MIGRATION AND URBAN CHANGE

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FOREWORD

Declining rates of national population growth, continuing differential levels of regional economic activity, and shifts in the migration patterns of people and jobs are characteristic empirical aspects of many developed countries. In some regions they have combined to bring about relative (and in some cases absolute) population decline of highly urbanized areas; in others they have brought about rapid metropolitan growth.

The objective of the Urban Change Task in IIASA's Human Settlements and Services Area is to bring together and synthesize available empirical and theoretical information on the principal determinants and consequences of such urban growth and decline.

Spatial population patterns and trends of 35 highly urbanized regions in 12 member countries of IIASA are set out in this paper, using data collected for the Migration and Settlement Comparative Study. The findings are discussed within the context of five hypotheses that deal with expected urban change under conditions of low natural increase and high levels of urbanization, and the limitations of such a comparative study are identified.

A list of recent publications in the Urban Change Series appears at the end of this paper.

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ABSTRACT

This paper examines the population development of large urban regions. It discusses several hypotheses pertaining to patterns of settlement change in highly urbanized countries. Such hypotheses refer to interrelations between population growth and urban size, the role of migration and natural increase as components of urban population change, the overall spatial mobility, the hierarchical migration, and the age distribution of migrants moving between, out of, and into large urban areas. Empirical material used in the analysis is derived from IIASA's Comparative Study on Migration and Settlement.

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INTRODUCTION

Concentration within the urban hierarchy was a dominant theme in the literature on settlement change during the 1950s and 1960s. Spatial concentration was expressed in terms of the increasing size--both absolute and relative--of the largest cities, their physical expansion (development of urban agglomerations or metropolitan areas), and the gradual elimination of lower-level units within the central-place systems. Predictions based on these trends showed the bulk of the population of the present-day urbanized countries to be clustered in a few megalopolises and the actual disappearance of small- and medium-sized towns by the end of the century.

Around 1970 several authors, notably Berry (1970), and Friedman and Miller (1965), began to claim that the suburbanization of population and economic activity, observed in many highly urbanized countries during the previous decades, could ultimately lead to dispersal at an interregional scale. Others, however, were still predicting a continuing concentration of population and employment in the largest metropolitan areas and a continuing relative economic decline of most rural and small-town areas.

The latter notions were deeply rooted in the existing theory of settlement development; hence the evidence of contraction of the population of a number of large metropolitan areas during the early 1970s was somewhat emphatically labeled as "a clean break with the past" (Vining and Strauss 1977).

On the other hand, the subsequent, more systematic analyses of economic and demographic trends as well as of historical patterns of urban growth have led a number of researchers to the conclusion that interregional population deconcentration represents a "normal" phenomenon, in fact a stage in the urban transition--a secular development cycle of urbanized areas (Klaassen and Pealinck 1979; Leven 1978a). Still, it has been generally acknowledged that theories of urban growth and structure are yet to incorporate these observed developments in their respective frameworks (see Hansen 1976).

Inadequacies of the available theory have also been reflected in the field of urban policies, which traditionally, and almost universally, adopted the goals of restricting the expansion of large urban agglomerations while promoting the growth centers within economically less active and sparsely populated regions. Hence, as Hall and Metcalf (1978) pointed out, in the case of highly urbanized countries some of these policies were addressing the past, rather than present-day issues. A reformulation of prevailing urban policies has therefore become an important issue in a number of countries. As mentioned earlier, however, this task has been faced with limitations of urban development theory, as well as piecemeal empirical evidence concerning settlement transformations during the recent past.

Against this background, Section I of this paper summarizes the recent discussion concerning explanatory factors and correlates of urban change, including policy aspects. The remaining sections are based on results of the Comparative Study on Migration and Settlement carried out at IIASA between 1975-78. Spatial population patterns and trends for 35 urbanized regions in 12 European countries and Japan are compared with selected hypotheses pertaining to patterns of urban change that could be expected under conditions of slow overall population growth and high levels of urbanization. Some of the limitations of such a cross-sectional approach are noted in concluding remarks.

I. URBAN CHANGE: INTERPRETATIONS AND POLICY RESPONSES

With the notable exception of Mumford's (1961) concept of a city life-cycle as well as of the urban transition concept (Klaassen and Paelinck 1979; van den Berg and Klaassen 1978), theories of urban development have traditionally focused on urban economic and population growth and on the transformation of space within urbanized areas (see Hansen 1976, for a critical appraisal). This is largely why the phenomenon of large-city contraction, which appeared in the 1970s, has been accepted with some reluctance and surprise.

In the field of urban economics, the emphasis on size as a positive and strong correlate of growth was contained in the early notion of "urban ratchet" introduced by Florence and developed by Thompson (1965). Once a city reaches a large population size (usually defined as 250,000-300,000 inhabitants), its further continuing expansion was claimed to be assured because of its agglomeration economies and diversified industrial base. Market tests were showing increasing economic efficiency gradients with increasing urban size, even beyond the population thresholds of the largest existing urban centers (Alonso 1971; Mera 1973). Concepts of spatial diffusion attach to cities located at upper levels of the urban hierarchy the role of origins of growth-inducing innovations (Lasuèn 1973). Adoption of such an assumption, corroborated by the empirical evidence available in the 1960s (see Richardson 1973) led to the formulation of settlement system models in which large cities enjoyed sustained growth based on their advantages as nodes for production and organizational linkages and hence, decision-making centers (Pred 1975). On the other hand, urban growth models were less successful in incorporating locational factors that represent negative externalities (for some new departures, see Thisse and Papageorgiou 1981).

In general, the formal theory of urban growth has fallen short of providing full insights into the type of urban change experienced in many urbanized countries during the 1970s, or into the phenomenon labeled by Richardson (1979) as spatial polarization reversal. Faced with such discrepancies, the planners and empirically oriented researchers have attempted to develop broader interpretive frameworks in which observed urban trends are attributed to sets of exogenous factors. As shown in Table 1, there is a certain consensus among the various authors in the selection of basic determinants of recent settlement deconcentration trends. The table, which summarizes rather than lists in full the determinants of urban change, follows the conventional disaggregation of five categories: economic, demographic, social, resource-environmental, and policy-related determinants.

Within the group of economic factors the evolving role of scale and agglomeration economies comes to the foreground. As Leven (1978a) noted, when scale is approached from the point of view of consumption rather than production, the settlement deconcentration may be more easily interpreted within the framework of economic location theory. Even with the reference to scale economies in production, however, modern organizational structures favor smaller over larger units and hence, physical deconcentration of economic activities (Illeris 1980). The reduction in the bulk-to-value ratios for most commodities has had similar effects (Leven 1978b). Technological improvements, in particular the advanced information-transmission systems, may have also rendered the spatial clustering of production establishments and the need for face-to-face contacts less crucial. Macrae (1978) argues that the need for outside contacts has been reduced by the internalization of technical skills within large corporations, the trend that makes more establishments footloose and corporations highly mobile. Richardson (1978) goes a step further by suggesting that if information linkages are becoming relatively more important than physical

Table 1. Basic determinants of urban change as identified in five studies.

Type of determinant	Leven (1978b)	Illeris (1980)	Bourne (1980)	OECD (1980)	UNECE (1981)
ECONOMIC	Declining role of the economies of scale and and of the agglomeration economies	Decrease in the internal (scale) and the external (agglomeration) economies in manufacturing; increased importance of stable labor force	Structural and technological change and the search for economic efficiency; random components of spatial economic development patterns	Readjustments of spatial economic patterns to slower growth rates of national economies; rapid rise in land costs, housing costs and service costs as an obstacle to the viable growth of urban economies	Structural and spatial (international and interregional) economic changes; gaps between evolving labor force composition and labor demand Technological change and its impact on communications, transportation and the location of economic activity
DEMOGRAPHIC	Diminishing rates of population growth and, consequently, of rural-to-urban migrations	Changing age structure and family composition		Changing distribution of population within cities and its aging	Declining rates of natural population growth, evolving age structure and migration patterns
SOCIAL	Declining quality of life in metropolitan as compared to non-metropolitan areas	Decreasing role of large specialized institutions	Locational shifts in capital distribution governed by the principles of exploitation;	Increased significance of social and economic inequalities and segregation within urban areas	Evolving social values, changes in life styles and preferences, increase in leisure time
RESOURCE-ENVIRONMENTAL		Deterioration of the metropolitan environment	Revival of traditional cultural predispositions; the amenity-disamenity factors	Widespread nature of physical decay within large metropolitan areas	Scarcity and conservation of resources, in particular of agricultural land, water and energy resources. Protection and conservation of the natural environment
POLICY	Housing, transportation and social policies implicitly favoring suburban versus urban and small versus larger urban places	Expansion in the provision of public services at the local level based on the priority of equal access	Implicit or unintended policy in the field of investment, taxation, trade, transportation, housing, etc.	Increased costs of the provision of public services in urban areas	Changes in political and administrative structures; centralization or decentralization of policy and decision making

input-output and infrastructural linkages, it may be necessary to revise the argument that emphasizes close correspondence between agglomeration economies and urban size. His empirical analysis reveals that the locational pull of large cities in the United States is quite weak in the case of many manufacturing industries, including some of the fast-growing sectors.

An alternative economic interpretation of recent shifts in the location of manufacturing away from large metropolitan areas may be based on the concept of industry-product cycles (see Thomas 1981, for a review and evaluation). A traditional spatial image of such a cycle is one in which an industrial innovation and its application (the phase of growth) occur in the large city, and the following phase of standardization brings the transfer of production to the city's hinterland or to smaller towns in other regions. These urban places, in turn, pay the price associated with the last phase of a product's life-cycle, i.e., its withdrawal and substitution by other commodities. Such a sequence follows from the discussion by Thompson (1968), according to whom the essential attribute of the large city is its role as incubator for innovations and new industries which, after initial development phase, filter down to smaller cities and other regions. However, such factors as improvements in communications and mounting negative externalities of large-city concentrations tend to impair these traditional functions of metropolitan areas. A more typical spatial representation of an industry-product cycle may therefore be one in which a large city participates in its later stages (standardization, in response to local market demand) or when the cycle is started and completed at other levels in the settlement system.

Yet another interpretation of settlement deconcentration trends borrows from the concepts of economic structural change and interregional trade. Simmons (1978) pointed out that any shift within or among sectors will have a corresponding spatial imprint owing to the functional differentiation of the settlement system. Such shifts may occasionally be contained within a single urban region, but they more likely involve movement between regions, both nationally and internationally. The latter development is especially true in the case of small, open economies, where changing trade relations tend to be effectively transmitted down to the local urban scale (Ohlsson 1979), and also in the case of sectors dominated by transnational corporations (Glickman 1981). Within large countries the slowing-down of aggregate manufacturing growth (characteristic of the 1970s) and the renewed expansion of agriculture and resource sectors--caused by increasing exogenous demand and prices--results in major interregional adjustments (Bourne 1980). At the same time, some large cities situated in older industrial regions, whose economy relies on stagnating industries, may experience a rapid contraction of economic activity and a heavy outmigration, thus evolving towards "negative growth poles" (van der Berg and Klaassen 1980).

The second category, demographic factors, is treated more extensively in Section IV of this paper whereas for the discussion of the remaining factors one may refer to the literature summarized in Table 1. The question of relative weight of the various determinants is perhaps not very important due to their strong mutual relations. For example, footloose services, and subsequently industrial establishments, may find it profitable to move into areas whose population potential is expanding because of retirement migrations, which are in turn guided by growing disposable incomes and evolving environmental preferences of the increasing proportions of people in the old-age categories. What has been less clearly recognized so far in the relevant literature is a given city's feedback relation between the performance of its economic and population change and its evolving spatial structure. The same applies to impacts of settlement deconcentration on national economic and demographic development. One can expect urban growth to be interrelated with such characteristics as a mean cost of journey-to-work, socioecological differentiation, and segmentation of the housing market. One may also believe that dispersed settlement patterns are conducive to higher birth rates, or, taking another perspective, generate higher resource (in particular energy) demand. Here we enter an area in which empirical evidence is very fragmentary whereas policy issues loom large.

Referring back to Table 1 one can see that some of the phenomena identified as determinants of metropolitan decline represent planning concerns as such, whereas others imply the emerging policy problems. Such problems are enumerated by Morrison (1975), Sternlieb and Hughes (1975), Drewe (1979), Korcelli (1980), and Nijkamp (1980) among others. The fundamental concern, perhaps, stems from interrelations between urban growth and national economic development, since not only "the performance of the national economy sets limits to the achievements of the individual metropolis" (Richardson 1978, p. 164 and 261), but the metropolis provides the environment for economic expansion and reconstruction at the national scale.

No matter how consistent such arguments may be, within a short time span, they are not likely to bring about a total reorientation of policies traditionally aiming at the slowing-down of population concentration within large metropolitan areas and at mitigating adverse social and environmental impacts of such concentrations. As Hall and Metcalf (1978) point out, spatial policies tend to lag behind the trends and developments that they are expected to cope with. Recent urban policy debates in the United States (President's Commission 1980; Glickman 1981) suggest that this lag may in fact be inevitable due to numerous indirect consequences of spatial policies. Evidently, the emergence of new policy approaches to human settlement hinges on the development of empirical analyses and evaluations of urban trends. This is the message conveyed recently by two international, policy-oriented urban study programs, carried on by the Organization for Economic Cooperation and Development (1980) and by the United Nations Economic Commission for Europe (1981). It also supplies a convenient entry to the remaining parts of this paper.

II. REGIONAL AGGREGATION UNITS

Many authors, for example Morrison (1975) and Alonso (1978), have argued that declining rates of population growth and its ageing (i.e., phenomena typical of later stages in the demographic transition), have markedly contributed to the slowing-down of the growth of large cities in developed, highly urbanized countries. Accordingly, a study of the reproduction and mobility patterns of a metropolitan area's population structure as against a nation-wide population should answer some of the questions pertaining to recent trends in human settlement development. This assumption forms the background of the present analysis, which draws on data and results of the Comparative Study on Migration and Settlement carried out in IIASA's Human Settlements and Services Area during 1975-78. In particular, it focuses on spatial mobility of the urban population. Migrations among urban regions, as well as flows between urban and non-urban regions, are interpreted as summary indicators of the patterns of urban change.

Summary descriptions of spatial migration patterns are made possible by means of a number of methods (see Nystuen and Dacey 1961; Tobler 1975; Slater 1976; Masser and Scheurwater 1978). Such procedures, based typically on graph-theoretical approaches, allow for the identification of dominant flows and of the flow hierarchy. These features cannot be fully respected in the operational definitions of spatial units used for multiregional demographic analysis, since the units in question have to meet a number of alternative criteria related to their size and planning relevancy, not to mention data availability constraints.

Nevertheless, the spatial aggregation problem in demographic analysis is not a trivial one, as the model results tend to vary depending on the type and scale of regions identified. Hence, an *a priori* recognition of migration flow configurations represents an important prerequisite for consistent areal definitions. An analogy can be drawn here between multiregional demographic analysis and intra-urban spatial interaction models. In both cases it is primarily the magnitude of flows that count since in their absence the simpler, cohort-survival or economic multiplier techniques would be deemed as sufficient analytical tools. From this point of view a relevant spatial system can be defined as one that maximizes the inter-unit flows for the given number of spatial units. In urban systems modeling such a postulate is contained in the Broadbent rule. (See Brown and Masser 1978. According to this rule the average zonal radius should be less than the average trip length.) In spatial demographic analysis the choice of spatial units is addressed as an aspect of a wider problem of aggregation and decomposition, involving the treatment of the number of population characteristics, involving the treatment of the number of population characteristics and time units. This has led to the formulation of principles for multilevel aggregation systems (Rogers 1976).

Taking into account the generally observed clustering of migration moves within relatively short distance intervals, one would postulate detailed spatial disaggregations for the purpose of multiregional demographic analysis. Such disaggregations would be operationally unfeasible at the level of most national systems. However, a higher spatial aggregation can be justified not only by computational and data limitation problems, but also on the grounds of assumed interdependence between distance of migration and its cause. For example, it has been postulated by many authors (e.g., Boudeville 1978) that at an advanced stage of urbanization the bulk of labor-oriented migrations take place between individual labor-market areas that are focused on large urban centers, whereas moves within such areas represent adjustments to changing socioeconomic and family status of migrants and to the evolving urban environment. Accordingly, the adoption of functional urban regions (FURs) as spatial units in multiregional demographic analysis should allow one to separate the effects of different types of moves, while focusing on labor-oriented migration.

The spatial units actually used in the Comparative Study on Migration and Settlement at IIASA were typically much larger than labor-market regions and, depending on the country concerned, captured between 20-50 percent of registered moves that involved the crossing of local administrative boundaries. The coarse-grain spatial divisions adopted reflected not only the limitations alluded to earlier, but also the researchers' priorities. For a number of countries these studies represented the first application of multiregional demographic techniques, in which the choice of the spatial system was overshadowed by the very testing of the model's efficiency. Nevertheless, most of the regional systems used in the national reports included one or more units whose identity, in terms of the settlement structure, could be clearly interpreted. This is true in the case of 13 out of 17 countries covered by the Comparative Study on Migration and Settlement. It is now proper to briefly describe the place of these regional units, listed in Table 2, within the respective national settlement systems. Wherever possible, their extent will be compared with the boundaries of functional urban regions defined for the corresponding set of countries within the framework of the Human Settlement Systems study at IIASA (see Kawashima and Korcelli 1981) or alternatively with metropolitan regions defined in a parallel research project by Hall and Hay (1980).

As it might be expected, areal units used in the Comparative Study for the largest of the 17 IIASA member countries, i.e., Canada (Termote 1980), the USA (Long and Frey 1981) and the USSR (Soboleva 1980) are extensive administrative or census regions that cannot be readily adopted for the purposes of the present analysis. The same is true of Italy, the preliminary report for which (Just and Rogers 1980) is based on the division into four statistical regions: Northwest, Northeast, Central, and South. This limits the scope of a cross-sectional study of settlement-focused population structure and points to 12 European countries and Japan.

The Migration and Settlement report for Austria (Sauberer 1981) is based upon the division of that country into eight Länder (one of which is Vienna in its administrative boundaries) and a more aggregate breakdown into four regions: the Northeast,

Table 2. Basic characteristics of 35 urbanized regions included in the cross-sectional analysis.

Code	THE MIGRATION AND SETTLEMENT STUDY REGIONS: Name of region	Year	Pop. size (1000)	Area in sq.kms.	Pop. density (persons per sq.km	Pop. share in the multi-regional system	COMPARABLE FUNCTIONAL URBAN REGIONS OR METROPOLITAN REGIONS[a]: Name of region	Year	pop. size (1000)	Area in sq. kms	pop. density (area sq.kms)
1	Vienna city	1971	1,615	414	3901	21.7					
2	East Austria (incl.Vienna)	1971	3,301	23,543	141	44.3	Vienna F.U.R.	1971	2,566	13,608	189
3	Sofia city	1975	1,077	953	1026	12.3					
4	Prague city	1975	1,161	291	3990	7.7					
5	Central Bohemia (incl.Prague)	1975	2,301	11,299	204	15.3					
6	Bratislava city	1975	331	368	700	2.3					
7	Bremen city	1974	724	404	1792	1.2	Bremen F.U.R.	1970	1,235	6,994	177
8	Hamburg city	1974	1,734	753	2303	2.8	Hamburg F.U.R.	1970	2,844	8,324	342
9	Nordrhein Westfalen	1974	17,219	34,044	506	27.8	Ruhr/Rhein agglomeration[b]	1970	12,004	16,005	750
10	West Berlin	1974	2,034	480	4238	3.3					
11	Uusimaa province (Helsinki region)	1974	1,073	10,351	97	23.8	Helsinki F.U.R.	1974	1,109	10,143	109
12	Paris region	1975	9,878	11,984	824	18.8	Paris M.R.	1970	9,503	13,608	698
13	North France	1975	3,914	12,542	312	7.4	Nord agglo-[c] meration	1970	2,348	2,931	801
14	Berlin capi-tal district	1975	1,098	403	2726	6.5					
15	Karl-Marx-Stadt	1975	1,979	6,009	329	11.8	Karl-Marx-Stadt M.R.	1975	590		
16	Leipzig-Halle district	1975	3,322	13,737	242	19.8	Halle Leipzig M.R.	1975	1,323		
17	Dresden district	1975	1,836	6,733	273	10.9	Dresden M.R.	1975	862		
18	South of GDR	1975	7,135	26,484	269	42.6	South of GDR	1975	7,135		
19	Southeast England	1970	17,316	27,408	642	32.0	London M.R.	1971	9,780	8,423	1,161
20	West Midlands	1970	5,178	13,013	398	9.6	Birmingham and Coventry M.Rs.	1971	3,450	3,728	925
21	Northwest England	1970	6,789	7,993	849	12.5	Liverpool and Manchester M.Rs.	1971	3,557	2,608	1,379
22	Central Hungary (Budapest)	1974	2,968	7,489	396	28.4	Budapest F.U.R.	1975	3,150	9,540	330
23	Kanto region	1970	30,258	36,742	824	28.9	Tokyo and Yokohama F.U.Rs.	1970	22,036	11,901	1,852
24	Kinki region	1970	16,511	23,237	711	15.8	Osaka, Kyoto, and Kobe F.U.Rs.	1970	14,200	12,654	1,122
25	Noord-Holland (Amsterdam)	1974	2,283	2,654	860	16.9	Amsterdam M.R.	1970	2,347	3,002	782
26	Zuid-Holland (Rotterdam)	1974	3,019	2,869	1,053	22.4	Rotterdam and The Hague M.Rs.	1970	2,961	3,171	934
27	Utrecht province	1974	849	1,328	640	6.3	Utrecht M.R.	1970	646	1,130	572
28	West Netherlands (Randstad)	1974	6,150	6,854	897	45.6	Randstad M.Rs.	1970	5,954	7,303	815
29	Warsaw Voivodship	1972	2,207	3,788	588	6.4	Warsaw F.U.R.	1973	3,364	20,701	168
30	Łódź Voivodship	1977	1,099	1,526	723	3.2	Łódź F.U.R.	1973	1,540	7,227	213
31	Gdańsk Voivodship	1977	1,288	7,394	176	3.7	Gdańsk F.U.R.	1973	1,427	11,530	124
32	Katowice Voivodship (Upper Silesia)	1977	3,557	6,650	538	10.3	Katowice F.U.R.	1973	3,790	10,822	350
33	Cracow voivodship	1977	1,144	3,255	354	3.3	Cracow F.U.R.	1973	1,691	8,753	193
34	Stockholm	1974	1,487	6,493	229	18.2	Stockholm M.R.	1970	1,439	7,154	201
35	South Sweden	1974	1,159	13,866	84	14.2	Malmö and Helsingborg M.Rs.	1970	836	7,447	112
TOTALS[d]			119,136	299,316 (9.7%)	398	30.3 (.40% of total urban population)					

[a] Metropolitan Region defined according to Hall and Hay; Functional Urban Regions according to Kawashima and Korcelli (1981), Sherill (1976, 1977), Lacko et al. (1978).

[b] Functional Urban Regions of: Bochum, Bonn, Dortmund, Duisburg, Düsseldorf, Essen, Köln, Krefeld, Münchengladbach and Wuppertal.

[c] Metropolitan Regions of: Lille, Valenciennes, Lens, Douai and Bruay-en-Artoix.

[d] Without double-counting of Vienna, Prague, South of GDR, and West Netherlands.

(Total area of 13 countries: 3,076,100 sq.kms) the Central, the Southern, and the Western. In the latter delineation the Northeast includes Vienna together with the two neighboring Länder of Niederösterreich and Burgenland. When compared with the functional urban region of Vienna, as defined by Sherrill (1976) who used commuting-to-work data, the Northeast region covers a 73 percent larger area, although the difference in terms of population numbers is only 28.6 percent. In addition to the Vienna FUR, it includes two smaller commuting regions centered around Wiener Neustadt and St. Pölten --industrial towns situated in the broader hinterland of Austria's capital (see Bobek 1975, quoted in Sherrill 1976). For the purposes of the present paper both Vienna city and the Northeast region constitute relevant spatial units; the former exemplifies a large, central city, whereas the latter serves as an approximation of the labor-market region, although admittedly it extends well beyond the range of daily commuting to the region's core.

In the multiregional demographic analysis for Bulgaria (Philipov 1981) the clear choice for cross-sectional comparisons is Region 7, which corresponds to the administrative extent of the city of Sofia. It is one of the seven regions obtained as a result of the aggregation of 28 administrative districts. The region in question is overbounded in relation to the city proper and may be considered closer to the urban agglomeration (metropolitan area) of Sofia. A corroboration of such a definition is found in the paper by Grigorev (1978) who shows that the Sofia District, which surrounds the capital, has been characterized by low population density (43.6 inhabitants per sq.km, as compared to 78.7 for the country as a whole) and absolute population decrease (by 4 percent between 1946 and 1975).

The 12 upper-level administrative districts of Czechoslovakia, adopted as regions in the Migration and Settlement Study (Kühnl 1981), include the city-districts of Prague and Bratislava. Unlike Sofia, the urban agglomeration of Prague extends well beyond the city's administrative boundaries into the district of Central Bohemia which is characterized by a high urbanization level (see Hampl, Jezek and Kühnl 1978). Hence, as in the case of Vienna, it is justifiable to consider Prague city and Central Bohemia (including Prague) as spatial units representing a central city (urban core) and a broader urban region.

Among the Länder of the Federal Republic of Germany, treated as regions in the Migration and Settlement Study (Koch and Gatzweiler 1980), two (Hamburg and Bremen) correspond to cores of functional urban regions. As shown in Table 2, these cities accounted for 63 and 58.5 percent of the total population of the respective urban regions in 1970, according to Sherrill (1977). Another Land that can be considered as an urban region is Nordrhein Westfalen. Unlike the previously identified units, it is characterized by a clearly polynucleated structure and contains a number of major urban centers as well as less urbanized peripheral zones. However, the combined share of the Ruhr conurbation together with the Düsseldorf-Cologne-Bonn axis in this region is overwhelming in terms of both population numbers and the economic activity. Also, zones of daily travel focused on these urban nodes cover the major part of its territory. This is evident from data in Table 2. Yet another urban unit covered in the study by Koch and Gatzweiler (1980) is West Berlin. While included tentatively in the analysis to follow, it displays quite specific demographic features and trends, which are largely attributable to its political and territorial status.

In the case of Finland, the spatial units adopted in the multiregional demographic analysis were 12 administrative provinces (Rikkinen 1979). The Helsinki region, containing the only major city of Finland and accounting for more than one-fifth of the total population and over a quarter of industrial value added, is closely approximated to the province of Uusimaa. According to Hirvonen (1981) the functional urban region of the Finnish capital, using population, employment, and commuting data at the commune level as indicators, covered most of Uusimaa (except for its northeastern section) and a small part of the neighboring province of Häme, whose main urban nodes Tampere and Lahti, however, formed separate urban regions. The difference between the population number of the two spatial aggregates--the Uusimaa province and the Helsinki urban region --amounted to just 35,025 inhabitants in 1974, i.e., about 3 percent of the total.

The division of France (Ledent 1981) into eight planning regions known as ZEATs (Zones d'Etude et d'Amenagement du Territoire) offers two compact and heavily urbanized regions, which can be selected for the comparative analysis. These are: the Paris region, consisting of seven departments (Paris, Yvelines, Essonne, Haut-le-Seine, Seine-St.Denis, Val-de-Marne, and Val d'Oise) and the North, which includes the old industrial agglomeration of Lille-Robaix-Tourcoing. The latter region has an overall population density of more than three times the national average or the next most densely occupied region--the East. The settlement-oriented regionalization map of France, compiled by Hall and Hay (1980), contains 86 metropolitan and 72 non-metropolitan regions. One of the 86 regions, Paris, comes very close to the corresponding spatial unit in the ZEAT partition. The area of the metropolitan unit is around 13 percent larger; in terms of population size an exact comparison is prevented due to the difference in the years for which the data are available (1970 and 1975). A graphic interpolation of population trends yields a 2.5-3.0 percent difference between the two regions for the corresponding points in time. In any case, the Paris region as used by Ledent (1981) can be treated as a very close approximation of the functional urban region of the French capital. The group of departments forming the North region in the ZEAT division was split by Hall and Hay into 11 metropolitan and 3 non-metropolitan regions. Out of the metropolitan group, 5 (Lille, Lens, Douai, Bruay-en-Artois, and Valenciennes) form a cluster containing approximately 61 percent of the population and only 23 percent of the total area of the North region.

The administrative division of the German Democratic Republic into 15 Bezirke (districts) basically follows the city-region principle, hence, it is particularly relevant for the study of settlement structure. Boundaries of individual districts to a large extent follow the spheres of influence of high-ranking urban centers (see Krönert 1981). The main exception to this rule is the capital district of Berlin, which basically corresponds to the extent of that city's built-up area. For the purposes of the multiregional demographic analysis (Mohs 1980), the districts were aggregated into five and ten regions. In the latter division, the districts of Halle and Leipzig are treated as one spatial unit [this reflects strong interrelations within the Halle-Leipzig urban agglomeration, see Ludemann and Heinzmann (1978)], whereas the Dresden, Karl-Marx-Stadt, and Berlin Bezirke constitute separate regions. In the five-region division, the districts of Halle, Leipzig, Karl-Marx-Stadt, and Dresden are treated as one area (the South), representing the most heavily urbanized and industrialized part of the GDR. The districts cannot be directly compared with functional urban regions as delineated by Krönert (1981) since the FUR's population size was not calculated.

Great Britain, with its extremely high level of urbanization, is almost certain to offer at least a few large city-oriented spatial units, no matter what the specific regionalization criteria used. The multiregional demographic study (Rees 1979) was based on the division of Great Britain's territory into 11 regions, out of which 3, South-East, West Midlands, and North West, broadly correspond to the extent of a densely occupied belt along the Liverpool-London axis, referred to by Hall et al. (1973) as Megalopolis England. The first region contains Greater London, the second, the West Midlands conurbation, and the third, the Merseyside and the South-East Lancashire conurbations. The population size, area, and density of the major metropolitan areas that form parts of those conurbations, is given in Table 2 and follow the definitions of Hall and Hay (1980). These areas account for some 53-66 percent of the total population of the respective regions. The proportions are very high, considering the fact that a number of smaller urban nuclei, closely integrated with the London, Birmingham, Liverpool, and Manchester areas, form separate metropolitan cores as defined by Hall and Hay.

For Hungary, the main concern was to make sure that Budapest, the country's primate city and one of the largest urban centers in central Europe, was taken into account in this comparative analysis. The task turned out to be rather straightforward since the regionalization scheme adopted in the multiregional population analysis (Bies and Tekse 1980) followed principles basically similar to those used by Lacko, Enyedi,and Koszegfgy (1978) who analyzed functional urban regions in Hungary. Boundaries of the Central Region are identical with those of the Budapest FUR, except in the north-eastern sector where the range of commuter flows extends into the western part of the Northern Region. An exact comparison of the two spatial aggregates is given in Table 2.

The case of Japan resembles that of Great Britain. The spatial division followed in the multiregional demographic study (Nanjo, Kawashima, and Kuroda 1981) was not really concerned with the mapping of the settlement system; even so, however, some of the units are almost totally urban and dominated by Japan's largest urban agglomerations. This pertains in particular to the regions of Kanto and Kinki. The former contains the Tokyo-Yokohama urban complex, whereas the latter includes Osaka, Kyoto, and Kobe. These metropolises, according to Kawashima's definition (1981), account for 72.8 and 86.0 percent of the total population of the respective regions in 1970.

The multiregional population analysis for the Netherlands used a division of 12 provinces, which, in the summary report (Drewe 1980), were aggregated into 5 major regions: North, East, West, Southwest, and South. Keeping the provinces as separate units, one can observe that three of the upper-level administrative units, namely, Noord-Holland, Zuid-Holland, and

Utrecht, contain Holland's four largest cities--Amsterdam, Rotterdam, Utrecht, and the Hague. The functional urban regions focusing on these cities as defined by Hall and Hay (1980), almost exhaust the territory of the respective provinces. A comparison is facilitated by data in Table 2. Taken together, the four urban regions correspond to the Randstad area, sometimes described as one polynucleated urban agglomeration. However, Dutch scholars emphasize the lack of functional interdependence within this region. Although each of its major urban centers performs high-level specialized functions, their range covers either the whole country or, as in the case of major functions performed by Amsterdam and Rotterdam, a large part of northwestern Europe. Still, due to the physical proximity of these cities and their high overall urbanization level, it is justifiable to include the entire West region of the Netherlands, consisting of the Noord-Holland, Zuid-Holland, and Utrecht provinces, as another spatial unit in the cross-sectional study of urban population structure and trends.

The regionalization of Poland (Dziewonski and Korcelli 1981) was designed in such a way as to allow an analysis of the fertility, mortality, and mobility patterns for major urban areas, as well as major planning regions. Out of the total 49 voivodships (upper-level administrative units), 5 were treated as separate regions, whereas the remaining ones were aggregated in accordance with the boundaries of the macro-regions, defined for economic planning purposes. Three out of the former five units (Warsaw, Lodz, and Cracow) have the status of city-voivodships, and the other two are also heavily urbanized--the Katowice voivodship corresponds in broad terms to the Upper Silesian Conurbation, whereas the Gdańsk voivodship is dominated by the so-called Tri-City, the agglomeration of Gdańsk-Gdynia-Sopot. The three city voivodships, although larger than the central cities themselves, fall short of encompassing daily commuting zones. The respective functional urban areas (Korcelli 1977) are more extensive in terms of area and population number. However, the FURs include rural hinterlands in addition to urban cores and their commuting zones; hence, the differences shown in Table 2 should be taken with reservations.

Finally, among the eight regions analyzed by Andersson and Holmberg (1980) in their Migration and Settlement Study for Sweden, Stockholm and the South merit closer attention. These regions correspond to the extent of counties (or groups thereof), and at the same time they can be approximated by aggregations of A-Regions, which have been defined in Sweden on the basis of spatial labor-market criteria. However, for consistency reasons, the standard units in our comparisons are regions defined by Hall and Hay (1980). In this light, the Stockholm region can be considered as almost identical with the respective metropolitan region in terms of population size, although in terms of territorial extent the two units do not completely overlap. The South region, according to Hall and Hay's definition consists of three metropolitan and two non-metropolitan zones. Out of the former, the Malmö-Lund and the Helsingborg regions represent jointly some 72 percent of the population of the South--over 0.8 million distributed within an area only marginally larger than that of the Stockholm region.

Altogether, out of the total of 124 regions on which the Migration and Settlement reports for the 13 countries are based, 35 can be identified as urban-oriented units. They jointly represent 9.7 percent of the total area, but more than 30 percent of the total population, and about 45 percent of the total urban population. Hence, a typical urban region has a somewhat larger population (mean of 3.8 million) as compared to an average unit (3.2 million) in the system. All the capital regions and a number of major industrial agglomerations have been accounted for; however, whereas both the areas of "old" and "new" urbanization are represented in the sample, the balance is slightly tilted in favor of the former type. This is mainly true of France and the Federal Republic of Germany where areas of recent urban expansion, situated in the southern parts of these countries, could not be singled out using the available spatial disaggregation.

With respect to the structure of national settlement systems, the selected regions contain mostly those urban centers that belong to the upper level in the urban hierarchy. Conclusions concerning the other components of settlement systems can only be derived indirectly with the help of the material to be presented. However, the diversity and changeability of growth and decline, traditionally experienced by smaller urban places, have only more recently become features of large cities as well. This development has become synonymous with the notion of urban change, as portrayed in the current urban studies literature. Against this background, a study of the demographic structure and trends within major urban regions of Europe and Japan may also contribute to the increased understanding of the evolution of national settlement patterns.

As emphasized earlier, the 35 regions fall into a broad spectrum in terms of population size, density, share in a multiregional system, and the degree of correspondence to metropolitan area (functional urban regions) boundaries. Since this diversity may be reflected in population trends, it should be taken into account in their interpretation. The initial disaggregation of spatial units into three categories is shown in Figure 1 and Table 3.

The first group, consisting of eight administrative cities, occupies low to medium ranks in terms of absolute population size, but is undoubtedly characterized by having the highest intensity of settlement. The next group consists of city-regions, predominantly monocentric. The third grouping represents larger urban agglomerations as well as more loosely interconnected, extensive urbanized regions; their overall density figures are around the mean, whereas the absolute population numbers are clearly the largest within the whole set of regional units under analysis.

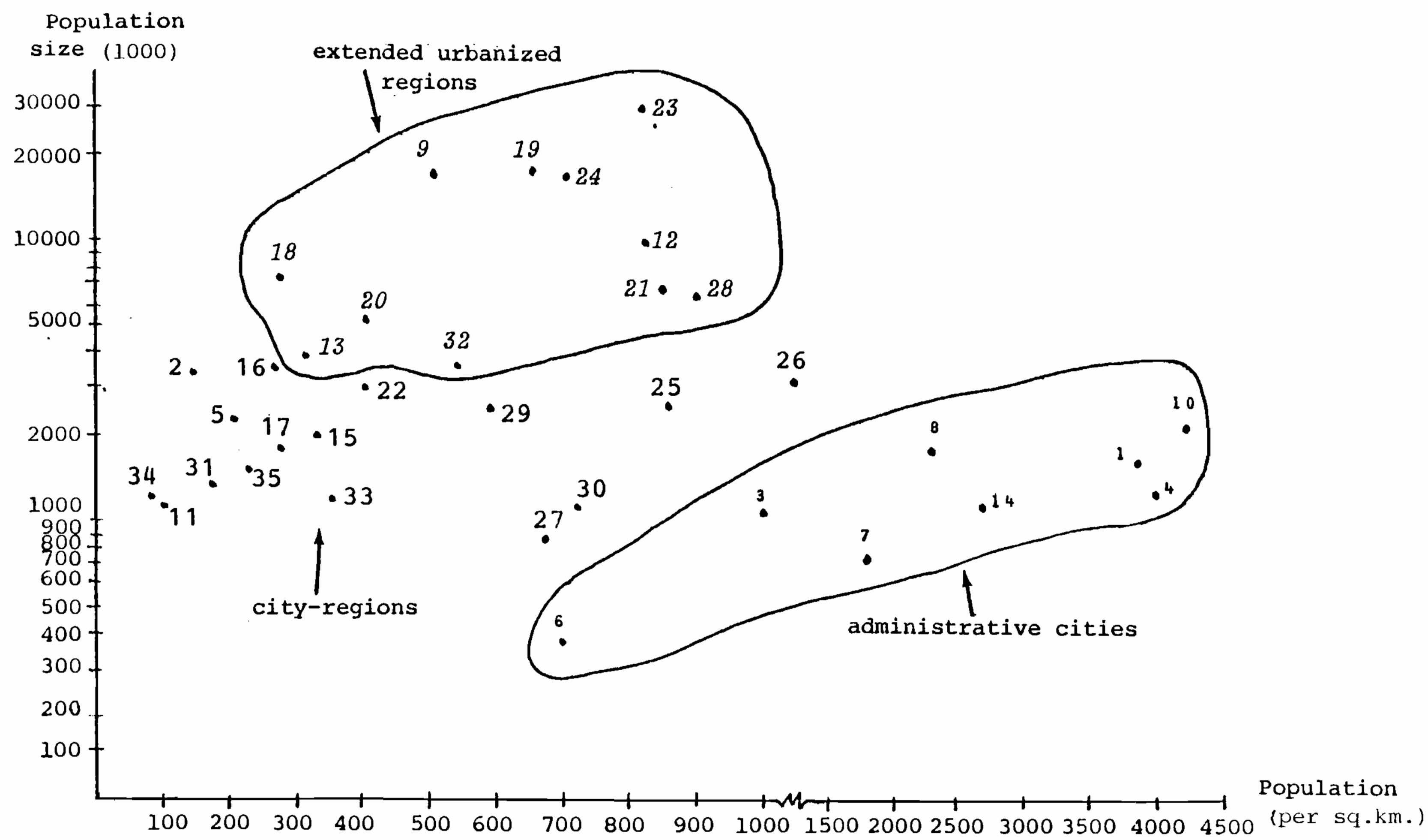

Figure 1. Distribution of urban regions by population size and density.

Table 3. The three categories of regional units.

Group	Code	Name of region	Pop.density (persons per sq.km)	Pop. size (1000)	NODALITY: Single center dominator	NODALITY: Poly-centric	DEGREE OF CLOSURE[a]: Metropolitan Area classification: Population	Metropolitan Area classification: Area	Functional Urban Region classification: Population	Functional Urban Region classification: Area
Group A	10	West Berlin	4238	2,034	x					
	4	Prague city	3990	1,161	x					
	1	Vienna city	3901	1,615	x				0,629	0,030
	14	Berlin capital city	2725	1,098	x					
	8	Hamburg city	2303	1,737	x				0,631	0,090
	7	Bremen city	1792	724	x				0,586	0,058
	3	Sofia city	1026	1,027	x					
	6	Bratislava city	700	331	x					
Group B	26	Zuid-Holland (Rotterdam-Hague)	1053	3,019		x	1,015	0,905		
	25	Noord-Holland (Amsterdam)	860	2,283	x		0,972	0,884		
	30	Łódź	723	1,099	x				0,714	0,211
	27	Utrecht	640	849	x		1,314	1,175		
	29	Warsaw	585	2,207	x				0,656	0,182
	22	Central Hungary (Budapest)	396	2,968	x				0,942	0,787
	33	Cracow	354	1,144	x				0,676	0,372
	15	Karl-Marx-Stadt	329	1,979		x				
	17	Dresden	273	1,836		x				
	16	Leipzig-Halle	242	3,322		x				
	34	Stockholm	229	1,487	x		1,033	0,908		
	5	Central Bohemia (including Prague)	204	2,301	x					
	31	Gdańsk	176	1,288	x				0,902	0,641
	2	East Austria (including Vienna)	141	3,301	x				1,286	1,731
	11	Uusimaa (Helsinki)	97	1,073	x				0,968	1,021
	35	South of Sweden	84	1,159	x		1,305	1,862		
Group C	28	West of Netherlands (Randstad)	897	6,150		x	1,033	0,941		
	21	NW England	849	6,789		x	1,887	3,065		
	12	Paris Region	824	9,878	x		0,970	0,881		
	23	Kanto Region	824	30,258	x		1,373	3,087		
	24	Kinki Region	711	16,511		x	1,163	1,836		
	19	SE England	642	17,316	x		1,771	3,251		
	32	Katowice (Upper Silesia)	538	3,557		x			0,939	0,615
	9	Nordrhein Westfalen	506	17,219		x	1,434	2,127		
	20	West Midlands	398	5,178		x	1,501	3,491		
	13	North of France	312	3,914		x	1,630	4,279		
	18	South of GDR	269	7,135		x				

[a] Proportion of regional population and area to the Metropolitan Area's (or Functional Urban Area's) population and area.

The degree of regional closure is expressed as a proportion of regional population and area to the respective values for the metropolitan region (or functional urban region) aggregations. Since delineation criteria used by Hall and Hay (1980) in their study of metropolitan regions were generally more restricted than those applied in the definitions of functional urban regions (Kawashima and Korcelli 1981), which generally included parts of the rural hinterland interconnected by central-places linkages, the figures are arranged separately for the two types of standard regions. The three administrative cities for which the respective quotients could be calculated, have the lowest of all proportions (around 0.6 for population and 0.03-0.1 for area). The city regions, on the other hand, reveal values close to 1.0. The deviation from this figure indicates the degree to which an individual region may be considered over-bounded or under-bounded when compared to an independently defined, standard urban (metropolitan) region. Finally, for the third grouping of regions, the corresponding values are over 1.0 when these units were compared with the major regions, rather than all the standard urban (metropolitan) regions contained within their boundaries.

Hypothetically, the degree of regional closure should be associated with overall population density (in accordance with the well-known distance-decay rule of urban density patterns). That is, the closure should be highest (index values close to 1.0) for middle-range values of population density and should decline with both increase and decrease of the overall density index. This holds true when one compares such pairs of regions as Stockholm with South of Sweden, or Vienna with Northeast of Austria. Generally, however, the regularity tends to be weak (see Figure 2) for two reasons. First, the definitions of standard urban (metropolitan) regions are not quite equivalent among, or even within individual countries. Second, and more importantly, the extent of the sphere of daily activities focused on an urban center varies depending on city functions, location, economic development, level, and overall intensity of spatial occupancy.

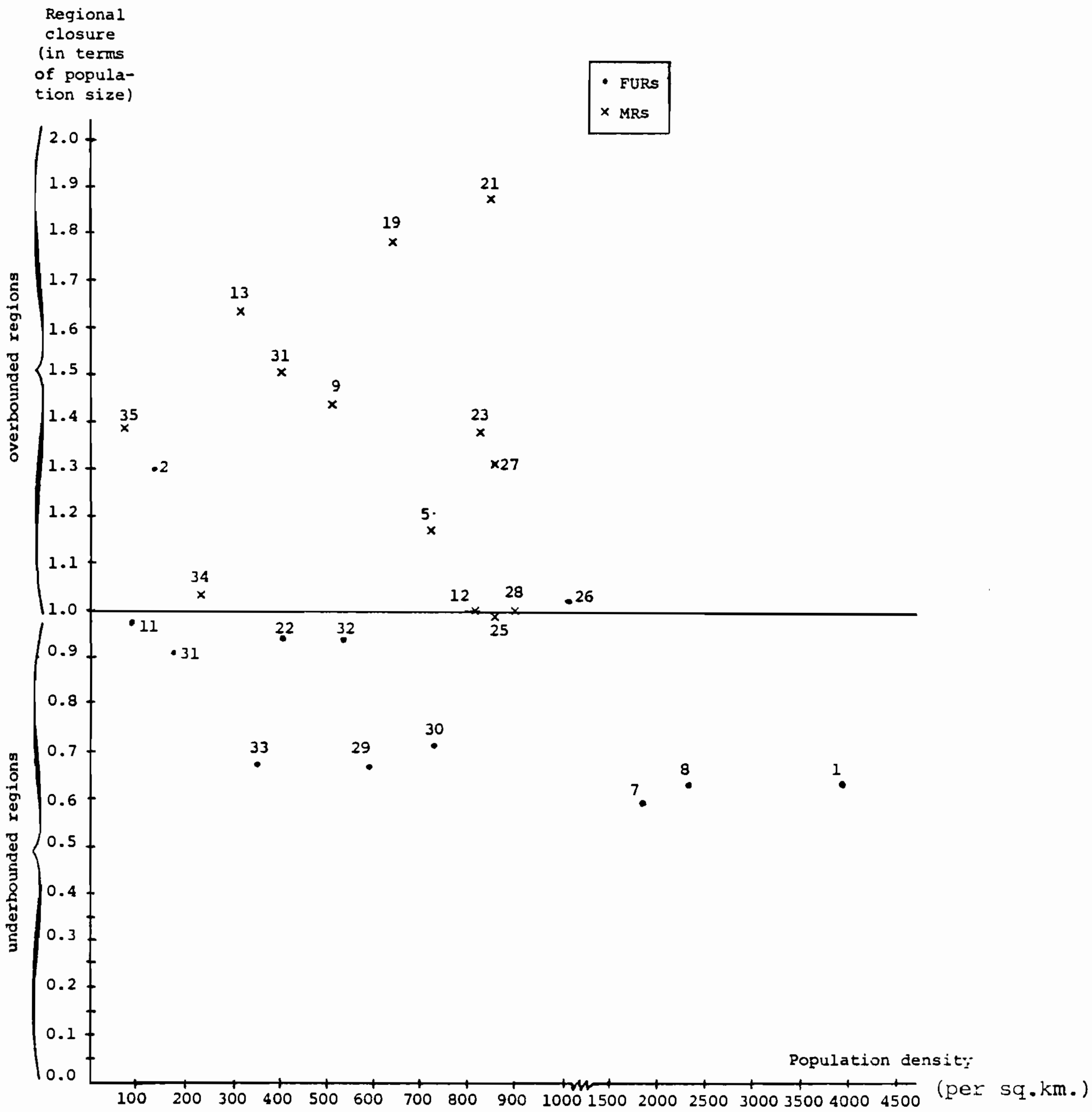

Figure 2. Interrelations between population density and regional closure.

III. FIVE HYPOTHESES CONCERNING PATTERNS OF URBAN CHANGE

From the descriptions and interpretations of contemporary patterns of urban change*, one may derive a number of hypotheses relating to their demographic aspects. These hypotheses may be tested with relevant data and findings of the Migration and Settlement Study. As previously noted, the focus of this study is on developed countries, which are characterized by low natural increase and advanced urbanization levels. In this respect the countries covered are not quite a uniform group; the proportion of their population living in urban areas in 1975 ranged from .50 (Hungary) to .84 (Sweden). The variation of the natural increase was also substantial: between minus 1.9 per thousand population for the FRG to 10.1 for Japan and Poland in 1977.

In spite of such differences, all countries included in the sample are in advanced stages of the demographic transition, as well as the urbanization transition. Their location at different points within these corresponding stages may be considered as a positive feature, from the point of view of this analysis, since it allows one to introduce implicitly the time factor. Three of the hypotheses identified consider spatial mobility patterns, whereas the remaining two deal with total population change and its components. Some of the empirical evidence may refer to more than one hypothesis at a time, as the data produced with the help of multistate demographic models (Willekens and Rogers 1978) capture the effects of interaction between fertility, mobility, and mortality patterns. Most of the figures presented below are either ratios or differences calculated with respect to national figures (or mean values for respective multiregional systems). This introduces a common denominator, although it by no means solves the difficult problems involved in international comparisons of population data.

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*See among others Beale (1977), Vining and Strauss (1977), Leven (1981), Hall and Hay (1980), Gordon (1978), Bourne (1981), Bourne et al. (1980), Simmons (1979), Glickman (1977a and b), Kawashima (1981).

Hypothesis 1. The rates of population growth in urban areas are inversely related to the level of urbanization (at a national scale) and to city-size.

The later stages of the demographic and the mobility transitions (Zelinsky 1971) are characterized by diminishing growth rates of the urban population. Typically, the level of urbanization becomes stable after reaching the value of some 80 percent. The large urban areas lead the trend. Whereas during the periods of rapid urbanization (such as the 1950s throughout most of Europe, or the present decade in the case of less developed countries) the large cities expanded faster than the total urban population, such a pattern was reversed during more advanced urbanization stages. There is ample empirical evidence of this evolution, although it suffers from the lack of comparability among spatial units for which data are usually available (for example, cities in their administrative boundaries). Yet, the few studies based on comparable units point towards similar conclusions. For example, in the case of cores of functional urban regions in 17 European countries the relation between growth and size was found to be increasingly negative or evolved from positive to negative between 1950-75 (Korcelli 1980). Typically, the growth rates shift from the level higher to the level lower than the national rate and subsequently evolve towards absolute population decline. However, population growth tends to be a negative function of urban size, although it varies positively within an urban region along with distance from its core. Thus, the relationship between growth and size can be obscured by variations in the proportion accounted for by hinterland zones within individual urban regions.

The data derived from the Comparative Study on Migration and Settlement basically support the above observations. During the mid-1970s 19 out of 35 urban regions experienced population growth slower than the national growth; half of the remaining units exceeded the respective national rates by less than 2 percent, whereas 13 regions suffered absolute population losses (Figure 3). Their number may in fact increase to 16 by the

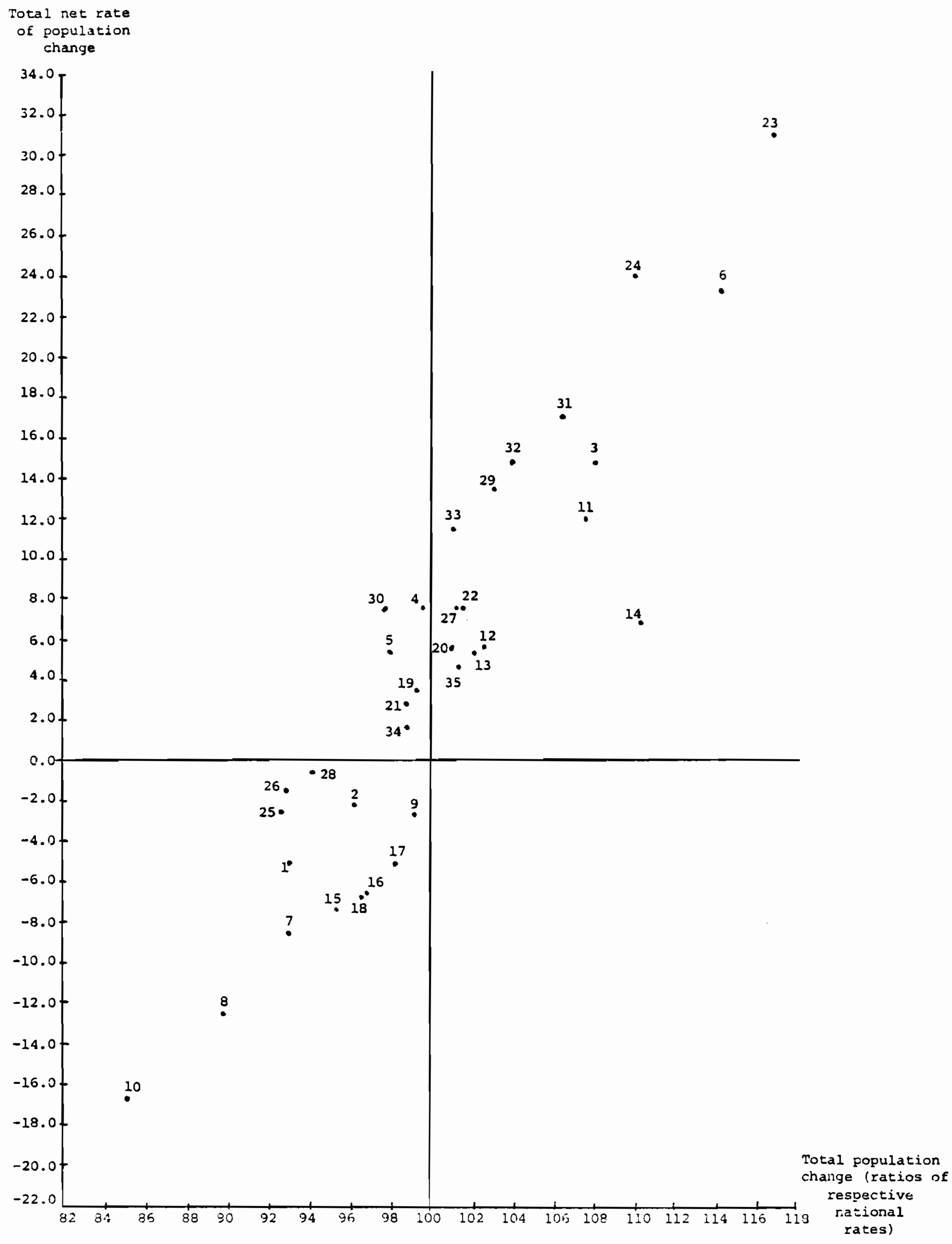


Figure 3. Total population change for urban regions.

year 2000 and to 21 two decades later. This trend results from the application of multiregional population projections (Willekns and Rogers 1978) at the national level and is based on the assumed continuation of present fertility, mortality, and spatial interaction patterns.

On the other hand, only limited support can be mounted in favor of the postulated association between urban growth and size. Perhaps, this statement would not have been true if the two previously discussed dimensions, i.e., national population increase and urbanization level, had been kept constant within the data sample, or if the regions were disaggregated into cores and rings. Unfortunately, the small number of observation units prevents such comparisons from being made. Still, the elimination of administrative cities (proxies for urban cores) results in a somewhat clearer pattern. When the prominent deviations represented by the Kanto and Kinki regions of Japan are disregarded, the distribution of urban regions by size and growth rate, calculated as the ratio of national population change, suggests a log-linear relationship (Figure 4).

One can also expect the population size of urban regions to be negatively related to their gross inmigration rate. This regularity should be due to two factors: the earlier discussed association between growth and size, and the closure of migration movements, increasing with physical size of the region as well as with its population potential. Indeed, the pattern represented in Figure 5 suggests a negative association, although much weaker than anticipated. On the other hand, the association between population size and gross outmigration rates shows no bias in the sample of data under analysis. Such a symmetric pattern is to be expected since unlike inmigration flows, the factors of growth and regional closure work in the opposite direction in this case.

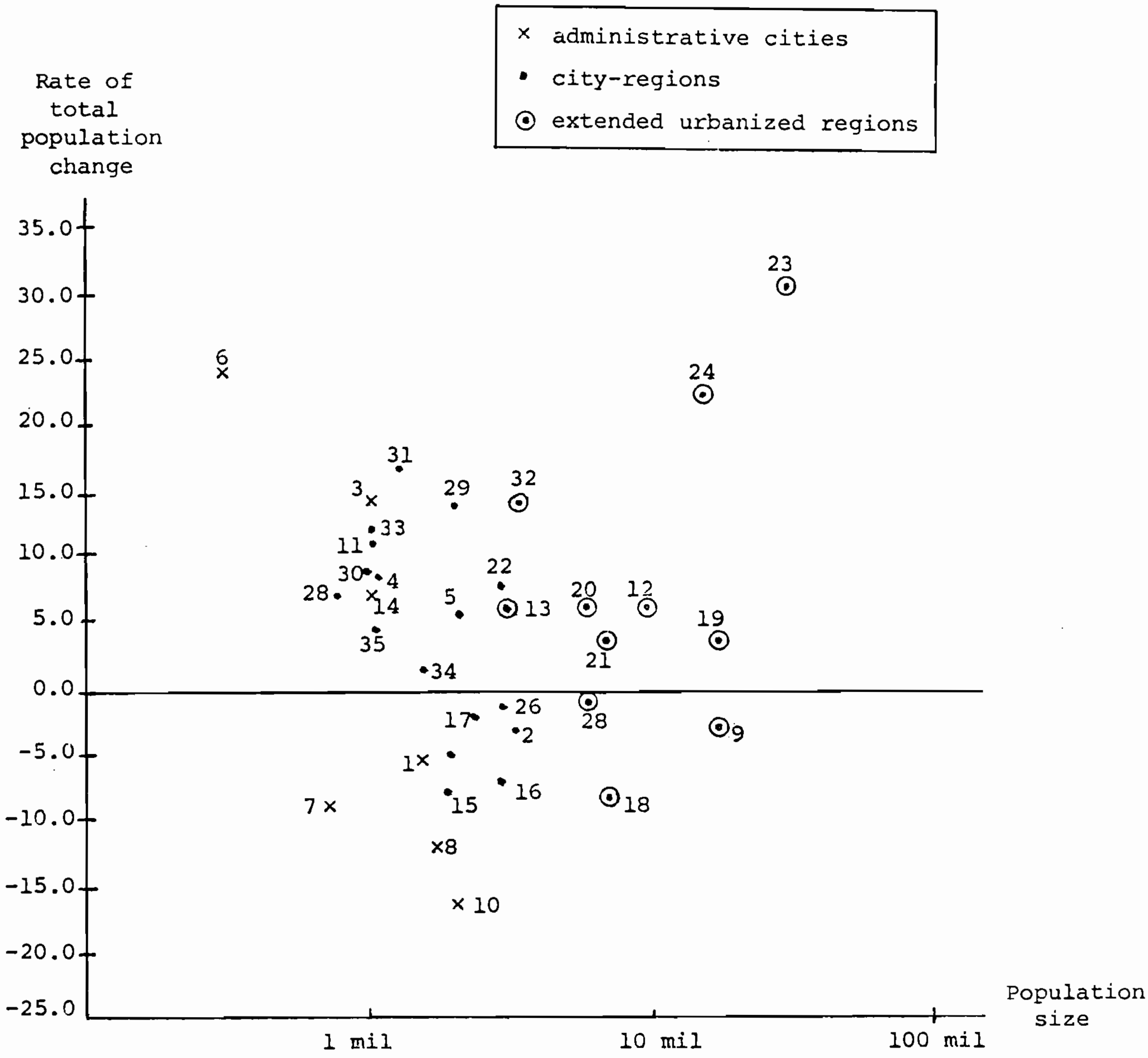


Figure 4. Relationship between population size of urban regions and their rate of total population change.

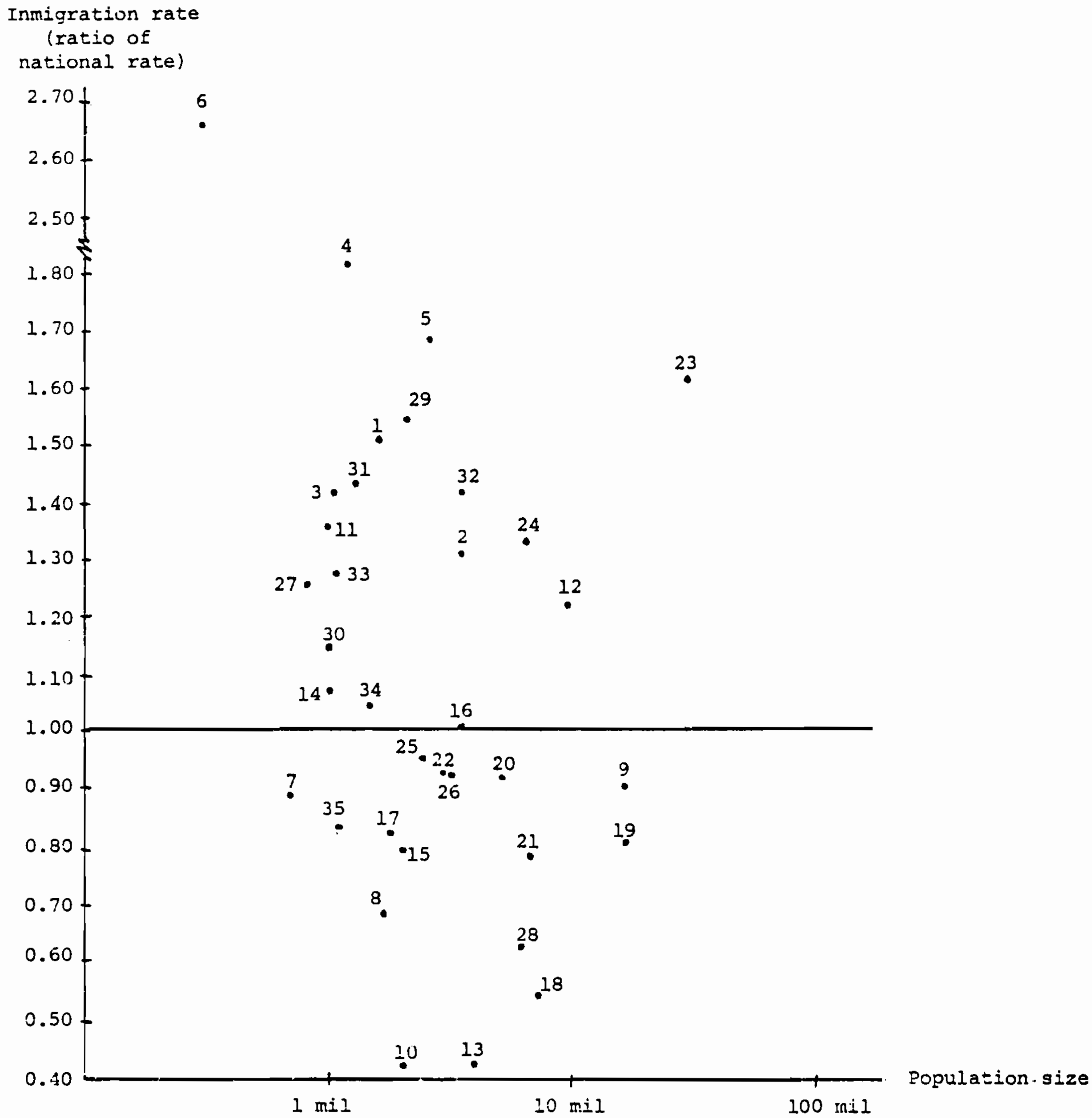


Figure 5. Relationship between population size of urban regions and their gross inmigration rates.

Hypothesis 2. The role of migration and natural increase, as components of urban population growth, evolve in the course of the urbanization process. During its advanced stages the contribution of migration to the growth of large cities becomes of secondary importance.

A substantial body of literature has recently accumulated pertaining to the changing proportions and interaction among the two major components of urban growth. Keyfitz (1980), in view of contrasting empirical evidence, attempted to put this question on a theoretical plane. Among other things, he identified conditions for the crossover point behind which, with all rates kept constant, the urban population growth becomes predominantly endogenous. After exploring various combinations of changeable rates, Keyfitz offers their simple, economic interpretation. Following this argument one may conclude that, in the developed countries of today, the growth of cities should be increasingly due to the natural increase of the urban population. Such a development is likely to occur when, at an advanced urbanization level, the core-periphery development patterns (Friedmann 1977) evolve in favor of peripheral zones. Higher investments in the countryside are translated into lower natural increase of its population, lower outmigration to urban areas and finally, higher urban-rural migration rates. Keyfitz's results were extended by Ledent who also presented detailed analysis of two alternative demographic models of urbanization: a continuous, bi-regional version of the Rogers model and the United Nations model (Ledent 1980). Subsequently, Keyfitz and Philipov (1981) have attempted to capture long-term interaction between migration and natural increase by focusing on the age structure and fertility of successive generations of rural-urban migrants as well as their offsprings.

Consideration of aggregate national growth rates of the urban population is not sufficient for the purposes of this paper, which is concerned with changes within settlement systems. The hypothesis suggested at the outset rests on the assumption, also reflected in the previous hypothesis, that large cities (metropolitan areas) actually lead the trends generally established for the urban sector, especially as they account for a substantial share (estimated at between 0.4 and 0.8 depending on the country and definition used) of the total urban population at advanced urbanization levels. Hence, the larger the urban region and the higher the urbanization level, the smaller the expected contribution of migration (as compared to natural increase) to the total population change.

The empirical evidence coming from the Migration and Settlement Study quite strongly supports the statements above. Out of the 35 regions, 24 feature a positive natural increase, whereas only 18 show positive migration. The natural increase appears as the greater contributor in 19 cases--migration in only 16. Out of the latter group seven regions are characterized by a negative migration balance (also less pronounced when compared with natural population decrease); in five regions with both rates positive, the migration component was just marginally larger. About half of the regions with a higher contribution of natural increase (including Paris (12), London (19), and Randstad (28) had a negative migration balance, but only one [Bremen (7)] had both rates negative (see Figure 6).

Similar net values, however, may conceal substantial differences in the demographic behavior. It is therefore necessary to look at some of the theoretically postulated specific relationships. Figure 7 shows a rather high correlation between the crude birth and death rates for the 35 spatial units under analysis--a pattern typical of a late stage in the demographic transition (the majority of regions fall into the sector with high death and low birth rates). The association between gross inmigration and outmigration rates postulated by Cordey-Hayes (1975) and others, finds limited support in the data set available (Figure 8). Finally, the relationship between birth rates and outmigration rates is of a totally symmetric nature.

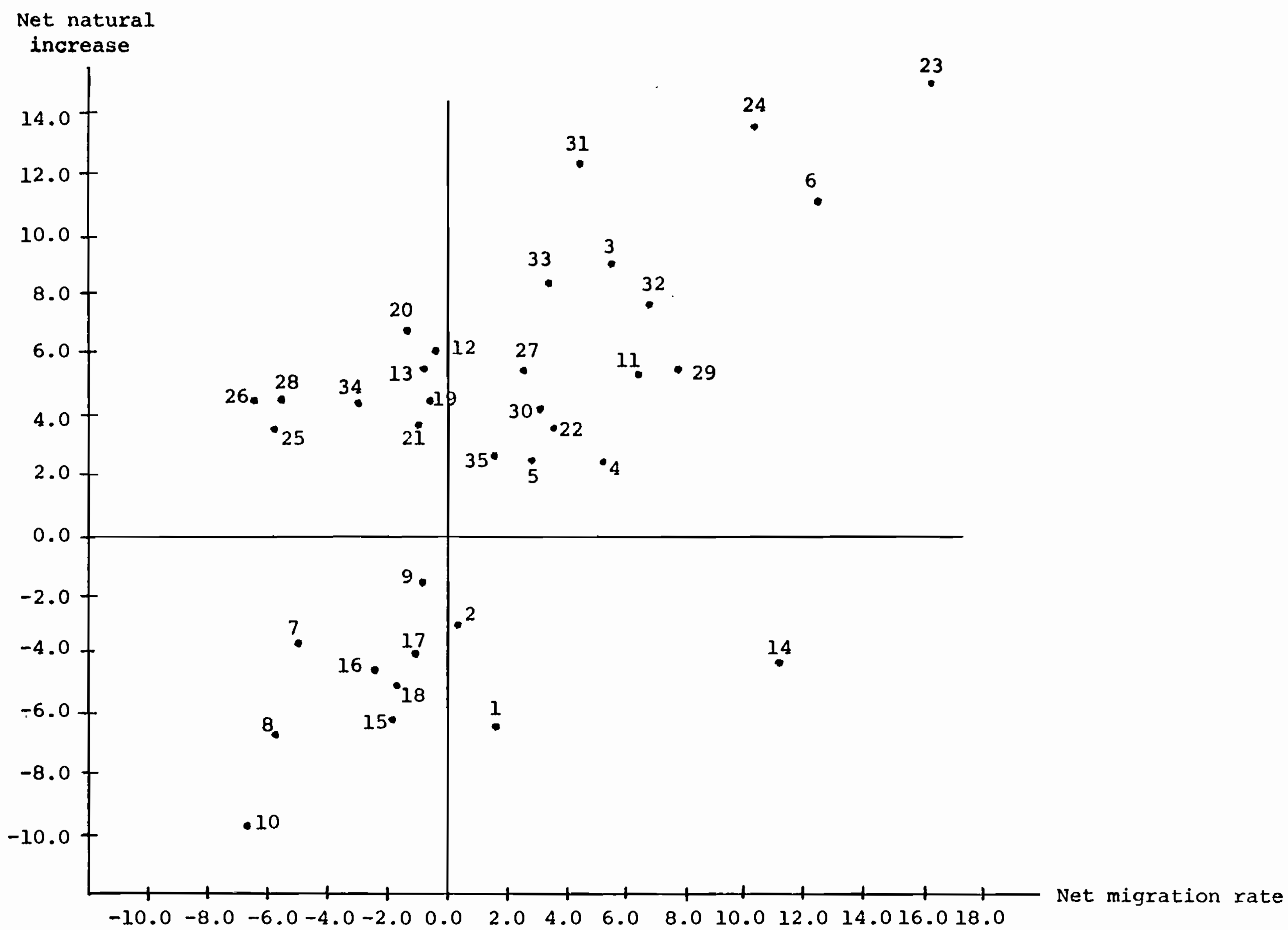


Figure 6. Major components of population change in 35 urban regions.

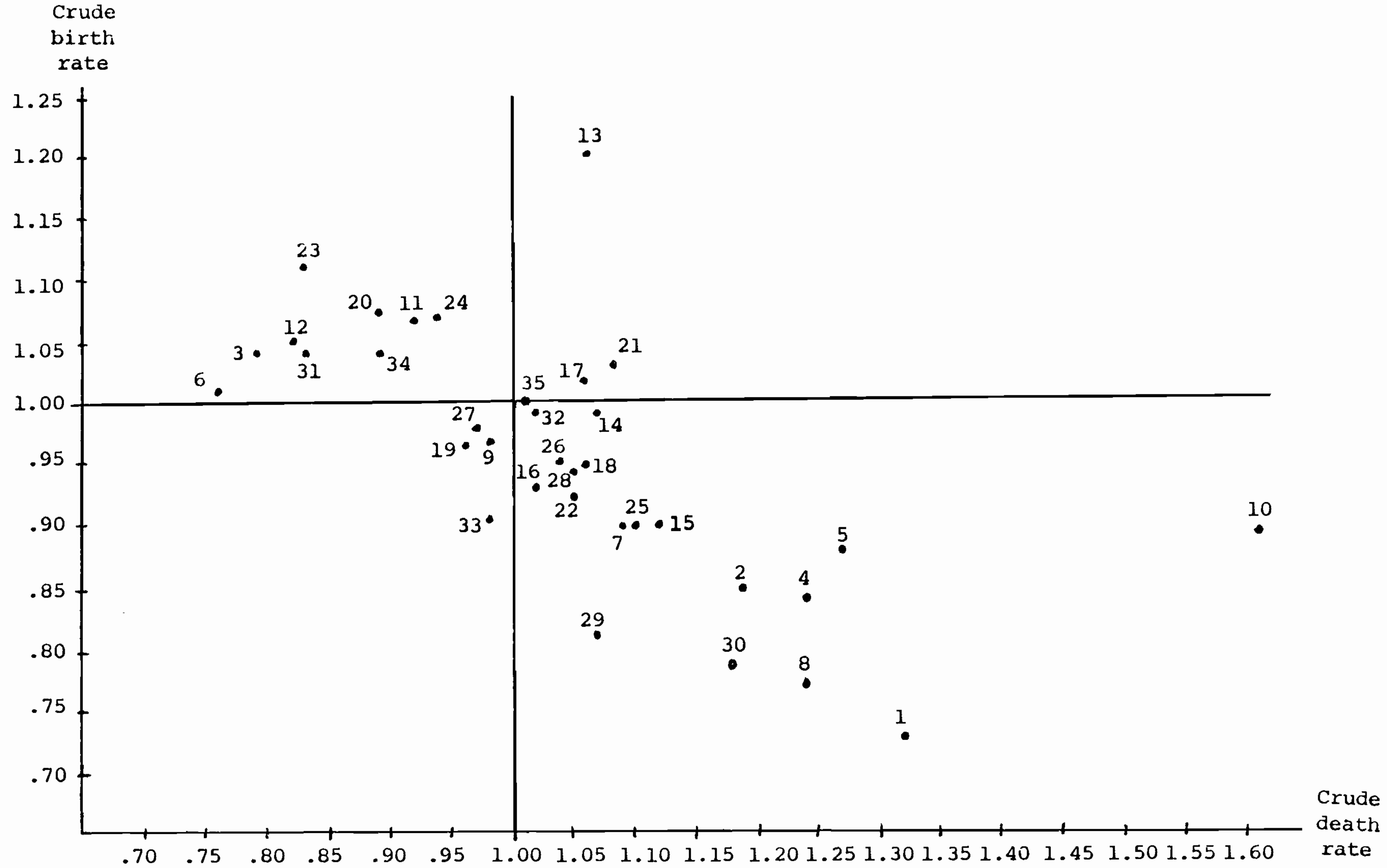


Figure 7. Interrelations between crude birth and crude death rates (proportions of national rates) in 35 urban regions.

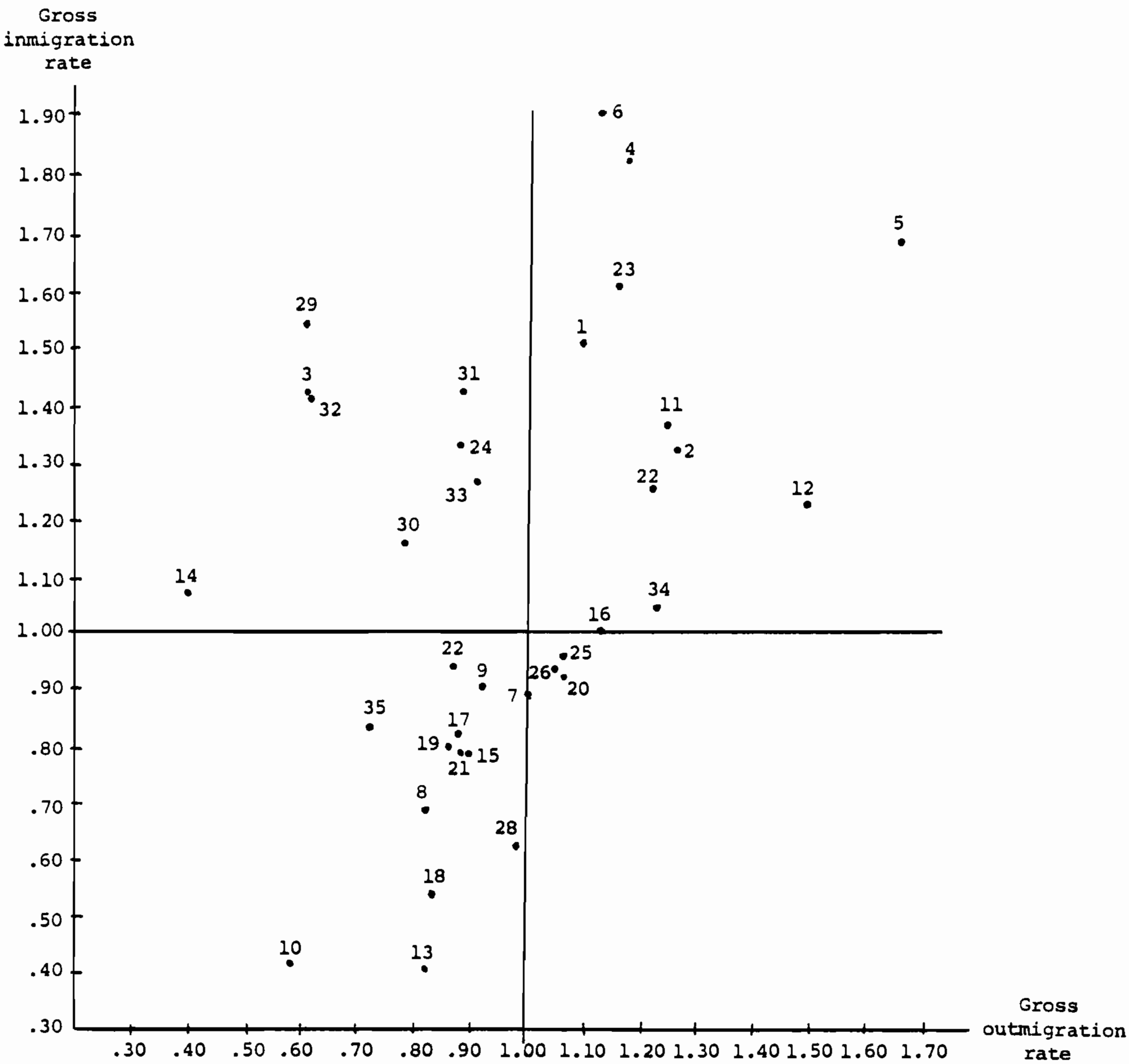


Figure 8. Interrelation between gross inmigration and outmigration rates (proportions of average rates for the respective multiregional systems) of 35 urban regions.

None of the above conclusions disproves the earlier findings concerning the contribution of the two aggregate components of population change in the urban regions. Still, it should be noted that the greater role of natural increase as a contributor to growth is due to the poor performance of urban regions in attracting migrants from other units within the respective multiregional systems, rather than to the high fertility of their resident population. Figure 9 shows that more than two-thirds of all the urban regions have natural increase rates lower than the relevant national rates. The patterns of net reproduction rates are even more striking: only five regions are situated above the respective national (multiregional) values.

The decrease of net migration, both its absolute magnitude and as contributor to total population change, appears to be a recent phenomenon. For example, during the 1960s migration accounted for as much as 75-95 percent of the total urban population growth in a number of European countries (Economic Commission on Europe, 1979, p. 204). In the case of cores of the largest Japanese urban regions (the urban agglomerations of Tokyo and Osaka) the ratios of natural increase to net migration have evolved from 1:2 during the late 1950s to 3.1 for Tokyo and 30:1 for Osaka during the 1970-75 period (Nanjo, Kawashima, and Kuroda 1981). As it has been noted, the analyses by Keyfitz (1980) and Ledent (1981) are restricted to the case when the total population is disaggregated into its rural and urban parts. Still, the data just presented point to a behavior of large urban regions that tends to be similar to the expected behavior of the total urban population under the migration and natural increase regimes prevailing in highly urbanized societies --as if all urban inmigration corresponds to rural outmigration.

The knowledge of disaggregate patterns of population growth and decline is essential for the study of urban change. In the simplest case, urban population may be treated as consisting of the metropolitan (P_a) and other urban (P_{u-a}) sectors. An expansion of the accounting formula used by Keyfitz (1980, p. 153) and Rogers (1968) to describe the evolving rural (P_r) and urban (P_u) population over time (t):

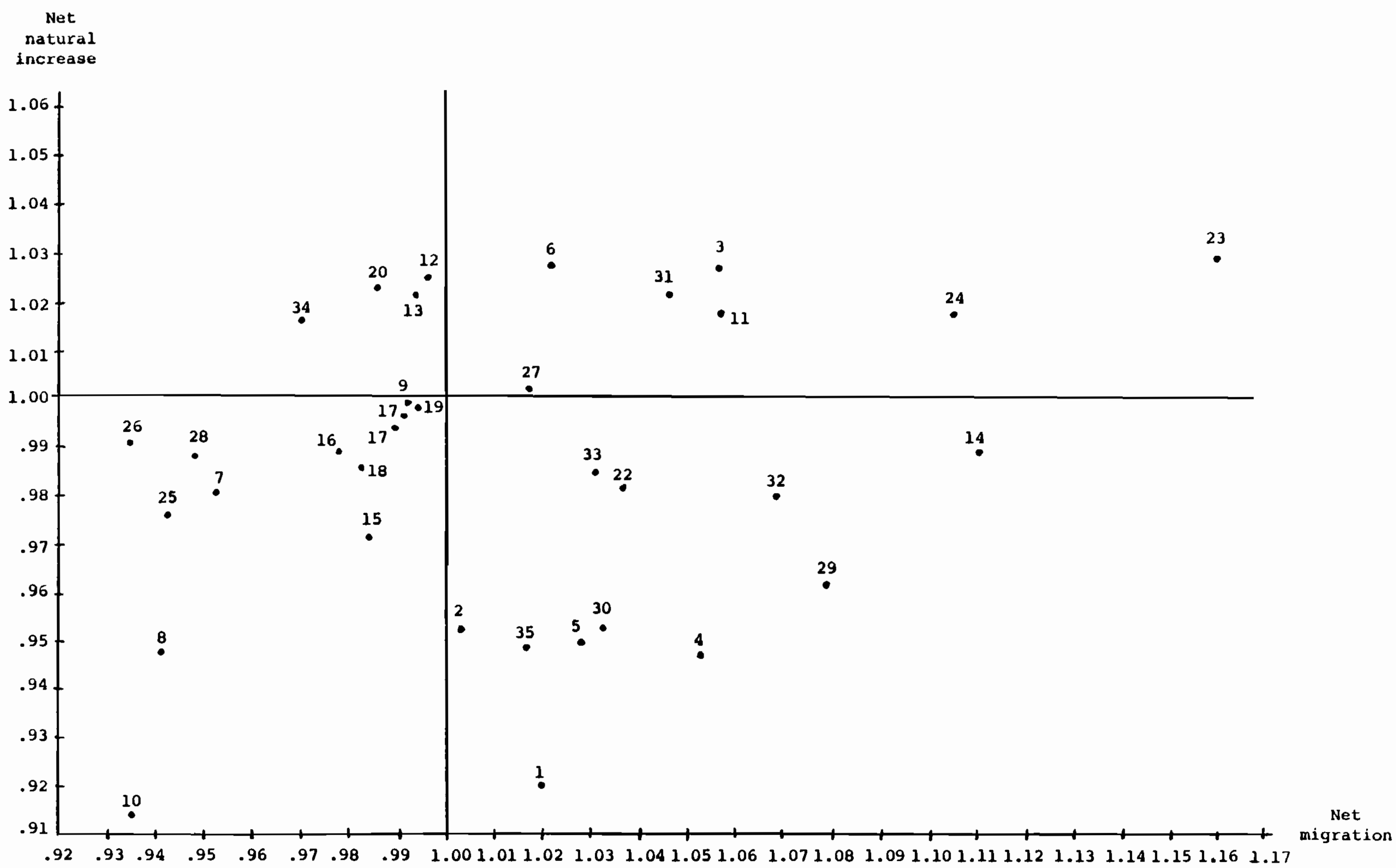


Figure 9. Natural increase and net migration patterns for 35 urban regions (proportions of respective national rates).

$$\frac{d\,P_r(t)}{dt} = (r - m)\,P_r(t) + n\,P_u(t)$$

$$\frac{d\,P_u(t)}{dt} = m\,P_r(t) + (u - n)\,P_u(t)$$

(where r and u are rates of natural increase of the rural and urban population, respectively) would yield:

$$\frac{d\,P_a(t)}{dt} = (r - m_u)\,P_r(t) + n_r\,P_{u-a}(t) + q_r\,P_a(t)$$

$$\frac{d\,P_{u-a}(t)}{dt} = m_{u-a}\,P_r(t) + q_{u-a}\,P_a(t) + [(u-a) - (n_r + n_a)]\,P_{u-a}(t)$$

$$\frac{d\,P_a(t)}{dt} = m_a\,P_r(t) + n_a\,P_{u-a}(t) + [a - (q_r + q_{u-a})]\,P_a(t)$$

where m_{u-a} - fraction of the rural population that moves to urban, non-metropolitan areas

m_a - fraction of the rural population that moves to metropolitan areas

n_a - fraction of the urban (non-metropolitan) population that moves to metropolitan areas

n_r - fraction of the urban (non-metropolitan) population that moves to rural areas

q_{u-a} - fraction of the metropolitan population that moves to urban, non-metropolitan areas

q_r - fraction of the metropolitan population that moves to rural areas and u-a are natural increase rates of the metropolitan, and of the remaining urban population

Following this approach one could find out to what extent the recently observed decrease in net migration towards large urban agglomerations has been due to the declining fraction of the rural population within a country as a whole, or, alternatively, to the reorientation of urban-to-urban migrations (see Alonso 1978). Such an analysis could be further expanded into a number of city-size and/or functional-type categories using a matrix format. Unfortunately, the data on which this paper is based are of little help in pursuing this analysis.

The approaches and findings discussed so far all pertain to the case when the contribution of natural increase and migration is defined as a difference between respective rates for a given spatial aggregate--a city, region, or total urban population of a given country. However, a number of authors consider the question of the components of population change in terms of their variability within a spatial system. When such a definition is preferred, migration generally appears as the greater contributor. For example, such a conclusion is reached by Kenneth (1977) who studied patterns of population change for 126 MELAs (Metropolitan Economic Labor Areas) in Great Britain during the 1961-71 period. Whereas the overwhelming majority of these areas had natural increase rates approximating Britain's 6 percent decennial increase, the net migration rates extended over a broad range from -10.0 to 40.0. Thus the differentiating effect in the population growth pattern within an urban system can be mainly attributed to the migration component. Similar conclusions are derived by Borchert (1980) for Dutch municipalities during 1961-73 and by Simmons (1977) for 124 urban regions in Canada. In the latter analysis net internal migration explains more of the total population change during 1966-71 than natural increase and net foreign immigration combined. Although during the subsequent period (1971-76) the variation in natural increase among the regions increased whereas that of net migration declined, the differentials between the two were still substantial. At the same time the rates of natural increase remained considerably higher than those of net migration for all the major hierarchical levels within the system (Simmons 1979:55).

One cannot expect such trends to continue for more than a few decades if current national population projections are to hold true. Once the natural increase at the national level falls toward zero, migration will gain ascendancy even in terms of rates. However, definitional problems are not easily resolved. For example, it is not clear whether contribution should be measured in terms of change or of growth only. As to spatial effects of such an evolution, the following generalization by Bourne (1981:144) seems instructive:

> During periods of rapid aggregate growth, particularly high rates of natural increase, almost all areas witness growth. During periods of high foreign immigration growth tends to become more focused spatially. Similarly, as the contribution of natural increase to aggregate growth declines, spatial variability increases.

Hypothesis 3. The population of large cities is characterized by greater spatial mobility when compared with rural and non-metropolitan populations.

According to the concept of mobility transition (Zelinsky 1971), spatial mobility increases during the rapid urbanization stage and remains high afterwards. As Rogers (1977) pointed out, however, the decrease of interregional welfare disparities may eventually bring about a decline in geographical mobility. Also, the short-distance migration may be largely replaced by daily commuting between residence and workplace.

No matter which way the overall mobility indices evolve during the later stages of the demographic and urbanization transition, the large-city population is expected to be more mobile than either the rural, or the small-city (non-metropolitan) population. This expectation stems from positive relationships, found in a number of developed countries, between the propensity to move and such variables as educational level and female labor participation (Brown and Neuburger 1977). Other factors, reportedly contributing to the greater spatial mobility of the large-city population include a delayed family formation and growth process and the accumulation within cities of individuals with previous migration experience and a high repeat-migration (including return-migration) probability (see DaVanzo and Morrison 1978 and DaVanzo 1980). On the other hand, large urban places may be sending out and attracting disproportionately fewer migrants due to the greater internal opportunities they offer (Simmons 1979).

From the earlier discussion one may recall (see Figures 9, 10 and 11) that the majority of urban regions (20 out of 35) were characterized by gross migration rates lower than aggregate values for the corresponding multiregional systems. Regions with outmigration rates higher than the aggregate rates were almost uniformly represented within the population growth and absolute decline categories.

This pattern becomes even more pronounced when mobility is measured by the expected fraction of life of an individual to be spent in the region of birth, the fraction calculated on the basis of age-specific migration and mortality rates (Willekens and Rogers 1978). For a typical urban region this fraction is some 3-4 percent higher than the mean share for the respective multiregional system (Figure 10). Only for eight regions are such probabilities lower than mean national values: four of these regions have experienced negative total population change and five, net migration loss. As it might have been anticipated, the pattern represented in Figure 10 is not independent of the population size of urban regions. Among eight regions for which the fraction of life to be spent in the region of birth is highest relative to corresponding mean values, five constitute large, polynucleated regions. They include the urban agglomerations of Kanto (23), Kinki (24), Nordrhein Westfalen (9), Southeast England (19), and Upper Silesia (32). On the other hand, administrative cities are clustered within lowest relative-fraction intervals.

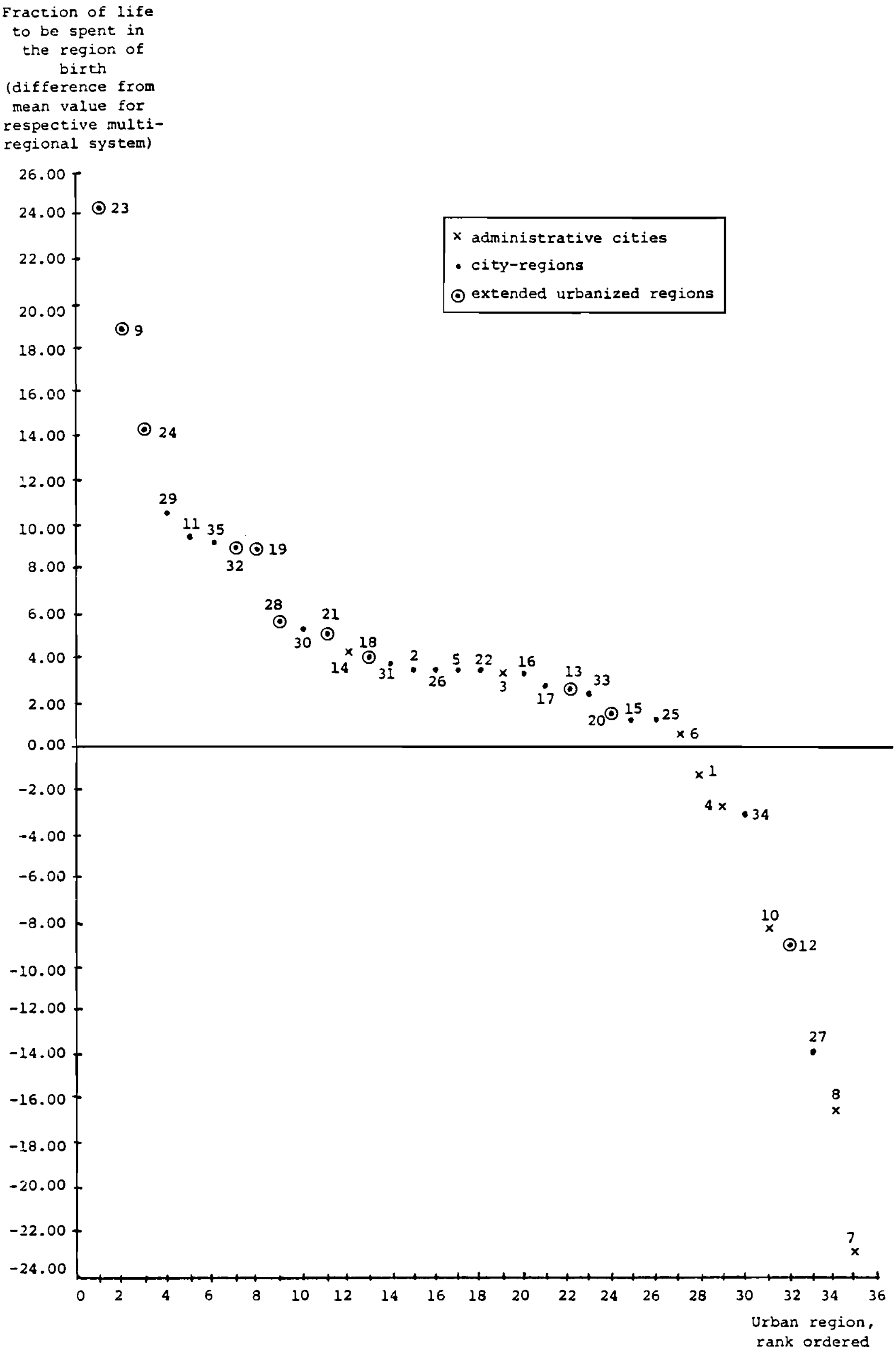
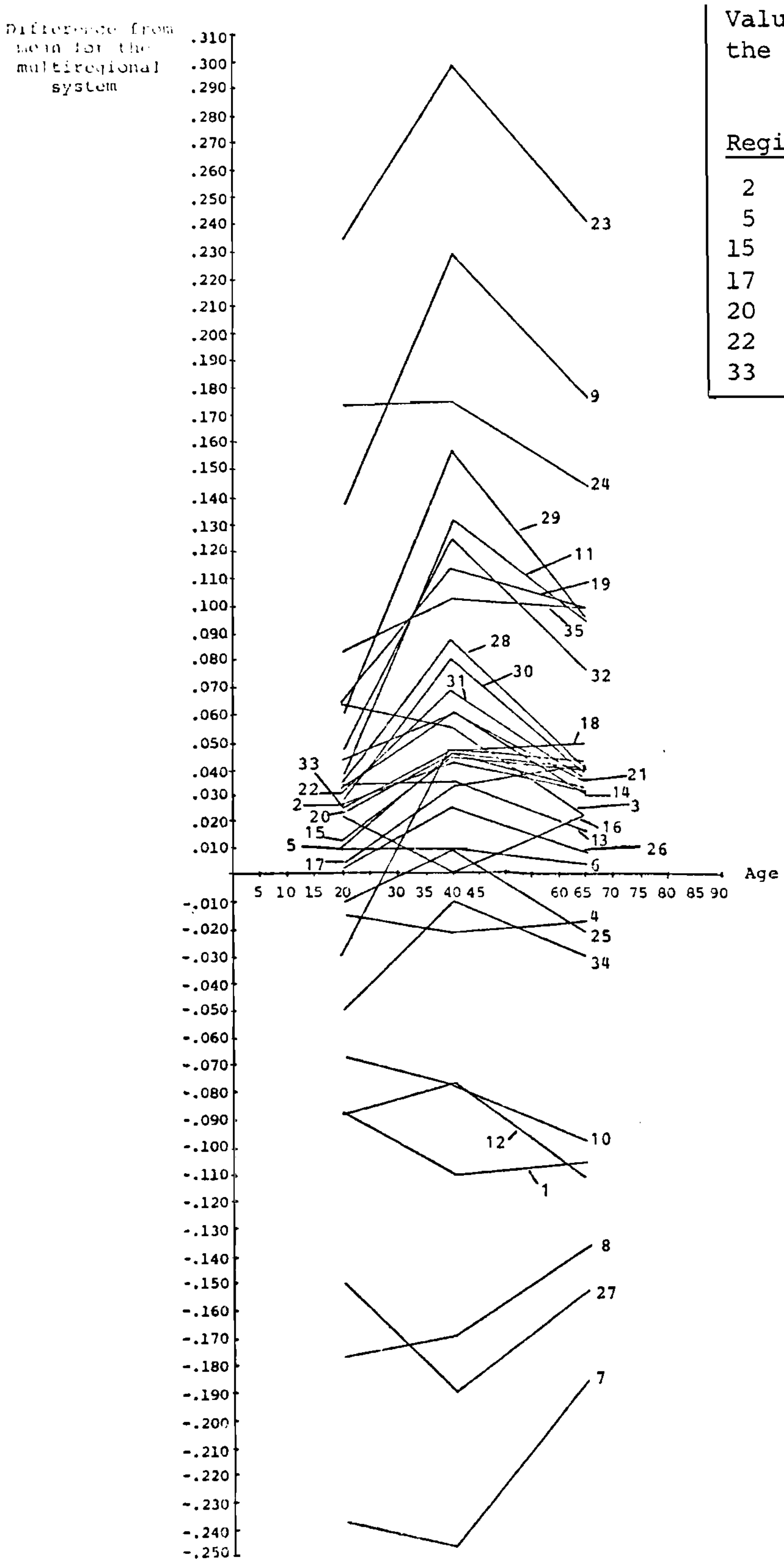


Figure 10. Spatial migration levels for 35 urban regions.



Values of regions marked on the left margin:			
	Value		
Region	left	middle	right
2	.25	.43	.31
5	.10	.46	.40
15	.11	.44	.41
17	.04	.33	.40
20	.19	.28	.06
22	.30	.47	.43
33	.21	.45	.33

Figure 11. Probability of surviving in the region of birth at exact age 20, 40, and 65.

The distribution of the values of another summary measure of population mobility, the net migraproduction rate (Willekens and Rogers 1978) is very close to the spatial allocation of the life expectancy.* Only in the case of 16 urban regions (out of 35) is a locally born individual expected to make more moves during his life span than an average person in the respective national (multiregional system). Six of these regions recorded absolute population losses around 1975, and seven regions experienced negative migration balance. No regularities can be found concerning the relationship between net migraproduction rates and population size of urban regions.

More information on spatial mobility patterns may be obtained by examining the probability of surviving in the region of birth at different ages. The points selected for comparisons are the exact ages 20, 40, and 65 years. The first is close to the average entry into the labor market (and to the peak value of age-specific propensity to migrate), the second is at the mid-career point, and the third represents conventional division between the professionally active life and retirement. The basic facets in the pattern observed (see Figure 11) are in accord with previous observations, i.e., for the great majority of urban regions the probability of surviving in the region of birth is higher than the mean probability within the respective multiregional system. As anticipated, the lower survival probabilities are associated predominantly with absolute population decline [Bremen (7), Hamburg (8), West Berlin (10), Vienna (1), Amsterdam (25)] or net migration losses [Paris (12), Stockholm (34)]. Generalized schedules are shown in Figure 12. For a typical urban region characterized by moderate population gain, a member of the standard birth cohort is less likely to die or outmigrate before reaching the age of 20 than an individual born in other regions. The difference in probability values increases substantially by the age of 40 and declines afterwards.

*This rate describes the average number of migrations a person will make during his lifetime.

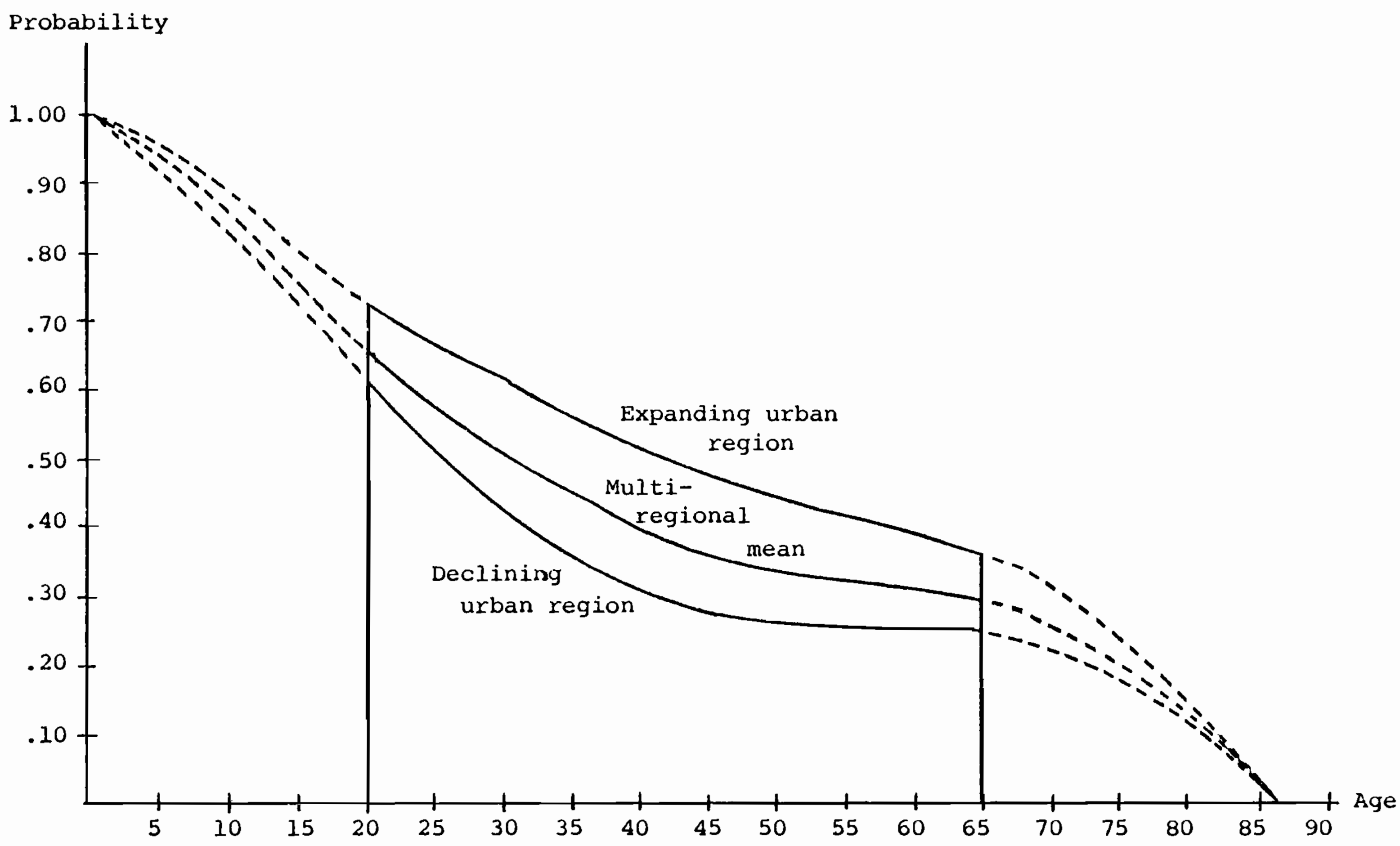


Figure 12. Generalized schedules of surviving probability in the region of birth between ages 20 and 65.

This pattern suggests that an individual born in a given urban region (when compared with a similar individual born elsewhere) is more likely to survive there between the age of 20 and 40, but after crossing the age of 40 the increased likelihood of death and outmigration result in a decrease of interregional probability differentials. The difference observed at the exact age of 65, however, is still somewhat higher in absolute terms (and even more so in terms of ratios) than at the age of 20, as the bulk of migrations related to retirement occur after 65. An urban region with declining population tends to experience a reverse schedule of survival probabilities compared with the one just described.

In sum, the large-city population seems to be less, rather than more, mobile when compared with the total population. This is at least what the interregional migration patterns suggest. Even though causal interpretation is not attempted at this point, one should note that various explanatory factors may be relevant in different national contexts. Some of these factors may be related to settlement policies (for example, restrictions on inmigration tend to discourage outmigration), others to substitution between migration and daily travel. The initial hypothesis, however, should not be totally discarded since the evidence is positive for regions (basically administrative cities) with highest population losses. Still, a typical urban region, one with a slowly growing or slowly decreasing population, is characterized by relatively low overall mobility.

Hypothesis 4. The dominant migration flows within highly urbanized countries are those among major urban regions. The traditional configuration of inter-urban moves which correspond to an urban hierarchy, evolves towards a pattern characterized by a lack of interdependence between net inflow and the city size.

This hypothesis, unlike the previous one which focuses on overall mobility levels, is concerned with directional mobility. It refers to the third stage in Zelinsky's scheme of mobility transition, during which rural-to-urban migration is gradually replaced by urban-to-urban flows and by commuting within urban regions as well as an increasing population shift outwards from the large cities and towards smaller communities.

The structure of national settlement systems in highly urbanized societies has been described as a combination of vertical (hierarchical) and horizontal linkages (see for example, Bourne 1975). The latter component is mainly represented by interconnections among the large cities which perform high-level service and decision-making functions. This is the basis for Pred's (1975) model of city-systems development, and of Dziewonski's (1980) concept of the system of main urban centers. Translated into population-related terms, such concepts suggest that the origin and destination-specific migration rates, spatial migraproduction rates, and other demographic mobility measures attain levels higher among urban regions than among non-urban regions or between urban and non-urban regions.

Instead of looking at in- and outmigration rates region by region, which in view of the divergencies in population size and the role played by physical distance would not be a helpful exercise, the data are arranged so as to enable a comparison of demographic interaction occurring between a given urban region and an aggregate of other urban regions *vis-à-vis* "non-urban" regions within the multiregional system. Figure 13 shows the spatial allocation of life expectancy at birth for 29 urban regions (the remaining six, i.e., Vienna, East Austria, Randstad, Helsinki, Sofia, and Budapest have no urban counterparts within the respective systems). One of the regularities to be observed pertains to the importance of the gravity factors, i.e., mass and distance. Strong interactions among urban regions occur typically when the units in question are situated close to each other and have large population potential compared with other regions. Relatively weak linkages are characteristic of smaller regions (including administrative cities) and of those urban regions whose urban counterparts represent much smaller potential. For example, an individual born in the West Midlands region (20) of England is expected to spend an average of 7.41

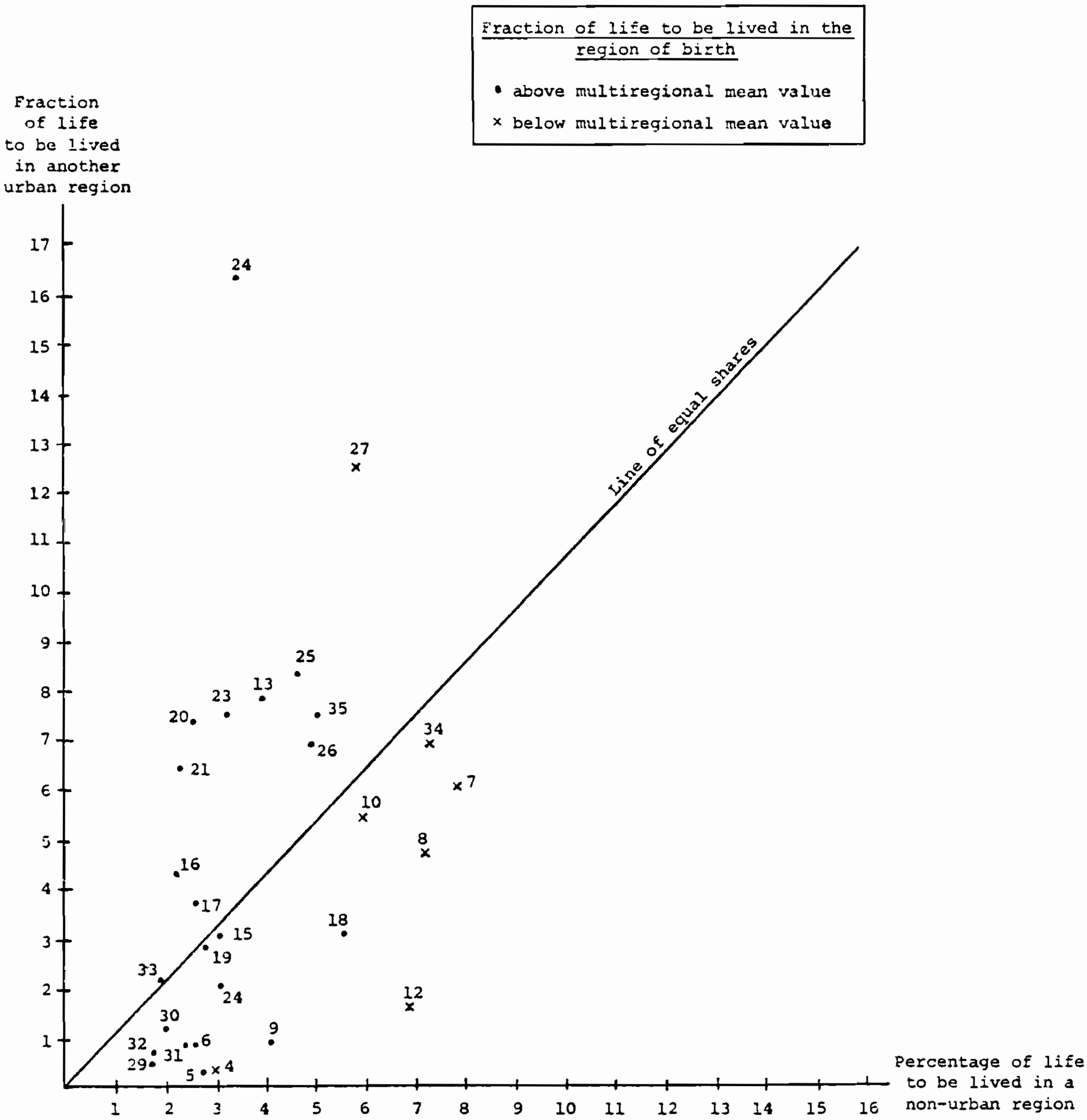


Figure 13. Spatial allocation of life expectancy at birth for 29 urban regions.

percent of his life span in each of the two other urban regions, i.e., Southeast and Northwest England, but only an average of 2.82 percent in each of the seven "non-urban" regions. On the other hand, a person born in Prague (4) would live only 0.24 percent of his life in Bratislava (the only other urban region in the multiregional system), versus an average of 2.95 percent in each of the "non-urban" regions. This case is also illustrative of data inadequacies; the latter proportion may be heavily accounted for by flows towards such cities as Brno and Ostrava which constitute cores of "non-urban" regions. Note also that due to variations in the number of regions only proportions between the "urban" and "non-urban" components, and not the percentage figures, are of any comparative value.

The pattern of spatial net migraproduction rates (Figure 14) conform to the life expectancy pattern. Regions with strong "non-urban" connections are somewhat more numerous than those with predominantly urban-oriented linkages. However, as indicated earlier, "non-urban" is not a uniform category; it may include traditional nodal regions and city hinterlands as well as remote rural periphery. Generally speaking, those urban regions characterized by relatively high outmigration rates display stronger interactions with the "non-urban" units. For example, according to observed migration patterns, a person born in Bremen (7) may be expected to move out of an average "non-urban" region more frequently than an average urban region within the system. In fact, a substantial fraction of the former moves is accounted for by the neighboring region of Lower Saxony, the main destination of Bremen-born migrants. The average share of urban regions as origins of outmigration by the natives of Bremen is lower than their respective life expectancy share, due to higher average outmigration rates experienced by "non-urban", as compared with urban regions. (In the calculations individuals assume mobility rates of the region of destination.)

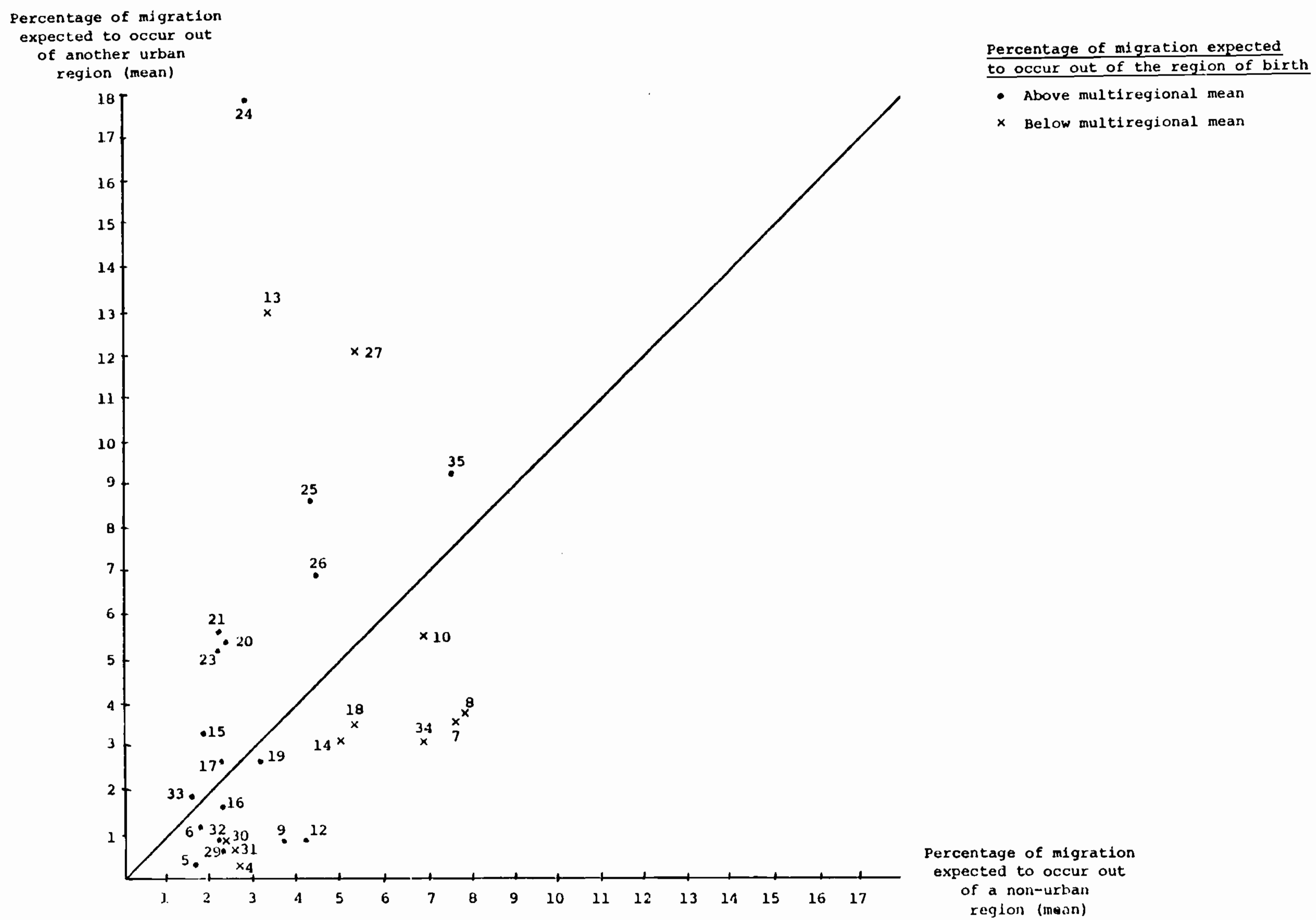


Figure 14. Spatial net migraproduction allocations for 29 urban regions.

The second part of the hypothesis relates to interdependence between net migration and urban size. Traditional theories of settlement structure imply that population flows among urban places represent a reversal of innovation diffusion patterns, i.e., the direction of the predominant numbers of moves is up the urban size hierarchy. During earlier stages of the urbanization transition, typical moves are those from rural to urban communities (both small and large), whereas its more advanced stages witness concentration within the settlement network, with smaller towns losing their population in favor of metropolitan areas. This process may involve a number of generations of moves, as well as of migrants.

Thus, according to the concept of hierarchical migration the individual sized categories of urban places record net migration gains in their interaction with each of the smaller sized categories, and net losses with respect to each of the larger sized groups of cities. This is true not only of net migration rates

$$m_{ij}/P_i > m_{ji}/P_j$$

but also of the absolute size of flows

$$m_{ij} > m_{ji} \qquad \text{for each } P_j > P_i$$

where m_{ij} is the number of migrants during a given time interval from city i to j, and

P is the population size

This regularity found in the growing urban systems, such as those of Japan (Kawashima 1981) and Poland (Dziewonski 1980) is not likely to hold true when the largest cities register absolute population losses (although it is still possible because of variations in the natural increase). Such a situation, however, may arise under various inter-urban and urban/non-urban (core-hinterland) patterns of population movements. As Alonso (1978) pointed out, under a low level of natural increase and rural outmigration, the flows among metropolitan areas represent a zero-sum game, in which individual urban units may fall into the category of net losers as a consequence of their relatively poor economic base and environmental quality, i.e., characteristics not necessarily related to overall population potential.

The concept of hierarchical migration has been questioned by Simmons (1977, 1979) and Drewett et al. (1978). Their analyses of migration flows among urban regions in Canada and Great Britain, respectively, take account of population deconcentration from large urban cores to peripheral areas and subcenters. During 1966-71 the net migration among 124 urban regions in Canada, aggregated into five hierarchical groups, showed moderate net losses for regions of order 5 (composed of the two largest metropolitan areas of Montreal and Toronto) and 3 (regions centered on medium-size towns), and heavier losses for order 1 (regions with small towns as cores). Net gainers were regions focused on cities with some 100,000-1,000,000 inhabitants (order 2), as well as regions of order 4, in particular those located in the proximity of large urban centers. When regions were rearranged so as to form 11 spatial subsystems centered on metropolitan areas of the two upper levels, the net migration patterns were dominated by interregional population shifts from eastern to central and from central to western provinces (Simmons 1977). In the subsequent period of 1971-76 the relation between the urban size (hierarchical level) and net migration became more pronouncedly negative, with increasing losses in the two largest metropolitan areas, declining gains of the remaining large urban regions, and a change from a heavy loss to a nominal gain for regions centered on the smallest towns in the system. In the 11-region breakdown the most visible changes, compared with the previous period, were shifts from a positive to negative internal migration balance for the metropolitan region of Toronto and a decline in the gains of Vancouver, the third largest urban region.

Drewett et al. (1978) have demonstrated that flows from bigger to smaller Metropolitan Economic Labor Areas in Britain accounted for a higher proportion of total moves within short distances than over long distances. This implies that hierarchical migration patterns are still characteristic of an interregional scale; however, deconcentration from large city-cores to metropolitan rings have rendered this generalization inadequate when intraregional population shifts are examined. Migration patterns of the seven largest urban regions of Great Britain (each with over 1 million inhabitants) reveal a positive association between population number and net migration loss during 1966-71. Still, the London region maintained a positive migration balance with each of the remaining six large metropolitan areas (Kenneth 1977).

The data on migration between pairs of urban regions, do not run against the hierarchical migration concept. To the contrary, in 30 cases the destination-specific outmigration rates are higher for urban regions with smaller population size (see Table 4 and Figure 15).* The size and direction of net flows, as measured by the index of migration effectiveness, reveals a somewhat different pattern. Although smaller regions recorded net migration gain only in 12 out of 33 cases, this reversal was typical of countries with 75 to 85 percent of the total urban population, including the Netherlands, FRG, GDR, and Sweden. Some of these flows, for example, Stockholm to the South of Sweden and Noord-Holland to Utrecht, can be attributed to environmental factors. Vienna and Prague maintained

*Due to its capital functions Berlin was treated as a "larger" unit than the Leipzig-Halle, Karl-Marx-Stadt, and Dresden regions. Similarly, Warsaw was considered "larger" than the Katowice region, despite smaller population size. Such exceptions would not have to be made had regional size been measured by the population number of the main urban center.

Table 4. Inter-urban migration between 33 pairs of urban regions: rates and net flows.

No.	Pairs of regions (A<>B)[a]	Migration flows: Outmigration rate from A to B	Outmigration rate from B to A	Effectiveness	Difference in population size (A-B)	Mean age of migrants (A - B)
1	Vienna-Austria	0.0035	0.0048	9.07	6.64	32.64-28.81
2	Prague-Central Bohemia	0.0044	0.0056	12.12	0.91	38.02-34.48
3	Prague-Bratislava	0.0001	0.0004	23.76	55.63	42.06-46.18
4	Hamburg-Bremen	0.0006	0.0014	- 3.43	41.09	31.64-33.11
5	Nordrhein Westfalen-Hamburg	0.0003	0.0029	- 6.21	81.70	32.60-33.21
6	West Berlin-Hamburg	0.0009	0.0007	-18.74	7.96	33.21-30.49
7	Nordrhein Westfalen-Bremen	0.0002	0.0041	- 6.37	91.93	31.91-32.23
8	Nordrhein Westfalen-West Berlin	0.0005	0.0051	7.43	78.87	31.56-34.57
9	West Berlin-Bremen	0.0004	0.0009	- 6.85	47.50	32.01-32.79
10	Paris-North	0.0005	0.0026	38.68	43.24	34.22-29.23
11	Berlin-Leipzig/Halle	0.0007	0.0009	42.15	-50.32	25.54-25.67
12	Berlin-Karl Marx Stadt	0.0004	0.0006	41.53	-28.63	26.11-23.98
13	Berlin-Dresden	0.0004	0.0009	55.39	-25.15	25.66-24.59
14	Leipzig/Halle-Karl-Marx-Stadt	0.0008	0.0015	3.41	25.33	26.86-24.59
15	Leipzig/Halle-Dresden	0.0007	0.0011	- 6.90	28.80	26.68-25.02
16	Karl-Marx-Stadt-Dresden	0.0011	0.0009	-13.70	7.23	26.73-26.00
17	Southeast England-Northwest England	0.0008	0.0026	11.92	43.67	32.07-30.89
18	Southeast England-West Midlands	0.0008	0.0031	8.05	53.96	30.86-33.06
19	Northwest England-West Midlands	0.0009	0.0013	4.36	13.46	31.31-32.17
20	Kanto-Kinki	0.0026	0.0057	17.13	29.39	33.79-31.24
21	Zuid-Holland-Noord-Holland	0.0040	0.0051	- 1.58	13.68	33.67-36.56
22	Zuid-Holland-Utrecht	0.0030	0.0084	-11.16	56.10	36.03-34.50
23	Noord-Holland-Utrecht	0.0045	0.0084	-17.95	45.78	38.08.33.56
24	Warsaw-Łódź	0.0001	0.0005	29.65	33.51	53.02-36.43
25	Warsaw-Gdańsk	0.0002	0.0004	18.96	26.29	42.81-55.68
26	Warsaw-Katowice	0.0002	0.0002	14.87	-23.42	45.32-35.24
27	Warsaw-Cracow	0.0001	0.0003	29.45	31.72	51.89-38.45
28	Katowice-Łódź	0.0001	0.0003	30.66	52.79	41.96-30.46
29	Katowice-Gdańsk	0.0001	0.0003	- 5.88	46.83	35.53-39.34
30	Katowice-Cracow	0.0004	0.0022	25.94	51.33	43.21-34.48
31	Gdańsk-Cracow	0.0001	0.0001	10.30	5.52	52.14-34.00
32	Cracow-Łódź	0.0001	0.0001	6.06	2.00	38.27.34.26
33	Stockholm-South Sweden	0.0023	0.0025	- 9.31	12.40	32.18-27.96

[a]A is regions with larger population size, and B is regions with smaller population size.

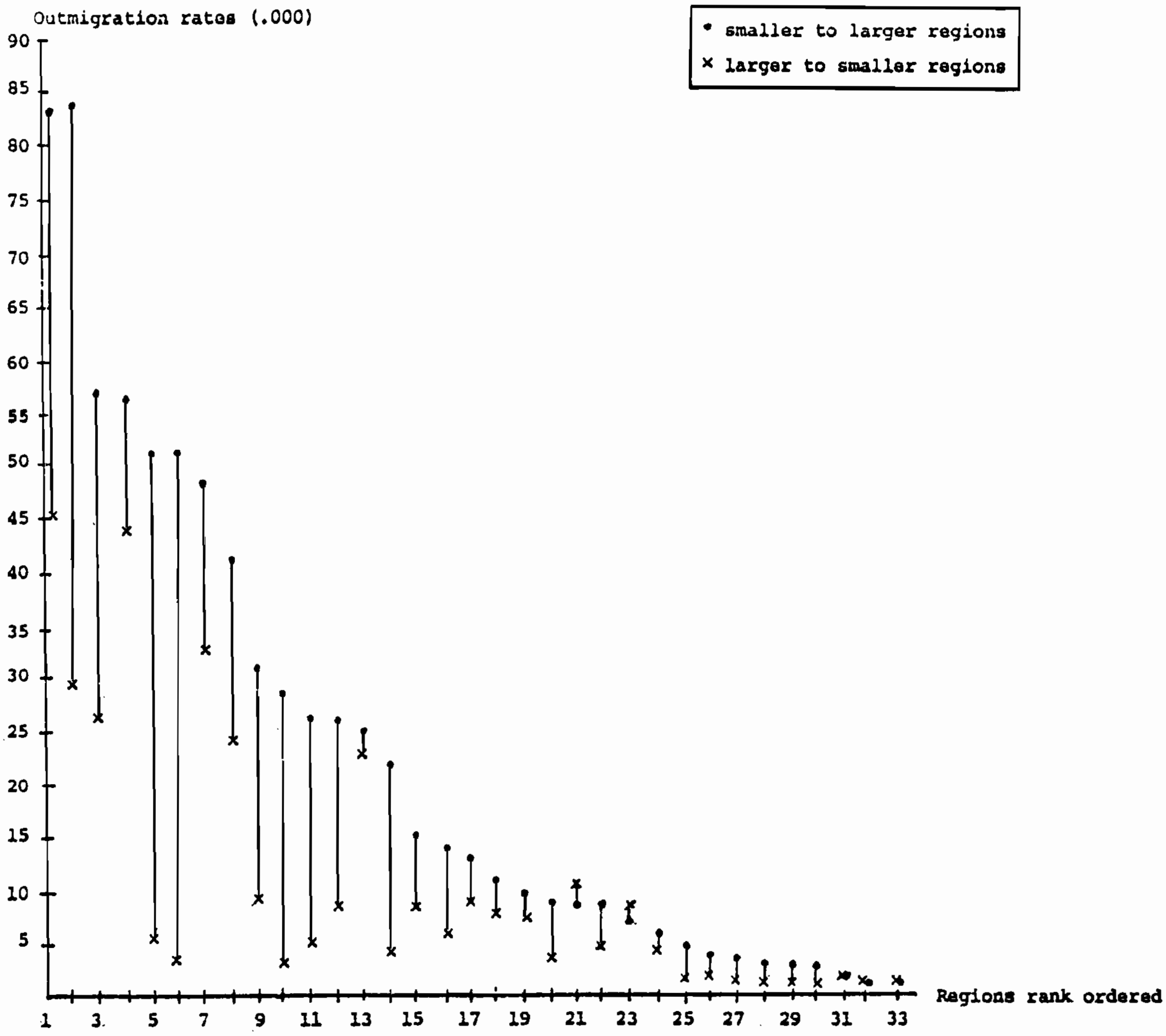


Figure 15. Migration flows among selected urban regions. Comparison of outmigration rates for 33 pairs of regions (see Table 4).

positive migration balance with their hinterlands, but the effectiveness values were very small. The latter is also true of interactions among the three urban regions of England. In any event the size of net flows cannot be explained by differences in population size between the origin and destination (see Figure 16).

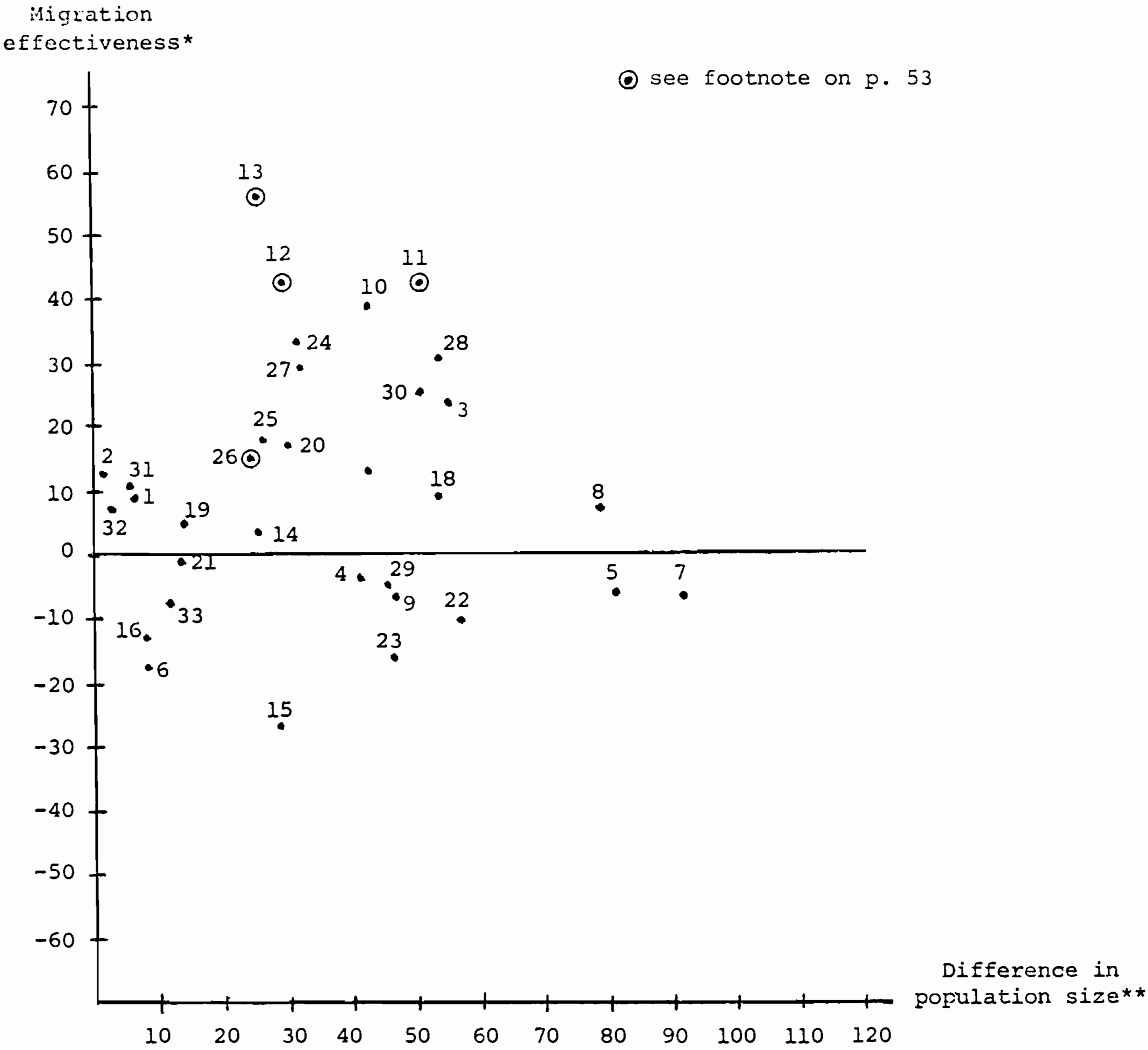
While the material presented falls short of providing consistent evidence against the concept of inter-metropolitan linkages, it offers little to support it. Intensive migration takes place mostly among those urban regions that form a contiguous territory (the Randstad, the south of the GDR, and Hall's Megalopolis England) or are situated fairly close to each other. Similarly, the concept of hierarchical migration cannot be disproved with the help of the available data, although it is clearly no longer applicable under conditions of urban contraction, as expressed by absolute population loss.

In support of the hypothesis one may argue (as many authors have) that the importance of inter-metropolitan migration rests not as much on volume as on composition and "quality". Such flows tend to be highly selective in social, economic, and demographic terms. The data allow us to take a closer look at one of the crucial characteristics of migrants, i.e., their age structure. This theme is treated below.

Hypothesis 5. The age profile of inter-urban migration is typical of the outflow schedule for a capital region, i.e., it is less labor dominant and less labor symmetric than the corresponding inflow schedule.

This statement paraphrases the hypothesis identified by Rogers and Castro (1981) pertaining to differences between inflow and outflow profiles for capital regions. Their data relate to 8 out of the 35 urban regions analyzed in this paper.

The age structure of migrants represents perhaps the most important characteristic of population flows from the point of view of both economic and demographic change. Its interrelation



* calculated as: $E_M = (M_{ij} - M_{ji})100/(M_{ij} + M_{ji})$

** calculated as: $D_P = (P_i - P_j)100/(P_i + P_j)$

Figure 16. Migration flows among selected urban regions. Relations between weighted net migration and weighted differences in population size between 33 pairs of regions.

with labor force formation and service demand is equally as strong as its fertility and mortality implications. The large cities have traditionally benefited from a heavy concentration of migrants within the early labor force and reproductive age groups, and from sending more of their elderly and mid-career members of the labor force to smaller urban and non-urban places. However, as inter-urban moves become a major component of inter-regional migration and the positive association between migration patterns and urban hierarchy tends to disappear, the differences between the inflow and outflow schedules will also diminish. This trend would have pronounced and (largely negative) long-term effects on the economic and demographic development of large metropolitan areas.

Such a hypothesis may not apply on an intraregional scale, in particular to migration between cores and peripheries within urban regions. The typical pattern is one in which moves towards large-city cores are dominated by young individuals, whereas families prevail among the outmigrating population (see Borchert 1980; van der Knapp and Sleegers 1981; Ley and Mercer 1980). There are no indications that such a pattern may undergo major change under conditions of interregional deconcentration of settlements.

As a preliminary step in the study of inter-urban migration profiles, the model migration-by-age schedule developed by Castro and Rogers (1979) was fitted to the data for urban regions of the Federal Republic of Germany, Poland, and Japan. The resulting generalized profiles are compared with conclusions arrived at by Rogers and Castro (1981) concerning aggregate migration into and out of selected capital regions.

Table 5 and Figure 17 show values of selected parameters of the age schedules for moves to and from the city of Hamburg. The parameters refer to one part of the generalized profile known as the labor curve. The aggregate-flow profiles are very similar to those identified for the eight capital regions. Contrary to expectations, however, the origin-destination-specific schedules do not greatly depart from the aggregate

Table 5. Selected parameters defining observed total model schedules of urban region-oriented and inter-urban flows: the FRG, 1975; Japan, 1970; and Poland, 1977.

Flows	Parameters*			Mean age
	a_2	α_2	λ_2	
Out of Hamburg (total)	0.049	0.076	0.634	36.04
Into Hamburg (total)	0.074	0.099	0.635	30.26
From Hamburg to Bremen	0.089	0.111	0.394	33.55
From Hamburg to Nordrhein Westfalen	0.069	0.097	0.320	35.85
Into Hamburg from Bremen	0.092	0.123	0.459	33.37
Into Hamburg from Nordrhein Westfalen	0.077	0.099	0.476	30.76
Out of Kanto (total)	0.064	0.111	0.204	34.83
Into Kanto (total)	0.096	0.134	0.577	33.51
From Kanto to Kinki	0.057	0.106	0.326	35.96
Into Kanto from Kinki	0.066	0.115	0.245	35.10
From Kinki to Kanto	0.069	0.109	0.281	33.07
Into Kinki from Kanto	0.064	0.108	0.321	34.00
Out of Warsaw (total)	0.001	0.653	0.126	54.24
Into Warsaw (total)	0.091	0.158	0.216	31.04
From Warsaw to 4 urban regions	0.001	0.599	0.114	52.49
Into Warsaw from 4 urban regions	0.065	0.148	0.242	43.13
Out of Katowice (total)	0.059	0.289	0.224	46.34
Into Katowice (total)	0.110	0.213	0.283	33.25
From Katowice to 4 urban regions	0.068	0.171	0.332	44.36
Into Katowice from 4 urban regions	0.079	0.319	0.213	41.80

* a_2 = height of labor peak

α_2 = rate of descent of labor force curve

λ_2 = rate of ascent of labor force curve (see Castro and Rogers 1979)

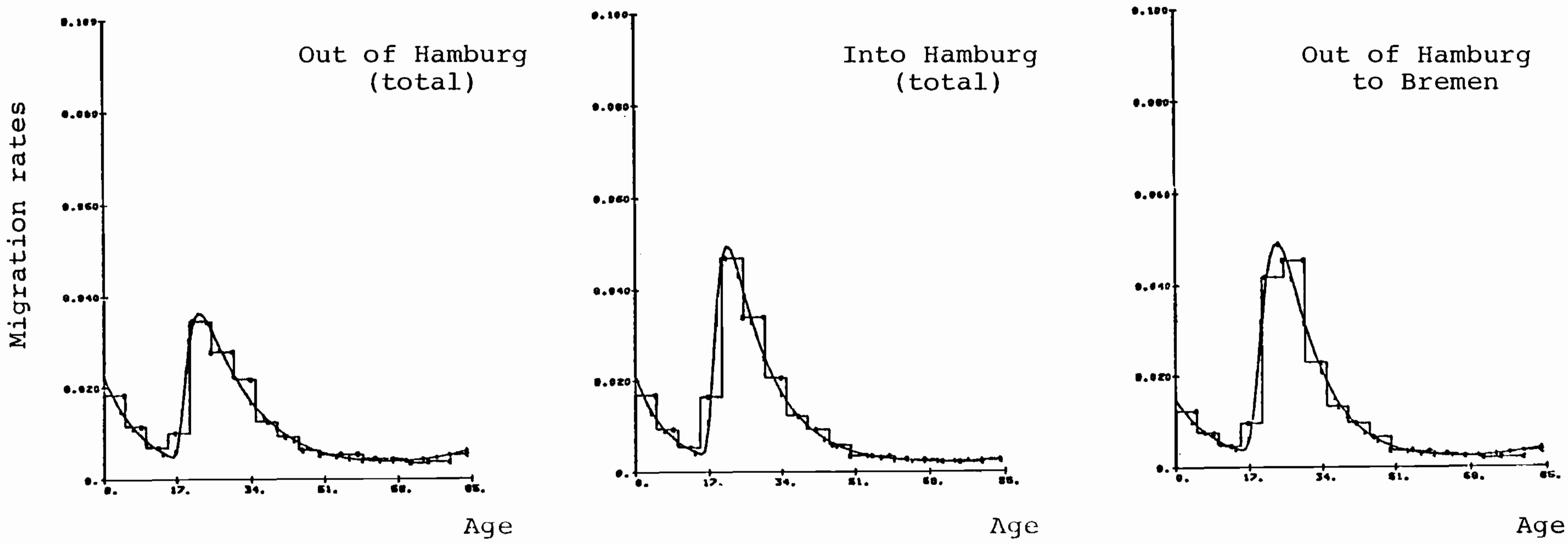


Figure 17. Migration age patterns for urban regions: F.R.G., 1974.

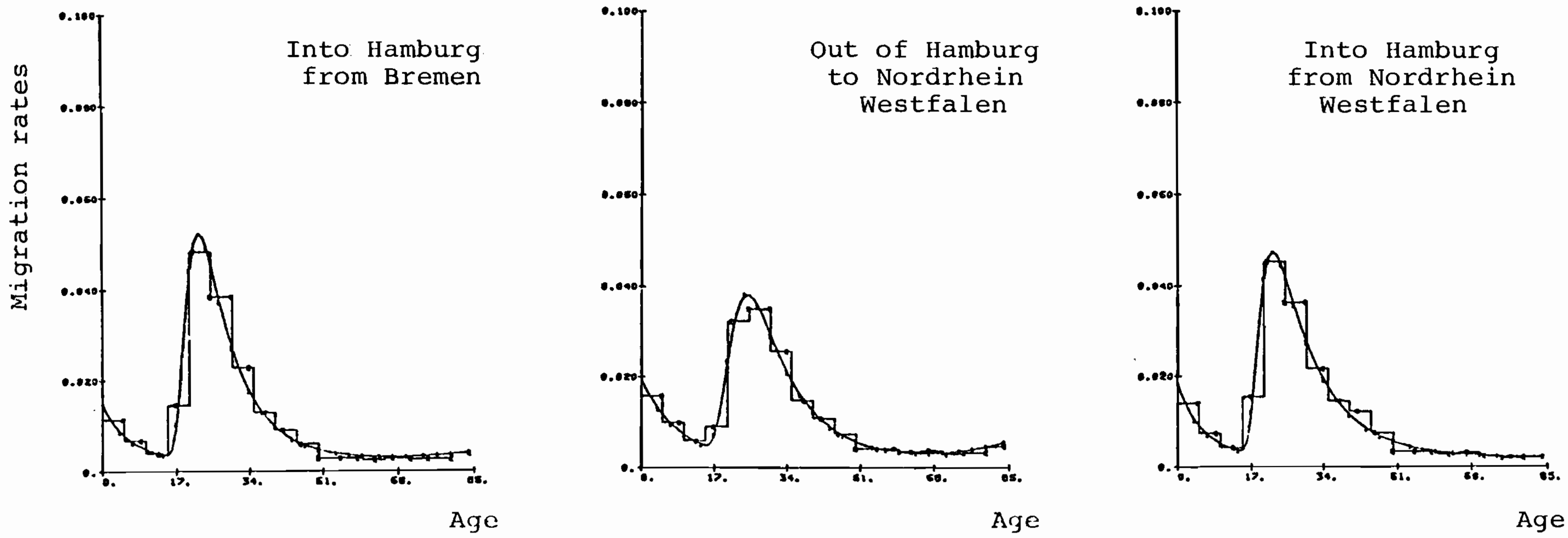


Figure 17. Continued.

schedules for inmigration. The outmigration profiles (from Hamburg to Nordrhein Westfalen and from Hamburg to Bremen) are more interesting in this respect as they show a shift in the labor peak, also reflected in the higher mean age of migrants, when compared with the total out-of-Hamburg schedule.

A different pattern emerges when migration profiles for the two Japanese urban regions are examined (Table 5 and Figure 18). In this case the origin-destination-specific flows closely resemble the aggregate out-of-Kanto (Tokyo) schedule, and sharply contrast with the aggregate into-Kanto migration. This is true of the height of the labor peak, as well as the rate of ascent and descent of the labor force curve.

The age profiles for flows into, out of, and between the five urban regions of Poland display some peculiar characteristics. As to the initial hypothesis the evidence is mixed, with some of the parameter values for origin-destination-specific flows being typical of either the aggregate in- or outmigration schedules (see Table 5 and Figure 19). A striking feature of the observed schedules is a large difference between the mean age of in- as opposed to outmigrants, a consequence of both the under-representation of younger migrants from the large cities and the prominence of outmigration by the elderly. This phenomenon has been documented and interpreted in sociological literature (Latuch 1970).

Another non-conventional characteristic of the age profiles of migrations between the urban regions of Poland is a secondary peak in the 45-50 age group. It is especially noticeable in the case of total outflows from Warsaw, but can also be found in the outmigration profiles for the Katowice (Upper Silesia) region. This elevation can be attributed to such factors as mid-career moves by senior executives from the main administrative and industrial centers towards provincial capitals and smaller cities in general. An introduction of longitudinal data would be required to test the viability of this irregularity in the age profiles. So far it gives results that are rather poor fits of the model curves to observed patterns.

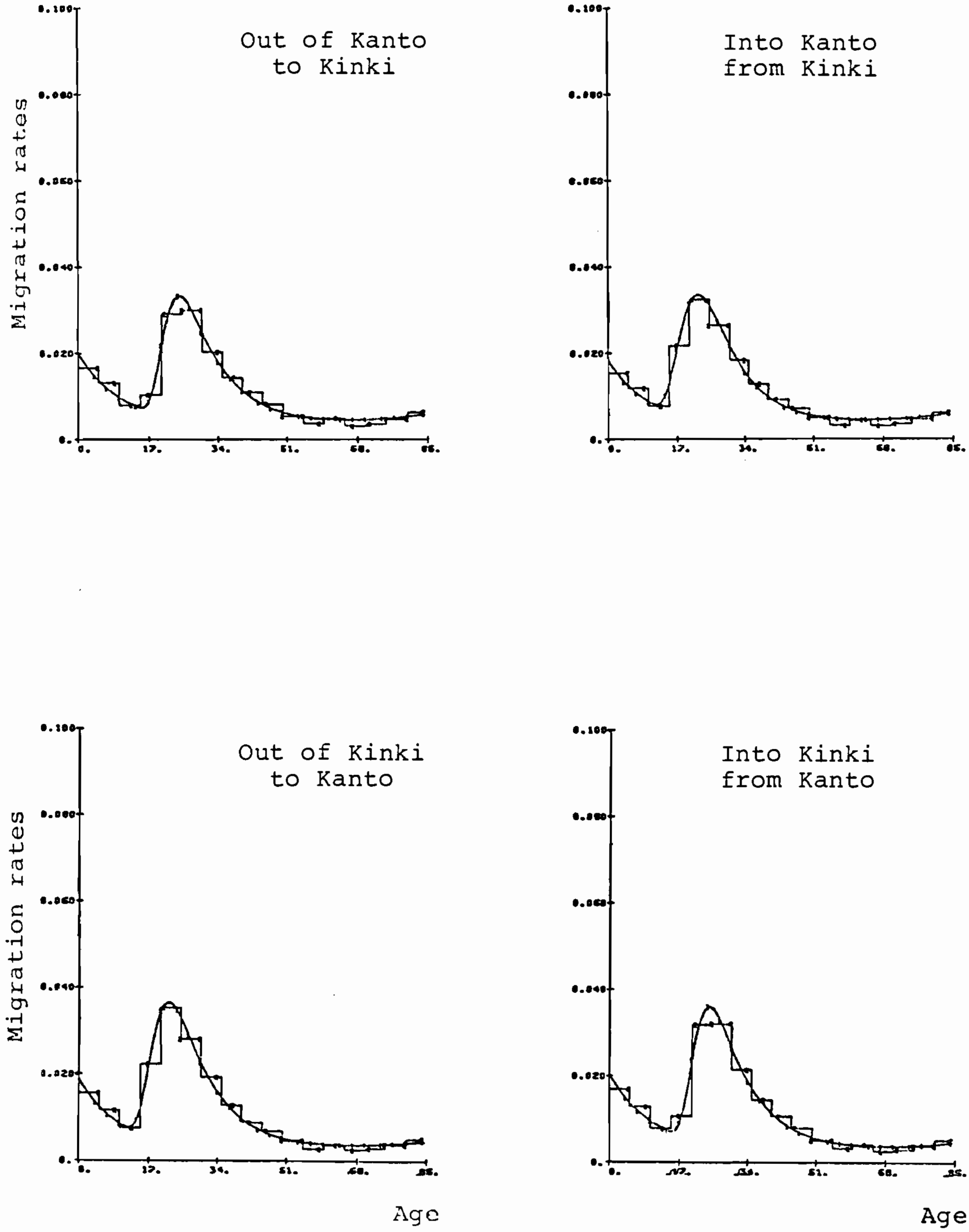


Figure 18. Migration age patterns for urban regions: Japan, 1970.

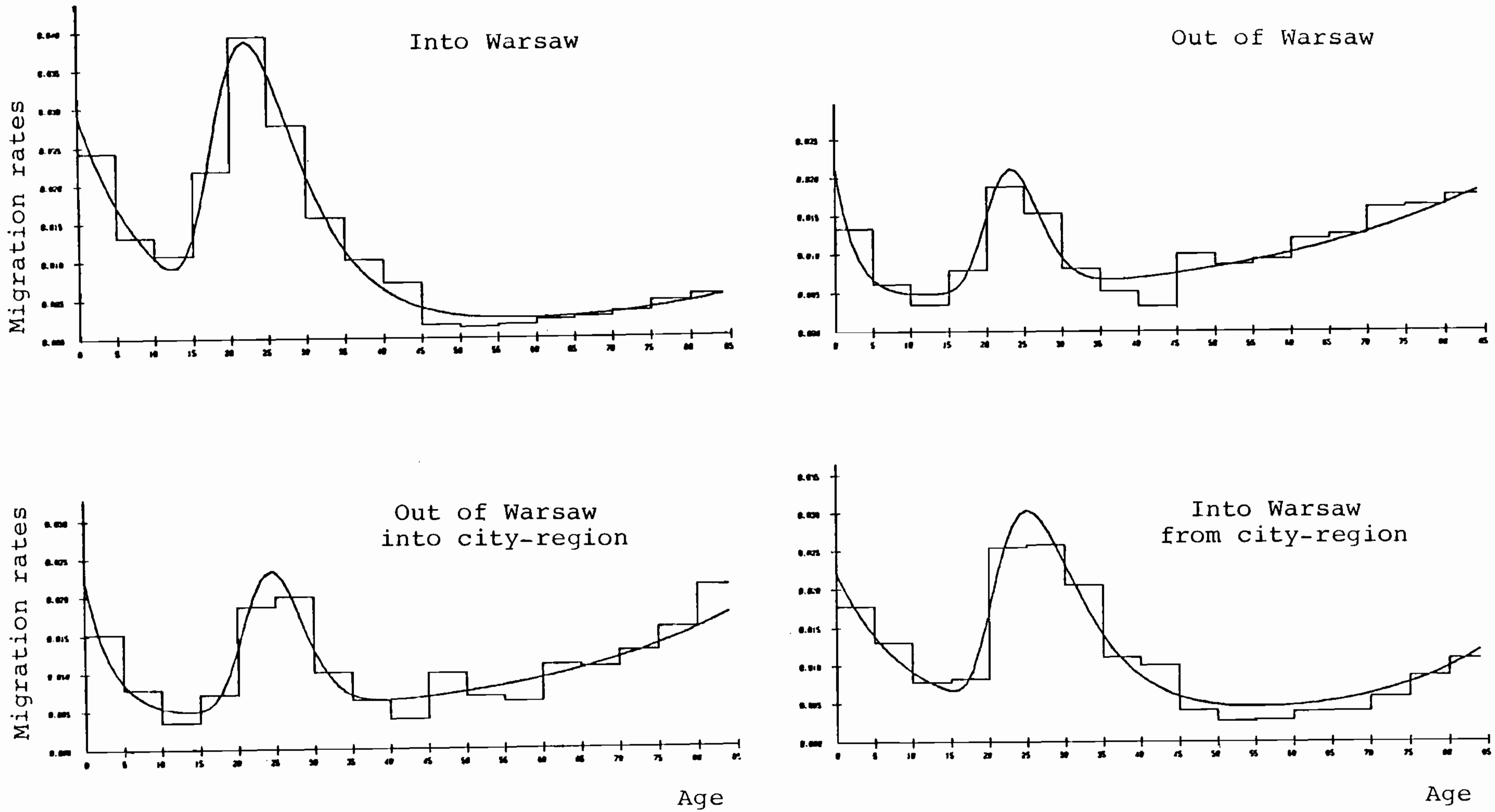


Figure 19. Migration age patterns for urban regions: Poland, 1977.

Thus, the hypothesis concerning age composition of inter-urban migrations finds a partial confirmation in the reviewed material. When compared with aggregate inmigration flows, the flows from and between urban regions are characterized by a shift of the labor force-related peak towards higher age groups (mainly from the 20-25 to 25-30 category), its lower relative height, and occasionally by evidence of a mid-career migration peak.

CONCLUSION

Several social sciences have contributed to the study of spatial migration patterns by focusing on different aspects and determinants of moves. Thus the sociological approach assumes the importance of family and kinship ties, the geographical hypothesis refers to the role of distance and size of the interacting centers, the demographic framework explores the impacts of the age and sex structure of the population at risk, while the economic hypotheses refer to variations in income, labor demand, education, housing, or environmental quality. Finally the policy approach is concerned with ways in which interaction between all the factors and variables can be translated into normative terms.

This paper looks at migration as a correlate of, and a proxy for the changing place of large cities within national settlement systems. It emphasizes relationships between population composition of urban regions and its spatial mobility. The nature of the data used would not allow one to go at this stage beyond the description of observed patterns and exploration into their implications for future development. A rigorous economic or policy interpretation could hardly be conceived at the chosen comparative scale even if much richer data were available.

With respect to the former objective, two limitations of the background material should be enumerated: (a) the set of urban regions was not large and homogeneous enough to allow extended statistical analysis; (b) population shifts between cores and peripheries of urban regions should not be accounted for owing to the large size of the spatial units.

Bearing these restrictions in mind, the findings derived from the Migration and Settlement Study are in accord with three out of five initial hypotheses that refer to patterns of urban development in highly urbanized countries. When the analysis is limited to those urban regions that have actually experienced population decline during the 1970s, four generalizations are partially supported. The only case in which there is basically no positive evidence pertains to the interregional mobility level of the population living in large urban areas.

REFERENCES

Alonso, W. (1971) The Economics of Urban Size. *Papers and Proceedings of the Regional Science Association* 26:67-83.

Alonso, W. (1978) The Current Halt in the Metropolitan Phenomenon. Pages 23-42 in *The Mature Metropolis*, edited by C.L. Leven. Lexington, Mass.: D.C. Heath and Co.

Andersson, A.E., and J. Holmberg (1980) *Migration and Settlement: 3. Sweden*. RR-80-5. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Beale, C.L. (1977) The Recent Shift of United States Population to Nonmetropolitan Areas, 1970-75. *International Regional Science Review* 2(2):113-122.

Berg, L. van der, and L.H. Klaassen (1978) *The Process of Urban Decline*. Netherlands Economic Institute, Series: Foundations of Empirical Economic Research 6, Rotterdam, the Netherlands.

Berg, L. van der, and L.H. Klaassen (1980) *The Contagiousness of Urban Decline*. Netherlands Economic Institute, Series: Foundations of Empirical Economic Research 6, Rotterdam, the Netherlands.

Berry, J.B.L. (1970) The Geography of the United States in the Year 2000. *Transactions of the Institute of British Geographers* 51:21-53.

Bies, K., and K. Tekse (1980) *Migration and Settlement: 7. Hungary*. RR-80-34. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Bobek, H. (1975) Zentrale Orte und Ihre Bereiche - Neuerhebung 1973, 6. Lieferung. *Österreich-Atlas*. Österreichische Akademie der Wissenschaften, Kommission für Raumforschung, Vienna, Austria.

Boudeville, J. (1978) Les regions de villes en l'Europe. Pages 54-84 in *Le structure urbaine en l'Europe occidentale: faits, theories, modelles*, edited by J.M. Paelinck. Hampshire, England: Saxon House.

Borchert, J.G. (1980) The Dutch Settlement System. Pages 283-335 in *The National Settlement Systems: Topical and National Reports*. International Geographical Union, Commission on National Settlement Systems, Warsaw, Institute of Geography and Spatial Organization, Polish Academy of Sciences.

Bourne, L.S. (1975) *Urban Systems: Strategies for Regulation*. A comparison of policies in Britain, Sweden, Australia and Canada. Oxford: Clarendon Press.

Bourne, L.S. (1980) Alternative Perspectives on Urban Decline and Population Deconcentration. *Urban Geography* 1(1):39-52.

Bourne, L.S. (1981) Recent Trends in Urban Growth and Population Redistribution in Canada. Pages 139-158 in *Human Settlement Systems: Spatial Patterns and Trends*, edited by T. Kawashima and P. Korcelli. Laxenburg, Austria: International Institute for Applied Systems Analysis, Pergamon Press Proceedings Series.

Bourne, L.S., P. Korcelli, and O. Wärneryd (1980) Changing Spatial Configurations in National Settlement Systems. Pages 51-81 in *The National Settlement Systems: Topical and National Reports*. International Geographical Union, Commission on National Settlement Systems, Warsaw, Institute of Geography and Spatial Organization, Polish Academy of Sciences.

Brown, A.A., and E. Neuburger (1977) *International Migration: A Comparative Perspective*. New York and London: Academic Press.

Brown, P.J.B., and I. Masser (1978) An Empirical Investigation of the Use of Broadbent's Rule in Spatial System Design. Pages 51-69 in *Spatial Representation and Spatial Interaction*, edited by I. Masser and P. Brown. Leiden and Boston: Martinus Nijhoft Social Sciences Division.

Castro, L.J., and A. Rogers (1979) *Migration Age Patterns: Measurement and Analysis*. WP-79-16. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Cordey-Hayes, R.D. (1975) Migration and the Dynamics of Multiregional Population System. *Environment and Planning A* 7:793-814.

DaVanzo, J. (1980) *Repeat Migration in the United States: Who Moves Back and Who Moves On?* WP-80-158. Laxenburg, Austria: International Institute for Applied Systems Analysis.

DaVanzo, J., and P. Morrison (1978) *Dynamics of Return Migration: Descriptive Findings from a Longitudinal Study.* P-5913. Santa Monica: The Rand Corporation.

Drewe, P. (1979) *Rethinking Population Distribution Policies.* Paper prepared for the Seminar on the Impact of Current Population Trends on Europe's Cities and Regions. Strasbourg.

Drewe, P. (1980) *Migration and Settlement: 5. Netherlands.* RR-80-13. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Drewett, R., A. Gillespie, J. Goddard, S. Kenneth and N. Spence (1978) *British Cities: Migration Trends.* Department of Geography, London School of Economics and Political Science, London.

Dziewonski, K. (1980) Systems of Main Urban Centers (Functioning within the National Settlement Systems). Pages 103-120 in *The National Settlement Systems: Topical and National Reports.* International Geographical Union, Commission on National Settlement Systems, Warsaw, Institute of Geography and Spatial Organization, Polish Academy of Sciences.

Dziewonski, K., and P. Korcelli (1981) *Migration and Settlement: 11. Poland.* RR-81-20. Laxenburg, Austria: International Institute for Applied Systems Analysis. Forthcoming.

Economic Commission for Europe (1979) *United Nations: Labour Supply and Migration in Europe: Demographic Dimensions 1950-1975 and Prospects.* Geneva-New York.

Friedmann, J. (1977) *Territory and Function.* Paper presented at 17th European Congress of the Regional Science Association, Cracow.

Friedmann, J., and J. Miller (1965) The Urban Field. *Journal of the American Institute of Planners* 31:312-319.

Glickman, N.J. (1977a) *Growth and Change in the Japanese Urban System: the Experience of the 1970's.* RM-77-39. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Glickman, N.J. (1977b) *The Japanese Urban System During a Period of Rapid Economic Development.* RM-77-46. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Glickman, N.J. (1981) *Emerging Urban Policies in a Slow-Growth Economy: Conservative Initiatives and Progressive Responses.* Paper presented at the Conference on Urbanization and Development, International Institute for Applied Systems Analysis, Laxenburg, Austria.

Gordon, P. (1978) *Deconcentration without a "Clean Break".* RM-78-39. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Grigorev, N. (1978) *Human Settlement Systems: Analysis and Tendencies of Development.* Paper presented at the Conference on the Analysis of Human Settlement Systems, International Institute for Applied Systems Analysis, Laxenburg, Austria.

Hall, P., H. Gracey, R. Drewett and R. Thomas (1973) *The Containment of Urban England*, Vols. 1 and 2. London: George Allen and Unwin.

Hall, P., and D. Hay (1980) *Growth Cities in the European Urban System.* London: Heinemann Education Books.

Hall, P., and D. Metcalf (1978) The Declining Metropolis: Patterns, Problems and Policies in Britain and Mainland Europe. Pages 65-90 in *The Mature Metropolis*, edited by C.L. Leven. Lexington, Mass.: D.C. Heath and Co.

Hampl, M., J. Jezek and K. Kühnl (1978) *Socio-Geographic Regionalization of Czech Socialist Republic.* Paper presented at the Conference on the Analysis of Human Settlement Systems, International Institute for Applied Systems Analysis, Laxenburg, Austria.

Hansen, N.M. (1976) *Systems Approaches to Human Settlements.* RM-76-3. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Hirvonen, M. (1981) On Urban Change in Finland. Pages 89-105 in *Human Settlement Systems: Spatial Patterns and Trends*, edited by T. Kawashima and P. Korcelli. Laxenburg, Austria: International Institute for Applied Systems Analysis, Pergamon Press Proceedings Series.

Illeris, S. (1980) Recent Development of the Settlement Systems of Advanced Market Economy Countries. Pages 257-280 in *The National Settlement Systems: Topical and National Reports.* International Geographical Union, Commission on National Settlement Systems, Warsaw, Institute of Geography and Spatial Organization, Polish Academy of Sciences.

Just, P., and A. Rogers (1980) *Migration and Population Redistribution in Italy*. Laxenburg, Austria: International Institute for Applied Systems Analysis (typescript).

Kawashima, T. (1981) Recent Urban Trends in Japan: Analysis of Functional Urban Regions. Pages 21-40 in *Human Settlement Systems: Spatial Patterns and Trends*, edited by T. Kawashima and P. Korcelli. Laxenburg, Austria: International Institute for Applied Systems Analysis, Pergamon Press Proceedings Series.

Kawashima, T., and P. Korcelli, eds. (1981) *Human Settlement Systems: Spatial Patterns and Trends*. Laxenburg, Austria: International Institute for Applied Systems Analysis, Pergamon Press Proceedings Series.

Kenneth, S. (1977) *Migration Trends and their Contribution to Population Change in the Urban System*. Working Report No. 50. Department of Geography, London School of Economics and Political Science, London.

Keyfitz, N. (1980) *Do Cities Grow by Natural Increase or by Migration?* RR-80-24. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Keyfitz, N., and D. Philipov (1981) *Migration and Natural Increase in the Growth of Cities* (typescript).

Klaassen, L.H., and J.H.P. Paelinck (1979) The Future of Large Towns. *Environment and Planning A* 11:1095-1104.

Knapp, G.A. van der, and W.F. Sleegers (1981) *Population Dynamics and Urban Change in the Netherlands*. Paper prepared for the Conference on Urbanization and Development, International Institute for Applied Systems Analysis, Laxenburg, Austria.

Koch, R., and H.-P. Gatzweiler (1980) *Migration and Settlement: 9. Federal Republic of Germany*. RR-80-37. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Korcelli, P. (1977) *An Approach to the Analysis of Functional Urban Regions: A Case Study of Poland*. RM-77-52. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Korcelli, P. (1980) *Urban Change: An Overview of Research and Planning Issues*. WP-80-30. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Krönert, R. (1981) The Settlement System and Functional Urban Regions in the German Democratic Republic. Part II: The Hierarchy of Functional Urban Regions. Pages 73-88 in *Human Settlement Systems: Spatial Patterns and Trends*, edited by T. Kawashima and P. Korcelli. Laxenburg, Austria: International Institute for Applied Systems Analysis, Pergamon Press Proceedings Series.

Kühnl, K. (1981) *Migration and Settlement: 14. Czechoslovakia.* RR-81-00. Laxenburg, Austria: International Institute for Applied Systems Analysis. Forthcoming.

Lacko, L., G. Enyedi, and G. Koszegfalvi (1978) *Functional Urban Regions in Hungary.* CP-78-4. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Lasuèn, J. (1973) Urbanization and Development. The Temporal Interaction Between Geographical and Sectoral Clusters. *Urban Studies* 10:163-188.

Latuch, M. (1970) *Migracje wewnetrzne w Polsce na tle industrializacji, 1950-60* (Internal Migrations and Industrialization in Poland, 1950-60). Warszawa: Panstwowe Wydawnictwo Ekonomiczne.

Ledent, J. (1980) *Comparative Dynamics of Three Demographic Models of Urbanization.* RR-80-1. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Ledent, J. (1981) *Migration and Settlement: 13. France.* RR-81-00. Laxenburg, Austria: International Institute for Applied Systems Analysis. Forthcoming.

Leven, C.L. (1978a) Growth and Nongrowth in Metropolitan Areas and the Emergence of Polycentric Metropolitan Form. *Papers of the Regional Science Association* 51:101-112.

Leven, C.L. (1978b) The Emergence of Maturity in Metropolis. Pages 3-20 in *The Mature Metropolis*, edited by C.L. Leven. Lexington, Mass.: D.C. Heath and Co.

Leven, C.L. (1981) *Regional Shifts and Metropolitan Reversal in the United States.* Paper prepared for the Conference on Urbanization and Development, International Institute for Applied Systems Analysis, Laxenburg, Austria.

Ley, D., and J. Mercer (1980) Locational Conflict and the Politics of Consumption. *Economic Geography* 56:89-109.

Long, L., and W. Frey (1981) *Migration and Settlement: 16. United States.* RR-81-00. Laxenburg, Austria: International Institute for Applied Systems Analysis. Forthcoming.

Lüdemann, H., and J. Heinzmann (1978) On the Settlement System of the German Democratic Republic: Development Trends and Strategies. Pages 121-143 in *Human Settlement Systems: International Perspectives on Structure, Change and Public Policy*, edited by N.M. Hansen. Cambridge, Mass.: Ballinger Publishing Co.

Macrae, N. (1978) Tomorrow's Agglomeration Economies. Pages 131-146 in *The Mature Metropolis*, edited by C.L. Leven. Lexington, Mass.: D.C. Heath and Co.

Masser, I., and J. Scheurwater (1978) The Specification of Multi-Level Systems for Spatial Analysis. Pages 151-172 in *Spatial Representation and Spatial Interaction*, edited by I. Masser and P.J.B. Brown. Leiden and Boston: Martinus Nijhoft Social Sciences Division.

Mera, K. (1973) On the Urban Agglomeration and Economic Efficiency. *Economic Development and Cultural Change* 21: 309-337.

Mohs, G. (1980) *Migration and Settlement: 4. German Democratic Republic*. RR-80-6. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Morrison, P.A. (1975) *The Current Demographic Context of National Growth and Development*. P-5514. Santa Monica, California: The Rand Corporation.

Mumford, L. (1961) *The City in History. Its Origin, Its Transformations, and Its Prospects*. London: Secker and Warburg.

Nanjo, Z., T. Kawashima, and T. Kuroda (1981) *Migration and Settlement: 15. Japan*. RR-81-00. Laxenburg, Austria: International Institute for Applied Systems Analysis. Forthcoming.

Nijkamp, P. (1980) *Perspectives for Urban Analyses and Policies*. CP-80-31. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Nystuen, J.D., and M.F. Dacey (1961) A Graph Theory Interpretation of Nodal Regions. *Papers and Proceedings of the Regional Science Association* 7:29-42.

Ohlsson, L. (1979) *Components of Urban Industrial Employment Change in a Small Open Economy: Sweden*. WP-79-32. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Organization for Economic Cooperation and Development (1980) *The New OECD Programme on Urban Problems* (typescript). Paris.

Philipov, D. (1981) *Migration and Settlement: 12. Bulgaria.* RR-81-21. Laxenburg, Austria: International Institute for Applied Systems Analysis. Forthcoming.

Pred, A. (1975) On the Spatial Structure of Organizations and the Complexity of Metropolitan Interdependence. *Papers of the Regional Science Association* 35:115-142.

President's Commission for a National Agenda for the Eighties (1980) *Urban America in the Eighties. Perspectives and Prospects.* Report of the Panel on Policies and Prospects for Metropolitan and Nonmetropolitan America. Washington, D.C.: U.S. Government Printing Office.

Rees, R.H. (1979) *Migration and Settlement: 1. United Kingdom.* RR-79-3. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Richardson, H.W. (1973) *The Economies of Urban Size.* Westmead: Saxon House, D.C. Heath Ltd.

Richardson, H.W. (1978) "Basic" Economic Activities in Metropolis. Pages 251-280 in *The Mature Metropolis*, edited by C.L. Leven. Lexington, Mass.: D.C. Heath and Co.

Richardson, H.W. (1979) *Defining Population Distribution Goals in Development Planning.* Paper presented at the UN/UNFPA Workshop on Population Distribution Policies in Development Planning, Bangkok.

Rikkinen, K. (1979) *Migration and Settlement: 2. Finland.* RR-79-9. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Rogers, A. (1968) *Matrix Analysis of Interregional Population Growth and Distribution.* Berkeley, California: University of California Press.

Rogers, A. (1976) Shrinking Large-Scale Population Projection Models by Aggregation and Decomposition. *Environment and Planning A* 8:515-541.

Rogers, A. (1977) *Migration, Urbanization, Resources, and Development.* RR-77-14. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Rogers, A., and L.J. Castro (1981) *Model Schedules in Multistate Demographic Analysis: The Case of Migration.* WP-81-22. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Sauberer, M. (1981) *Migration and Settlement: 10. Austria.* RR-81-16. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Sherrill, K. (1976) *Functional Urban Regions in Austria.* RM-76-71. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Sherrill, K. (1977) *Functional Urban Regions and Central Place Regions in the Federal Republic of Germany and Switzerland.* RM-77-17. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Simmons, J.W. (1977) *Migration and the Canadian Urban System: Part I. Spatial Patterns.* Research Report 85. Toronto: Centre for Urban and Community Studies, University of Toronto.

Simmons, J.W. (1978) The Organization of the Urban System. Pages 61-69 in *Systems of Cities: Readings on Structure, Growth and Policy*, edited by L.S. Bourne and J.W. Simmons. New York: Oxford University Press.

Simmons, J.W. (1979) *Migration and the Canadian Urban System: Part III. Comparing 1966-1971 and 1971-1976.* Research Report 112. Toronto: Centre for Urban and Community Studies, University of Toronto.

Slater, P.B. (1976) A Hierarchical Regionalization of Japanese Prefectures Using 1972 Interprefectural Migration Flows. *Regional Studies* 10:123-132.

Soboleva, T. (1980) *Migration and Settlement: 8. Soviet Union.* RR-80-36. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Sternlieb, G., and J.W. Hughes (1975) *Post-Industrial America: Metropolitan Decline and Inter-Regional Job Shifts.* Center for Urban Policy Research, New Brunswick: Rutgers, The States University of New Jersey.

Termote, M. (1980) *Migration and Settlement: 6. Canada.* RR-80-29. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Thisse, J.F., and G.G. Papageorgiou (1981) Reconciliation of Transportation Costs and Amenities as Location Factors in the Theory of the Firm. *Geographical Analysis* 13 (forthcoming).

Thomas, M.D. (1981) *Growth and Change in Innovative Manufacturing Industries and Firms.* CP-81-5. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Thompson, W.R. (1965) *A Preface to Urban Economics.* Resources for the Future. Baltimore: Johns Hopkins University Press.

Thompson, W.R. (1968) Internal and External Factors in the Development of Urban Economies. Pages 43-80 in *Issues in Urban Economies*, Resources for the Future, edited by H.S. Perloft and L. Wings. Baltimore: John Hopkins University Press.

Tobler, W.B. (1975) *Spatial Interaction Patterns.* RR-75-19. Laxenburg, Austria: International Institute for Applied Systems Analysis.

United Nations Economic Commission for Europe (1981) Committee on Housing, Building and Planning. *Proposal for Further Work on the Study on Long-Term Perspectives for Human Settlements Development in the EEC Region* (typescript). Geneva.

Vining, D.R., and A. Strauss (1977) A Demonstration that the Current Deconcentration of Population in the United States in a Clean Break with the Past. *Environment and Planning A* 9:751-758.

Willekens, F., and A. Rogers (1978) *Spatial Population Analysis: Methods and Computer Programs.* RR-78-18. Laxenburg, Austria: International Institute for Applied Systems Analysis.

Zelinsky, W. (1971) The Hypothesis of the Mobility Transition. *Geographical Review* 61:219-249.

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