn*gsi(t) + fin + f(t) + uin(t)$$

<3>

$X_{in}(t)$: the real value added per worker of industry n in city i at time t
$k_{in}(t)$: total capital stock of industry n in city i at time t
$E_{in}(t)$: total employment(representing localization economies)
$g_{si}(t)$: a specialty or diversity index(representing urbanization economies)
f_{in}: city fixed effect
$f(t)$: time fixed effect

Technology is specified at the industry level, for reasons of sample size and exposition, giving n different technologies. Urbanization economies and localization economies are represented by total employment and the $g_{si}(t)$ index, respectively. For the error structure there are time fixed effects(t), which will be used to measure Korea's enormous gains in total factor productivity, and city fixed effects(i) for each

<Table 1> Industry Groupings

Industry	Sub Industry(SIC Code)
Traditional	Food and Beverage (15)
	Tobacco(16)
	Textile(17)
	Apparel(18)
	Leather, Luggage, Footwear(19)
	Wood & Wood Products(20)
	Paper & Paper Product(21)
	Furniture(36)
Heavy	Coke, Refined Petrol & Nuclear Fuel(23)
	Chemicals & Chemical Products(24)
	Rubber & Plastic Products(25)
	Other Non Metallic Product(26)
	Basic Metals(27)
	Fabricated Metals(28)
Transport	Motor Vehicles(34)
	Other Transport Equipment(25)
Machinery & Electrical Machinery	Machinery & Equipment(29)
	Electrical Mach. & Apparatus(31)
High Technology	Office & Computing Machinery(30)
	Radio, TV, Communication Equip(32)
	Medical & Optical Instruments(33)
Other	Publishing, Printing, Rec, Media(22)
	Recycling(37)

industry(n), with the error term, $u_{in}(t)$, assumed to be i.i.d. For later use in analyzing industry location decisions, we will be interested in city and time fixed effects. Hausman tests are generally decisive in rejecting random effect formulation in favor of fixed effect one. Industry groupings of South Korean manufacturing industries are given in <Table 2>.

<Table 2> Externalities and Productivity for the Whole Manufacturing Industry

Variable	Model 1	Model 2	Model 3	Model 4
Ln(k)	.630[a](28.435)	.646[a](29.841)	.509[a](22.280)	.519[a](22.477)
Ln(e)	.062[a](4.850)	.039[a](2.846)	.077[a](6.965)	.064[a](5.273)
G_s	−.303[b](2.497)	−.242[b](1.985)	−.030(0.271)	.017(0.156)
P_{31}		−.343[a](2.734)		.235[b](2.121)
P_{32}		−.032(0.245)		−.033(0.295)
P_{33}		−.021(0.142)		.002(0.018)
P_{34}		.130(0.961)		.049(0.415)
P_{35}		−.044(0.326)		−.054(0.457)
P_{36}		.132(1.008)		.136(1.181)
P_{37}		.124(0.984)		.082(0.738)
P_{38}		.000(0.002)		−.091(0.798)
Year83			.295[b](4.791)	
Year88			.555[a](8.534)	.266a(4.529)
Year91			.625[a](9.408)	.519a(8.268)
Year92			.591[a](8.583)	.587a(9.138)
Year93				.551a(8.251)
R^2	.74	.77	.80	.83
No. of obs.	345	345	345	345

Note: The number in each parenthesis represents t−statistics. Superscripts a, b and c denote that each corresponding coefficient is significant at the one percent, five percent and ten percent significance level, respectively. P_{31} through P_{38} are regional dummies standing for Gyeonggi, Gangwon, Chungbuk, Chungnam, Jeonbuk, Jeonnam, Gyeongbuk and Gyeongnam provinces, respectively.

IV. Empirical Results: Decentralization of Urban Industries

The basic results of the estimated parameters of production functions for the whole industry are given in <Table 3>, while those for each industry are reported in <Table 4> through <Table 7>. We estimate parameters in four different categories. In Model 1, we do not include any fixed effect. Only city fixed effects are included in Model 2, while time fixed effects only are included in Model 3. Finally, in Model 4 both city and time fixed effects are included. We include in our estimation of parameters for

<Table 3> Externalities and Productivity(Model 1: No City or Time Fixed Effect)

Industry \ Variable	SIC Code	ln(k)	ln(e)	g_s	R^2	N
Traditional	15	.675[a](18.64)	.098[a](5.45)	.556[a](3.24)	.63	340
	16	1.224[a](8.22)	.879[a](7.93)	2.264[a](1.98)	.68	64
	17	.576[a](19.61)	.018(1.35)	.197(0.99)	.58	305
	18	.380[a](10.75)	.018(1.10)	.412(1.51)	.33	266
	19	.441[a](9.88)	.019(0.82)	.118[b](2.12)	.40	180
	20	.366[a](9.71)	.025(1.44)	.292(1.55)	.24	316
	21	.492[a](15.97)	.123[a](5.86)	.664[a](2.12)	.63	257
	36	.511[a](16.93)	.073[a](4.97)	.107(0.49)	.52	289
Heavy	23	.701[a](7.92)	.132[b](2.18)	.322(0.66)	.73	76
	24	.515[a](13.32)	.126[a](5.82)	.708[a](2.26)	.56	283
	25	.579[a](19.07)	.058[a](3.41)	.115(0.47)	.59	295
	26	.607[a](22.04)	.090(4.33)	.299[c](1.71)	.65	335
	27	.489[a](12.19)	.094[a](4.25)	.071(0.25)	.53	258
	28	.512[a](15.29)	.048[a](3.26)	.097(0.52)	.51	304
Transport	34	.373[a](8.30)	.093[a](4.56)	.481(1.24)	.44	193
	25	.528[a](9.16)	.002(0.10)	.442[c](1.76)	.41	174
Machinery, Electrical Machinery	29	.469[a](13.72)	.058[a](4.06)	.107(0.52)	.46	303
	31	.566[a](19.80)	.069[a](3.86)	.958[a](3.71)	.68	243
High Technology	30	.543[a](11.54)	.042(1.37)	.007(0.01)	.58	131
	32	.600[a](17.16)	.022(1.08)	.035(0.12)	.66	235
	33	.581[a](12.51)	.055[b](2.56)	.606(1.56)	.48	193
Other	22	.501[a](9.86)	.111a(4.98)	.224(0.89)	.36	281
	37	.507[a](11.62)	.014(0.29)	.296(0.47)	.66	77

Note: The number in each parenthesis represents t statistics. Superscripts a, b and c denote that each corresponding coefficient is significant at the one percent, five percent and ten percent significance level, respectively.

the whole manufacturing industry four time dummies as well as eight regional dummies.[3)]

The estimated parameters for localization economies reported in <Table 3> for the whole

3) These stand for Gyeonggi, Gangwon, Chungbuk, Chungnam, Jeonbuk, Jeonnam, Gyeongbuk and Gyeongnam provinces, respectively.

<Table 4> Externalities and Productivity(Model 2: City Fixed Effect included)

Industry \ Variable	SIC Code	ln(k)	Ln(e)	g_s	R^2	N
Traditional	15	.689^{a}(19.05)	.114a(6.11)	−.227^{a}(−1.22)	.66	340
	16	1.260a(9.25)	1.017^{a}(7.93)	−2.653^{a}(−2.11)	.77	64
	17	.601a(20.81)	.004(0.31)	.405^{b}(1.98)	.63	305
	18	.377a(10.43)	−.015(0.88)	−.259(−0.94)	.40	266
	19	.366a(8.16)	.024(0.98)	−.944^{c}(−1.87)	.50	180
	20	.367a(9.90)	.017(0.95)	−.045(−0.23)	.30	316
	21	.518a(16.00)	.087a(3.62)	.702^{b}(2.10)	.62	257
	36	.510^{a}(16.81)	.039^{b}(2.38)	.083(0.37)	.56	289
Heavy	23	.616^{a}(6.68)	.156^{a}(2.62)	−2.049^{b}(−2.03)	.77	76
	24	.553^{a}(13.91)	.100^{a}(4.35)	−.502(−1.45)	.60	283
	25	.608^{a}(19.23)	.029(1.55)	.185(0.70)	.62	295
	26	.629^{a}(23.25)	.071a(6.96)	.168(0.77)	.69	335
	27	.512^{a}(12.85)	.076^{a}(3.25)	.051(0.17)	.58	258
	28	.517^{a}(15.89)	.053^{a}(3.36)	.016(0.08)	.54	304
Transport	34	.427^{a}(8.77)	.070(2.88)	.604(1.45)	.49	193
	25	.556^{a}(9.79)	−.011(−0.41)	−.248(−0.85)	.45	174
Machinery, Electrical Machinery	29	.498^{a}(14.38)	.037^{b}(2.33)	.194(0.86)	.50	303
	31	.584^{a}(20.17)	.043^{b}(2.28)	.900^{a}(3.29)	.71	243
High Technology	30	.553^{a}(12.17)	.070^{b}(2.23)	.166(0.25)	.65	131
	32	.605a(17.22)	.006(0.30)	.101(0.33)	.68	235
	33	.603a(12.36)	.046^{b}(2.03)	.922^{b}(2.27)	.54	193
Other	22	.537^{a}(10.56)	.094^{a}(4.16)	−.021(−0.08)	.41	281
	37	.530a(12.19)	−.027(−0.53)	−.730(−0.98)	.72	77

Note: The number in each parenthesis represents t−statistics. Superscripts a, b and c denote that each corresponding coefficient is significant at the one percent, five percent and ten percent significance level, respectively.

manufacturing industry are statistically significant for all Models. On the other hand, the estimated coefficients for urbanization/Jacobs economies, measured by the g_s index of urban diversity, come out with significance in Models 1 and 2, while they are not significant in Models 3 and 4.

<Table 4> through <Table 7> show the

<Table 5> Externalities and Productivity(Model 3: Time Fixed Effect included)

Variable / Industry	SIC Code	ln(k)	ln(e)	g_s	R^2	N
Traditional	15	538^{a}(12.41)	.122^{a}(6.81)	−.639^{a}(3.86)	.66	340
	16	.980^{a}(6.86)	1.052^{a}(9.61)	−1.833^{a}(−1.82)	.77	64
	17	.401^{a}(11.27)	.0462^{a}(3.54)	.355b(1.94)	.65	305
	18	.280^{a}(8.75)	−.006(−0.44)	−.286(−1.20)	.51	266
	19	.342^{a}(7.05)	.025(1.14)	−1.115^{b}(−2.12)	.47	180
	20	.187^{a}(4.46)	.044(2.80)	−.089(−0.52)	.41	316
	21	.336^{a}(10.20)	.170^{a}(8.73)	.985^{a}(3.51)	.72	257
	36	.323^{a}(9.07)	.082^{a}(6.20)	.198 (0.98)	.62	289
Heavy	23	.498^{a}(5.80)	.249^{a}(4.43)	−.052(−0.13)	.82	76
	24	.343^{a}(8.74)	.157^{a}(8.08)	−.191(−0.68)	.66	283
	25	.370^{a}(12.26)	.064^{a}(4.62)	.223(1.11)	.73	295
	26	.425^{a}(13.92)	.130(6.96)	.123(0.77)	.73	335
	27	.240^{a}(5.64)	.170^{a}(8.37)	.590^{b}(2.35)	.66	258
	28	.319^{a}(9.37)	.069^{a}(5.43)	.075(0.47)	.65	304
Transport	34	.196^{a}(4.45)	.140^{a}(7.58)	.563^{c}(1.68)	.60	193
	25	.218^{a}(4.02)	.084^{a}(4.03)	−.210(−1.03)	.63	174
Machinery, Electrical Machinery	29	.213(6.39)	.085(7.44)	.205(1.25)	.67	303
	31	.504^{a}(17.12)	.087^{a}(5.03)	.782^{a}(3.17)	.72	243
High Technology	30	.475^{a}(10.07)	.075^{a}(2.55)	.419(0.68)	.65	131
	32	.425^{a}(11.70)	.085^{a}(4.38)	.003(0.01)	.75	235
	33	.430^{a}(8.18)	.072^{a}(3.49)	.663^{d}(1.80)	.55	193
Other	22	.234^{a}(4.64)	.118^{a}(6.23)	−.261(−1.22)	.54	281
	37	.466^{a}(9.29)	−.012^{b}(−2.42)	.370(−0.58)	.69	77

Note: The number in each parenthesis represents t−statistics. Superscripts a, b and c denote that each corresponding coefficient is significant at the one percent, five percent and ten percent significance level, respectively.

estimated parameters for localization and urbanization economies for each industry across

<Table 6> Externalities and Productivity(Model 4: both City And Time Fixed Effects included)

Industry \ Variable	SIC Code	ln(k)	ln(e)	g_s	R^2	N
Traditional	15	.551[a](12.45)	.136[a](7.36)	−.305[c](1.68)	.69	340
	16	1.003[a](8.77)	1.244[a](11.83)	−2.426[a](−2.50)	.87	64
	17	.439[a](12.17)	.033[c](2.36)	.529[a](2.76)	.69	305
	18	.267[a](8.25)	.002(0.17)	−.184(−0.79)	.58	266
	19	.247[a](5.10)	.042[c](1.81)	−.904[b](−1.91)	.57	180
	20	.187[a](4.50)	.035[b](2.14)	.099(0.56)	.45	316
	21	.351[a](9.71)	.145[a](6.32)	.996[a](3.28)	.73	257
	36	.310[a](8.50)	.051[a](3.40)	.093(0.45)	.65	289
Heavy	23	.418[a](4.98)	.271[a](5.12)	−.1927[a](2.31)	.86	76
	24	.366[a](8.74)	.138[a](6.54)	−.023(−0.08)	.069	283
	25	.378[a](11.63)	.045[a](2.92)	.192(0.88)	.75	295
	26	.443[a](14.26)	.114[a](6.14)	.185(1.10)	.76	335
	27	.258[a](5.98)	.156[a](7.22)	.703[a](2.59)	.70	258
	28	.323[a](9.12)	.072[a](5.29)	.110(0.65)	.67	304
Transport	34	.223[a](4.55)	.133[a](5.60)	.808[b](2.24)	.63	193
	25	.223[a](3.86)	.087[a](3.57)	.045(−0.19)	.66	174
Machinery, Electrical Machinery	29	.232[a](6.76)	.074[a](5.64)	.263(1.46)	.69	303
	31	.521[a](17.31)	.063[a](3.42)	.711[a](2.70)	.74	243
High Technology	30	.482[a](10.80)	.105[a](3.56)	.534(0.88)	.72	131
	32	.423[a](11.55)	.072[a](3.53)	.104(0.39)	.77	235
	33	.432[a](7.64)	.063[a](2.94)	.971[a](2.54)	.60	193
Other	22	.263[a](5.01)	.110[a](5.62)	−.127(−5.67)	.57	281
	37	.484[a](9.47)	.021(0.40)	−.655(0.88)	.74	77

Note: The number in each parenthesis represents t−statistics. Superscripts a, b and c denote that each corresponding coefficient is significant at the one percent, five percent and ten percent significance level, respectively.

different model specifications, Model 1 through Model 4. <Table 4> shows that most of estimated coefficients for agglomeration externalities in each industry are statistically significant at the one percent significance level without any fixed factors Model 1. However, this model does not consider any fixed effect, which might lead to an omitted variable bias. In this regard, city specific factors are included in the model to allow for mean variation in real value-added productivity across cities in Model 2 <Table 5>. Coke, refined petroleum production and fuel and chemicals & plastic products show strong localization effects. Notably, high-technology industry shows that localization economies are more effective than urbanization economies, for which Henderson, Lee and Lee(2001) found stronger urbanization economies than localization economies. The estimated parameters of urbanization economies in the high-technology industry in our study are insignificant or even show positive signs.

As a next step, time-specific fixed factors only are included in Model 3 and the results are reported in <Table 6>. The results show similar pattern as in Model 1 and Model 2. This fact implies that the role of localization economies on regional productivity is more important than urbanization economies in Korean manufacturing. Additionally, this regression shows that time factors are more important in explaining agglomeration economies in manufacturing industries.

Finally, a more realistic model is estimated as suggested in the theoretical model, where both city and time specific factors are included simultaneously. Notably, the R^2s in each industry are higher than before. So this specification is the fittest for analyzing and comparing localization versus urbanization economies. Even here, localization economies are strongest in heavy industries such as coke, refined petroleum production & nuclear fuel, and chemicals & chemical products. On the other hand, tobacco, leather, luggage, and footwear industries show strong urbanization economies.

Summing up these results, the effects of localization economies on productivity are found to be more important in Korean manufacturing industries than those identified in previous studies. The absolute values of estimated parameters of localization economies in most cases are much larger than those of urbanization economies. We can obtain robustness of estimators from four different models. In industry view, urbanization economies have strong effects only in food and beverage, tobacco, leather, wood(light industry), coke (heavy industry). Nevertheless, localization economies have most dominant effects in almost all of 23 manufacturing industries in Korea. The effects of the localization economies on the real value-added per worker are the lowest in traditional manufacturing, such as food and beverage, textile, apparel, leather, luggage & footwear, wood, and papers. On the other hand, localization economies are the highest in heavy and transportation industries including coke, refined petroleum production, and nuclear fuel. Also chemical and chemical products are associated with strong localization economies. Light industries have more advantages from urbanization economies and heavy and other industries from localization economies, which is in line with the results for Japanese manufacturing industries reported by Nakamura (1985).

V. Conclusion

This paper analyzed and compared agglomeration economies, localization versus urbanization economies, in 23 manufacturing industries in South Korea. A panel data covering more than 50 cities for 1983, 1988, 1991, 1992 and 1993 is adopted. A Fixed effect model for the panel data is relied on considering city characteristics and time trends. Two types of scale externalities are compared; localization economies where current scale of own industry activity locally affects individual plant productivity, and urbanization economies where current scale of overall city economic activity affects individual firm's productivity. Localization economies are measured by the total employment in the own industry. Our model for analyzing decentralization of urban industries and urban scale economies use the specialization index.

Our empirical results show that localization economies are found to be more important in most Korean manufacturing industries, consistent with most previous studies, but also that localization economies are much stronger even in high-tech industry, in which Henderson, Lee and Lee(2001) found stronger urbanization economies than localization economies. We can obtain robustness of estimators from four different models. The reason for strong localization economies of high-tech industry is that most of local government has tried to induce high-tech companies to locate in its administrative area for regional development. Although localization economies exert dominant effects on almost all of 23 manufacturing industries in South Korea, urbanization economies have relatively strong effects in food and beverage, tobacco, leather, wood(light industry), and coke(heavy industry) industries. In general, light industries have more advantages from urbanization economies and heavy and other industries from localization economies, which is similar to the case of Japanese manufacturing industries in 1979 shown by Nakamura(1985).

For further studies, more plentiful data set is needed. This study analyzes scale economy of 23 manufacturing industry before the economic crisis because of availability of data set. It would be interesting to compare localization economies and urbanization economies in different periods, before the economic crisis and after economic crisis.

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ABSTRACT

도시산업의 분산과 도시 규모경제

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※ 주요단어: 분산, 제조업의 지방분산, 지역화경제, 도시화경제, 고정효과(Fixed Effect) 모형

본 연구에서는 산업의 지역분산 여부를 실증적으로 분석해 보았다. 이를 위해 우리나라 주요 대도시로부터 위성도시로의 급속한 분산이 일어났던 1983년~1993년 동안의 제조업의 공간입지유형을 분석하였다. 23개 제조업에 대한 '시' 수준의 공간에서 나타난 규모에 대한 외부효과를 분석하였다. 집적경제의 두 가지 범주의 공간 규모경제, 즉 지역화경제와 도시화경제가 분석에 사용되었다. 지역화경제는 동일한 종류의 산업이 밀집하여 산업활동에 영향을 주는 공간에서의 규모의 경제를 말한다.

이에 반해, 도시화경제는 도시 전체의 규모가 커짐에 따른 개별 기업체들의 생산력에 미치는 공간에서의 규모의 경제를 말한다. 실증분석을 위해 통계자료는 지역과 시간이 통합된 패널자료(pooled data)를 사용하고 고정효과 모형을 이용하였다. 시간 더미변수와 지역 더미변수를 고려하여 시간 및 지역적 추세와 특성을 감안하였다. 이들 더미변수를 고려하지 않은 모형, 한 종류만 고려한 모형, 둘 다 고려한 모형을 비교하여 실증분석 결과의 강건성(robustness)을 확보하였다. 우리는 전체 제조업 및 23개 개별 제조업에서 지역화경제가 보다 중요하다는 실증분석 결과를 얻었다. 구체적으로 살펴보면, 경공업 부문에서는 도시화경제의 효과가 더 크고, 중공업 부문에서는 지역화경제가 더 큰 것으로 나타났다. 이러한 실증분석 결과는 그간 지역으로의 산업분산 정책이 나름대로 효과가 있었음을 의미하는 것이다. 그리고 흥미로운 점은 Henderson(2001)의 연구에서 도시화경제가 보다 중요하다고 나타난 첨단산업에서도 지역화경제가 더 효과가 크게 나타났다는 것이다.