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URBAN GROWTH IN KOREA, 1970-1980: AN APPLICATION OF THE HUMAN ECOLOGICAL PERSPECTIVE

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This study aims to understand the conditions under which Korean cities grew. Building upon ecological theories of population redistribution, Duncan's "ecological complex" in particular, variables that are expected to influence urban growth in Korea are derived. Using a series of Population Censuses of Korea, 1970 and 1980, multiple regression analyses are conducted.

The analysis shows that ecological theories are fairly effective in explaining urban growth in Korea. To be specific, ecological variables accounted for about two-thirds of the urban growth rate and between 37 percent and 76 percent of net migration rates, depending on age groups. Indigenous labor surplus, population potential, and sustenance differentiation were most influential over the urban growth rate. However, determinants of net migration rates by age are more complex. In general, those variables pertaining to population and environmental rubrics (i.e., indigenous labor surplus and population potential) tended to strongly affect net migration rates while sustenance differentiation and public expenditure tended to affect net migration rates of selected age groups. This study also shows that the effect of poulation size substantially decreased in the 1970s, consistent with previous studies. It is recommended that more studies of this sort be conducted in Third World settings to make more reliable generalizations about the growth of Third World cities.

INTRODUCTION

The human ecological perspective has been frequently utilized in explaining the population redistribution in Western countries (e.g., Sly 1972; Poston 1980; Saenz and Colberg 1988). The general argument is that such ecological concepts as population, sustenance organization, environment, and technology have strong ramifications for the growth (or decline) of communities. Ecological studies of population redistribution are rare, however, in the context of Third World urbanization. London (1986) examined the rate of migration to metropolitan Bangkok, Thailand with both ecological and political-economic variables. This study is limited because: (1) it focuses upon the primate city as the migration destination, ignoring other smaller cities, and (2) it utilizes "push" factors, such as driving out migrants off their farmland. Nonetheless, this study shows that ecological variables have significant effects upon population redistribution, independent of political-economic variables, suggesting that ecological

variables can be a promising perspective in Third World settings as well.

This study, coming from these traditions, attempts to understand how city growth occurs in developing nations. Using Korean censuses as a major source of data, this study applies the factors pertaining to the city to understanding the differential growth rates of cities. As such, it has by and large two purposes. First, it aims to evaluate the applicability/utility of the ecological perspective in the context of developing economies. It is my view that since ecological studies of urbanization in Third World settings are rare, the utility of the ecological perspective has not been fully demonstrated. The second purpose of this study is, using these variables, to examine the characteristics of Korean urbanization. As is discussed later, studies conducted in the context of Korea are fairly descriptive. Thus, analytical studies are needed.

THEORY AND CONCEPTS

Human ecology is frequently defined as the study of the relationship between a population and its environment. Since "[a] concrete human population exists not in limbo but in an environment" (Duncan 1959, p. 681), the interaction of a population with its environment produces complex forms and processes of the population. Population redistribution in general and urban growth in particular are seen as part of the adaptation to this dynamic. Moreover, the adaptation process involves an increase in the complexity of sustenance organization and an alteration in the mode and level of technology. Thus, the population redistribution should be viewed as a response to a change in population, environment, sustenance organization, and technology.

(1) A population refers to "any internally structured collectivity of human beings that routinely functions as a coherent entity" (Berry and Kasarda 1977, p. 14). It is a major unit of analysis for ecologists. Territoriality is often utilized as a feature of population since ecologists assume that "at least spatially delimited population aggregates have unit character" (Duncan 1959, p. 681).

Population size and structure are two major attributes of the population. In Third World urbanization, larger cities appear to have higher growth potential than their smaller counterparts. Classical economists use the term "agglomeration effect" to represent the situation where a unit increase in output is larger than one unit increase in input. The large cities provide a favorable market where labor is easily found and goods and services are easily circulated. Some ecologists tend to point out the indirect effect of

population size: an increase in population, combined with an increasing frequency of interaction, will lead to sustenance differentiation, which will ultimately result in urban growth (Hawley 1950; Gibbs and Martin 1962; also see Durkheim 1933). The combination of these effects leads to an expectation that population size of a city will have a positive influence over the growth of city.

Besides the gross size of population, its internal structure can strongly affect the redistribution of population (Pursell 1972; Bradshaw 1976; Poston and White 1978; Ervin 1987). As young-age cohorts move on to working ages, their labor mobility is highly influenced by the existing job market. When these cohorts are smaller than the existing job market, they can find jobs in their native community relatively easily and the volume of in-migration will be sizeable. But when these cohorts are larger than the existing labor market, their labor participation will be more competitive and in-migration will be small, accordingly. Since this age structure refers to the potential to generate future labor surplus on its own, it can be termed indigenous labor surplus. Inasmuch as rural-urban migration is highly age-selective in the Third World and, as a result, greatly "distorts" the age structure of both sending and receiving towns and cities, the effect of indigenous labor surplus should not be neglected.

(2) Environment is broadly defined as "all that is external to and potentially or actually influential upon an object of investigation" (Hawley 1986, pp.10-11). Considering the breadth and often elusiveness of the definition, it has been suggested that an ecological study limit the area of inquiry to environmental conditions defined as "those factors which, in light of existing technology, serve as limiting resources for the adaptation and/or growth of populations (Poston *et al.* 1984, p. 98)."

The influence of environmental factors is evident in Third World urban growth. In the study of large cities over the world, Dogan (1988, p. 54) argues that "[a]mong the 285 cities with more than one million inhabitants, between 190 and 210 are seaports or riverine ports." In the earlier study of urbanization in developing countries, Breese (1966, p. 102) points out that "it is noticeable in urbanization everywhere that the factors of *site* and *situation* have considerable impact upon the nature of the urban area" (emphasis added). In still another study dealing with secondary cities in developing countries, geographer Rondinelli (1983) points out that "favorable location and natural resources," among others, are very influential in the actual growth of cities. As such, it is expected that those cities situated at favorable locations will grow fast.

(3) Organization is defined as the "entire system of interdependences

among the members of a population which enables the latter to sustain itself as a unit" (Hawley 1981, p.12). It has been claimed that changes in sustenance organization will result in a change of population size. As sustenance activities grow in number and complexity, they will create more niches and attract migrants.

Identification of the key function is important in explaining population dynamics. First, the key function "regulates and to a considerable extent determines the conditions under which the contingent functions are performed" (Hawley 1986, p. 34). As the volume and productivity of the key function increase, they bring more materials, whose volume in turn expands the size and organization of the community. Hawley (1968, p. 332) once claimed that "the size of population supportable by the system varies with the productivity of the key function." In this study, manufacturing concentration is identified as the key function behind urban growth in Korea.

It is generally accepted that cities grow with the rise of manufacturing industries. However, human ecologists do not pay much attention to the role the public sector plays. According to Lipton (1977) and Gugler (1982), a major reason Third World countries are rapidly urbanizing is "urban-biased" policies: cities are favored over rural areas in various policy measures such as public investment, taxation, education, etc. The result of such bias is the exodus of rural farmers and the growth of cities (Bradshaw 1987). Of course, the role of government is not in itself an ecological variable, but it is included here because it is believed to follow the "natural" process of urban growth.

(4) Technology: Duncan (1959, p. 42) claims that "the most distinctive feature of ecosystems that is due to the inclusion of man is the modification, or even the creation, of flows of materials, energy, and information occasioned by technology." Although the term "technology" is inclusive of a whole gamut of "production" activities, ecological literature tends to focus upon transportation and communications systems that facilitate the flow of commodities and services. Such classical studies as Gras (1922) and McKenzie (1933) emphasize this dimension of technology in the emergence of "urban dominance." Kasarda (1980, p. 377) claims that "[a]ccessibility and corresponding transportation costs have always been the paramount factors in locational decisions of industrial firms" and thus in population growth.

(5) Urban Labor Surplus: ecologists appear not to have dealt with urban labor market structure in explaining population redistribution. The urban labor market, however, can be treated as an ecological variable, inasmuch as population redistribution is a function of "the ratio of numbers to the

opportunities for living" (Hawley 1950, p. 149). The Third World in particular has a limited number of niches in the city, ultimately to depress the growth of cities.

Although most ecologists would agree on the importance of these concepts, the focus of analysis differs among them. It should be noted, however, that those differences are not a matter of substance, but a matter of degree. Usually, the difference depends upon how each ecologist treats organization. Some, following Hawley, utilize such broad concepts as ecological organization or ecosystem. For instance, Hawley (1968, p. 329) has stated that the basic concern of human ecology is "with the general problem of organization as an attribute of population." On the other hand, Gibbs and Martin (1959) unequivocally stresses "sustenance organization." Although they prefer to treat organization as a dependent variable, they state that human ecology "seeks to establish the consequences of the presence or absence of particular characteristics of sustenance organization in human population" (Gibbs and Martin 1959, p. 33).

Finally, Duncan's "ecological complex" consists of four referential concepts: population, environment, organization, and technology. Although Duncan also stresses the importance of sustenance organization, he leaves open the possibility for a variety of models, when he (1959, p. 683) states that "change in any of them will set up ramifying changes in the others." The ecological complex may be blamed for being underbounded (Bailey 1990), but the use of organization in broader terms can lead to the inclusion of many other factors, directly or indirectly related. Hence, this "complex" is useful for exploratory studies and this study follows the ecological complex model of population redistribution for this reason.

URBAN GROWTH IN KOREA

South Korea (The Republic of Korea) is now commonly referred to as one of the "newly industrialized countries" or a member of "four little dragons" which include Taiwan, Hong Kong, and Singapore. Since the early 1960s, Korea has experienced one of the world's highest economic growth rates. The country's real Gross National Product grew at an annual average of nearly 10 percent and exports by about 40 percent per year. Per capita consumption of electricity rose more than forty times during the last three decades. Unemployment rates are down to less than three percent. The country is now the world's twelfth-largest trading nation (Korea. Bureau of Statistics. *Korea Statistical Yearbook*, various years).

The economic transformation during the past three decades accompanied

corresponding urban growth both in absolute and relative terms. The percentage of South Korean population living in cities of 50,000 or over increased rapidly from 28 percent in 1960 through 41 percent in 1970, 57 percent in 1980, to 74 percent in 1990. More than the level of urbanization of the country, the growth of individual cities (the absolute number of people living in cities) had increased four-and-half times from about 7 million in 1960 to 32 million in 1990. A United Nations (1987) publication projects that the level of urbanization will reach nearly 80 percent in the year 2000, a higher figure than the average among industrial countries. The capital city of Seoul led the increase from 2.4 million in 1960 to more than 10 million in 1990.

Although the country experienced continued economic growth and urbanization, there appear to be significant changes in the trend of population redistribution between the 1960s and 1970s. During the 1960s, city growth due to net migration was mainly confined to the national metropolis (Seoul), which absorbed nearly two-thirds of the total net urban migrants (Yu 1973; Kim and Sloboda 1981). During the 1970s, on the other hand, the direction of net migration and corresponding urban growth appear to have shifted markedly. During 1970-1975, the growth rate (and net migration rate as well) of Seoul was below the national urban average and Seoul accounted for "only" one-third of total urban migrants (Koo and Hong 1979; Kim and Sloboda 1981). In the early 1970s then, what Richardson (1980) calls a "polarization reversal" was set in motion (Mills and Song 1979; Nam 1988).

Despite the rapid change in the ecological structure of South Korean cities in the past three decades, studies on the growth dynamics of cities are few and sketchy. As discussed, a bulk of studies are descriptive, estimating the volume, direction, rapidity, and demographic sources of urban growth and migration. These studies tended to approach the process of urban growth from a policy-makers view, identifying problems of rapid urbanization and suggesting policy options for them. Accordingly, little attention has been paid to the effect of the structural-ecological change on urban growth dynamics. The fact that urban growth has been dispersed since 1970 makes this study even more interesting. If cities other than the primate city are growing so rapidly, under what conditions do these cities grow? What properties distinguish the growth (and net migration) rates of cities in the epochal era of South Korean urbanization, 1970-1980?

DATA AND MEASUREMENT

The empirical findings of this study will be, to a large extent, the product of regression analysis of data pertaining to Korean towns and cities. Thus, the unit chosen for analysis is the community that reached urban township/city in 1970. In principle, a minimum size of 20,000 and 50,000 is required for township and city, respectively. In practice, though, it can be slightly lower than the above sizes, since the status of town and city is administratively determined by the central government.

The number of these towns/cities is 123 (32 cities and 91 towns) in 1970. Of these, eight towns are dropped from analysis either because their size is too small or because they are located off the mainland. Excluding some other cities whose data are missing, the size of the sample for final analysis is 108.

The information regarding the dependent and independent variables is taken primarily from a series of the Korean Population Census, conducted in 1970 and 1980. All demographic data are taken from published volumes. One major problem of these volumes for this study is that most economic data are suppressed by city or larger unit (e.g., province and a rural/urban dichotomy). Thus, all necessary information for smaller units such as township is not available. Accordingly, a one-percent sample tape is utilized to obtain economic data. These data are particularly well-suited to the goals of this study, since they are easily subject to the unit of analysis. Another source of data is the *Korea Municipal Yearbook* (Korea Ministry of Home Affairs) from which government expenditure in public works is derived.

Dependent Variable: this study utilizes two dependent variables: the urban growth rate and net migration rate. The urban growth rate is measured by an average annual change of population size of a city in a ten-year period. Net migration rate is estimated by using the life table (Korea Statistical Bureau 1982) survival rate (S_x) method (Shryock *et al.* 1975). It should be noted here that net migration is estimated for each sex and 5-year age bracket and these figures are summed to obtain net migration for 10-year age brackets.

Independent Variables: the population rubric consists of two variables: population size and indigenous labor surplus. Population size of a city is operationalized simply as the census population: namely, the total number of people living in the city. Indigenous labor surplus is the difference between the number of people aged 5-14 who will enter the labor force during the intercensal period and the job openings created by retirement

and deaths of people already in the labor force. It is measured as a ratio (per 100) by the following formula: $\{S_x P_{5\text{-}14} - (1-S_x)P_{15\text{-}54} - P_{55\text{-}64}\} \times 100/P_{15\text{-}64}$, where S_x is the survival rate.

Environment consists of site and situational factors. The index of site is a dummy variable. Since cities located near metropolitan areas and the Seoul-Pusan corridor are reported to be growing fast in Korea, those cities which fall within 100 km south of Seoul, 50 km from Pusan, or 10 km from the Seoul-Pusan railroad/expressway are scored 1; other cities 0. The situational factor is measured by the index of population potential, the potential amount of contact of one city in relation to the rest of the cities. Following conventional measures, the population potential of a city is the sum of the size of the population of an *i*th city divided by distance between these cities.

Since human ecological theories emphasize communication and transportation technology in the process of population redistribution, communication/transportation concentration is identified as reflecting the technology dimension of the "ecological complex." It is simply the percentage of the labor force in the communication and transportation industry. Sustenance organization is measured in two ways: one is the key industry which has a multiplier effect upon other activities and the other is the degree to which sustenance activities are differentiated. More specifically, they are manufacturing concentration and sustenance differentiation. Manufacturing concentration is operationalized simply as the percentage of workers engaged in manufacturing industries.

Sustenance differentiation is the degree to which a population is differentiated in its activities. Following conventional measures (see Gibbs and Martin 1962; Gibbs and Poston 1975), the index of sustenance differentiation is operationalized by using the following formula: ISD = $1 - \sum X_i^2 / (\sum X_i)^2$, where X_i is the number of workers in the *k*th industry. The industrial categories are taken from the Korean Standard Industrial Classification.

Government Investment: since government investment is claimed to "subsidize" business activities (as well as directly employing workers) by building infrastructure, it is measured by per capita government expenditure (in 1971, 1973, and 1975) in i) road construction and ii) public works such as land subdivision, city planning, water supply, erosion control, etc. The amounts in these two areas are summed, divided by the size of population in 1970, and put in 1,000 won (the Korean monetary unit).

Labor Surplus: most simply, urban labor surplus is the percentage of the labor force which is unemployed (unemployment rate). The unemployed are those who are out of work, but actively searching for a job. The

estimation of the unemployment rate follows the official definition used in the Census count. It has been claimed that urban labor surplus, besides open unemployment, appears in various disguised forms, typically the informal sector, in Third World cities. Thus, a second measure of urban labor surplus is the percentage of workers employed in the informal sector. It should be noted first that the Korean Census does not distinguish between formal and informal sectors. Accordingly, a proxy index is developed, based on the "status of employment." In this connection, the index of the informal sector is measured by the percentage of the self-employed and unpaid family employment. (Other categories reported in the census include the employed worker, the employer, and the unemployed). Since non-agricultural occupation is the basis of urban work, primary occupation workers (e.g. farmers, fishermen, etc.) are excluded from the measure of the urban informal sector.

ANALYSIS AND DISCUSSION

As a first step, summary statistical characteristics of each variable are examined. Since some variables are not normally distributed, they are transformed. The mean and standard deviations are presented in Table 1, along with zero-order correlations. Below the table is shown how these variables are transformed.

Table 1 shows the zero-order correlation between independent variables measured in 1970 and the dependent variable, measured as an annual average rate of population change between 1970-1980. As a preliminary examination, the urban growth rate alone is presented as a dependent variable. Net migration rates by 10-year age group are shown in regression analysis.

As the table shows, all but one expected relationship receive support at the bivariate level. Two variables (LABOR and XPOTEN) have rather sizable correlations with the urban growth rate ($r = -.69$ and .71, respectively). Three variables (XPOP, S3ISD, and RMAN) are moderately, but significantly, associated with the urban growth rate ($r = .61$, .64, and .53, respectively). Correlation coefficients for other variables are weaker than the above five variables, but nonetheless are statistically significant at $p = .001$. The examination of zero-order correlations tends to suggest: (1) the selection of these variables is useful, and (2) variables pertaining to population, environment, and organization are more influential than other variables. These suggestions should be directly tested through multiple regression.

It might be interesting to note that there is a positive association between

TABLE 1. A MATRIX OF ZERO-ORDER CORRELATIONS (N=108)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	–										
(2)	.61	–									
(3)	–.69	–.54	–								
(4)	.71	.87	–.62	–							
(5)	.42	.24	–.58	.46	–						
(6)	.40	.52	–.26	.50	.18	–					
(7)	.53	.44	–.42	.48	.23	.26	–				
(8)	.64	.64	–.40	.65	.25	.60	.61	–			
(9)	.42	.44	–.30	.30	.02	.41	.42	.41	–		
(10)	.41	.49	–.46	.55	.39	.30	.36	.38	.26	–	
(11)	–.39	–.36	.25	–.40	–.21	–.39	–.20	–.39	–.05	–.31	–
Mean	1.52	–2.85[a]	40.6	–2.56[a]	[b]	2.01	3.53	.52	.55	2.09	33.63
Std.	2.61	1.59[a]	4.93	1.54	[b]	.80	1.24	.20	1.19	1.30	13.45

Notes: [a] Should be divided by the fifth power of 10.

[b] Dummy, N = 78 for 0 and N = 34 for 1.

Notations: (1) POP7080 = average annual growth rate, (2) XPOP = negative reciprocal of population size, (3) LABOR = indigenous labor surplus, (4) XPOPTEN = negative reciprocal of population potential, (5) SITE = dummy, (6) RTRANS = square root of transportation and communication concentration, (7) RMAN = square root of manufacturing concentration, (8) S3ISD = 3rd power of index of sustenance differentiation, (9) LPCGOVT = natural log of per capita government expenditure, (10) UNEMP = % unemployed, (11) INFO = % informal labor.

unemployment rate and the urban growth rate. This is hardly surprising, however. Studies have repeatedly shown that in the Third World, cities grow in face of high unemployment (Squire 1981; Bairoch 1988; Todaro 1989). In general, urban unemployment rates are on the order of 10 to 20 percent, which is one and one-half to three times higher than its rural counterpart. The negative relationship confirms that cities are growing in the presence of a higher unemployment rate in Korea as well.

The hypotheses are directly tested in multiple regressions. It should be noted here that the examination of zero-order correlation (Table 1) shows a multi-collinearity problem. Because of high covariance between XPOP and XPOTEN, two separate equations are calculated, one excluding XPOP and the other excluding XPOTEN. The following two tables show the result of these regression analyses. The independent variable consists of urban growth rate and urban net migration rate, decomposed by 10-year age group. The first table (2a) is the result of regression, excluding the variable of population size and the second table (2b) excludes the variable of population potential. The first column of each table is the list of independent variables. The following columns show the standardized

regression coefficients (β), the independent variable being the urban growth rate first and then five age-specific net migration rates. The adjusted R^2 at the bottom refers to the percent of the total variance explained by the pool of the independent variables.

Although the interpretation is complicated due to the separate regressions, the general picture is clear. First, ecological variables are highly efficient in explaining urban growth (and urban net migration) in Korea. In general, the nine variables in each regression explain slightly less than two-thirds of the urban growth variation (R^2 = .658 and .632, respectively). To be specific about net migration rates, more than seventy percent of the variation of the urban migration rate for the age group 15-24 is explained by

TABLE 2a. PARAMETER ESTIMATES OF STANDARDIZED MULTIPLE REGRESSION, EXCLUDING POPULATION SIZE (N=108)

	POP7080	MR1524	MR2534	MR3544	MR4554	MR5564
LABOR	−.36***	−.43***	−.18	−.32**	−.41***	−.35**
XPOTEN	.27**	.34***	.23	.21	.26*	.28*
SITE	.04	.01	.19*	−.00	−.05	−.04
RTRANS	−.08	−.09	−.04	−.08	−.09	−.13
RMAN	−.09	.07	.05	−.00	.08	.10
S3ISD	.22*	.23*	.15	.32*	.05	.11
LPCGOVT	.15*	.07	.19*	.19*	.22*	.20*
UNEMP	−.09	−.02	−.12	−.14	−.14	−.12
INFO	−.13	−.08	−.17*	−.02	−.03	−.07
Adjusted R^2	.658	.763	.448	.430	.394	.477

* p < .05, ** p < .01, *** p < .001.

TABLE 2b. PARAMETER ESTIMATES OF STANDARDIZED MULTIPLE REGRESSION, EXCLUDING POPULATION POTENTIAL (N=108)

	POP7080	MR1524	MR2534	MR3544	MR4554	MR5564
XPOP	.09	.14	.02	−.05	−.04	.06
LABOR	−.41***	−.49***	−.24*	−.40**	−.51***	−.42***
SITE	.07	.06	.21*	.01	−.03	.07
RTRANS	−.06	−.07	−.02	−.05	−.05	−.10
RMAN	.11	.09	.06	.01	.10	.11
S3ISD	.28**	.29*	.22	.40**	.15	.19
LPCGOVT	.13	.03	.17	.18*	.21*	.18*
UNEMP	−.05	.02	−.08	−.09	−.08	−.07
INFO	−.13	−.10	−.19*	−.04	−.05	−.08
Adjusted R^2	.632	.724	.426	.413	.367	.446

* p < .05, ** p < .01, *** p < .001.

nine predictor variables in each equation, 76.3 percent without XPOP and 72.4 percent without XPOTEN. The amount of explained variation is smaller for other age groups, but even the lowest amount of variation explained by each equation is more than one-third of the net migration rate. In short, these variables are fairly significant in explaining urban population change.

Second, variables pertaining to population and environmental rubrics of the ecological complex are most effective in explaining urban growth. These variables are LABOR (indigenous labor surplus) and XPOTEN (population potential). In the equation without XPOP (Table 2a), the regression coefficient of LABOR is –.36 for POP7080 and runs from –.18 for MR2534 to –.43 for MR1524. Except the smallest coefficient for MR2534, all coefficients are significant at conventional significance levels. In the absence of XPOTEN (Table 2b), the coefficients of LABOR are even higher and all of them are significant for both POP7080 and net migration rates. Indeed, LABOR exercises the strongest influence over net migration with only one exception: MR2534 in the model without XPOP, which is exceeded by some other variables such as XPOTEN, SITE, and LPCGOVT. It is clear then that the impact of an indigenous labor surplus is to slow down urban growth by discouraging in-migration and/or by encouraging outmigration.

The population potential variable, XPOTEN, appears to affect urban growth through net migration for selected age groups. In general, it appears to exercise the second strongest influence over urban growth (β = .27). But its significant effect for net migration is limited to the youngest and older age groups, namely MR1524, MR4554, and MR5564. Sustenance differentiation has a consistently positive and significant influence in both regressions (β = .22 and .28), but its effect is much limited in terms of net migration by age. To be specific, in both equations, those age groups whose net migration is significantly affected by sustenance differentiation are only two out of five age groups, namely MR1524 (β = .23 and .29, respectively) and MR3544 (β = .32 and .40, respectively).

These considerations suggest that much touted ecological models of population redistribution appear to be less effective in Korean urban growth. Sly (1972), for instance, argued that population redistribution is by and large a direct response to changes in sustenance organization while "environment and technology do not operate directly on migration, but effect migration through changes in organization (1972, p. 619)." The analysis of Korean urban growth appears to lend only slight support for this model. Although it does not directly test the model, the overriding influence of environmental and population variables appear to contradict such an assertion. In comparing zero-order correlations, LABOR and

XPOTEN are more strongly associated with urban growth than either RMAN or S3ISD. In comparing regression coefficients, the coefficients of the former variables are larger than those of the latter. Consequently, it is more likely, as Frisbie and Poston (1975, p. 782) argue, that "demographic changes are [not] merely responses to organizational stimuli." In short, different variables may exercise different levels of influence over population redistribution in different contexts. And in Korea, indigenous labor surplus and population potential exercise an overriding influence upon urban growth while the effect of sustenance differentiation is evident.

LPCGOVT is an interesting case, since its effect tends to increase and gain statistical significance with age. In one equation without XPOTEN, it has significant influence over urban growth and all net migration rates but MR1524. In the other equation, it has no significant, although positive, effect upon urban growth, but its effect becomes significant with age. In short, it can be stated that government expenditure in public works affect urban growth through migration of older age groups in Korea.

It would be as interesting to discuss the variables whose influence is limited. These variables are: transportation/communication concentration, manufacturing concentration, urban labor surplus (i.e., unemployment and informal labor), population size, and site. For transportation and communication concentration, it has been shown that technology of various kinds in itself does not have a direct effect upon population redistribution (Gibbs and Martin 1962; Clemente and Sturgis 1972; Clark 1990). Although it is not directly examined here, transportation and communication concentration might influence urban growth indirectly, as the organizational model of population redistribution suggests.

The reason that manufacturing concentration is not a major factor is far from clear. It might be that, as in other Third World countries, manufacturing development has little to do with urban growth. However, this interpretation contradicts previous studies that the dispersement of export-oriented industries away from Seoul led to the growth of hinterland cities (Kwon 1981; Nemeth and Smith 1985; Park 1988). A plausible, albeit *ex post facto* in nature, explanation is that manufacturing development, since it has a multiplier effect upon other activities, affects urban growth indirectly through sustenance differentiation. This interpretation suggests that manufacturing industries themselves may attract only a limited number of migrants.

In this study, the urban labor surplus turned out not to be a major factor, either. It is particularly so with respect to (overt) unemployment. The reason is difficult to unravel. First, the official unemployment rate may not fully

reflect urban labor surplus in developing nations. This is supported by the fact that in this study, the unemployment rate has an inverse relationship with the informal sector. It might be argued that rural peasants do not have sufficient information about their destination, but such an argument should be rejected. South Korea is a relatively small country with well-educated people. Moreover, it is well integrated through a network of transportation and communication systems. Todaro's (1969, 1989) equilibrium model might be more plausible, suggesting that urban growth in the Third World is not a result of employment opportunities *per se*, but an interactive product of the unemployment rate and urban wage. That is, rural-urban migration continues until expected income or wage differentials between urban and rural reach an equilibrium point where they balance out the probability of being unemployed.

The effect of population deserves some scrutinization. It is widely known that there is a tendency for larger cities to grow fastest in the Third World. And, this tendency is confirmed in Korea in the 1960s (Meyer and Min 1987). To understand whether such a tendency is reversed, the relationship between city size and growth rate is prepared in Table 3. As is indicated, larger cities grew faster in the 1960s. However, the growth rate in the 1970s suggests a different pattern: large cities tended to slow down while upper-middle cities grew faster. The 1960-1970 growth rate of the national capital, Seoul, in particular nearly halved during 1970-1980. Nationwide, at least fifteen cities exceeded Seoul in growth rate during 1970-1980 while no cities did during 1960-1970. Accordingly, this table supports the argument that in the 1970s, "polarization reversal" was taking place.

Finally, the fact that site factor does not exercise a significant influence, net of other variables, should not obscure the fact that cities are growing rapidly around Seoul and Pusan and their corridor. Indeed, the growth rates

TABLE 3. CITY SIZE AND GROWTH RATES, 1960-1970 and 1970-1980

City Size	Growth Rate	
	1960-1970	1970-1980
Seoul	8.15 (N = 1)	4.13 (N = 1)
500,000-[a]	4.73 (N = 2)	4.51 (N = 4)
100,000-500,000	3.94 (N = 6)	4.15 (N = 11)
50,000-100,000	3.30 (N = 17)	3.19 (N = 19)
- 50,000	1.71 (N = 72)	.60 (N = 73)
Whole country[b]	2.30	1.74

Notes: [a] Excludes Seoul.

[b] Natural increase rate for the whole country.

of these urban areas stand out in comparison with other hinterland cities (SITE = 0) that grew at the average rate of .95, well below the national population growth rate of 1.74 percent. Thus, it should be interpreted that these locations have other favorable factors for city growth. The site factor is a composite measure, consisting of proximity to metropolitan areas (Seoul and Pusan) and the Seoul-Pusan corridor. To examine the separate effect of site indicators, those nineteen urban areas located closely to metropolitan centers grew at the average rate of 3.87 percent per year. Urban areas located within 100 km south of Seoul grew faster (4.15%) than those located within 50 km from Pusan (rate = 3.49%), the second largest city. Those urban areas located along the Seoul-Pusan corridor also experienced a rapid growth of 3.23 percent. In particular, those areas that are located within 100 km from Seoul along the corridor grew at an impressive rate of 5.06 percent, on the average. In short, cities located at favorable sites grew rapidly, although location itself was not a significant factor.

CONCLUSION

The primary aim of this dissertation was to understand under what conditions cities grow in developing nations in general and in South Korea in particular. To achieve this aim, this dissertation began by discussing the ecological perspective of population redistribution. Dimensions or rubrics of Duncan's "ecological complex" were utilized in identifying factors which supposedly explain variations in urban growth. Using South Korean censuses as a primary source of data, the relationships between independent variables measured in 1970 and the urban growth rate (and net migration rates by 10-year age group), measured as a change rate during the 1970-1980 period, were examined.

The analysis of data has shown that the ecological hypotheses advanced here received relatively strong support. The variables used accounted for a significant proportion of the variation in changes in population size of Korean cities and urban towns. Of the variables examined, those that belong to the population and environmental rubrics appear to have exercised the strongest influence over urban growth. To be specific, indigenous labor surplus and population potential were highly influential in urban growth and, although somewhat limited to certain age groups, in net migration rates. Of the organizational variables, sustenance differentiation exercised a significant influence over urban growth. However, its effect is much limited to younger age groups. In addition, the influence of sustenance differentiation is less than the organizational model of population

redistribution would have anticipated. As was suggested by both zero-order correlations and multiple regression, indigenous labor surplus and population potential clearly exercised a stronger effect than organizational variables as well as other variables utilized in this study.

Although this study demonstrated the applicability/utility of the ecological perspective in Korean urban growth, the conclusion should be cautiously interpreted in the context of the Third World. The developmental trajectory of every nation is different from that of every other in historical, geopolitical, cultural, and economic terms. Thus, ecological studies of this sort should be further conducted in other developing countries in order to make more reliable generalizations about how city growth occurs.

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