MIGRATION AND SETTLEMENT:
11. POLAND

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FOREWORD

Interest in human settlement systems and policies has been a central part of urban-related work at the International Institute for Applied Systems Analysis (IIASA) from the outset. From 1975 through 1978 this interest was manifested in the work of the Migration and Settlement Task, which was formally concluded in November 1978. Since then, attention has turned to dissemination of the Task's results and to the conclusion of its comparative study, which, under the leadership of Dr. Frans Willekens, is focusing on a comparative quantitative assessment of recent migration patterns and spatial population dynamics in all of IIASA's 17 National Member Organization countries.

The comparative analysis of national patterns of interregional migration and spatial population growth is being carried out by an international network of scholars who are using methodology and computer programs developed at IIASA.

In this report, Professors Kazimierz Dziewoński and Piotr Korcelli, of the Institute of Geography and Spatial Organization, Polish Academy of Sciences, analyze the changing population patterns in Poland and their relations to spatial policy. The analysis focuses on regional interdependence and the role of major urban agglomerations in the spatial population system.

Reports summarizing previous work on migration and settlement at IIASA are listed at the end of this report.

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1 INTRODUCTION

The patterns of spatial population growth observed today in Poland (see for example Rosset 1975) reflect historical occurrences and processes, and form starting points for future demographic change. Three main elements have shaped these patterns: secular demographic trends; political, social, and economic upheavals; and industrialization and urbanization (continuing evolutionary processes of socioeconomic transformation).

1.1 Secular Demographic Trends

In Poland, as in other countries, the secular trends are connected with the aftermath of the so-called population explosion. This phenomenon consists of a sudden increase in the population of a region or country, creating in turn enormous reserves of manpower – a potential tool for political and social change and economic development. The population explosion, caused by the extension of the average expectation of life, typically from 30–35 to 60–70 years, is brought about by improvements in sanitary conditions, successful elimination of many contagious diseases, increased food production, and last but not least, extended periods of economic stability and peace. It is of course also true that these factors themselves lead to an increase in the number of live births and a decrease in levels of infant mortality; however, in countries such as Poland that have already reached the present upper limits for expectation of life, the demographic consequences of the population explosion appear to be coming to an end.

Generally speaking, the population transition in all countries develops along a specific course, following a number of characteristic and easily identifiable phases. In the first phase, the sharp rise in the size of the population is due to both an increase in the average age (low death rates) and an increase in the number of children surviving past infancy. In the second phase, the decrease

in death rates continues but a fall in birth rates is observed, and the general growth of the population begins to slow down. In the third phase, the death rates begin to increase again slightly (because an increasing proportion of the population is reaching the upper limits for expectation of life) and the fall in birth rates continues, causing the population growth to slow down further – often below the replacement level. The fourth and last phase may be conceptually viewed as a stabilization of the population, with a characteristic fluctuation in numbers reflecting the age-structure of the population. Naturally, this simple, four-phase description is based on the assumption that no new secular factors will appear in the country during the period studied: this is a convenient assumption but in reality is not very probable.

The various stages of the population transition in Poland may be traced in Tables 1 and 2 and in Figure 1. During the 19th century and up until the beginning of the First World War, the total population (within the present national boundaries) rose from an estimated 6 million in 1800 to about 25 million by 1900 and 30 million by 1914, an approximately five-fold increase. According to recent forecasts by the Polish Central Statistical Office, by the end of the 20th century there will be between 40 and 43 million people in Poland, an increase of some 20% over the 1978 population of 35 million.

Between 1808 and 1977 the birth rate fell from approximately 60 per thousand population to less than 20 per thousand; the death rate fell from 50 per thousand (1808) to 7 per thousand (1966) but has recently increased again to about 10 per thousand. The rate of natural increase (births minus deaths) has fluctuated during the period; the rate fell from 18 per thousand at the end of the 19th century to 10 per thousand during the 1970s, and will probably fall to zero by the middle of the next century or even earlier. The growth of population during the 19th century would have been still greater but for the large-scale emigration (especially to the United States but also to Germany, Brazil, Canada, and other countries) which continued from the middle of the 19th century up to the First World War, and, although at much-decreased rates, until the Second World War.

It may be said therefore that the population explosion in Poland began sometime in the 19th century; present-day population dynamics are already characterized by phenomena typical of the third transition phase. The process of population aging is well advanced (the present average expectations of life are about 67 years for men and 74.5 years for women). Over the long term the birth rate is falling, and there is a slight but clear tendency for the death rate to increase.

1.2 Political, Social, and Economic Upheavals

To discuss the population patterns of Poland without any reference to the political, social, and economic upheavals the country has experienced would be an impossible task. These factors have created specific phenomena which are

TABLE 1 Population growth, population density, and level of urbanization in Poland: 1900–2000.

	Population within 1937 national boundaries				Population within 1977 national boundaries		
Year	Number (millions)	Density (persons/km^2)	Percentage that is urban	Year	Number (millions)	Density (persons/km^2)	Percentage that is urban
1900	25.2	65	19.6	1897/1900[a]	23.7	75	26.6
1921	27.2	70	24.6	1921/1925[a]	26.6	85	32.8
1931	32.2	83	27.4	1931/1935[a]	29.8	96	35.5
1938	34.8	90	30.0	1939/1940[a]	32.5	104	36.9
				1946	23.9	77	31.8
				1950	25.0	80	36.9
				1955	27.6	88	43.8
				1960	29.8	95	48.3
				1965	31.6	101	49.7
				1970	32.7	104	52.3
				1975	34.2	109	55.7
				1977	34.9	111	57.4
				1978	35.0	112	57.5
				1979	35.4	113	58.2
				Projection[b]			
				1980	35.9	115	58.6
				1985	37.5	120	61.3
				1990	38.8	124	64.1
				1995	39.9	128	66.4
				2000	41.0	132	68.5

[a]Estimated.

[b]Prepared by the Central Statistical Office, Warsaw.

SOURCES: Committee for Demographic Studies (1975); Dzieworński (1976), p. 40; Rocznik Statystyczny GUS (1979, 1980).

TABLE 2 Rates (per thousand population) of marriages, births, deaths, and natural increase in Poland: 1900–1979.

Year	Marriages	Births	Deaths	Natural increase
Partitioned Poland (within 1921 boundaries)				
1900	8.2	44.0	25.5	18.5
1905	7.3	41.1	25.6	15.5
1910	7.3	38.5	22.3	16.2
1913	6.5	35.4	21.1	14.3
Interwar Poland				
1920	10.6	31.2	27.0	4.2
1925	8.1	35.2	16.7	18.5
1930	9.4	32.5	15.5	17.0
1935	8.4	26.2	14.1	12.1
1938	8.1	24.6	13.9	10.7
People's Republic of Poland				
1946	11.9	26.2	10.2	16.0
1947	13.0	28.7	10.9	17.8
1948	13.3	29.4	11.2	18.2
1949	11.2	29.7	11.5	18.5
1950	10.8	30.7	11.6	19.1
1951	10.7	31.0	12.4	18.6
1952	10.4	30.2	11.1	19.1
1953	10.0	29.7	10.2	19.5
1954	9.8	29.1	10.3	18.8
1955	9.5	29.1	9.6	19.5
1956	9.4	28.1	9.0	19.1
1957	9.1	27.6	9.5	18.1
1958	9.2	26.3	8.4	17.9
1959	9.5	24.7	8.6	16.1
1960	8.2	22.6	7.6	15.0
1961	7.9	20.9	7.6	13.3
1962	7.5	19.8	7.9	11.9
1963	7.2	19.2	7.5	11.7
1964	7.4	18.1	7.6	10.5
1965	6.3	17.4	7.4	10.0
1966	7.1	16.7	7.3	9.4
1967	7.5	16.3	7.8	8.5
1968	8.0	16.2	7.6	8.6
1969	8.3	16.3	8.1	8.2
1970	8.5	16.6	8.1	8.5
1971	8.9	17.2	8.7	8.5
1972	9.3	17.4	8.0	9.4
1973	9.4	17.9	8.3	9.6

TABLE 2 *Continued.*

Year	Marriages	Births	Deaths	Natural increase
1974	9.5	18.4	8.2	10.2
1975	9.7	18.9	8.7	10.2
1976	9.5	19.5	8.8	10.7
1977	9.5	19.1	9.0	10.1
1978	9.3	19.0	9.3	9.7
1979	9.1	19.5	9.2	10.3

SOURCES: Committee for Demographic Studies (1975); Rocznik Demograficzny GUS (1979).

superimposed upon and partially obscure the underlying secular changes. The general character of these phenomena may be defined as follows. The upheaval itself creates a completely new situation, which is shown by a sudden change or discontinuity in practically all demographic indicators. Sometimes the upheaval accelerates the secular changes but there is always a definite change – a sudden increase in death rates, a fall in birth rates, or great transfers of population from one region to another – all of which lead to significant changes and gaps in the age structure of the population. All these phenomena are evident both in the country as a whole and in individual regions. However, the initial distortion is followed by specific compensatory processes, such as an increase in the birth rate, a fall in the death rate, or a reversal in the direction of migratory flows which helps to repopulate the depleted areas. These phenomena are characterized by a wave structure of declining amplitudes; periods of demographic "lows" follow demographic "highs", and the crests of waves come with diminishing intensity every 20 to 25 years.

In the recent past Poland has had to face two such upheavals: the two World Wars. Both involved heavy population losses and large-scale population transfers.

In the First World War losses were large among both the military and the civilian populations. Civilian losses were due mainly to epidemics and hunger and, to a smaller extent, to direct warfare within the country. Total losses (including those caused by the decrease in the birth rate) are estimated at 4 million. The First World War also led to large-scale migrations: evacuations of civilian populations from the battle zones, repatriation of Polish people from abroad after the reconstitution of an independent Polish State, and the emigration of the German population. The total number of such migrations was about 2 million.

It took 20 interwar years to bring the total population back to its pre-1914 size. During this time the country was also overcoming the consequences of the great world economic crisis of the late twenties and early thirties, which had contributed to the sharp decline in birth rate from 35 per thousand in

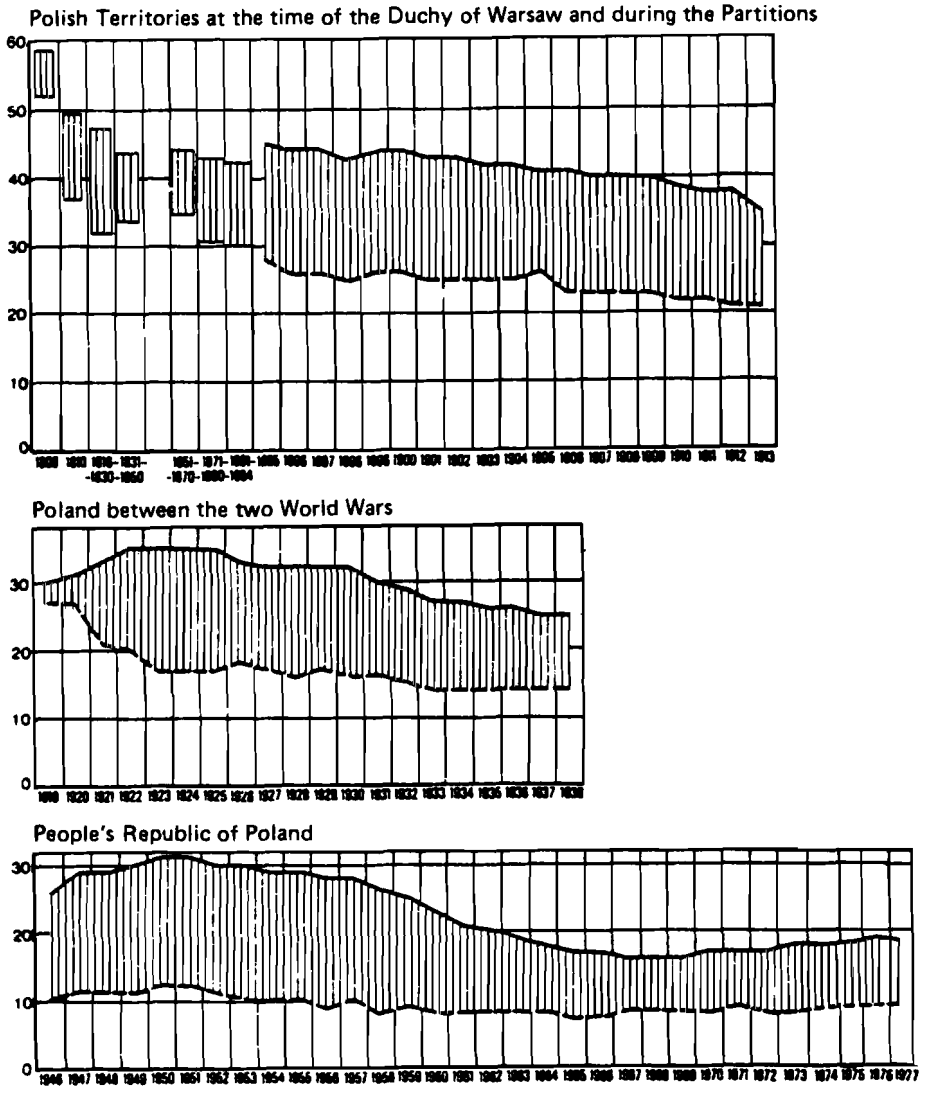


FIGURE 1 Population change in Poland: 1808–1977. Note that in each diagram the upper curve represents birth rate, the lower curve death rate, and the shaded area the rate of natural increase. Sources: Committee for Demographic Studies (1975); Rocznik Demograficzny GUS (1977).

1924 to 24 per thousand in 1938 (other factors instrumental in this decline were the gaps left in the age composition of the population by losses in the First World War). The fall in birth rate was only partly compensated by the concurrent fall in death rate (from about 17 per thousand to about 14 per thousand). As a result, the rate of natural increase fell during the interwar years from its 1925 peak of 18.5 per thousand to 10.7 per thousand in 1938.

The population losses during the Second World War were truly enormous, involving altogether some 8 million people (including 6 million killed). These losses were much larger than those in the First World War, especially among the civilian population. The Second World War also caused many more migrations. These movements started with the flight of people from the battle zones, continued with evacuations and transfers by the Nazis during the war years, and were concluded at the end of the war with the large-scale resettlement of parts of the population when the territory of the Polish State was shifted to the west and its present boundaries established. Together, these migrations involved over 14 million people.

Although the whole country emerged from the vicissitudes of war as a strongly-integrated territorial community, the resettlement of population connected with the changes in its territory in 1945 created different age structures in the old and new regions. The effects of the War on the national age structure may be easily observed in the fluctuations of the birth rate during the last thirty years. Over this period the fluctuations have almost completely obscured the secular trends in the rate. The postwar high in birth rate was reached in 1951, followed by a low in 1968, and it seems that the next high is passing now. However, the first high for the rate of natural increase was not reached until 1953, followed by a low in 1969 and another high in 1976.

1.3 Industrialization and Urbanization

Industrialization and urbanization are at present the main factors and the most immediate causes of change in the demographic structure of Poland, and in particular the spatial demographic patterns of the country. (There is another important factor, technological progress and change, but to explore its implications is beyond the scope of this report.) A clear distinction between industrialization and urbanization is not always made. It is important, however, to remember that although closely connected and interrelated these processes are not identical. Industrialization is mainly an economic phenomenon basically concerned with production and services, while urbanization is mainly a social process having its greatest impact on the way of life of the population and on the human environment. Both processes are very complex: in some aspects they may coincide but in others they do not.

In Poland, these two processes differ considerably in their spatial patterns. Industrialization, which in the modern sense developed rather late, was characterized by two main types of locational "pulls": easily-accessible natural

resources and large markets for consumption of the final products. Generally speaking, these pull factors formed the basis for the concentration of industrial plants either in or around mining districts, or in urban centers which later developed into urban agglomerations. The impact of industrialization upon population traditionally has been and still is strongest in the southern regions, where the mineral resources are most accessible for large-scale industrial exploitation, around the regional centers in the central lowlands, and near the seaports on the Baltic at the mouths of the two largest rivers, the Wisła (Vistula) and the Odra (Oder).

The urbanization tendencies have been rather different in character. The largest urban agglomerations, located in the south of the country, coincide with the mining districts, while the "central-place" functions have been responsible for the development of a relatively dense and regular pattern of cities which are additionally diversified on a hierarchical functional basis.

As a result, Poland contains at present two separate systems: one of specialized industrial centers and the other of the hierarchical central-place network. The two systems coincide mainly at the highest level, that is, in the larger urban agglomerations. Otherwise, there is a specific preponderance of industrial settlements in the southern regions and of cities with predominantly central-place functions in the northern regions. However, neither industrialization nor urbanization are limited to specific areas where industrial or urban populations are concentrated. Both processes have effects that spread outwards, diffusing either industrial and technological know-how or the urban way of life.

Industrialization and urbanization have specific impacts on population distribution and various demographic characteristics. Both processes lead to high local concentrations of population and at the same time a lowering of the rates of fertility and natural increase. These falling rates are partially compensated by simultaneous migrations into the industrial regions and urban agglomerations; these migrations tend to increase the proportion of the population in the productive ages, thus partially offsetting the demographic consequences of concentration. However, this positive influence of rural–urban migration diminishes with the depletion of the manpower reserves in the rural areas. When a large population exodus occurs, the rates of fertility and natural increase tend to fall, in some areas, below simple replacement level.

As may be seen from the preceding remarks, industrialization and urbanization can be considered both as formative factors and as primary causes of demographic change. Their feedback effects are important, leading in some situations to declining populations. In one sense industrialization and urbanization may be considered as mechanisms resulting from and fulfilling the successive stages or phases of the population transition.

1.4 External Migrations

Population dynamics within a country, in particular internal migrations, are not unrelated to similar developments in other countries. A short discussion of the

role played by external migration in the population dynamics of a given country is therefore necessary. One possible way of explaining this role is to define external migration as a factor complementary to the processes of industrialization and urbanization.

When increasing manpower reserves (caused by the population explosion) in rural areas are not completely consumed by internal processes and the needs of industrialization and urbanization, the tendency for external migration increases. This was the situation in Poland at the end of the 19th and the beginning of the 20th centuries. However, the closing of North America to European, and in particular East European migrants during and after the First World War, compounded a little later with the economic stagnation all over the world, quickly created enormous overpopulation in the rural areas of Poland. This phenomenon led to hidden but very extensive agricultural unemployment; however, industrialization and urbanization since the Second World War have now largely eliminated rural overemployment. Conversely, in countries where sudden economic growth occurred and the manpower available from the earlier population explosion was exhausted, there was a tendency to import labor from other countries.

So far Poland has remained a country with some reserves of manpower in agriculture; therefore it is not at present a manpower-importing country, but the changing demographic situation could conceivably reverse this situation in the future.

1.5 Future Population Dynamics

Past and present population trends in Poland have created specific questions and problems for the future, whose solution is of great interest and importance not only for scientists but also for policy makers and planners. Some of the more important questions are as follows:

- At what size and when will the population of Poland reach a state of zero growth?
- In the transition to such a state will there be any major fluctuations in age structure and size of population?
- What is the probability (or degree of uncertainty) of eventually reaching such a state?
- Is there any optimal path toward such a state?
- How significant is the impact of migratory movements and their intensity on the total rates of natural increase? Do such movements slow down or hasten the advent of zero population growth?
- How does migration influence the present and future development of various regions and their roles in the national community and economy?

- Which variations in regional development seem to be dependent on the directions of interregional migrations?
- What are the consequences of changes in the intensity and direction of migratory flows, and is it possible to identify such changes?

1.6 The Scope of the Study

This report examines some of the research and policy questions identified above, concentrating on regional fertility, mortality, and mobility patterns and their implications for the size and composition of the total population of Poland. In Section 2 recent patterns of spatial population change are discussed, while Section 3 presents the results of an application of the multiregional population model adopted by the Migration and Settlement Task at IIASA. Section 4 is devoted to population policy.

Throughout the report, the method of spatial disaggregation used is based on the administrative divisions of Poland. It is therefore appropriate to introduce these divisions here, as well as to discuss briefly the nature of the statistical data used in the study. Until 1975 the administrative structure of Poland was based on a three-level hierarchy with 22 voivodships* (including five city-voivodships), approximately 400 poviats* (including 74 city-poviats), and some 4500 communities. As a result of recent administrative reform, a two-tier pattern has now been formed, with 49 voivodships as upper-order units and about 800 towns and over 2000 townships as lower-order units (the establishment of the "townships" which replaced the former "communities" in fact took place in 1973). For analytical purposes the use of the present system of subdivision is clearly preferable: the sets of demographic data available for the new voivodships are quite complete and the smaller size of the units makes it possible to adjust regional boundaries to the observed spatial variation in socioeconomic phenomena, as well as to experiment with a number of alternative territorial disaggregations. However, when series of data for longer (historical) periods are of importance, the statistical material for the old administrative units may still offer major advantages.

For consistency reasons, all the regional data used in the present report pertain to administrative units (or to subdivisions or aggregates of these units) as established between 1973 and 1975 (see Figure 2). Since the amount of statistical material available for these units for periods before 1973 is rather limited, the discussions in Section 2 on the trends in fertility, mortality, and migration refer mostly to the national level. The bulk of the data used refer to 1977, although in Section 2 some other recent information (especially for the years 1974–1976 and 1978) is also presented and analyzed. This raises the question of how representative are the 1977 figures of recent population patterns

*A *voivodship* may be translated as a province and a *poviat* as a county.

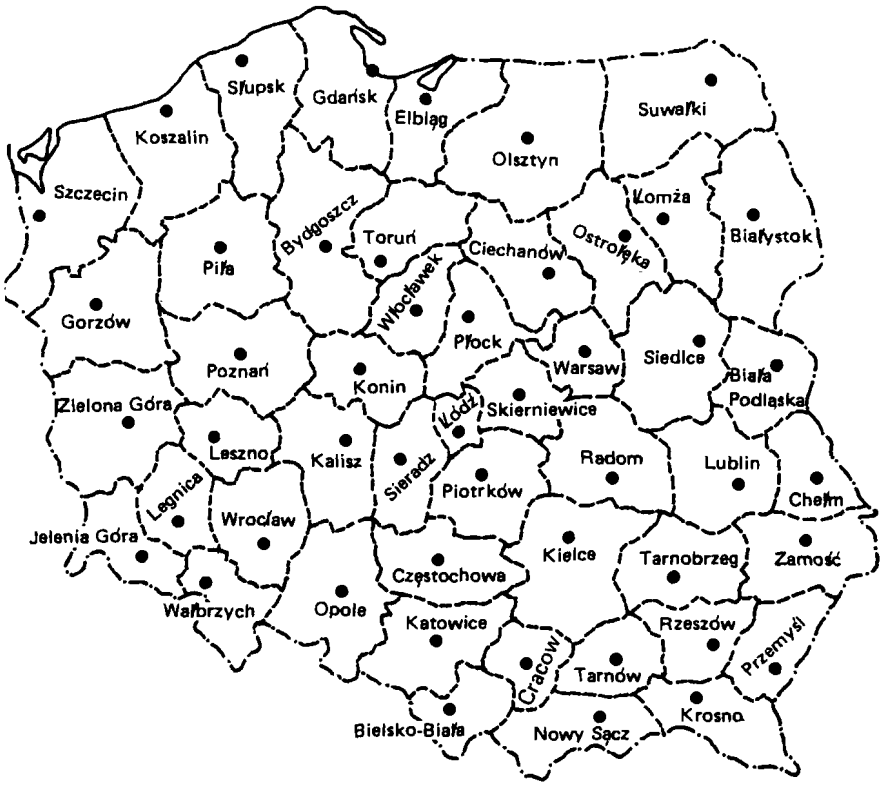


FIGURE 2 The administrative division of Poland into 49 voivodships.

in Poland. To answer this question, one must consider separately the mobility, fertility, and mortality components of population change.

In terms of the total volume of internal migration the figure for 1977 is less than 2% above the mean for the period 1970–1977 (894,000 moves as opposed to the eight-year mean value of 877,000). It is larger than the individual values for most of the years in the last decade, yet considerably smaller than the figure for 1976 (972,000 moves) and also lower than that for 1978 (964,000). The 1976 value corresponded to the stage of major adjustments in the migration patterns following the establishment of the new voivodships in June 1975, whereas the 1977 data were only affected by the later, and more minor, stages of these adjustments.

So far as fertility trends are concerned, the early 1970s were a period of increase. This increase reached its peak in 1976 and the following year (1977) was characterized by a return to the downward trend which had been prevalent until the late 1960s. For example, crude birth rates for the years 1970, 1975,

TABLE 3 Basic population data for the 49 voivodships (administrative units): 1977.

No.	Voivodship	Population			Crude rates (per thousand)			
		Number (thousands)	Density (persons/km^2)	Percentage that is urban	Birth	Death	Natural increase	Net migration (thousands)
1	Warsaw (capital-voivodship)	2,226	587.6	88.4	15.5	9.7	5.8	+22.1
2	Biała Podlaska	282	52.7	27.4	19.4	10.4	9.0	−1.7
3	Białystok	626	62.3	51.2	17.6	9.4	8.2	−0.5
4	Bielsko-Biała	798	215.6	46.5	19.0	8.7	10.3	+1.0
5	Bydgoszcz	1,015	98.1	61.6	19.5	8.9	10.6	−1.7
6	Chełm	224	57.9	34.9	20.0	10.1	9.9	−1.1
7	Ciechanów	400	62.9	29.2	20.3	10.2	10.1	−2.9
8	Częstochowa	734	118.7	48.3	18.2	10.2	8.0	−2.6
9	Elbląg	430	70.5	55.1	22.5	7.1	15.4	−2.1
10	Gdańsk	1,299	175.6	76.1	19.9	7.5	12.4	+7.0
11	Gorzów	444	52.4	56.6	21.5	7.4	14.1	−0.9
12	Jelenia Góra	491	112.1	62.9	19.8	7.4	12.4	−4.4
13	Kalisz	654	100.4	41.8	19.6	9.7	9.9	−1.2
14	Katowice	3,578	538.0	86.9	17.1	9.3	7.8	+14.8
15	Kielce	1,050	114.0	39.5	19.6	9.8	9.8	−3.9
16	Konin	429	83.6	34.2	20.3	9.6	10.7	−2.5
17	Koszalin	445	52.6	58.4	21.0	7.1	13.9	−0.6
18	Cracow (city-voivodship)	1,151	353.6	69.1	17.1	8.8	8.3	+4.0
19	Krosno	431	75.5	29.6	20.8	9.3	11.5	−0.5
20	Legnica	435	107.8	60.7	21.4	6.7	14.7	+4.5
21	Leszno	347	83.6	43.2	21.1	9.4	11.7	−1.5
22	Lublin	908	133.7	51.9	19.1	9.1	10.0	+2.6
23	Łomża	321	47.9	29.3	19.5	10.1	9.4	−2.8
24	Łódź (city-voivodship)	1,103	722.7	91.0	14.9	10.6	4.3	+5.3
25	Nowy Sącz	609	109.2	34.5	22.1	9.1	13.0	−2.7

26	Olsztyn	675	54.8	52.2	21.9	6.6	15.3	−5.6
27	Opole	981	114.9	48.2	18.7	8.1	10.6	−5.8
28	Ostrołęka	363	55.9	26.4	21.2	9.9	11.3	−2.8
29	Piła	425	51.8	49.8	21.8	8.6	13.2	−1.5
30	Piotrków	587	93.7	39.9	19.5	10.6	8.9	−2.4
31	Płock	487	95.1	40.0	19.1	9.5	9.6	−1.6
32	Poznań	1,201	147.4	68.6	18.9	9.6	9.3	+3.1
33	Przemyśl	378	85.1	33.1	20.5	10.2	10.3	−1.9
34	Radom	685	93.7	40.2	20.3	9.5	10.8	−3.6
35	Rzeszów	626	142.2	33.4	21.0	9.0	12.0	+0.4
36	Siedlce	603	71.0	25.0	20.3	10.1	10.2	−4.9
37	Sieradz	387	79.4	28.5	18.4	11.2	7.2	−2.6
38	Skierniewice	391	98.8	38.0	18.2	10.5	7.7	−1.4
39	Słupsk	365	48.9	50.8	22.4	6.9	15.5	−1.3
40	Suwałki	419	39.9	43.2	21.0	7.7	13.3	−3.5
41	Szczecin	878	88.0	72.8	20.1	7.0	13.1	+0.1
42	Tarnobrzeg	542	86.2	30.0	19.9	10.4	9.5	−1.9
43	Tarnów	589	141.9	32.1	21.3	9.7	11.6	−2.6
44	Toruń	601	112.3	58.2	20.2	9.1	11.1	+0.5
45	Wałbrzych	721	172.8	72.1	19.4	7.8	11.6	−5.2
46	Włocławek	407	92.4	40.3	19.9	9.8	10.1	−2.6
47	Wrocław	1,049	166.8	71.1	18.5	7.4	11.1	−0.8
48	Zamość	471	67.4	20.9	18.4	10.5	7.8	−4.0
49	Zielona Góra	591	68.6	56.6	21.5	7.5	14.0	−3.1
	Total	34,850	111.5	57.4	19.1	9.0	10.1	−27.3

SOURCE: Rocznik Statystyczny GUS (1978).

1976, 1977, and 1978 were 16.6, 18.9, 19.5, 19.1, and 19.0 per thousand, respectively; the net reproduction rates for the same years were 1.011, 1.059, 1.074, 1.045, and 1.035, respectively. Mortality patterns for the 1970s reveal a slow, albeit continuous increase in crude death rates (8.1, 8.7, 9.0, and 9.3 per thousand, respectively, for the years 1970, 1975, 1977, and 1978) and a stabilization of the expectation of life.

To sum up, the 1977 data seem to be quite representative for the decade of the 1970s: they are clearly preferable to the 1976 data (which were perturbed by the voivodship reorganization), and are comparable to the values for 1975 and 1978. Moreover, the 1978 data were not available in full at the time when this report was written.

The number of upper-level administrative units (49 voivodships) was considered to be too great for the purposes of the multiregional population analysis presented in Section 3. Therefore, these units were aggregated into 13 regions. While the nature of the aggregation is explained later in the text, it seems necessary to point out that spatial aggregation was required for both technical and conceptual reasons; for example, it was found that the intervoivodship migration matrix, when disaggregated by five-year age categories of migrants, contained a number of zero elements. However, it was felt that total migration, fertility, and mortality data at the voivodship level were relevant for the study, especially when considering the paucity of the time-series regional data available. Hence, most of the discussion in Section 2 is based on statistical material for the 49 voivodships, while Section 3 deals with the 13 larger territorial units.

Another subdivision frequently mentioned in the report is the urban–rural breakdown of data. Following the notation of Polish Central Statistical Office publications, the definition of urban areas is based on their legal status (in 1977, for example, the number of urban areas was 803; these accounted for the entire urban population of 19,988,000). Three of the 49 voivodships (Warsaw, Łódź, and Cracow) are defined as "city-voivodships" (the "capital-voivodship" in the case of Warsaw), but since only a part (although a major part) of their territory is urban, a fraction of the population in each of these voivodships is still considered rural (see Table 3).

2 CURRENT PATTERNS OF SPATIAL POPULATION CHANGE

2.1 Birth and Fertility Rates

In 1977 the crude birth rate for Poland was 19.1 per thousand inhabitants. As shown by Table 3, there were substantial regional variations, ranging from 14.9 and 15.5 per thousand for the urban voivodships of Łódź and Warsaw to 22.4 and 22.5 per thousand for the voivodships of Słupsk and Elbląg on the Baltic coast. The difference between average values for urban and rural areas (Rocznik Demograficzny GUS 1978) was 3.0 per thousand (averages of 17.8 and 20.8 per thousand, respectively). In urban areas birth rates ranged from 14.6 per

thousand (Konin and Warsaw) to 22.5 per thousand (Ostrołęka); in the rural areas rates varied from 15.6 per thousand (Białystok) to 24.5 per thousand (Elbląg). Gross reproduction rates (Rocznik Demograficzny GUS 1979) varied widely from 0.736 (Łódź) to 1.563 (Nowy Sącz) and 1.553 (Łomża) with a national average of 1.097. The national net reproduction rate was 1.045, with urban and rural averages of 0.841 and 1.451, respectively (see Table 4).

TABLE 4 Variations in the rates of infant mortality and gross and net reproduction rates in Poland: 1950–1977.

Year	Poland total	All urban areas	City of Warsaw alone	All rural areas
Deaths of infants (per thousand live births)				
1950	111.2	102.6	79.3	116.0
1955	82.2	73.3	40.8	88.9
1960	54.8	49.7	27.9	58.9
1965	41.5	38.8	24.7	43.4
1967	37.9	35.7	25.3	39.5
1970	33.4	31.6	23.3	34.8
1971	29.7	29.0	26.1	30.3
1972	28.6	28.0	26.6	29.2
1973	26.1	25.7	24.6	26.4
1974	23.7	23.6	23.2	23.9
1975	25.1	24.8	21.1	25.3
1976	24.0	23.7	21.7	24.4
1977	24.5	24.2	20.7	24.9
1978	22.5	22.2	20.8	22.9
Gross reproduction rate				
1950	1.790	1.558	1.270	1.936
1955	1.742	1.546	1.258	1.941
1960	1.438	1.168	0.778	1.731
1965	1.217	0.925	0.594	1.582
1967	1.127	0.856	0.586	1.493
1970	1.064	0.832	0.617	1.389
1971	1.094	0.848	0.601	1.447
1972	1.082	0.842	0.603	1.439
1973	1.094	0.839	0.623	1.509
1974	1.092	0.834	–[a]	1.518
1975	1.096	0.855	–[a]	1.537
1976	1.114	0.888	0.715	1.534
1977	1.079	0.868	0.732	1.602
1978	1.069	0.872	0.706	1.476
Net reproduction rate				
1950	1.491	1.300	1.180	1.610

TABLE 4 *Continued.*

Year	Poland total	All urban areas	City of Warsaw alone	All rural areas
1955	1.519	1.366	1.228	1.675
1960	1.339	1.098	0.759	1.601
1965	1.149	0.879	0.580	1.487
1967	1.071	0.818	0.566	1.421
1970	1.011	0.794	0.585	1.315
1971	1.040	0.810	0.580	1.370
1972	1.034	0.807	0.580	1.369
1973	1.055	0.805	0.599	1.449
1974	1.051	0.805	–[a]	1.458
1975	1.059	0.826	–[a]	1.484
1976	1.074	0.857	–[a]	1.494
1977	1.045	0.841	–[a]	1.451
1978	1.035	0.845	–[a]	1.425

[a]Not available.

SOURCES: Committee for Demographic Studies (1975); Rocznik Demograficzny GUS (1976, 1977, 1978).

These data indicate clearly how close Poland is to a state of zero population growth (see also Figure 3), although attainment of this state will be delayed due to the existing age structure and the still-increasing expectation of life. At the same time, the data show considerable differences in values between urban and rural areas as well as regional variations between areas which lie within prewar Polish boundaries and those which were incorporated at the end of the Second World War. The latter variations are due to the different age structure created in some areas by the postwar resettlement of population. However, the general long-term trend is for these differences to diminish. It should be noted that both the gross and the net reproduction rates are less than unity for the medium-sized and large cities, implying that these cities are not reproducing their populations over the long term; a complementary observation is that the areas with the lowest reproduction rates also have the highest rates of in-migration.

The case of Łomża is an interesting example of a different stabilizing factor. Łomża is an economically less-developed region with heavy out-migration, especially among females, but the data indicate that compensatory processes are already at work, as shown by the higher marriage rate and the high rate of fertility among the resident women.

2.2 Mortality Rates

Death rates in Poland (9.0 per thousand in 1977) are somewhat lower than in Western Europe; this is due to the younger age structure of the Polish

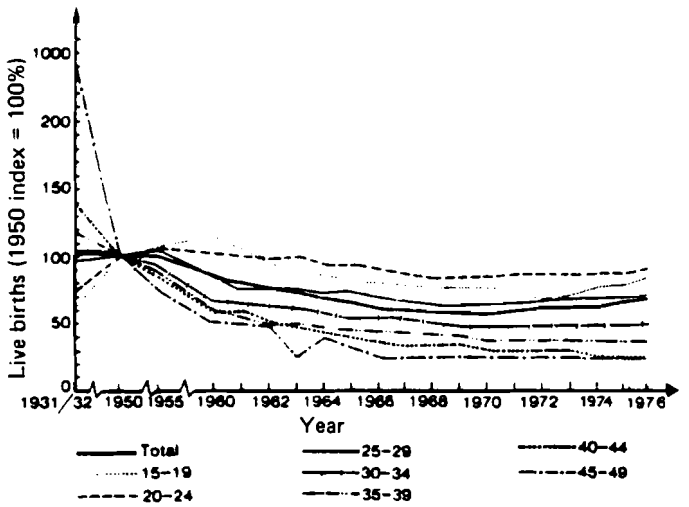


FIGURE 3 The variation in female fertility, by age groups: 1931/1932–1976. Based on an index of 1950 = 100%. Sources: Committee for Demographic Studies (1975); Rocznik Demograficzny GUS (1977).

population. It may be assumed, therefore, that there are definite similarities between Poland and other European countries: Poland is simply at an earlier stage of the population transition. This view is supported by data on expectation of life which, although some three to four years below the corresponding indices for the Scandinavian countries, do not differ significantly from those of other European countries such as France, the GDR, and the FRG.

The regional differentials in crude death rates, although quite large (in 1977 they ranged from 6.7 per thousand in the Legnica and Olsztyn regions to 10.6 per thousand in Piotrków and Zamość), show wide annual fluctuations. Regional variations in age-specific death rates, however, are not very significant. The differences between urban and rural areas are also not very marked; the rates vary by a maximum of 0.8 per thousand from the national average. Regional variations are slightly higher: in the less-developed regions they amount to differences of approximately 1–2 per thousand from the national mean. Regional differences in infant mortality which were very substantial in the past (even as recently as the 1960s) have since then markedly diminished. On the national level, infant death rates are still rather high, pointing to a need for improvement in sanitary and health conditions. However, the decline of these rates over the last decade has been pronounced (24.5 per thousand live births in 1977 as compared to 33.4 per thousand in 1970). For rural areas, the decline has been even quicker, resulting in an almost complete closure of the urban–rural gap.

TABLE 5 Expectation of life in Poland: 1931/1932–1976.

	Males			Females		
Year	Total	Urban	Rural	Total	Urban	Rural
1931/1932	48.2	51.4	47.4	51.4	55.9	50.0
1952/1953	58.6	59.0	58.3	64.2	65.4	63.4
1955/1956	61.8	62.2	61.6	67.8	68.7	67.0
1960/1961	64.8	65.0	64.7	70.5	71.2	69.9
1965/1966	66.9	66.8	66.9	72.8	73.1	72.6
1970/1972	66.8	66.7	66.9	73.7	74.0	73.6
1973	67.2	66.6	67.7	74.3	74.2	74.5
1974	67.8	67.3	68.3	74.6	74.6	74.8
1975	67.0	66.7	67.3	74.3	74.2	74.4
1976	66.9	66.6	67.1	74.6	74.5	74.6

SOURCE: Rocznik Demograficzny GUS (1977).

The total expectation of life (Table 5) was increasing until 1974, but since then it has shown a slight decline. This decline, as in other countries, is most pronounced for the male component of the population. As a result, the female–male differential has increased from 5.7 years in 1960/1961 to 7.7 years in 1976. On the other hand, variations between urban and rural areas are now fairly insignificant, although rural expectations of life for both men and women have been slightly higher than those in urban areas for the last decade.

2.3 Migration

2.3.1 POPULATION MOBILITY

Since postwar resettlement came to an end, levels of external (i.e., international) migration have been low, with emigration consistently exceeding immigration. Since 1960, net emigration has varied from 10,000 to 25,000 persons per year. Internal mobility within Poland (as measured by the number of intercommunity moves) fell from about 1,250,000 in 1960 to 798,000 in 1974, rising again to 971,500 in 1976. For the last 15 years the annual number of moves has oscillated around 850,000–900,000. Table 6 presents annual data for the period 1946–1979: the total number of migrations are given as well as the rates per thousand population.

The number of migrants is expected to decrease in the future due to the inevitable changes in the age structure of the population. The annual *increase* of population in the productive ages (men between 18 and 64 and women between 18 and 59) will diminish in years to come, from a peak of 357,200 in 1975 to about 60,000 in 1985. This fall will cut deeply into the number of potential migrants in spite of the increase in mobility rates due to social and

TABLE 6 Absolute numbers and crude rates of internal migrations[a] in Poland: 1946–1979.

Year	Number of migrations (thousands)	Crude migration rate (per thousand population)
1946	2,257	Variable due to postwar resettlement
1947	1,270	
1948	1,058	
1949	1,199	
1950	1,340	53.1[b]
1951	1,350	
1952	1,386	
1953	1,349	
1954	1,459	
1955	1,440	46.7[b]
1956	1,444	
1957	1,322	
1958	1,323	
1959	1,372	
1960	1,256	42.5
1961	1,163	38.8
1962	1,034	34.1
1963	987	32.2
1964	933	29.9
1965	915	29.1
1966	840	26.5
1967	842	26.3
1968	862	26.7
1969	899	27.6
1970	882	27.1
1971	875	26.6
1972	895	27.0
1973	839	25.2
1974	798	23.7[c]
1975	864	25.4
1976	972	28.3
1977	894	25.5
1978	964	27.5
1979	937	26.5

[a]Defined as those which involve crossing the boundary of one of the smallest administrative units.
[b]Average value.
[c]Year of administrative reform, producing an increase in the size of the smallest administrative unit.
SOURCE: Rocznik Demograficzny GUS (1979).

economic changes. The latter may contribute to an increase in the number of interurban moves, but such an increase is likely to be overshadowed by a decrease in the intensity of rural-to-urban and rural-to-rural flows. The large regional variations in mobility patterns are caused not only by differences in age structure but also by past demographic and social history and the present structure of settlements – urban settlements in particular.

The three maps shown in Figure 4 present these mobility differences in terms of three indicators (for 1975/1976) for each of the 49 voivodships. The two rates, which both combine in- and out-migration, refer to total intercommunity mobility (intraregional migration) (Figure 4a) and to interregional migration (Figure 4b). The relation between these two indicators is a measure of the "degree of closure" of each region to interregional movement (see Figure 4c). Total *intercommunity* mobility is largest in the northern voivodships and in the western and eastern frontier regions. The highest *interregional* mobility is observed in the voivodships in territories incorporated at the end of the War and in three of the less-developed voivodships in the northeast (Łomża, Ostrołęka, and Suwałki). It is interesting to note that the city-voivodships of Warsaw, Łódź, and Cracow have the lowest mobility of all the highly urbanized regions.

Figure 5 contains three maps, showing the in-migration (Figure 5a), out-migration (Figure 5b), and net migration rates (Figure 5c) for the same 49 voivodships. It can be seen that the net migrations add to the concentration of population in the largest urban agglomerations, although their effects on overall population redistribution are strongly diminished due to the low fertility levels in these areas. However, in six voivodships the net migration is practically zero and in another 22 voivodships it is very low ($\leqslant \pm 5$ per thousand population). This would seem to suggest that almost half of the entire country is immune to significant changes in the spatial distribution of population attributable to interregional migration: such a conclusion is certainly suggested by the spatial distribution of crude in- and out-migration rates. When age-specific rates are considered, however, the picture becomes more complicated because interregional differences in the age and sex structures of in- and out-flows tend to be considerable; this in turn results in important interregional fertility and mortality effects. A more complete discussion of age-specific migrations can be found in Section 3.

Other rather interesting insights into the spatial anatomy of population mobility can be gained by disaggregating the total flows into those for urban and those for rural areas, as shown in parts a and b of Figure 6. On a national level, the rural areas are losing population, with northeastern regions showing the largest losses and the south the smallest. Against this main trend, a number of rural communities around the largest cities actually show net gains but this can only be seen when the data are disaggregated by townships. The urban areas are characterized by gains, the largest of these being in the north and northeastern regions with the geographically scattered voivodships of Legnica (a copper-mining district), Olsztyn, and Rzeszów gaining relatively the most.

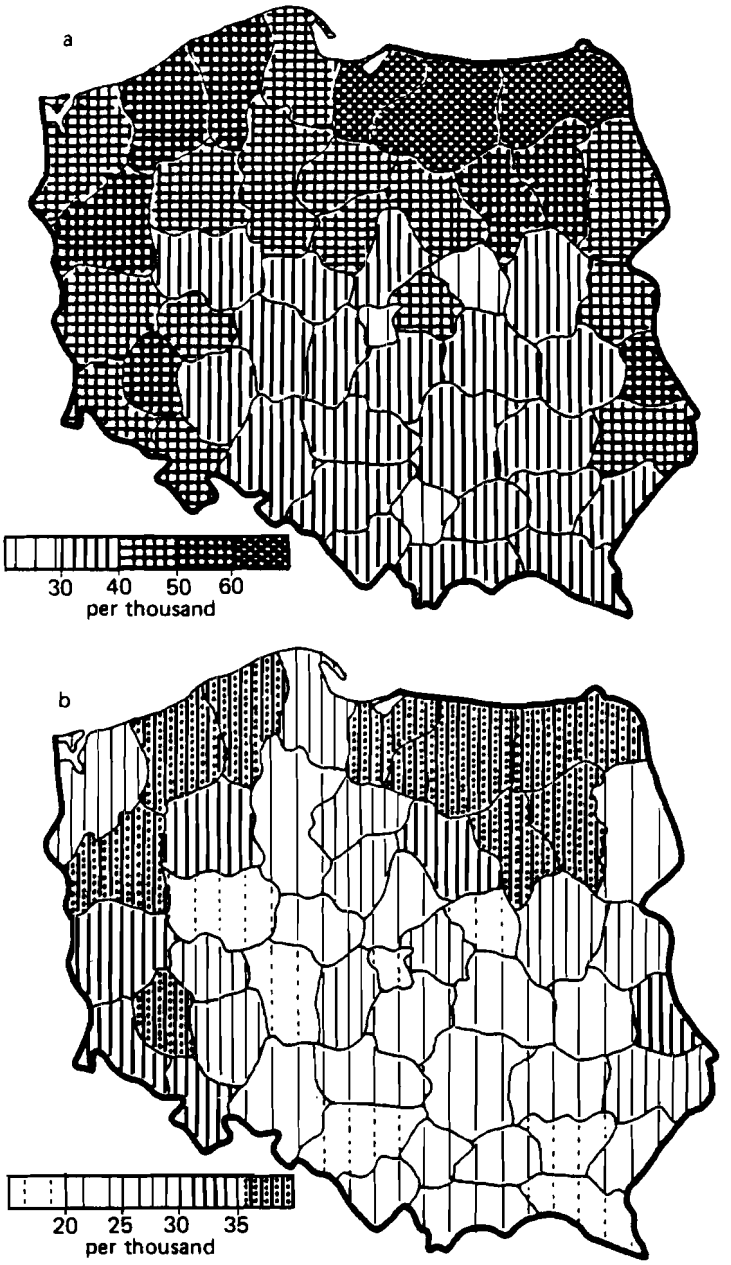


FIGURE 4 Three measures of mobility in Poland: (a) intercommunity mobility rates; (b) interregional mobility rates; (c) regional degree of closure to migration. [Degree of closure = intercommunity rate/(intercommunity rate + interregional rate)]. Source: Authors' own calculations based on the publications of the Central Statistical Office. The data are annual averages for 1975/1976. *(Continued overleaf.)*

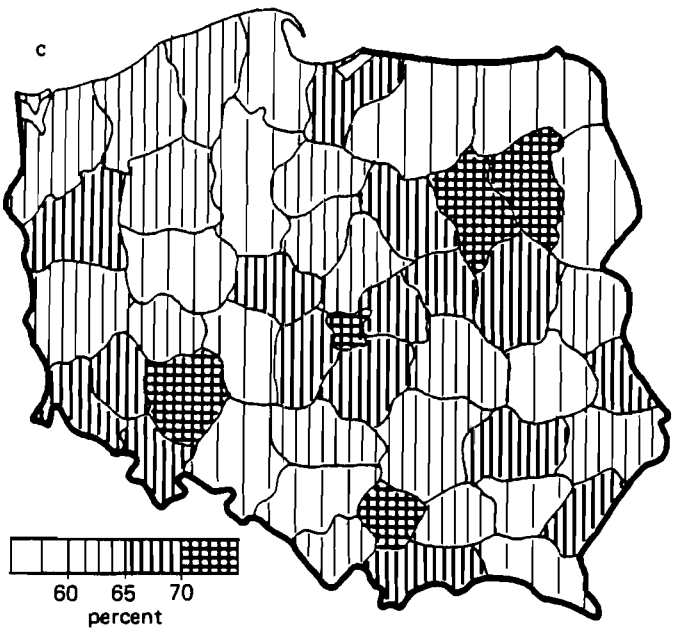


FIGURE 4 *Continued.*

On a regional level, these gains are basically inversely related to the degree of urbanization already achieved in a given region.

According to the concept of mobility transition (Zelinsky 1971) the demographic transition, which is characterized by a gradual shift from high to low rates of mortality and fertility, is paralleled by an evolution of internal migration patterns. This evolution finds expression first in a move from low to high migration rates, and second in a characteristic sequence of dominant migration streams, starting with rural-to-rural migration in the early stages, and then successively followed by rural-to-urban, urban-to-urban, and finally urban-to-rural flows. Compared with the theory of demographic transition, however, the mobility-transition hypothesis has not been so thoroughly substantiated empirically, for at least three reasons. First, it is concerned with long-term secular trends, whereas data on internal migration have been systematically collected and published only recently. Second, unlike fertility and mortality, internal migration is extremely sensitive to economic factors, and fairly responsive to both direct and indirect migration policies. Third, in contrast to births and deaths, the occurrence of migration cannot be (or at any rate usually is not) unequivocally observed and registered (Rogers 1976). This is a consequence of the methods used for collecting migration data, as well as variations in the

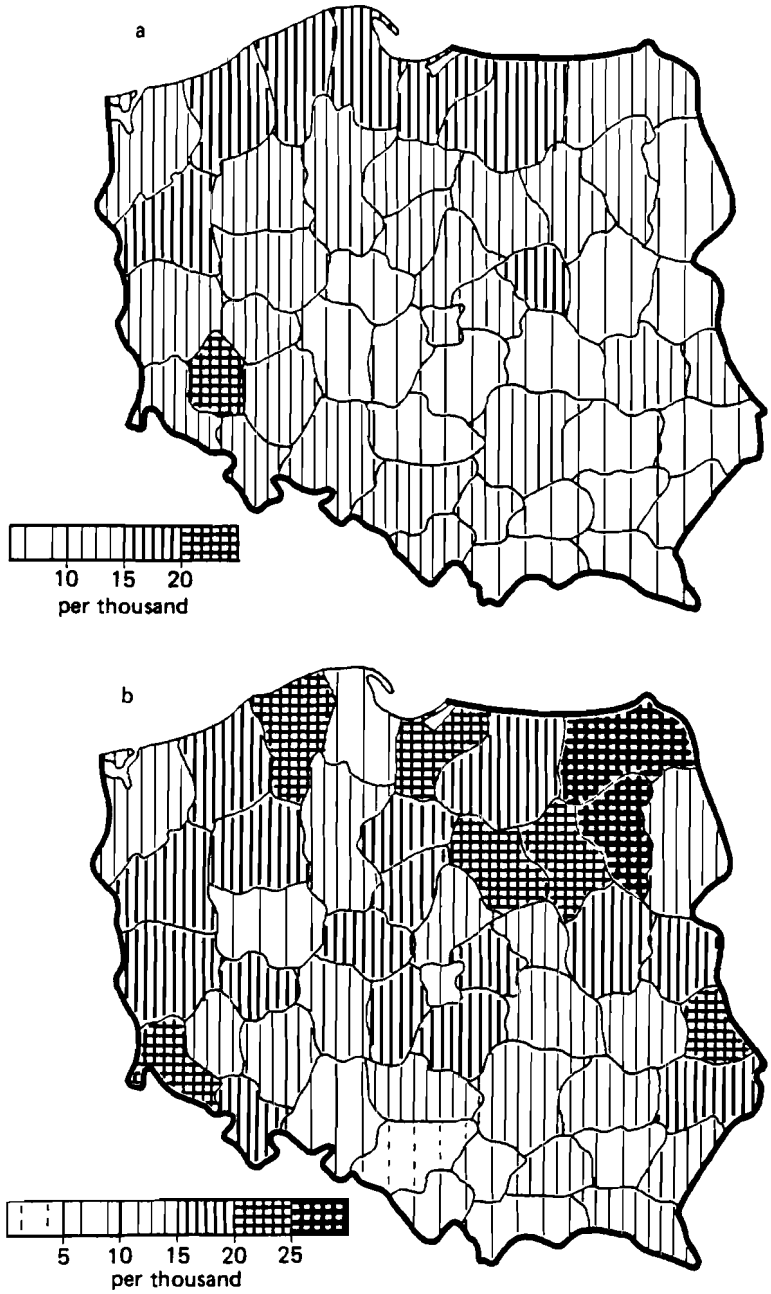


FIGURE 5 Rates of internal migration in Poland, by region: (a) in-migration; (b) out-migration; (c) net migration. *(Continued overleaf.)*

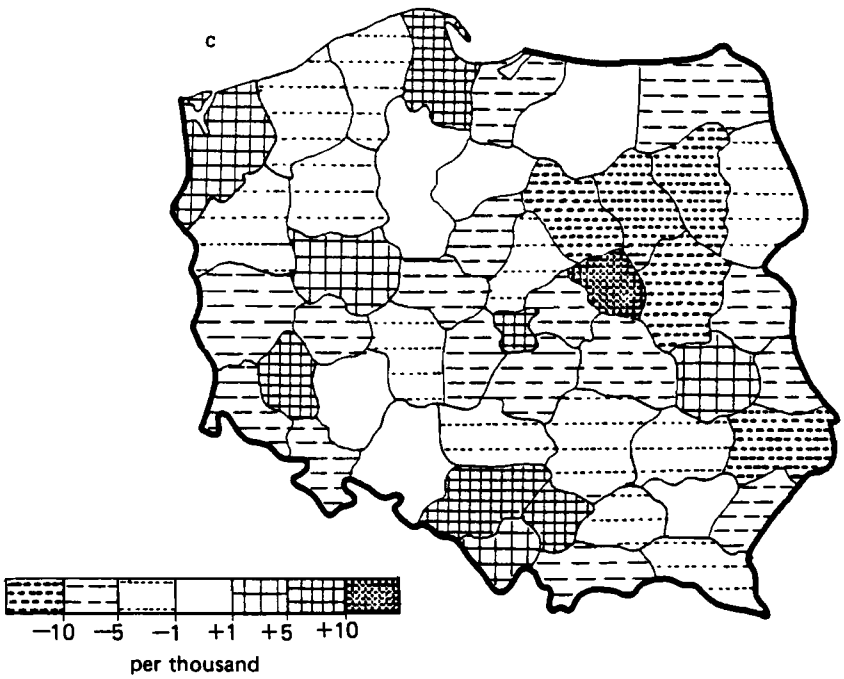


FIGURE 5 *Continued.*

nature of the spatial units of reference used. Most migration surveys disregard moves within individual administrative units at the lowest level, a fact that distorts the proportions of total migration accounted for by individual migration "directions". Any change in the system of administrative divisions has a similar effect, and it also affects the total number of registered moves, in other words the aggregate mobility level.

It is necessary to consider these factors when dealing with the rural–rural and rural–urban dimensions of internal migration patterns in Poland. As already noted (see Table 6), the total number of moves per thousand inhabitants declined from 53.1 in the early 1950s to 26.3 by 1967, and it again increased somewhat during the 1970s (reaching a peak of 28.3 per thousand in 1976). The huge migratory movements in the postwar period were the result of resettlement during the late 1940s and subsequent extensive industrialization during the early 1950s (Latuch 1970). A spatially more-uniform growth pattern during the 1960s brought a national levelling of the total mobility indices, while the economic policies of the 1970s, promoting regional specialization and a polycentric population distribution, have resulted in the more recent mobility increase. Table 7 shows that the absolute numbers of rural-to-rural migrations reached a peak during the period 1956–1960 as a consequence of the

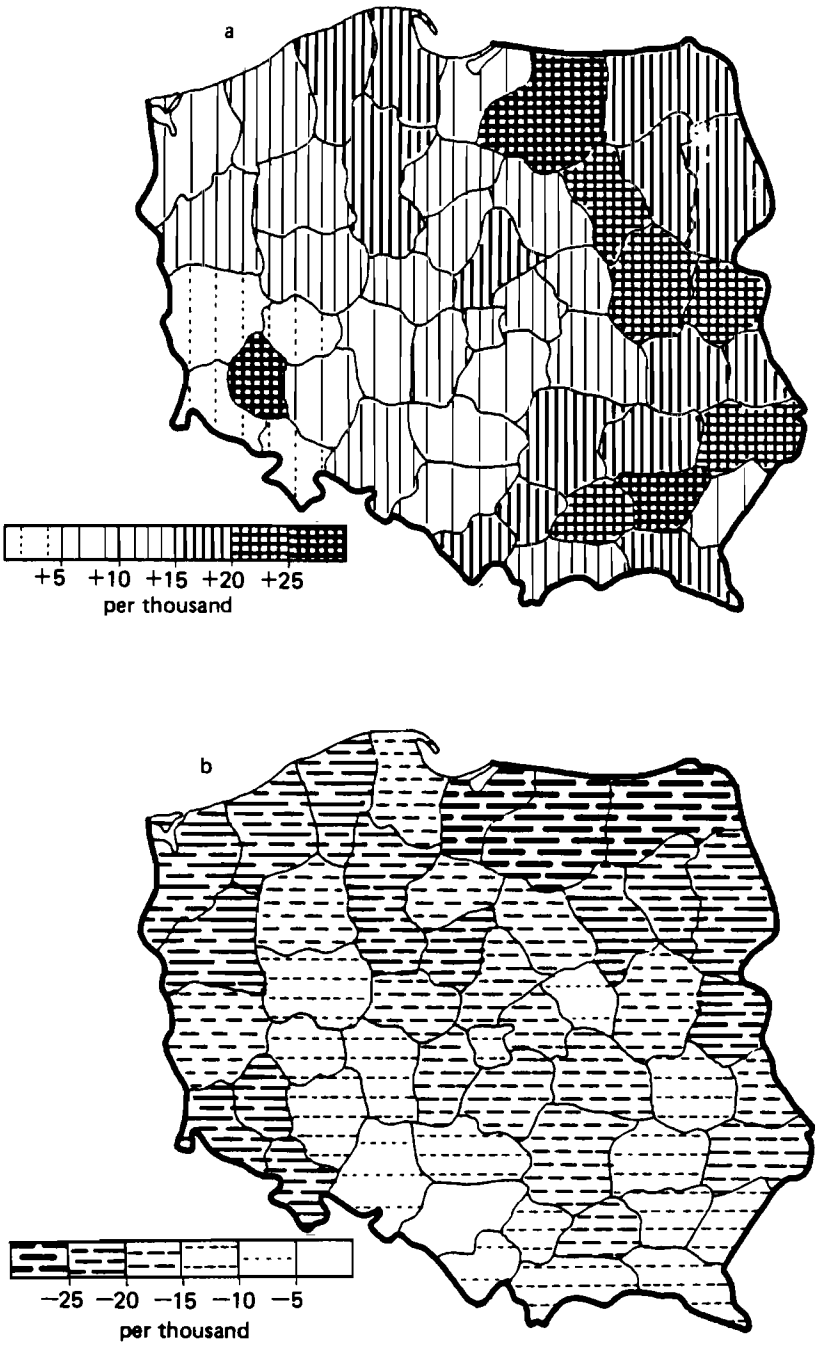


FIGURE 6 Rates of net migration in Poland: (a) for urban areas; (b) for rural areas.

TABLE 7 Urban/rural components of internal migration: 1952–1978.

Year (annual averages)	Urban-to-urban		Rural-to-urban		Urban-to-rural		Rural-to-rural	
	Number (thousands)	Percentage of total	Number (thousands)	Percentage of total	Number (thousands)	Percentage of total	Number (thousands)	Percentage of total
1952–1955	392.7	28.2	363.1	26.7	263.4	18.1	389.2	27.0
1956–1960	311.6	23.2	322.1	24.0	238.1	17.7	471.7	35.1
1961–1965	225.7	22.4	260.8	25.9	160.2	15.9	359.5	35.7
1966–1970	189.4	21.9	253.1	29.3	113.6	13.1	308.8	35.7
1971–1974	196.9	22.6	278.4	32.0	110.4	12.7	284.1	32.7
1975	219.5	25.0	342.4	35.0	91.3	12.0	210.4	28.0
1976	263.5	27.0	360.2	37.1	118.7	12.2	229.1	23.6
1977	253.4	28.3	321.3	35.9	114.8	12.8	205.2	22.9
1978	274.7	28.5	346.4	35.9	129.7	13.5	213.2	22.1

SOURCES: Dzieworński et al. (1977), p. 145; Rocznik Demograficzny GUS (1978).

administrative reform of 1956 which involved a substantial increase in the number of basic administrative units. Since then, rural-to-rural migrations have become fewer, although in terms of percentage share this drop has only become visible since 1970. On the other hand, the proportion of all migrations accounted for by rural-to-urban migration was at a low during the period 1956–1960, and since then has been steadily increasing (Figure 7). Urban-to-rural migration has been declining since the mid-1950s, both in absolute and in relative terms. Finally, urban-to-urban migration declined somewhat from 1952 to 1970 but has started to increase again in recent years; however, its share of the total is still smaller than that of rural-to-urban migration.

The relatively large share of rural-to-rural migration can be explained by reference to three categories of moves. The first involves short-distance moves, often across community boundaries, related to change of marital status. Similar moves occurring within urban areas are rarely recorded in migration statistics because, in terms of population, and in the case of large cities, also in terms of area, urban administrative units tend to be substantially larger than rural units. Second, rural-to-rural migrations include a substantial number of moves from rural to suburban areas, that is, from places situated beyond to places within the commuting radius of individual urban centers. Such moves are associated with occupational mobility, a factor not usually attributed to rural-to-rural migration in the mobility-transition concept. The third category includes migrations by the nonagricultural rural population; for example, the data for 1974 reveal that less than 30% of rural-to-rural moves involved persons or their dependents who were actually employed in agriculture.

Rural-to-urban migration is the most direct manifestation of economic-development strategies based on industrial growth. The actual size of rural-to-urban flows, however, has been controlled by the generally scarce housing facilities in spite of the demand for labor in urban areas; any local shortfalls of

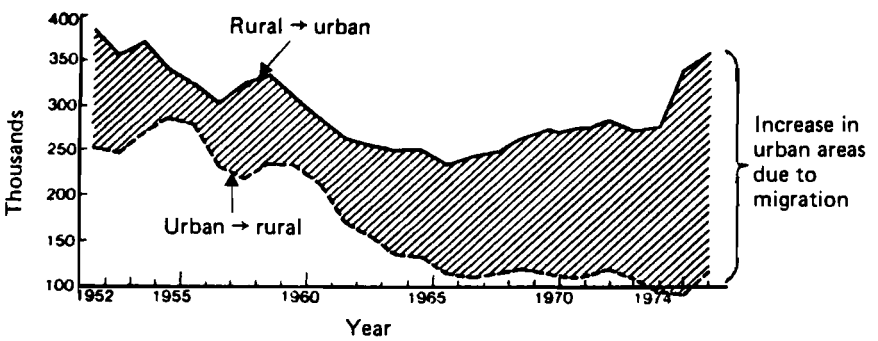


FIGURE 7 Population flows between urban and rural areas of Poland: 1952–1976. Sources: Committee for Demographic Studies (1975); Rocznik Demograficzny GUS (1977).

labor have mainly been covered by increased numbers of people commuting to work. (This topic will be discussed in more detail in Section 2.3.4.) The expanded housing construction program since 1970, together with the continuing industrial growth in a number of urban centers, stimulated both the absolute and the relative growth of rural-to-urban migration in the latter part of the 1970s.

Urban-to-urban migrations, which substantially decreased between 1950 and 1970, were affected during that period by policies of urban-growth limitation carried out in the five largest urban centers since 1965, and since 1954 in Warsaw. However, the share of urban-to-urban migrations has once again increased during the 1970s, and it is likely that interurban flows will continue to grow in the next few decades as a consequence of improvements in housing, the evolution of various migration push and pull factors, and the increased spatial division of labor. It has been estimated (Dzienio 1975) that, due to past demographic trends, the number of new entrants into the labor force in 1985 will be 30% smaller than in 1970, while the number of persons reaching retirement age in 1985 will actually be some 12% greater. Growing scarcity of labor may stimulate interurban moves, especially when coupled with an increased educational level and a growing recognition of "quality-of-life" indicators as real migration incentives. The same factors may contribute to a gradual increase in the absolute size of urban-to-rural migration, but it seems unlikely that the share of this type of migration in the total will increase significantly before the year 2000. The apparent increase in urban-to-rural migrations from 1976 to 1978 probably represented a temporary adjustment related to the change of spatial administrative divisions.

Finally, the present high proportion of rural-to-rural migration can be mainly attributed to the methods of definition and measurement of migration. In the future, this category of migratory flows will probably account for a declining share of total moves. The post-1970 trends toward an increase in rural-to-urban and urban-to-urban flows is likely to continue and the latter category may account for the greatest proportion of the total after 1990. Total spatial mobility will be further stimulated by various economic factors, but this trend will be counterbalanced by a demographic factor, namely, the declining proportion of the total population in those age groups that have the highest propensities to migrate.

2.3.2 MIGRATION FLOWS AND PATTERNS

An analysis of recent statistical information indicates that migration flows in Poland are characterized by fairly consistent territorial patterns. Practically all of the changes observed have been closely connected with new and large investment programs, which, once started, continue over a decade or longer. Examples of these programs are the development of the various copper-mining districts and the new seaport in Gdańsk; in all probability, the newly developing coal basin near Lublin will follow a similar course. A comparison of annual data for the period 1974–1978 has revealed that the large urban agglomerations

consistently show stable "fields of attraction" and structure of migrations (Dziewoński and Korcelli 1981).

In terms of spatial patterns, three migrational macroregions may be identified. The first is the southern belt, comprising the Upper-Silesian industrial region around Wrocław and Katowice with Cracow as an independent center (although secondary in terms of size); the western end of the belt turns northward. The second area is the central region which is composed of two major subareas: Poznań, with Bydgoszcz–Toruń as a secondary center, and Warsaw, with Łódź and Lublin as complementary centers. Finally, the third area is the northern belt which has strong latitudinal connections along the Baltic coast and farther to the east; the northern belt is centered around the seaports on the Bay of Gdańsk and also includes the complementary centers of Szczecin and Białystok.

One aspect of this pattern should be stressed: the southern and northern belts are characterized largely by two-way reciprocating flows, indicating greater mobility and stronger interregional integration. The flows in the central area, however, are mostly one-way, gathering population into the large urban centers; this may indicate that the central area is in a rather earlier phase of the mobility transition.

Additional information may be gained from the study of migratory flows (based on 1974 data) between all cities and rural communities. With the exception of the Upper-Silesian conurbation (Katowice agglomeration) – the core of the Upper-Silesian industrial region – migrations to all the urban agglomerations are regional rather than national in scale (see Figure 8), clearly influenced by the friction of distance. Migrations to the smaller (middle-sized and small) cities are even more local in character. On the other hand, migrants to Upper Silesia arrive in significant numbers from all over the country.

2.3.3 MECHANISMS AND STRUCTURES OF MIGRATORY FLOWS

At present, the main causes of and factors associated with migration in Poland are connected with possibilities of improvement in the economic and social position of the migrants, the desire for better living conditions, and the expectation of an improved social and physical environment.

In countries such as Poland with a planned economy, the problems of permanent unemployment are practically nonexistent, although there are some areas where the employment of women could and should be increased, and other areas where there still exists some degree of overemployment in agriculture. Under these conditions the main incentive for potential migrants is the desire to improve their economic or social position by changing residence – by moving to an area offering better opportunities for employment as well as for education and social advancement. Included in the list of better opportunities is the possibility of alternative employment, in other words freedom of choice of employer, a choice which is much sought after by a large proportion of migrants. This type of pull factor greatly influences migrations toward large cities (roughly

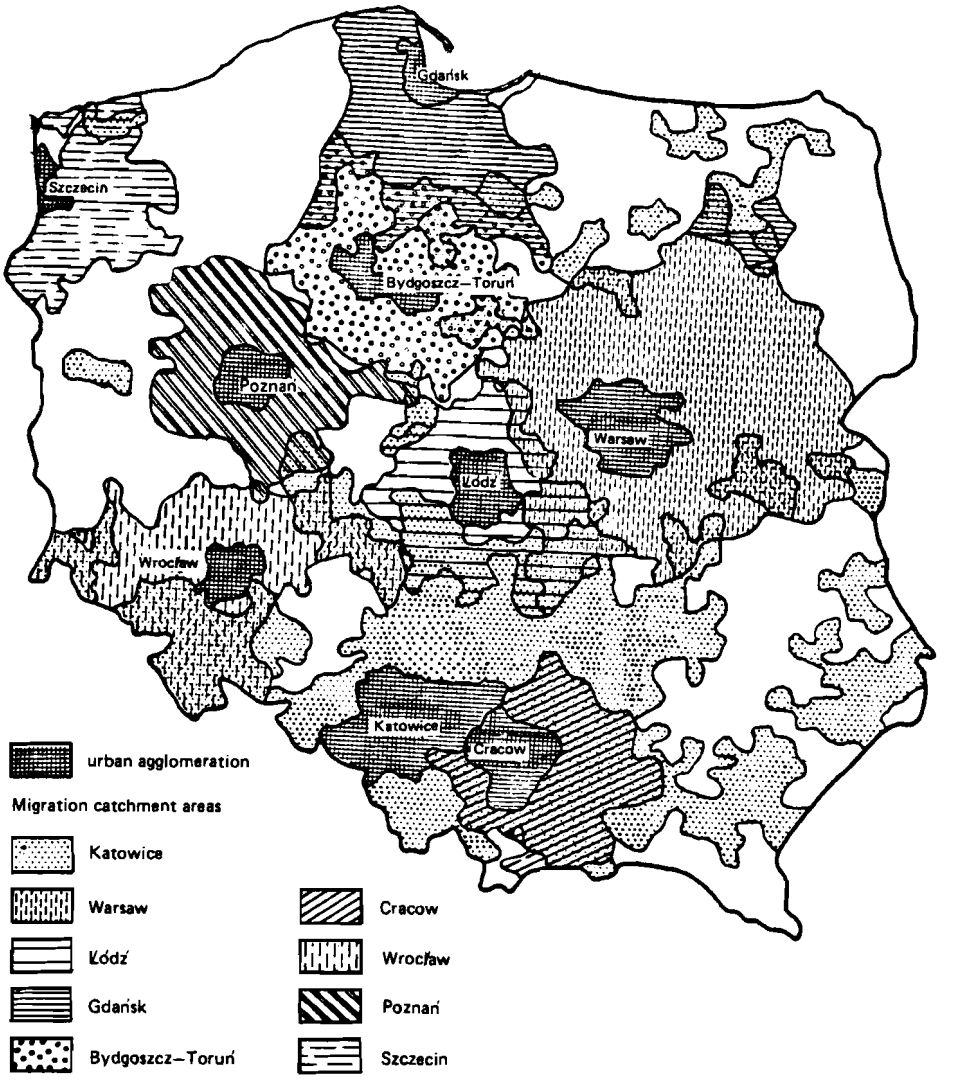


FIGURE 8 Migration catchment areas of the major urban agglomerations in Poland.

speaking those with 100,000 or more inhabitants). The association in the minds of potential migrants between employment and educational opportunities is important and it influences the behavior of migrants in several ways. Going to school in a specific city implies to a certain extent that one will remain and work there afterwards, since finding employment locally appears easier than it would

be in other less-known or completely-unknown places. Employment in a particular enterprise or an institution may offer special possibilities and opportunities to increase one's qualifications. The opportunity to educate their children is perceived as an important factor in the search for employment by parents; as a result, the attraction of places with good educational institutions and facilities, usually located in the larger cities, is very strong. More recently there has been something of a diffusion of such institutions to medium-sized cities, which will in time tend to weaken the relative attractiveness of the larger cities to the potential migrant.

The desire for better living conditions as a reason for migration is slowly coming to the fore along with general improvements in wages, incomes, and living standards. At present this type of migration is usually from the outlying zones of urban agglomerations to the more-central districts when a dwelling, usually a flat, becomes available. The move is often connected with the advancement of professional qualifications and with increasing seniority at the place of employment. On the other hand, it has been observed that the possession of a good dwelling, especially in Warsaw, strongly diminishes the probability of a further move by a skilled or white-collar worker from one urban center to another. However, so long as there continue to be serious housing shortages, the influence of living conditions will be limited to intraurban movements; the intensity of these movements is growing as more people try to achieve an improvement in their place of residence. The influence of higher living standards and availability of specialized services is growing in importance and in the future these factors may become decisive.

Additional factors in the search for improved social and/or physical environments are emerging but it is as yet difficult to comment on their significance. Some of these factors may explain the fairly frequent phenomenon of return migration. This often takes place either when a person becomes a fully-skilled worker and is able to find a professional position, not necessarily better paid but in their home region, or when the person retires from active work. Such return migrations are most numerous between Upper Silesia, where the natural environment has significantly deteriorated, and the more-distant regions which still have attractive and comparatively unspoiled natural environments. Regional loyalties in Poland are rather strong and play a major role in the quest for improvement of social environment. So far the search for a better natural environment has been mainly expressed in recreational movements and sometimes in the location of second homes which, on retirement, may turn into permanent residences – perhaps leading to a future exodus of inhabitants of the large urban agglomerations to the suburbs and beyond.

Because present-day migrations are due mainly to industrialization and urbanization, most migratory flows are directed toward urban centers. According to recent studies (see, among others, Żurkowa 1979), the typical patterns in Poland are as follows. Rural migrants move on the local level to small cities, on the regional level to medium-sized and larger centers, or on the macroregional

level to the large urban agglomerations (usually to outlying districts of the agglomerations). Migrants from smaller cities move to neighboring medium-sized centers or to the nearest urban agglomeration. Migrants from medium-sized cities move to urban agglomerations but without regard to their location: this implies that, in Poland, the distance migrated in such cases does not play a very large role – the attraction of the agglomerations appears to vary according to their size, provision of specialized functions, degree of development, and quality of cultural traditions and facilities. Finally, migrations between urban agglomerations are still not numerous but are increasing in importance, especially with respect to certain occupational categories, such as highly-skilled and professional groups.

Migratory behavior may extend over long periods and occur in specific and distinct successive phases: these phases may occur either within the lifespan of an individual or may last over several generations. The present migration to small cities and suburban zones represents a stage in the transition toward larger urban centers. However, the future of these migration patterns is not very clear. With the general slowdown in migrations and the tendency toward equalization of housing conditions in settlements of all types, the patterns may still persist although on a diminished scale, they may simply disappear, or they may even be completely reversed. This last case would imply that the whole country had reached the next phase of settlement, that of posturbanization, parallel to and connected with postindustrial civilization.

2.3.4 RELATION BETWEEN MIGRATION AND COMMUTING TO WORK

It was noted earlier that local differences between industry's demand for labor and the housing supply available in urban centers contributed to the emergence of large-scale commuting to work during the 1950s and 1960s. By the early 1970s, the number of commuters for the country as a whole was not much less than 3 million (2,845,000 in 1973)*. Rural-to-urban trips accounted for 58%, and urban-to-urban trips for 27% of the total journeys to work among individual administrative units. Nearly 30% of these trips were to cities of 100,000 inhabitants and over, and another 20% were to cities with between 20,000 and 50,000 inhabitants. The large increase in the numbers of people commuting to work can be attributed to the demand pull factor and the housing-supply constraints already mentioned, as well as to the low monetary cost of subsidized transport (in some cases free transport is provided by individual industrial enterprises).

Because the catchment areas for migration and the respective commuting zones for individual urban centers show a high degree of mutual overlap, it has been hypothesized that daily journeys to work, in a number of cases, serve as a

*The definition of commuting used is analogous to that of migration, i.e., it includes all trips to work which involve the crossing of the boundary of an administrative unit of the lowest level (township or town).

substitute for migration and tend to be followed by an eventual change of residence if the relevant constraints are lifted. Microanalytical studies on sequences of moves over time have not yet been comprehensive enough to confirm such a hypothesis, but it is supported by aggregate data. For example, there is a high positive correlation between the intensities of in-migration and in-commuting for all major city-size categories and also between the intensities of out-migration and out-commuting for rural communities situated within commuting range of the given city center. Urban centers of over 100,000 inhabitants accounted for 30% of in-migration from both rural and urban areas and those with populations in the range 20,000–50,000 attracted 20% of such migration. These percentages are almost identical to the proportions of in-commuters attracted to cities of the same size. Furthermore, a significant positive correlation is observed between the number of commuters and the share of migration in the total population growth of individual urban centers. Other structural similarities between commuting and migration include the following:

(a) Most of the flows move up the urban size hierarchy (i.e., their origins are smaller centers and their destinations larger); while in contrast flows between places of comparable size are of smaller magnitude.
(b) Urban residents travel longer distances to bigger urban areas, whereas the destinations of trips and moves originating in rural areas are more evenly distributed among small, medium-sized, and large urban areas.

Such differences may be explained by local variations in available skills, the relative accessibility of information about potential destinations, and characteristics of the transportation networks.

The commuting–migration sequence, which is a major characteristic of spatial population mobility in Poland, also has some important consequences for patterns of occupational (and intersectoral) mobility. A move from one occupation to another (and thus, by analogy, from one sector to another) tends to proceed in two stages. In the first stage, a commuter originating from a rural area obtains work in an urban area but usually continues to work part-time in agriculture; in the second stage a complete intersectoral transition occurs which may or may not be accompanied by a migration. The first stage is illustrated by the phenomenon of the so-called peasant-workers, whose number reached 1.5 million in 1970 but since then has tended to decrease in some regions. The second stage exhibits pronounced interregional variations; for example, in the southern and southeastern regions the existing commuting patterns are traditional and firmly established and may prove to be relatively permanent phenomena.

2.3.5 MIGRATION AND URBAN GROWTH

In the previous section it was noted that urban-to-urban migration throughout Poland displays a consistent pattern, namely, that the number of moves to a

given urban area is broadly proportional to urban size. According to data for the period 1966–1972, each of the six major size categories of urban areas maintained a positive net-migration balance with respect to all smaller-sized areas, and (with the obvious exception of Warsaw) a negative balance with all larger-sized categories. The contribution of net migration to the total population increase of urban centers is also found to be roughly proportional to urban size. Since 1970, in-migration has accounted for approximately 60% of urban growth on the national level, while in the case of the largest cities its contribution has varied between 80 and 90%. These proportions, however, are not necessarily reflected in differential urban-growth rates. The highest growth rates have normally been experienced by medium-sized cities with populations of 20,000–50,000; urban centers of 200,000 inhabitants and over grew during the period 1960–1970 at a rate slightly lower than the rate for the total urban population. The explanation of these variations are found in the distribution of rates of natural increase. Although there is no clear-cut dependence between fertility level and urban size when considering places with populations below 100,000, a strong negative correlation is noticed for the group of larger cities, and especially those with populations over 300,000 (Jagielski 1975). In addition, interurban moves account for 30–50% of the total in-migration to the larger cities, compared with a share of less than 5% of the in-migration to places with populations below 100,000. Although in-migrants quickly assume the fertility patterns of the resident population, cities with large inflows of migrants still have substantially higher indices of natural growth than do cities without such inflows. At the same time, rural-to-urban movements naturally tend to compensate somewhat for the relatively higher fertility rates in rural areas.

When considering possible future trends in urban growth from the point of view of migration flows, especially for the large urban agglomerations, it is necessary to bear in mind the following factors: the changing incentives to migrate, the growing proportion in the total of interurban flows, and the growing intensity of intrametropolitan migration.

Assuming a continuing increase in the intensity of interurban flows, it is not at all certain that the present structure of flows, i.e., according to the size hierarchy of urban areas, will persist in the future. Some medium-sized cities that offer a reasonable mix of employment, services, and environment-related incentives may be among the net gainers; at the same time, some large cities are likely to experience net migration losses which, when coupled with their low rates of natural increase, may result in very small, zero, or even negative population growth.Such developments, however, are still some way in the future. In the short term, the present mix of migration and fertility factors makes a further, more or less substantial growth of the large urban agglomerations inevitable.

Intraurban flows form an important part of urban-to-urban migration. These flows will almost certainly expand in response to housing improvement and they may assume the radial patterns described by the family life-cycle concept (see for example, Johnston 1969). These patterns are likely to prevail due to

the fact that demographic variables, such as family size and female labor-force participation represent important components of overall social ecological differentiation within Polish cities (Węcławowicz 1975). Past experience indicates that the selection of place of residence and place of employment *within* an urban agglomeration are mutually independent, and that the distance between home and work (and consequently the traveling time) tend to increase for those persons who migrate within the given urban area. Such trends are also likely to continue, although they may be partly counterbalanced by conscious planning efforts to arrest the polarization of major land uses within cities.

3 MULTIREGIONAL POPULATION ANALYSIS

3.1 Regional Divisions and Statistical Data

To gain more insight into the anatomy and possible future evolution of spatial population patterns in Poland, a multiregional analysis was performed, following the concepts and procedures defined by Willekens and Rogers (1978). This section is based on the results of the analysis, carried out for a system of 13 regions (see Table 8 and Figure 9) using the 1977 data for new voivodships*. The system of data aggregation is based firstly on the division of Poland into eight macroregions, established for planning purposes. In the present study five voivodships, representing the largest urban agglomerations, were excluded from their respective macroregions and considered as additional analytical regions, giving a total of 13 regions. The results of the multiregional population analysis can therefore be compared with official forecasts and plans, and used by planning authorities; on the other hand, by treating the largest urban agglomerations as separate units, the basic components of rural–urban and intermetropolitan flow patterns can also be traced throughout the analysis.

The data used in the 13-region version of the analysis were taken from the current population register. The majority of the data were obtained from Rocznik Demograficzny GUS (the Polish Demographic Yearbook), 1978 edition. These included the total population disaggregated by age, births disaggregated by age of mother, and total deaths disaggregated by age. The age-structure, fertility, and mortality data were aggregated to fit 18 five-year age groups, from 0–5 up to 85 and over. The interregional migration data, also disaggregated by age, were obtained from current statistics, and aggregated into a 13 X 13 matrix, as well as by five-year age groups. The data pertain to moves, rather than to the migrants

*See Section 1.6 for an explanation of the administrative divisions and their recent changes. At the time when this case study was started, only preliminary data existed for the 49 new voivodships and the first rounds of calculations were performed (at IIASA) using the 1973 data for the old voivodships, aggregated into 9 regions. Subsequent calculations were undertaken, at the Institute of Geography and Spatial Organization of the Polish Academy of Sciences, for 11 regions based upon 1974 data for the new voivodships. That part of the analysis was fairly provisional in character because it only allowed the disaggregation of the population into ten-year rather than five-year age groups and involved a somewhat crude estimate of the age of migrants. Its results were briefly discussed by Korcelli (1978).

TABLE 8 Basic data for the 13 regions: 1977.

No.	Region	Constituent voivodships	Total population (thousands)		Crude rates (per thousand)			Out-migration		In-migration		Net migration		Total rate of population change (per thousand)
			June 30	December 31	Birth	Death	Natural increase	Number	Rate (per thousand)	Number	Rate (per thousand)	Number	Rate (per thousand)	
1	Warsaw	Warsaw-capital city	2,207	2,226	15.5	9.7	5.8	11,583	5.2	28,764	13.0	+17,181	7.8	13.5
2	Łódź	Łódź-city, Łódź	1,099	1,103	14.9	10.6	4.3	7,345	6.7	10,899	9.9	+3,554	3.2	7.5
3	Gdańsk	Gdańsk	1,288	1,299	19.9	7.5	12.4	9,800	7.6	15,889	12.2	+5,889	4.6	17.3
4	Katowice	Katowice	3,557	3,578	17.0	9.3	7.7	18,835	5.9	43,160	10.1	+24,325	6.8	14.5
5	Cracow	Cracow-city, Cracow	1,144	1,151	17.1	8.8	8.3	8,925	7.8	12,455	10.9	+3,530	3.1	11.4
6	East-Central	Ciechanów, Piotrków, Płock, Radom, Sieradz, Skierniewice	2,931	2,937	19.4	10.2	9.2	36,280	12.4	24,521	8.4	−11,759	−4.0	5.2
7	Northeast	Białystok, Łomża, Olsztyn, Ostrołęka, Suwałki	2,398	2,404	20.2	8.5	11.7	25,042	10.4	16,917	7.1	−8,131	−3.4	8.3
8	Northwest	Elbląg, Koszalin, Słupsk, Szczecin	2,107	2,118	21.2	7.0	14.2	27,525	13.1	26,439	12.6	−1,086	−0.5	13.7
9	South	Bielsko-Biała, Częstochowa, Opole	2,107	2,513	18.6	8.9	9.7	23,192	9.3	21,955	8.8	−1,237	−0.5	9.2
10	Southeast	Kielce, Krosno, Nowy Sącz, Przemyśl, Rzeszów, Tarnobrzeg, Tarnów	4,208	4,225	20.7	9.6	11.1	34,826	8.3	23,092	5.5	−11,734	−2.8	8.3
11	East	Biała Podlaska, Chełm, Lublin, Siedlce, Zamość	2,480	2,488	19.3	10.4	8.9	23,043	9.3	15,599	6.3	−7,444	−3.0	5.9
12	West-Central	Bydgoszcz, Kalisz, Konin, Piła, Poznań, Toruń, Włocławek	4,713	4,732	19.8	9.3	10.5	33,845	7.2	27,863	5.9	−6,982	−1.3	9.2
13	West	Gorzów, Jelenia Góra, Legnica, Leszno, Wałbrzych, Wrocław, Zielona Góra	4,060	4,078	20.1	7.6	12.5	38,171	9.4	31,057	7.7	−7,114	−1.7	10.8
	Total		34,698	34,850	19.1	9.1	10.0	298,410	8.6	298,410	8.6			10.0

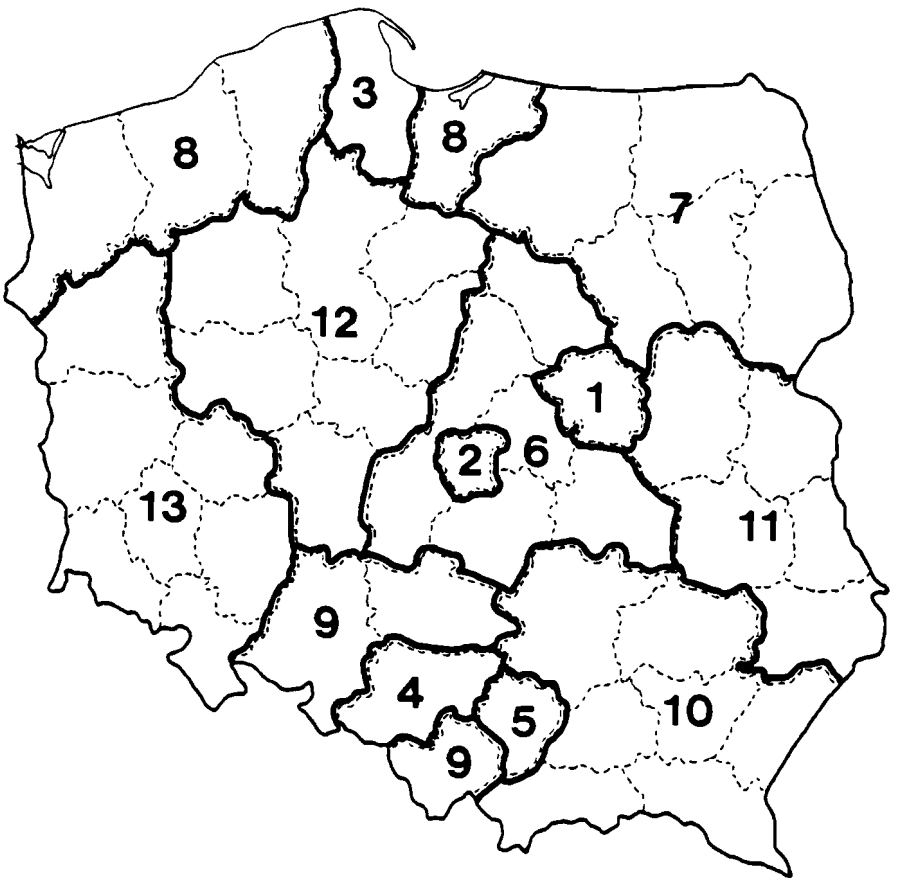


FIGURE 9 The 13-region division of Poland used in the present study. Details of each region are given in Table 8.

themselves, and international migrations are not considered. It should be noted that all the data used in the present analysis are primary data and that therefore no estimation procedures were necessary.

At this point it is appropriate to discuss briefly the nature and composition of each of the 13 regions which, as indicated earlier, represent aggregates of the upper-level administrative units (voivodships) which have existed since 1975 (see Table 8).

Regions 1–5 represent highly urbanized areas and thus possess specific demographic features. During the period studied, they were all characterized by net migration gains (as opposed to Regions 6–13, each of which had more out- than in-migration); except for the region of Gdańsk, they all also had birth

and natural-increase rates lower than the national averages and net reproduction rates below unity.

Region 1 consists of the city-voivodship of Warsaw, whose boundaries roughly correspond to the extent of the urban agglomeration of Warsaw, and, except for the underbounded northeastern sector, to the range of intensive daily commuting flows. The region ranks third in numbers of in-migrations but second, after the Katowice area, in terms of net inflow, which indicates that out-migration is relatively small.

Region 2 – the city-voivodship of Łódź, an industrial agglomeration in central Poland – is a much less important destination for interregional migration compared with Warsaw, but still has a net annual migration gain of over three thousand persons. On the other hand, Łódź has the lowest birth rate (14.9 per thousand) and highest death rate (10.6 per thousand) of all the 13 regions. It is the slowest-growing of the major urban agglomerations of Poland.

Region 3 consists of the Gdańsk–Gdynia–Sopot conurbation together with its rather extensive rural–urban hinterland. Relatively high birth rates and low death rates in this region are attributable to the post-World War II shifts in population distribution, considerable present-day in-migration (caused by expansion of industrial and port facilities), and a relatively high rural proportion (24.6%) of the total population.

Region 4 corresponds to the Upper-Silesian industrial district. Its population is 87% urban and characterized by a birth rate below the national average, but higher than those for Warsaw and Łódź. A major component of regional population dynamics here is migration. The region ranks first in terms of both gross and net in-migration, although out-migration (in particular to the neighboring regions) is quite considerable. These migration patterns give evidence of a high level of regional interdependence.

Region 5 is the city-voivodship of Cracow. Its net in-migration is relatively small, similar to that of the Łódź agglomeration. Unlike Łódź, however, birth rates in Cracow are rather high (although still below the national average), a phenomenon related to the large share of recent migrants in the region's resident population and to its "young" age structure. Heavy in-migration occurred mainly during the 1950s when the new town of Nowa Huta, now within the city limits of Cracow, was built to accommodate workers from a huge local steel plant.

Regions 6 (East-Central), 7 (Northeast), and 11 (East) are areas of considerable rural out-migration. While the bulk of moves (in particular in the case of Region 7) are intraregional, the remainder are primarily oriented toward Warsaw and (in Region 6) also toward Łódź. Natural-increase patterns among these regions are far from uniform. While the East and East-Central regions are characterized by natural-increase rates lower than the national average, the Northeast region is "young" in demographic terms, with a relatively high birth rate and moderately low death rate which give rise to a rate of natural increase of 11.7 per thousand, slightly higher than the national average. The Northeast

region is, however, internally heterogeneous: its northern part (in particular Olsztyn voivodship) features high intraregional mobility, while the remaining areas send considerable numbers of migrants across regional boundaries. It should be noted that Region 11 (East) will probably soon undergo major industrial development which may result in a reversal of the observed net migration patterns; this prediction has been tested in one of the simulation runs of the multiregional model.

Region 8 forms a latitudinal belt along the Baltic coast (with a gap corresponding to Gdańsk voivodship which constitutes a separate unit). The voivodships in this area, which have shared a similar political and demographic history over the past thirty years or so, are characterized by the highest rates of birth and natural increase (although only half as high as those experienced during the 1950s) and the lowest death rates in the country, as well as high levels of population mobility. Migration gains by the major urban centers in the region, in particular Szczecin, are offset by substantial out-migration from the rural areas, resulting in a negligible net migration loss for the region as a whole.

Region 9 is formed of three voivodships to the north, south, and west of the Katowice region. The area has been heavily industrialized (partly as a result of industrial dispersal from the Upper-Silesian industrial district) and is closely related, both in terms of production linkages and travel patterns, with the Katowice core region. Basic demographic rates are very close to national averages, and migration flows are fairly well balanced.

Region 10 constitutes a large unit, composed of seven voivodships in the southeastern part of Poland. Traditionally, this area was characterized by overpopulation in the rural areas, but more recently this has been counterbalanced by industrial development. It is a high-fertility region, with the second-highest birth rate and the highest net reproduction rate in the country. Fairly extensive net out-migration occurs but this is not large enough to offset the high fertility of the region: the total annual rate of population change is 8.3 per thousand, compared to the national average of 10.0 per thousand.

Region 12, in west-central Poland, is the largest in terms of population and is evenly balanced with respect to urban–rural proportions and degrees of industrial and agricultural development. Its major urban foci, the cities of Poznań, Bydgoszcz, and Toruń, receive considerable numbers of in-migrants, originating from both within and outside the region, but a net migration loss is noted for the region as a whole. Birth and death rates are close to the national averages.

Region 13 occupies the southwestern part of Poland and is dominated by the city of Wrocław and the recently developed copper-mining and processing district of Legnica. It constitutes another demographically "young" area, with low death rates and moderately high birth rates. Mobility is high and migration patterns are very complex; the net migration loss is a relatively small percentage of the total number of migrations.

Figure 10 presents the natural-increase and migration components of population change for the urbanized regions (Regions 1–5) and the remaining areas

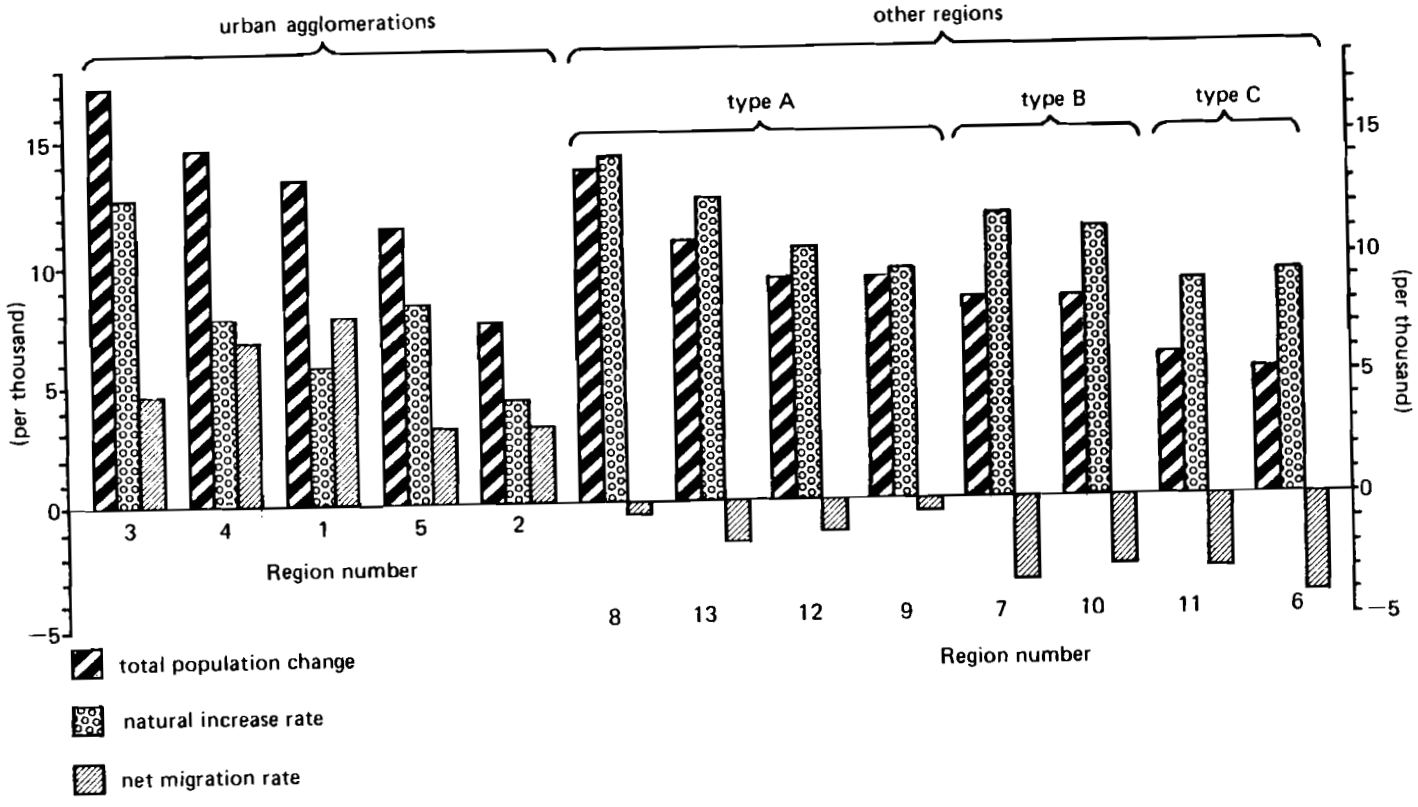


FIGURE 10 Components of population change in the 13 regions of Poland: 1977.

(Regions 6–13), in order of annual rate of total population change. Although the populations of all of the 13 regions are growing in absolute terms, the two subsets are clearly distinct from one another. In the urbanized regions the net migration rates are consistently positive (as compared to the remaining areas where they fall below zero) and thus the total population change is greater than the rate of natural increase. In addition, important variations exist within each of the regional types identified. Within the urbanized-regions subset, the migration component is dominant for the Warsaw region, while in the remaining urbanized areas natural increase accounts for most of the total growth. The high rate of total population growth in the Gdańsk region (Region 3) is due both to the region's high natural-increase rate (which can be largely explained as an age-composition effect) and the large net migration inflow from other regions. In the contrasting case of Łódź (Region 2), low rates for both natural increase and migratory gains combine to produce a much lower overall rate of population growth.

The other subset, Regions 6–13, is also by no means internally homogeneous. Within this group three types of population change can be identified, following the zonal geographical pattern described earlier. The three types are as follows (region numbers in parentheses): Northwest (8), West (13), West-Central (12), and South (9) (type A); Northeast (7) and Southeast (10) (type B); and East (11) and East-Central (6) (type C). Type A regions show high overall rates of population growth (comparable to the corresponding rates for the major urban agglomerations) owing to small net migration losses coupled with high (Northwest and West) or near-average (West-Central and South) rates of natural increase. As will be shown later, the high rates of natural increase in Regions 8 and 13 are attributable to the present age composition of the two regions; their net reproduction rates are in fact slightly lower than for the nation as a whole. Types B and C comprise the main regions of net out-migration. In the case of type B (Northeast and Southeast) the rate of natural increase is high enough to maintain the total population increase at levels comparable to those in the type A regions (and only slightly below the national rate). This is not true, however, in the case of type C regions 6 (East-Central) and 11 (East), which are situated within the migration catchment areas of the Warsaw, Katowice, and Łódź agglomerations.

Migrations across the boundaries of the 13 regions identified here (see Table 9) constituted 33.4% of all internal migrations (i.e., moves across administrative boundaries) registered in Poland in 1977. This proportion indicates that the majority of moves (66.6%) take place within, rather than between, individual regions. (It should be noted that in the earlier, nine-region version of the analysis, the proportion of interregional migration, 28.6%, was substantially lower.) Nevertheless, both the percentage and the absolute volume of interregional flows seem to be sufficiently large to exert great influence on the evolution of interregional patterns of age structure, as well as those of fertility and mortality. The data for the period 1970–1978 indicate, in fact, that the

TABLE 9 Flow matrix of interregional migrations: 1977.

Region of destination		Region of origin													
No.	Name	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
1	Warsaw		599	505	591	378	7,884	5,351	1,292	583	1,642	6,710	1,654	1,575	28,764
2	Łódź	325		187	199	57	6,221	387	581	265	506	348	1,129	694	10,899
3	Gdańsk	344	191		390	107	1,159	2,357	4,635	280	733	922	3,422	1,143	15,689
4	Katowice	438	375	352		2,505	3,584	2,589	1,862	9,866	8,938	2,810	3,784	6,061	43,160
5	Cracow	206	65	87	1,473		349	316	303	1,625	6,504	363	376	788	12,455
6	East-Central	3,299	3,334	554	1,068	193		3,077	1,822	1,504	2,546	1,645	2,903	2,576	24,521
7	Northeast	1,861	255	1,084	893	177	2,754		3,198	517	808	1,642	2,020	1,708	16,917
8	Northwest	650	457	3,312	931	187	1,956	3,416		659	1,519	1,693	6,772	4,887	26,439
9	South	286	217	165	5,364	989	2,079	857	867		3,434	1,117	1,536	5,044	21,955
10	Southeast	589	291	417	3,237	3,334	2,894	878	1,382	2,393		2,767	1,124	3,786	23,092
11	East	2,136	221	468	1,035	230	1,823	1,834	1,427	730	2,919		952	1,824	15,599
12	West-Central	762	741	2,062	1,366	251	3,044	2,170	5,818	1,106	1,344	1,114		8,085	27,863
13	West	687	599	607	2,288	517	2,533	1,808	4,338	3,662	3,933	1,912	8,173		31,057
	Total	11,583	7,345	9,800	18,835	8,925	36,280	25,040	27,525	23,192	34,826	23,043	33,845	38,171	298,410

proportion of interregional moves in the total is positively related to total population mobility rates. This demonstrates the role of physical distance in the shaping of observed migration flows. Thus a decline in the total number of moves primarily affects long-distance migrations, resulting in a spatial consolidation of migration catchment areas oriented toward the existing regional centers.

3.2 The Multiregional Model

The modeling framework developed by Rogers and associates [see Rogers (1975, 1978), and Willekens and Rogers (1978)] allows one to study the complex interdependence between interregional demographic factors. Unlike the behavior of single-region cohort-survival models, the structure and evolution of population in a multiregional model are dependent not only on regional fertility and mortality levels, but also on the size and composition of interregional migration flows, taking into account the age structure, fertility, and mortality of migrants.

Conceptual problems related to the application of the multiregional model, and also the single-region version, include the necessary assumptions of constant transition probabilities and the total closure of the system. In addition, interregional age-specific migration patterns are exogenous to the model. The model projections should be viewed as highly conditional, although, especially in the short- and mid-term, they are not very sensitive to minor changes in parameter values. Since patterns of migration are generally less stable than those of fertility and mortality, it is essential that the data used pertain to a relatively "normal" period, or are representative of trends in the intensity and direction of internal population movements that are likely to be sustained. However, many of these restrictions are necessary only when the basic form of the model is considered. Within a broader modeling framework, separate submodels pertaining to the demometrics of migrations can be used (see Rogers 1976). On the other hand, changing demographic parameters may be introduced into the model, either as empirical or policy variables, thus allowing the long-term impacts of observed trends, population policies, or exogenous "shocks" introduced into the multiregional system to be traced. Two such attempts, performed within the case study, will be discussed in a later section.

3.3 Multiregional Life Table

A number of important characteristics of a multiregional population system can be uncovered in the analysis of the multiregional life table. This table describes the history of a hypothetical cohort born in a certain region and subjected to a given set of age- and region-specific mortality and out-migration rates. The effects of migrations on the interregional population structure are traced not only with respect to the absolute size of the flows and their sizes relative to the populations of the regions of origin and destination, but also

by taking account of the timing of migration (the age-specific probability of moving) and the existing interregional fertility and mortality differentials.

Tables 10 and 11 summarize the demographic interdependence among the 13 regions of Poland, based on 1977 migration and mortality data*. They show expectations of life at birth (Table 10) and spatial migration levels (Table 11). Table 10 indicates the total expectation of life for a hypothetical member of the cohort born in a given region, as well as its spatial structure, i.e., the time allocations among the various regions. Table 11 allows the expectation of life to be interpreted in terms of the proportions of the total life span of an individual born in region i which will be lived in region j; these proportions allow for multiple transitions, as some persons may make more than one move during a given five-year interval.

Based on the 1977 data shown in Table 10, the proportion of life to be spent in the region of birth is largest for those born in the capital-voivodship, Warsaw. A person born in the Warsaw region is expected to live in the area (except for temporary moves) for 60.24 years out of a total of 71.22 years. The remainder is allocated among other regions, the most important of which are Regions 6 (2.70 years), 11, and 7 – the regions forming a contiguous belt around the capital region. It should be emphasized again that the proportions are calculated on the assumption that the 1977 patterns adequately represent the demographic future of a cohort.

The other urbanized regions (2–5) share broadly similar characteristics, with high values for the diagonal matrix elements (people tending to remain in their region of birth) and the remainder heavily concentrated in the neighboring regions. In the case of Łódź, the second-largest proportion of total life span (after that spent in Łódź itself) is accounted for by Region 6 (East-Central) which surrounds Łódź; for natives of Gdańsk, Regions 8 (Northwest) and 12 (West-Central) account for the second- and third-highest proportions. Those born in Cracow can expect to spend considerable proportions of their lives in its traditional hinterland – Region 10 (Southeast) – and also in Region 4 (Katowice) which attracts a considerable proportion of migrants originating from the Cracow area. Only in the case of Katowice do the allocations tend to be more uniformly distributed over the whole country (although even here the values still peak in the surrounding regions), thus confirming the hypothesis of reciprocal flows between Upper Silesia and the other regions of Poland and demonstrating the nationwide extent of Upper Silesia's "migration field".

The lowest proportions of total life span to be spent by individuals in their region of birth occur in the cases of Region 6 (East-Central), with 44.64 years out of a total of 70.31, and Region 8 (Northwest), with 45.20 years out of 70.19. Region 6, as mentioned earlier, is characterized by large gross and net out-migration, but Region 8 has a balanced migration pattern. However,

*Note that Tables 10A and 10B are based not on the observed 1977 data but on alternative migration scenarios; this is discussed at some length in Section 3.6.

TABLE 10 Expectation of life at birth, total population: 1977.

Region of residence		Region of birth												
No.	Name	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Warsaw	60.24	1.68	1.02	0.55	0.88	5.64	4.80	1.56	0.73	1.13	5.87	1.02	1.08
2	Łódź	0.43	55.63	0.37	0.18	0.15	3.82	0.49	0.62	0.30	0.33	0.40	0.58	0.43
3	Gdańsk	0.43	0.48	55.47	0.33	0.27	0.99	2.02	3.92	0.34	0.47	0.87	1.63	0.76
4	Katowice	0.67	1.12	0.85	58.22	5.06	2.88	2.54	2.10	8.26	4.97	2.73	2.04	3.47
5	Cracow	0.24	0.19	0.19	0.94	54.56	0.39	0.37	0.38	1.41	3.16	0.44	0.25	0.52
6	East-Central	2.70	4.98	0.89	0.68	0.48	44.64	2.41	1.58	1.18	1.24	1.47	1.28	1.28
7	Northeast	1.58	0.65	1.62	0.58	0.40	1.80	48.52	2.58	0.52	0.52	1.41	0.99	0.92
8	Northwest	0.66	0.90	4.49	0.61	0.42	1.32	2.57	45.20	0.65	0.80	1.34	2.70	2.15
9	South	0.37	0.56	0.38	2.97	1.81	1.50	0.91	0.95	50.59	1.87	1.07	0.85	2.43
10	Southeast	0.65	0.67	0.73	1.91	5.30	1.98	0.97	1.35	2.04	51.95	2.23	0.69	1.89
11	East	1.72	0.51	0.74	0.66	0.53	1.34	1.57	1.24	0.68	1.42	48.82	0.54	0.93
12	West-Central	0.81	1.47	3.26	0.97	0.60	2.26	2.12	5.04	1.15	0.93	1.17	54.80	3.90
13	West	0.72	1.28	1.23	1.45	1.06	1.82	1.70	3.66	2.86	1.96	1.65	3.40	50.60
	Total	71.22	70.08	71.25	70.06	71.52	70.31	70.98	70.19	70.70	70.75	69.47	70.79	70.37

TABLE 10A Expectation of life at birth, total population: Simulation A. (The assumptions of Simulation A and the inferences that can be drawn from this alternative migration scenario are discussed in Section 3.6.)

Region of residence		Region of birth												
No.	Name	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Warsaw	65.37	0.84	0.51	0.26	0.47	3.36	2.77	0.81	0.36	1.04	3.42	0.51	0.55
2	Łódź	0.20	62.16	0.18	0.08	0.08	2.38	0.24	0.33	0.15	0.30	0.20	0.30	0.22
3	Gdańsk	0.21	0.24	62.67	0.17	0.14	0.52	1.18	2.39	0.17	0.44	0.48	0.91	0.39
4	Katowice	0.31	0.55	0.40	63.52	2.85	1.63	1.40	1.12	4.81	5.03	1.52	1.08	1.90
5	Cracow	0.13	0.10	0.10	0.53	62.37	0.21	0.20	0.21	0.83	3.40	0.24	0.12	0.28
6	East-Central	1.60	3.07	0.42	0.37	0.25	55.23	1.47	0.91	0.69	1.30	0.84	0.73	0.74
7	Northeast	0.90	0.32	0.92	0.32	0.21	1.09	58.33	1.60	0.27	0.48	0.81	0.54	0.51
8	Northwest	0.35	0.50	2.75	0.33	0.22	0.77	1.58	55.54	0.34	0.80	0.79	1.62	1.30
9	South	0.18	0.28	0.18	1.73	1.04	0.89	0.49	0.51	59.43	1.90	0.60	0.45	1.44
10	Southeast	0.30	0.30	0.35	0.96	2.85	1.06	0.46	0.68	1.04	51.71	1.18	0.31	0.98
11	East	0.98	0.25	0.40	0.36	0.29	0.79	0.92	0.73	0.37	1.50	57.80	0.27	0.53
12	West-Central	0.40	0.78	1.80	0.50	0.31	1.29	1.16	3.01	0.60	0.84	0.61	62.00	2.27
13	West	0.37	0.66	0.61	0.79	0.58	1.04	0.94	2.21	1.69	2.00	0.93	1.98	59.25
	Total	71.29	70.02	71.35	69.94	71.65	70.26	71.13	70.09	70.75	70.75	69.43	70.82	70.36

TABLE 10B Expectation of life at birth, total population: Simulation B. (The assumptions of Simulation B and the inferences that can be drawn from this alternative migration scenario are discussed in Section 3.6.)

Region of residence		Region of birth												
No.	Name	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Warsaw	59.44	1.67	1.03	0.56	0.88	5.58	4.75	1.57	0.74	1.16	5.81	1.02	1.09
2	Łódź	0.42	55.46	0.37	0.18	0.15	3.78	0.48	0.61	0.30	0.33	0.40	0.57	0.43
3	Gdańsk	0.43	0.48	55.20	0.33	0.27	0.92	2.00	3.89	0.34	0.47	0.89	1.62	0.76
4	Katowice	0.68	1.12	0.85	57.95	5.03	2.87	2.53	2.10	8.22	4.94	2.72	2.04	3.46
5	Cracow	0.24	0.19	0.19	0.94	54.39	0.39	0.37	0.38	1.41	3.13	0.44	0.25	0.52
6	East-Central	2.66	4.94	0.88	0.68	0.48	44.19	2.39	1.57	1.17	1.23	1.46	1.28	1.28
7	Northeast	1.57	0.64	1.61	0.58	0.40	1.78	47.92	2.55	0.52	0.53	1.40	0.99	0.92
8	Northwest	0.66	0.90	4.45	0.61	0.42	1.31	2.54	44.77	0.64	0.80	1.33	2.68	2.13
9	South	0.38	0.55	0.38	2.95	1.81	1.50	0.91	0.95	50.36	1.86	1.07	0.85	2.41
10	Southeast	0.66	0.67	0.73	1.90	5.25	1.97	0.97	1.34	2.03	51.36	2.22	0.69	1.88
11	East	2.51	0.75	1.09	0.97	0.78	1.97	2.31	1.82	1.00	2.08	48.96	0.80	1.36
12	West-Central	0.81	1.46	3.24	0.97	0.60	2.24	2.10	5.00	1.15	0.93	1.17	54.62	3.88
13	West	0.73	1.23	1.22	1.44	1.06	1.81	1.69	3.62	2.84	1.95	1.64	3.38	50.25
	Total	71.20	70.08	71.24	70.06	71.52	70.31	70.97	70.19	70.70	70.75	69.47	70.79	70.37

TABLE 11 Spatial allocations of expectation of life at birth, total population: 1977.

Region of residence		Region of birth												
No.	Name	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Warsaw	0.8459	0.0240	0.0144	0.0079	0.0123	0.0802	0.0676	0.0222	0.0103	0.0610	0.0845	0.0144	0.0154
2	Łódź	0.0060	0.7938	0.0052	0.0025	0.0021	0.0543	0.0069	0.0088	0.0042	0.0047	0.0057	0.0081	0.0061
3	Gdańsk	0.0061	0.0068	0.7786	0.0048	0.0038	0.0132	0.0285	0.0551	0.0048	0.0066	0.0126	0.0230	0.0180
4	Katowice	0.0093	0.0160	0.0120	0.8310	0.0707	0.0410	0.0358	0.0299	0.1168	0.0703	0.0393	0.0289	0.0493
5	Cracow	0.0034	0.0028	0.0027	0.0135	0.7628	0.0055	0.0052	0.0054	0.0200	0.0447	0.0063	0.0035	0.0074
6	East-Central	0.0379	0.0711	0.0124	0.0097	0.0067	0.6349	0.0340	0.0226	0.0166	0.0175	0.0211	0.0181	0.0182
7	Northeast	0.0222	0.0092	0.0228	0.0083	0.0056	0.0256	0.6835	0.0368	0.0074	0.0074	0.0203	0.0140	0.0131
8	Northwest	0.0093	0.0129	0.0630	0.0087	0.0058	0.0188	0.0362	0.6440	0.0091	0.0113	0.0192	0.0382	0.0306
9	South	0.0052	0.0079	0.0053	0.0424	0.0254	0.0214	0.0128	0.0136	0.7156	0.0264	0.0154	0.0121	0.0345
10	Southeast	0.0091	0.0096	0.0103	0.0272	0.0741	0.0282	0.0137	0.0192	0.0289	0.7343	0.0322	0.0098	0.0269
11	East	0.0241	0.0073	0.0104	0.0094	0.0074	0.0191	0.0222	0.0177	0.0096	0.0201	0.7071	0.0077	0.0132
12	West-Central	0.0133	0.0210	0.0457	0.0139	0.0085	0.0321	0.0298	0.0717	0.0163	0.0131	0.0169	0.7742	0.0554
13	West	0.0102	0.0176	0.0172	0.0207	0.0149	0.0258	0.0239	0.0521	0.0404	0.0278	0.0237	0.0480	0.7191
	Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Region 8 is a very high-mobility area, a feature clearly explained by the age structure of its population and reflected in its high birth rates and low death rates (see Table 8). The spatial distribution of expectation of life proportions for these two regions (and also for other areas) again suggests that the distance-decay function dominates in the overall pattern. For example, individuals born in Region 6 are likely to spend the largest fractions of their total life span (excluding time spent in the region of birth) in the regions of Warsaw (5.64 years), Łódź (3.82 years), and Katowice (2.88 years), while the natives of Region 8 may expect to spend 5.04 years in Region 12 (West-Central), 3.92 years in Region 3 (Gdańsk), and 3.66 years in Region 13 (West).

On examining individual elements of Table 10 it can be seen that Region 4, which comprises the Upper-Silesian industrial district, accounts for substantial fractions of the total expectation of life of persons born in all the other regions, except for Warsaw and Gdańsk. These fractions are as high as 8.26 years for those born in the South, 5.06 years for those born in Cracow, and 4.97 years for natives of the Southeast. On the other hand, Regions 2 (Łódź) and 5 (Cracow) account for the smallest fractions of the total expectation of life of people born elsewhere (except for those born in the immediate surrounding regions), and cannot therefore be regarded as important migration destinations in the multiregional system under analysis. In fact, these two regions have the lowest absolute volume of in-migration (see Table 9). Except for the Cracow–Katowice link, the flows between large cities (shown by elements in the upper left sector of Table 10) are quite limited in relative terms, a fact running counter to the hypothesis that the largest cities form a strongly-integrated subset of origin and destination areas for interregional migration in Poland. It is possible that the pattern would look different, however, if migrants were disaggregated by level of education. Finally, Table 10 shows that there are only very small variations in total expectations of life among the 13 regions, none of the regional totals deviating more than 1% from the national mean of 70.60 years, except for Region 11 (East) which is 1.13 years or 1.6% below the national mean, and Region 5 (Cracow) which is 0.92 years or 1.3% above the national mean.

Table 11 presents another aspect of the pattern, showing proportions of the total lifetime spent in each region (i.e., spatial migration levels). The highest diagonal elements are again those referring to the capital-voivodship of Warsaw and the Katowice voivodship, where the probability of leaving the region of birth is quite low. On the other hand, the corresponding elements for the East-Central and Northwest regions show that the populations of these two regions experience the highest gross out-migration levels. The "attractive strength" of Warsaw as a region of destination for migrants born in other regions is very selective, with the majority of migrants originating in only four of the regions (6, 7, 10, and 11) under analysis. Upper Silesia (i.e., Region 4), on the other hand, attracts migrants from a larger number of regions and it also contributes substantially to the in-migration to the South, the Southeast, and the West – regions which also happen to be major origins of migration to Region 4 (see Table 11).

The reciprocity of Upper-Silesian migration patterns, partly explained by return migration and the transfers of skilled labor to newly-industrialized areas, are once again evident.

3.4 Fertility and Mobility Analysis

Interregional fertility patterns in Poland are characterized by considerable variations in terms of net reproduction rates (NRR*), with the urbanized regions (except for Region 3) showing total values below unity, and the remaining regions being above the replacement level, with the maximum of 1.341 occurring in Region 10 (Southeast). (Recall from Section 2 that the intraregional variations are also quite considerable.)

As can be seen from Table 12, the pattern of spatial net reproduction rates is actually smoothed (shows less extreme variation) compared to its single-region version, the degree of smoothing being determined by the assumption used in the calculations that migrants adopt the fertility and mortality regimes prevailing in their regions of destination. Basically, the total spatial NRRs for regions of high fertility and net out-migration are lower than the corresponding single-region NRRs, and for regions of low fertility and net in-migration they are higher than the single-region values. Initial interregional fertility differentials are, however, large enough to overshadow the out-migration patterns when NRRs are presented within a multiregional framework. Consequently, the order of individual regions in terms of total spatial NRR is nearly the same as the corresponding list for the single-region rates. In both cases the urbanized regions are characterized by NRRs below replacement level while the regions of highest NRRs are also those with the highest net out-migration rates. Nevertheless, the total spatial NRRs of regions with net out-migration are considerably lower, and those of regions of net in-migration somewhat higher, than the corresponding single-region values. For the country as a whole, the inclusion of migration effects increases the total NRR from 1.040 to 1.079.

From the values shown in Table 12 one may conclude that only one region (Southeast) is able to reproduce its population without the contribution of other regions (shown by the only diagonal element greater than one), even assuming a continuation of the present net out-migration from the Southeast. Other features of the multiregional population system include the substantial

*The spatial net reproduction rate (NRR) is defined (Willekens and Rogers 1978) as

$$ {}_{i}\mathrm{NRR}_{j} = \sum_{x=0}^{z} {}_{i}L_{j}(x)F_{j}(x) $$

where ${}_{i}\mathrm{NRR}_{j}$ is the total number of children a member of a life table population born in region i may expect to have in region j, ${}_{i}L_{j}(x)$ is the number of person-years lived in each region j between the ages x and $x + 4$ by a member of the multiregional life table population born in region i, and $F_{j}(x)$ is the age-specific fertility rate in region j.

TABLE 12 Spatial net reproduction rates, total population: 1977.

Region of birth of child		Region of birth of parent												
No.	Name	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Warsaw	0.709	0.016	0.008	0.005	0.008	0.060	0.051	0.014	0.006	0.010	0.068	0.009	0.010
2	Łódź	0.003	0.644	0.003	0.001	0.001	0.040	0.004	0.006	0.002	0.003	0.004	0.005	0.004
3	Gdańsk	0.005	0.005	0.822	0.004	0.003	0.011	0.026	0.053	0.004	0.005	0.012	0.020	0.009
4	Katowice	0.006	0.012	0.008	0.768	0.055	0.031	0.028	0.022	0.091	0.053	0.030	0.022	0.038
5	Cracow	0.002	0.002	0.002	0.010	0.724	0.004	0.004	0.004	0.015	0.037	0.004	0.002	0.005
6	East-Central	0.036	0.071	0.010	0.009	0.006	0.776	0.036	0.022	0.016	0.017	0.020	0.018	0.018
7	Northeast	0.020	0.009	0.022	0.008	0.005	0.027	0.853	0.040	0.007	0.007	0.021	0.014	0.013
8	Northwest	0.007	0.010	0.060	0.007	0.005	0.017	0.035	0.718	0.007	0.010	0.017	0.036	0.029
9	South	0.004	0.007	0.004	0.039	0.023	0.020	0.012	0.012	0.807	0.025	0.014	0.011	0.033
10	Southeast	0.009	0.010	0.010	0.031	0.090	0.035	0.015	0.022	0.033	1.012	0.040	0.010	0.031
11	East	0.021	0.006	0.009	0.009	0.007	0.020	0.023	0.017	0.009	0.021	0.845	0.027	0.013
12	West-Central	0.008	0.017	0.040	0.012	0.007	0.030	0.028	0.069	0.014	0.011	0.014	0.876	0.053
13	West	0.007	0.012	0.013	0.016	0.011	0.021	0.020	0.046	0.034	0.023	0.020	0.041	0.763
	Total	0.879	0.821	1.011	0.918	0.944	1.090	1.134	1.043	1.044	1.233	1.103	1.070	1.017
	Single-region NRR	0.801	0.768	1.001	0.884	0.905	1.159	1.206	1.033	1.067	1.341	1.159	1.087	1.002

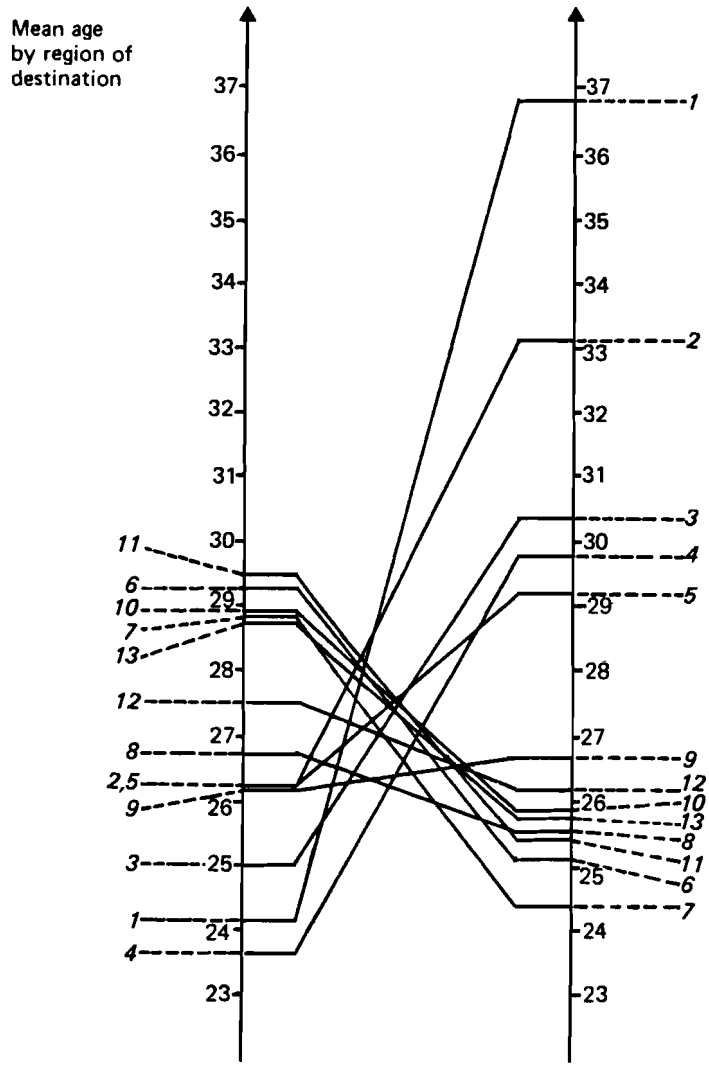
TABLE 13 Spatial net reproduction allocations (%), total population: 1977.

Region of birth of child		Region of birth of parent												
No.	Name	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Warsaw	84.5	1.0	0.3	0.5	0.8	5.4	4.5	1.3	0.6	0.9	5.7	0.8	1.0
2	Łódź	0.4	78.4	0.2	0.1	0.1	3.6	0.4	0.5	0.2	0.2	0.3	0.5	0.4
3	Gdańsk	0.6	0.7	81.3	0.4	0.3	1.0	2.3	5.0	0.4	0.4	1.0	1.9	0.9
4	Katowice	0.7	1.4	0.7	83.6	5.8	2.8	2.4	2.2	8.7	4.3	2.7	2.0	3.7
5	Cracow	0.3	0.3	0.1	1.1	76.7	0.3	0.3	0.4	1.5	3.0	0.4	0.2	0.5
6	East-Central	4.3	8.6	1.0	1.0	0.6	71.2	3.2	2.1	1.5	1.4	1.9	1.7	1.7
7	Northeast	2.4	1.0	2.1	0.9	0.5	2.5	75.2	3.8	0.6	0.6	1.9	1.3	1.3
8	Northwest	0.8	1.5	6.0	0.8	0.5	1.5	3.1	68.8	0.7	0.8	1.6	3.3	2.8
9	South	0.5	0.8	0.4	4.2	2.4	1.6	1.0	1.1	77.2	2.0	1.3	1.0	3.2
10	Southeast	1.1	1.2	1.0	3.3	9.6	3.2	1.4	2.1	3.1	82.0	3.6	0.9	3.0
11	East	2.6	0.7	0.8	1.0	0.7	1.7	2.0	1.6	0.8	1.2	76.7	0.6	1.2
12	West-Central	1.0	2.0	4.0	1.3	0.7	2.8	2.4	6.5	1.3	0.8	1.3	81.8	5.2
13	West	0.8	1.5	1.2	1.7	1.1	1.9	1.7	4.4	3.2	1.8	1.9	3.8	75.0

contributions by a number of regions to the aggregate fertility level in Region 4 (Katowice), and of only a few neighboring regions to the corresponding value for Region 1 (Warsaw). The distribution of the spatial allocations of the net reproduction rate (Table 13) reveal additional, rather important characteristics. For example, natives of Regions 8 (Northwest) and 6 (East-Central) are more likely, in comparison to natives of other regions, to give birth to children outside their own regions of birth. On the other hand, the urbanized areas of Warsaw, Gdańsk, and Katowice, in addition to having some of the highest NRR allocations occurring in the region of birth, also benefit the most in terms of children born locally to in-migrants who are natives of other regions.

These variations are attributable both to interregional fertility differentials and to migration characteristics, including the age patterns of migrants. The latter, in fact, show considerable variations. Even more striking, however, are the differences between the mean ages of out- and in-migrants for individual regions (Figure 11). For the mean age of in-migrants, the order of the regions is similar to that for the total rate of population increase; the main out-migration regions (such as East-Central, Southeast, and East) are characterized by the highest mean ages of in-migrants, while the regions of in-migration, in particular Katowice, Warsaw, and Gdańsk, show the lowest mean ages of in-migrants. The reverse pattern is observed when the mean age of migrants is calculated by region of origin. On this basis, out-migrants from the major in-migration regions show high mean ages – over 30 years in the cases of Warsaw, Łódź, and Gdańsk, while for the regions with high net migration losses the corresponding figures are between 24 and 27 years.

The pattern of mean ages of migrants described above seems to be typical of other countries as well (although the high degree of variation is more unusual) and it suggests the following interpretation: labor-market entry and education-oriented moves, which mainly involve migrants in their early twenties, take place from less- toward more-urbanized and industrialized regions. Out-migration from the urban, industrial regions occurs at a later stage in the life cycle: it may take the form of a return migration, a forward move related to career advancement, or, less frequently, retirement. Furthermore, as evidenced by the data in Table 14, the age patterns for specific migration flows are influenced by physical distance. For example, migrants who move to Warsaw from the neighboring regions of East, Northeast, and East-Central are younger on the average than those arriving from the more-distant Gdańsk, Katowice, or West-Central regions. A similar interrelation is noticed when inflows to other urbanized regions (except for Katowice) are examined. One plausible explanation is that long-distance moves mainly involve persons with higher levels of skills, which are gained at a later age. This may not necessarily be true in the case of Region 4 (Katowice), due to special labor-recruitment policies (see Section 4) carried out at the national level, which contribute to the extension of Katowice's migration catchment area far beyond the range typical of the remaining urbanized regions, Warsaw included.



Region numbers are shown in *italic type*

FIGURE 11 Mean age of migrants in Poland, by region of origin and region of destination.

It is interesting to compare spatial reproduction rates with the corresponding measures of intensity of mobility – the spatial migraproduction rates (Table 15). For all the regions studied, the net migraproduction rates (NMR), which give the expected number of migrations an individual will make during his/her

TABLE 14 Mean age of migrants, by region of origin and region of destination: 1977.

Region of destination		Region of origin													Total
No.	Name	1	2	3	4	5	6	7	8	9	10	11	12	13	arrivals
1	Warsaw	–	27.7	31.8	26.6	28.1	23.2	22.8	25.4	26.6	25.1	23.2	26.0	25.5	24.07
2	Łódź	38.3	–	29.1	29.9	32.3	25.1	26.3	25.4	28.3	28.2	26.5	26.3	28.1	26.30
3	Gdańsk	31.6	28.7	–	25.0	27.2	25.7	24.5	23.2	27.4	27.6	25.9	25.4	24.9	24.96
4	Katowice	34.1	25.2	28.3	–	25.1	22.8	22.3	22.8	24.4	23.6	23.2	22.9	22.6	23.62
5	Cracow	36.2	28.6	33.8	29.8	–	27.2	23.7	25.8	26.2	25.0	27.0	28.7	26.3	26.30
6	East-Central	35.2	34.8	35.9	30.8	31.7	–	24.4	28.1	28.3	26.9	25.7	26.6	27.2	29.28
7	Northeast	36.9	31.6	32.9	29.3	28.7	26.8	–	25.6	29.9	28.5	26.9	27.8	28.2	28.75
8	Northwest	35.6	31.1	26.1	28.2	31.7	28.4	25.4	–	28.5	28.6	27.8	25.8	25.1	26.66
9	South	35.5	31.2	32.5	29.1	30.4	24.3	23.3	25.5	–	24.9	25.3	24.8	24.5	26.23
10	Southeast	37.6	36.1	34.3	31.7	30.7	25.3	25.1	27.4	29.5	–	26.2	29.1	27.9	28.88
11	East	39.0	37.0	37.2	30.8	30.2	25.4	25.3	29.4	29.9	25.9	–	29.1	29.2	29.53
12	West-Central	40.8	35.9	31.4	29.9	32.1	25.5	25.8	25.9	28.1	26.6	28.7	–	26.0	27.45
13	West	39.9	34.2	32.1	31.1	35.5	29.1	24.9	25.4	28.5	29.7	28.8	27.4	–	28.66
	Total departures	36.92	33.23	30.39	29.90	29.27	25.09	24.37	25.49	26.70	25.78	25.39	26.22	25.67	–

TABLE 15 Spatial net migraproduction rates, by region of birth and region of out-migration, total population: 1977.

Region of out-migration		Region of birth												
No.	Name	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Warsaw	0.3021	0.0087	0.0054	0.0029	0.0045	0.0290	0.0248	0.0081	0.0038	0.0059	0.0303	0.0053	0.0056
2	Łódź	0.0026	0.3497	0.0022	0.0011	0.0009	0.0228	0.0029	0.0036	0.0017	0.0020	0.0024	0.0034	0.0025
3	Gdańsk	0.0031	0.0033	0.3964	0.0023	0.0019	0.0065	0.0142	0.0277	0.0024	0.0033	0.0061	0.0114	0.0053
4	Katowice	0.0030	0.0051	0.0038	0.2892	0.0231	0.0131	0.0115	0.0095	0.0377	0.0225	0.0124	0.0092	0.0158
5	Cracow	0.0015	0.0012	0.0013	0.0059	0.3018	0.0024	0.0023	0.0024	0.0089	0.0202	0.0027	0.0015	0.0033
6	East-Central	0.0241	0.0458	0.0073	0.0059	0.0040	0.5354	0.0227	0.0142	0.0105	0.0110	0.0132	0.0115	0.0115
7	Northeast	0.0110	0.0045	0.0114	0.0042	0.0028	0.0135	0.4698	0.0197	0.0036	0.0036	0.0104	0.0071	0.0066
8	Northwest	0.0067	0.0093	0.0474	0.0063	0.0042	0.0137	0.0270	0.5476	0.0065	0.0081	0.0139	0.0282	0.0226
9	South	0.0026	0.0039	0.0026	0.0216	0.0131	0.0110	0.0066	0.0068	0.4439	0.0137	0.0078	0.0061	0.0179
10	Southeast	0.0038	0.0040	0.0043	0.0120	0.0344	0.0129	0.0059	0.0084	0.0127	0.4100	0.0147	0.0041	0.0119
11	East	0.0110	0.0032	0.0045	0.0043	0.0034	0.0090	0.0107	0.0082	0.0043	0.0098	0.4311	0.0034	0.0061
12	West-Central	0.0040	0.0075	0.0171	0.0051	0.0030	0.0122	0.0112	0.0274	0.0060	0.0047	0.0061	0.3562	0.0211
13	West	0.0051	0.0087	0.0086	0.0103	0.0074	0.0131	0.0122	0.0269	0.0206	0.0141	0.0120	0.0248	0.4381
	Total	0.3804	0.4549	0.5123	0.3710	0.4046	0.6945	0.6218	0.7105	0.5626	0.5286	0.5629	0.4723	0.5683

lifetime, are less than unity and they vary considerably over the country. As expected, total rates are the highest for Regions 8 (Northwest) and 6 (East-Central). In the case of Region 8 they primarily reflect the high overall spatial mobility of the native population, while in Region 6 they show the effect of the dominant out-migration character of the region. An individual born in the Northwest region is expected to make a total of 0.71 moves, 0.55 of which will originate from the region of birth; the figures for the East-Central region are nearly as high at 0.69 and 0.54, respectively. The next-highest shares of the total NMR for individuals born in Region 8 are those from the neighboring regions of Gdańsk (0.028 moves) and West-Central (0.027 moves). In the case of Region 6, the next-highest out-migration probabilities for persons born in this region are those from Warsaw (0.029 moves) and Łódź (0.023 moves).

The smallest number of moves that a person born in a given region is expected to make during his/her lifetime occur in the cases of Katowice (0.37 moves) and Warsaw (0.38 moves); out of these totals 0.289 and 0.302 moves, respectively, are expected to originate from the region of birth. The low total NMR values for the urbanized regions reflect the advantages these regions offer in terms of socioeconomic conditions and – to a certain extent – the effects of past migration policies which have indirectly discouraged out-migration from these regions by limiting in-migration.

The share of the total regional NMRs accounted for by the region of birth shows a low variation across the country of only just over four percentage points (the maximum and minimum values being 79.4% and 75.4%, respectively). Differences between individual regions reflect a combination of factors relating to geographical preferences and the age of migrants. In the case of Warsaw, where the share of the region of birth is the highest, the age of migrants seems to be of primary importance. With a mean age of 36.92 years, migrants departing from the capital region are not likely to make many subsequent moves. The problem, however, is not quite that simple, because the mean age pertains to all out-migrants, both those born in Region 1 and those born elsewhere. Furthermore, the age structure of migrants does not adequately explain the lowest region-of-birth share which is found in the West-Central region, in which the mean departure age (26.22 years) is not very low; once they move out of their region of birth, the natives of the West-Central region become relatively more mobile than persons born in other regions.

3.5 Implications of Current Demographic Patterns

As has been described by Rogers (1975), a multiregional population system, when exposed to constant fertility, mortality, and migration schedules (both age-specific and origin–destination-specific) will eventually reach a stable age structure, a constant rate of population increase, and a stable regional distribution. The age structure of such a "stable" population is independent of the initial age distribution of the population.

TABLE 16 Projection of multiregional population change, by region, summary indicators: 1977–stability. Based on the observed (1977) data.

Projection	Region 1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Population (thousands)														
1977	2,207	1,099	1,288	3,557	1,144	2,931	2,398	2,107	2,506	4,208	2,480	4,713	4,060	34,698
2002	2,770	1,194	1,739	4,610	1,392	3,147	2,797	2,596	2,959	5,012	2,713	5,502	4,684	41,113
Stable equivalent	2,021	552	1,379	4,509	1,583	1,734	1,599	1,515	2,306	7,420	1,784	2,984	2,403	31,799
Mean age (years)														
1977	35.82	36.15	31.63	33.19	33.82	33.43	31.67	30.01	32.53	32.68	33.76	32.63	31.39	32.78
2002	37.67	39.04	34.70	35.96	36.87	35.31	34.46	34.75	35.05	33.06	35.45	34.86	36.12	35.33
Stable equivalent	39.16	39.79	36.98	37.73	38.40	36.24	36.13	36.79	36.52	33.64	36.06	36.65	37.88	36.43
Growth rate														
1977–1982	0.0130	0.0067	0.0161	0.0139	0.0111	0.0051	0.0084	0.0128	0.0092	0.0059	0.0059	0.0088	0.0099	0.0098
1997–2002	0.0067	0.0014	0.0092	0.0080	0.0057	0.0014	0.0040	0.0053	0.0047	0.0059	0.0022	0.0045	0.0030	0.0049
Stable equivalent	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028
Regional share of population (%)														
1977	6.36	3.17	3.71	10.25	3.30	8.45	6.91	6.07	7.22	12.13	7.15	13.58	11.70	100.00
2002	6.74	2.90	4.23	11.21	3.39	7.65	6.80	6.31	7.20	12.19	6.60	13.38	11.30	100.00
Stable equivalent	6.36	1.74	4.34	14.18	4.98	5.45	5.03	4.77	7.25	23.33	5.64	9.38	7.56	100.00
Labor force: 20–59 age group (thousands)														
1977	1,320	657	717	2,042	671	1,481	1,196	1,165	1,316	2,054	1,263	2,436	2,276	18,576
2002	1,653	713	1,001	2,691	809	1,593	1,405	1,445	1,582	2,442	1,361	2,979	2,584	22,255
Stable equivalent	1,132	313	736	2,485	862	857	780	793	1,193	3,570	883	1,530	1,252	16,387
Regional share of labor force (%)														
1977	7.1	3.5	3.9	11.0	3.6	8.0	6.4	6.3	7.1	10.9	6.8	13.1	12.3	100.0
2002	7.4	3.2	4.5	12.1	3.6	7.2	6.3	7.1	11.0	6.1	6.1	13.4	11.6	100.0
Stable equivalent	6.9	1.9	4.5	15.2	5.3	5.2	4.8	4.8	7.3	21.8	5.4	9.3	7.6	100.0

TABLE 16A Projection of multiregional population change, by region, summary indicators: 1977–stability. Based on Simulation A: this alternative migration scenario is discussed in Section 3.6.

	Region													
Projection	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Population (thousands)														
1977	2,207	1,099	1,288	3,557	1,144	2,931	2,398	2,107	2,508	4,208	2,480	4,713	4,060	34,698
2002	2,530	1,140	1,661	4,382	1,420	3,363	2,959	2,644	3,034	4,689	2,874	5,619	4,836	41,151
Stable equivalent	2,065	527	1,660	3,826	1,389	2,958	3,869	1,988	2,696	4,658	3,339	4,192	2,684	35,851
Mean age (years)														
1977	35.82	36.15	31.63	33.19	33.82	33.43	31.67	30.01	32.53	32.68	33.76	32.63	31.39	32.78
2002	38.88	39.79	35.23	36.54	36.89	34.60	33.83	34.69	34.93	33.21	34.81	34.67	35.88	35.31
Stable equivalent	39.57	40.03	37.34	38.03	38.66	35.59	35.47	36.80	36.50	33.59	35.56	36.47	37.68	36.47
Growth rate														
1977–1982	0.0094	0.0051	0.0141	0.0117	0.0122	0.0077	0.0105	0.0135	0.0101	0.0057	0.0080	0.0098	0.0115	0.0098
1997–2002	0.0038	−0.0004	0.0075	0.0061	0.0065	0.0047	0.0067	0.0059	0.0057	0.0040	0.0051	0.0057	0.0042	0.0051
Stable equivalent	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028
Regional share of population (%)														
1977	6.36	3.17	3.71	10.25	3.30	8.45	6.91	6.07	7.22	12.13	7.15	13.58	11.70	100.00
2002	6.15	2.77	4.04	10.65	3.45	8.17	7.19	6.43	7.37	11.39	6.99	13.65	11.75	100.00
Stable equivalent	5.76	1.47	4.63	10.67	3.87	8.25	10.79	5.55	7.52	12.99	9.31	11.69	7.49	100.00
Labor force: 20–59 age group (thousands)														
1977	1,320	657	717	2,042	671	1,481	1,196	1,165	1,316	2,054	1,263	2,436	2,276	18,576
2002	1,480	674	947	2,540	822	1,731	1,504	1,472	1,624	2,269	1,461	3,053	2,680	22,255
Stable equivalent	1,145	297	872	2,099	752	1,484	1,908	1,396	2,242	1,659	1,559	2,153	1,401	18,454
Regional share of labor force (%)														
1977	7.1	3.5	3.9	11.0	3.6	8.0	6.4	6.3	7.1	10.9	6.8	13.1	12.3	100.00
2002	6.7	3.0	4.3	11.4	3.7	7.8	6.8	6.6	7.3	10.2	6.6	13.7	12.0	100.00
Stable equivalent	6.2	1.6	4.7	11.4	4.1	8.0	10.3	5.6	7.6	12.1	9.0	11.7	7.6	100.00

TABLE 16B Projection of multiregional population change, by region, summary indicators: 1977–stability. Based on Simulation B: this alternative migration scenario is discussed in Section 3.6.

	Region													
Projection	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Population (thousands)														
1977	2,207	1,099	1,288	3,557	1,144	2,931	2,398	2,107	2,508	4,208	2,480	4,173	4,060	34,698
2002	2,752	1,191	1,733	4,596	1,389	3,124	2,772	2,578	2,949	4,970	2,914	5,488	4,661	41,116
Stable equivalent	2,253	577	1,455	4,594	1,559	1,797	1,667	1,583	2,350	7,132	2,707	3,122	2,477	33,273
Mean age (years)														
1977	35.82	36.15	31.63	33.19	33.82	33.43	31.67	30.01	32.53	32.68	33.76	32.63	31.39	32.78
2002	37.62	39.04	34.69	35.97	36.88	35.35	34.51	34.76	35.05	33.11	35.23	34.87	36.13	35.33
Stable equivalent	39.04	39.79	36.96	37.74	38.43	36.27	26.16	36.77	36.53	33.67	36.10	36.66	37.88	36.48
Growth rate														
1977–1982	0.0126	0.0067	0.0159	0.0137	0.0109	0.0047	0.0080	0.0126	0.0090	0.0082	0.0088	0.0083	0.0098	0.0098
1997–2002	0.0065	0.0014	0.0090	0.0078	0.0040	0.0012	0.0038	0.0051	0.0047	0.0055	0.0047	0.0045	0.0028	0.0049
Stable equivalent	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028
Regional share of population (%)														
1977	6.36	3.17	3.71	10.25	3.30	8.45	6.91	6.07	7.22	12.13	7.15	13.58	11.70	100.00
2002	6.69	2.90	4.21	11.18	3.38	7.60	6.74	6.27	7.17	12.09	7.09	13.35	11.34	100.00
Stable equivalent	6.77	1.73	4.37	13.81	4.69	5.40	5.01	4.76	7.06	21.44	8.13	9.38	7.44	100.00
Labor force: 20–59 age group (thousands)														
1977	1,320	657	717	2,042	671	1,481	1,196	1,165	1,316	2,054	1,263	2,436	2,276	18,576
2002	1,643	713	998	2,684	807	1,580	1,392	1,433	1,578	2,418	1,470	2,971	2,571	22,255
Stable equivalent	1,264	327	777	2,523	849	888	812	828	1,216	3,430	1,330	1,599	1,291	17,134
Regional share of labor force (%)														
1977	7.1	3.5	3.9	11.0	3.6	8.0	6.4	6.3	7.1	10.9	6.8	13.1	12.3	100.0
2002	7.4	3.2	4.2	12.1	3.6	7.1	6.3	6.4	7.1	10.9	6.6	13.3	11.6	100.0
Stable equivalent	7.4	2.3	4.5	14.7	5.0	5.2	4.7	4.3	7.1	20.0	7.8	9.3	7.5	100.0

Table 16 provides selected summary indicators of the evolving interregional pattern of population in Poland, based on the actual data for 1977* and then projected into the future by assuming that the 1977 schedules of fertility, mortality, and interregional migration will continue unchanged. From the table it is possible to compare data for the observed initial population (in 1977), a mid-term projection for the year 2002, and the stable equivalent** of the original population. The projections make it possible to study the mid- and long-term implications of present-day demographic rates; these analyses can be particularly instructive when they examine the changing regional proportions of the total population resulting from initial interregional variations in fertility, mortality, and migration patterns.

As shown in Table 16, annual population growth rates are above zero for all the 13 regions, both in the observed data and in the projections. By 2002 the initial rates will have declined markedly, but the order of regions will have changed little, except for an upward shift of Region 10 (the area of highest fertility) from joint eleventh position to fourth place. On the other hand, the heavy out-migration from the East-Central region and low fertility levels coupled, in the case of Łódź, with negligible net in-migration will have caused population growth rates to decline in these two regions to 0.0014 by the year 2002. Other cases of a faster-than-average decline in growth rates are those of the Northeast, Northwest, East, and West regions: these are all areas of lower-to-medium fertility and net out-migration whose population was mainly expanding in 1977 because of the effects of age composition on birth rates.

The evolution of the mean age shows a growing uniformity in the age structure of the various regions. Differences between the highest and the lowest mean age drop from 6.14 years in 1977 to 5.98 years in 2002; although they grow again at stability to 6.15 years, this increase is mainly attributable to the "deviant" behavior of Region 10 (Southeast). The latter area constitutes the only region for which the mean age is more-or-less constant throughout the projection period, despite the corresponding increase in the national mean age by 2.55 years between 1975 and 2002, and the additional increase of 1.10 years between 2002 and stability. The high fertility in Region 10 again appears to more than counterbalance its considerable net migration losses to other regions. Another interesting feature is the evolution of the mean age for the capital-voivodship of Warsaw. Although its population is progressively aging over time, the deviation from the national mean actually declines (from 3.04 years in 1977 to 2.34 years in 2002, although rising again slightly to 2.73 years by stability). Here, variations in the age of migrants supply a plausible explanation of the

*Note that Tables 16A and 16B are based not on the observed 1977 data but on alternative migration scenarios; this is discussed at some length in Section 3.6.

**The stable equivalent of the observed population is defined (Willekens and Rogers 1978, p. 68) as the total population which, if distributed as the stable population, would increase at the same rate and lead toward the same population as would, in the long run, the observed population under projection.

trend observed; as seen from Table 14, the region of Warsaw is characterized by a mean age of 36.92 years for out-migrants compared with a mean value of 24.07 years for in-migrants.

In terms of changing regional shares, the 13 regions can be aggregated into five groups. The first group consists of Regions 3 (Gdańsk), 4 (Katowice), and 5(Cracow). These are areas with net in-migration and moderate fertility levels; their shares of the total population expand both up until 2002 and afterwards. The second type is represented by Regions 7 (Northeast), 8 (Northwest), we (West-Central), and 13 (West), which more or less maintain their respective shares until the year 2002, but experience a relative loss of population thereafter. The regions in question are characterized by balanced or negative migration flows and relatively high birth rates (largely related to the age composition of the local population) but only moderate underlying fertility levels. The third case is one of continuous decline of regional share, as exemplified by Regions 2 (Łódź), 6 (East-Central), and 11 (East). The first of these has a low fertility level and low-to-medium net migration gains, while the latter two are regions with relatively high net migration losses. The fourth group is composed of Regions 1 and 9, which have remarkably stable regional shares. Region 1 (Warsaw) represents a situation when net migration gains, as of 1977, are sufficiently large to support moderate mid-term expansion, but later this factor will be outweighed by the low fertility level and age-composition effects, restricting any further growth. Region 9 (South) will maintain its share until 2002 and afterwards due to the assumed continuation of its moderate fertility level and well-balanced migration patterns. Finally, the fifth type of change is one shown only by Region 10 (Southeast). This region will experience a stable growth path until 2002 but subsequently a very pronounced long-term expansion will occur; this indicates that the region's high fertility level will eventually become dominant over the out-migration trends observed in 1977.

From the standpoints of planning and social policy, the relative sizes of the major age groups, especially those of categories most heavily contributing to the labor force, are important factors. Table 16 shows no major divergences between the total regional population shares (all ages) and the shares for the 20–55 age group. The data do support the hypothesis that, for areas of net in-migration and low fertility levels, the shares of the labor-force age groups should be higher than the corresponding total values; the reverse situation is observed for those regions with net migration losses and high birth rates.

As regards the overall age composition, the structure of the stable population (Figure 12) shows the disappearance of the gaps present in the 1977 age pyramid, including those caused by the Second World War (in the 30–35 and 55–60 age groups) as well as the secondary fluctuations in the number of births. The patterns for the South and West-Central regions closely resemble the national age structure; this fits in with the observed characteristics of these regions, namely their moderate natural population increase and balanced migration patterns. The out-migration regions of Southeast, East, Northeast, and

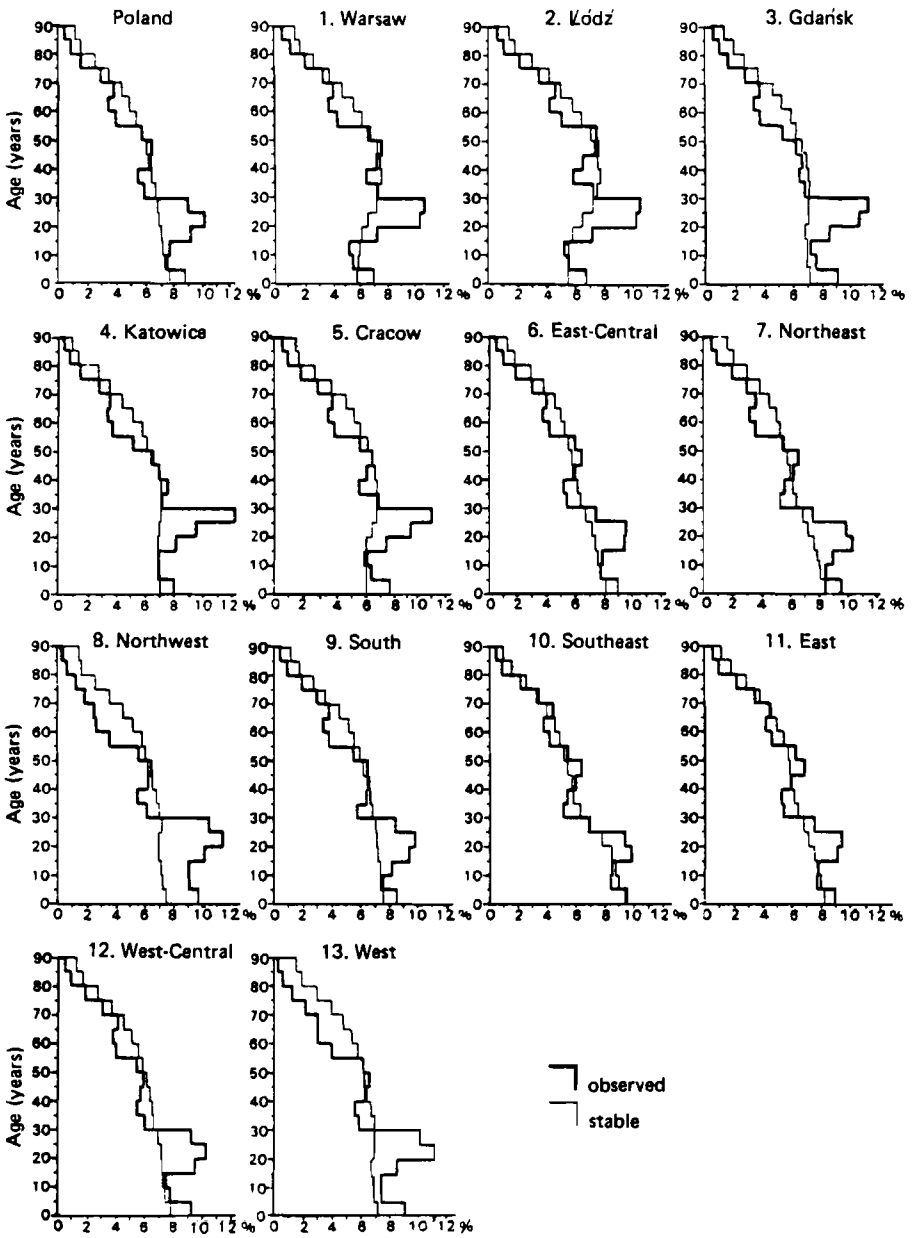


FIGURE 12 Age structures of the observed (1977) and stable populations of Poland, by region.

East-Central show higher proportions of children (16–18% of the total population being in the 0–10 age group) than do the other regions. Age profiles for four other regions, namely Northwest, West, Gdańsk, and Katowice, while generally resembling the national age composition at stability, are characterized by a slight concavity in the 10–25 age group. The urban regions of Warsaw, Łódź, and Cracow, on the other hand, have their age profiles for the stable population distinctly expanded in the 30–40 age group (showing the magnitude of in-migration), as compared with younger age groups, in particular the 0–10 category whose share is 30–50% smaller than the corresponding figure for the total national population.

3.6 Testing Alternative Migration Patterns

It is interesting to compare the projections described in the last section with demographic forecasts of Poland's changing interregional population patterns arrived at by physical planners at the national level. Bearing in mind that the model's projections disregard external (international) migration and make no provisions for including the already-established downward trend in fertility patterns, they seem not at all unrealistic, at least in the medium term (until 2002). In other words, it seems fairly valid to assume, at least in the basic version of the multiregional analysis, that the internal migration and mortality patterns observed in the late 1970s can be extended with some confidence into the near future. However, it is also possible to introduce alternative scenarios into the model, and two such attempts are discussed below.

It may be anticipated that declining fertility levels, as well as increasing movement toward service-sector rather than manufacturing occupations, will result in a reduction in migration to the main industrial regions as early as the 1980s. However, this may not be true for all the regions. In particular, the southeastern part of Poland (mainly Region 10) is considered by planners as a major potential out-migration area until at least 1990. It is likely that the region will grow at a much slower rate than the one identified in Table 16, and that the difference will be due to a drop in fertility accompanied by sustained out-migration. It is interesting to know what modification to the initial data set would be necessary to bring the projected future rate of population growth for the region to a level corresponding to, or lower than, the national rate.

An attempt was made to introduce some of the main assumptions of Polish physical planners into the basic data set. Since it is more realistic to treat migration, rather than the other demographic processes, as a policy variable, the fertility and mortality rates were kept constant during the simulation runs of the multiregional model, while the migration flows were rearranged in various ways. In "Simulation A" all flows were reduced to 50% of their 1977 values, except for the out-migration from the Southeast region which was maintained at its 1977 level. "Simulation B" was intended to study the effects of implementing major economic-investment programs in a single region. The East

(Region 11) was selected due to its development potential as a new coal-producing and manufacturing area. In Simulation B out-migration from Region 11 was reduced so as to equal in-migration, with all other flows held at their 1977 levels.

Based on the assumptions of Simulations A and B, new tables of expectation of life (Tables 10A and 10B, respectively) were drawn up corresponding to that for the observed 1977 data (Table 10). On comparing Tables 10 and 10A it can be seen that Simulation A results in a considerable increase in the fraction of life span to be spent in the region of birth, for example in Region 1 (Warsaw) from 60.24 to 65.37 years and in Region 6 (East-Central) from 44.64 to 55.23 years. The lowest allocation for the region of birth is now observed for Region 10 (51.71 years under Simulation A compared to 51.95 years in the 1977 data) rather than Region 6 which held this position in 1977. Turning now to Simulation B and comparing Tables 10 and 10B, it can be seen that the fraction of life span spent by natives of Region 11 (East) in their region of birth increases only slightly to 48.96 years under Simulation B as compared with 48.82 years in the original observed data; this increase is much smaller than under Simulation A, for which the corresponding value is 57.80 years. The increase in Region 11's own share under Simulation A takes place mostly at the expense of its contributions to Region 1 (Warsaw) and Region 4 (Katowice) which constitute the main migration destinations for its native population.

These comparisons demonstrate the importance of migration in the evolution of interregional population patterns. Model projections for the year 2002 and for the stable equivalent population, based on the same rearranged migration flows, are equally instructive in this respect (see Tables 16, 16A, and 16B). The reduced-migration Simulation A gives a projection for the total national population in 2002 which is some 38,000 higher than that based on the observed data, showing the potential effects of less people moving from high-fertility to low-fertility areas. Secondly, regional growth rates are considerably redistributed. Under the assumptions of Simulation A, by the year 2002 six of the net out-migration regions would be growing at a rate higher than the national rate (as compared with only three such regions in the observed-data projection). Also, Simulation A exposes the dependence of Warsaw, and even more strongly Łódź, on population inflow from other regions. In fact, under Simulation A the rate of growth for Łódź would drop below unity by 2002.

In Simulation B the corresponding shifts are also quite marked: Region 11 (East), due to its relatively high rate of natural increase, would grow faster than the country as a whole in the long run. Under Simulation B its labor force would be some 110,000 greater by the year 2002 compared with the basic model projection. Region 1 (Warsaw), the main recipient of migration flows from the East region, would, however, only be affected slightly by such a rearrangement of migration flows.

As a consequence of changing rate-of-growth patterns under the two simulations, the ways of grouping the regions based on their regional shares of the population would be different from those described in the last section. According to Simulation A, regions with their population shares expanding significantly both until 2002 and between 2002 and attainment of stability would be Gdańsk and the Northeast; Gdańsk appears to be gaining in all the projections due to a unique combination of relatively high fertility, considerable in-migration, and dependence on several areas rather than a single region as a source of in-migrants. An interesting feature of the pattern resulting from Simulation A is that for a number of regions, including Warsaw, Katowice, Cracow, East-Central, Northwest, South, Southeast, and West-Central, the respective regional proportions would be quite stable over time. Only two regions would experience a pronounced population decline after the year 2002, and the urbanized areas (except for Łódź) would generally hold their own both until the turn of the century and thereafter.

Simulation B, as expected, gives distributions of regional shares which are much more similar to those based on the observed-data version, except for Region 11 (East), which experiences a slight decrease of its share by 2002 and then a subsequent increase until stability is attained.

As described above, the introduction of simulated migration patterns has made it possible to see what sort of changes in the migration flow matrix would be necessary, keeping other parameters constant, to bring about either "required" or "most likely" future regional population distributions. In this sense Simulation A, with its well-balanced growth patterns, seems particularly interesting. Further tests of this kind would seem useful, especially if they incorporate more-comprehensive scenarios, including simultaneous or stepwise alterations of more than one demographic component at a time. In future work, it is also intended to subdivide the population into urban and rural components, as well as to disaggregate the bulk data by levels of skill.

The experiments with the multiregional population model carried out for Poland to date have revealed certain interesting basic types of interdependence between spatial fertility and mobility patterns, and have also illustrated a number of general characteristics of the model's behavior. The more-important points may be listed as follows.

(1) In the case of the major urbanized areas, the migration gains observed during the 1970s are sufficiently large to result in further population concentration in these areas over the next few decades. Although this process is very slow, a considerable decrease of general mobility levels, or a major reorientation of migration flows would be required to reverse the established direction of the process.

(2) As far as the remaining regions are concerned, variations in fertility rates are seen as the main differentiating factor in the long run. In this respect observed patterns of natural increase (and, to a lesser extent,

of migrations) are strongly dependent upon age-composition differentials between the populations of the various regions, and may be relatively short-lived.

(3) No conceivable magnitude of change in the rates of migration would significantly affect the population size and rate of growth of the net out-migration regions over the next two or three decades. However, such changes could have very pronounced effects in the long term.

(4) The spatial patterns of population growth observed at present are therefore not likely to produce any major interregional redistribution effects before the turn of the century. None of the regions seem likely to gain or lose population rapidly in the medium term. However, this conclusion might be altered if the disaggregation into rural and urban populations suggested earlier were introduced.

(5) The model results are not very sensitive to changes in the initial population patterns. Thus, the general trends outlined hold true largely irrespective of the particular system of territorial division adopted or the year of observation chosen. In fact, the multiregional life table and population-projection characteristics based on the 9-, 11-, and 13-region divisions, and on the fertility, mortality, and migration data for 1973, 1974, 1975, and 1977, produce largely similar pictures of spatial population growth in Poland. When a change in an initial condition (such as an alternative migration scenario) is introduced, however, the impact of the change may be traced throughout the multiregional system in a way which leads to straightforward interpretation.

4 POPULATION DISTRIBUTION POLICIES

When considering a country such as Poland that has had a system of socialist planned economy for over thirty years, it is necessary to discuss the goals, means, and instruments of population distribution policies before describing the policies themselves. The formulation of goals is a complex procedure which may be traced through both the official formal documents and policy declarations and the political and scientific discussions which precede the final statements of aims, as well as in the commentaries which usually follow their approval and acceptance. Out of such diverse sources, two specific goals emerge which are independent from one another and sometimes even opposite and mutually contradictory. These goals are: first, the radical diminution of any economic and social disparities which exist between various societal layers, social groups, and, in spatial terms, between regions; and second, the acceleration of national economic growth as a tool for social development (construction of the socialist community) and improving the living conditions of the entire population. Recently a third goal was added, namely, the preservation of the natural environment.

Within the planning system various supplementary instruments play specific roles in population distribution policies. These include investment planning, wage

and price policies, and the assignment of priorities for the implementation of plans in specific industries, enterprises, services, and/or regions and places. As far as the population distribution is concerned, investment planning clearly belongs to the category of indirect policies; the remaining instruments must be considered as implicit because they clearly exert a strong influence on population distribution but this influence is only rarely explicitly acknowledged during their formulation and application.

4.1 Direct Policies

During the last thirty-five years, a number of specific actions and policies concerned directly with population distribution have been undertaken in Poland. Some of these direct policies superseded one another and others were applied concurrently.

4.1.1 RESETTLEMENT OF RECOVERED TERRITORIES (INCORPORATED IN 1945)

This was a truly courageous policy begun in 1945 and continued until the early fifties under very great postwar economic and social difficulties. Transport systems were hastily but poorly repaired from war damage and for a long time did not function satisfactorily. Both agriculture and industry were in ruins. In these extremely difficult circumstances, it was necessary to move some 5–6 million people. The movements included the repatriation of the Polish population from the eastern areas ceded to the USSR and of the German population to eastern and western Germany, as well as transfers of people out of the overpopulated rural areas in the central and southeastern regions. The majority of these moves were geographically latitudinal with south–north migration being limited to the local scale. One major obstacle was the basically rural character of migrants moving to highly urbanized (by Polish standards) areas. In spite of numerous mistakes made and major difficulties encountered, the policy was very successful, thanks to the Polish people's great courage, deep patriotism, and will to build a better future. However, the policy resulted in the country becoming divided into two demographic areas with distinctly different age structures. This division still persists although spatially the dividing lines in the south of the country have disappeared due to the superimposed influence of the strongly industrialized Upper-Silesian coal basin and industrial district, as well as to the large percentage share of the indigenous population. The dividing lines in central Poland, between the Poznań region and the neighboring area in the territories incorporated in 1945, are also slowly disappearing with time.

After 1956 a smaller wave of repatriate Poles arrived from the Soviet Union, and there was some movement of Germans, mainly from Silesia to the FRG. The last, even smaller movement occurred during the seventies after the normalization of relations between Poland and the FRG.

4.1.2 POSTWAR RECONSTRUCTION

This policy was an absolute necessity. For several years immediately after the war, the repair and reconstruction of buildings and facilities which were partially intact was on the whole economically and even technically more feasible than completely new construction. This was, therefore, a period of intense effort in areas where the population was already concentrated. However, some additional efforts were made to adapt various urban centers to their changed positions and functions (especially as communications and transport centers). The influx of rural population to the cities (in general the urban population had suffered greater losses than the rural) brought about an equalization of age and sex structures between the urban and rural areas. In fact, for about ten years the rates of natural increase in the urban areas were higher than in the countryside. Later this somewhat unusual situation was reversed and the traditional patterns once again prevailed.

Special policies and a completely separate organizational system were adopted in the case of Warsaw. The capital city was seriously damaged in September 1939 and afterwards was almost completely destroyed, first in one district as a result of the Ghetto Uprising in April 1943 and later in the whole central area as a result of the national uprising in August and September 1944. Warsaw resumed its functions as the nation's capital immediately after its liberation in 1945. This was an act of deliberate policy adopted by the government in spite of several serious proposals to move the capital, at least temporarily, to some other large city; although this policy was perhaps rather unusual in conception and strongly opposed by some, it turned out to be very successful.

4.1.3 ANTI- AND PRONATALIST POLICIES

At the end of the fifties it was realized that difficulties in raising the general standard of living might be partly due to the high rates of natural increase. Therefore an effort to diminish the pressure of population on the size and structure of investment programs was made by introducing certain antinatalist measures. These involved organization of family planning education and counselling, as well as legal provision for abortions. Within about ten years the rates of birth and natural increase fell so far that demographers began to express alarm because they felt that the size and balanced structure of the future population were endangered. Demands for a change toward actively pronatalist policies were expressed, and several such measures were adopted during the 1970s. These include the provision of extended leave for working mothers (both paid and unpaid leave, of up to three years in the case of the latter) with a guarantee of the right to return to the same or a comparable job, and the extension of kindergarten systems. It seems very likely that the recent increase in fertility rates can be attributed, at least in part, to these policies, although it is still difficult to assess how stable such effects will be. Some demographers feel that the

introduction of more-widespread birth control (and later of the return to more pronatalist policies) may have had some short-term influence on population dynamics but that such measures are unlikely to change underlying general trends.

4.1.4 LIMITING THE GROWTH OF THE LARGEST URBAN CENTERS

Around 1965, new policies aimed at limiting the growth of the largest urban and industrial agglomerations were introduced as a temporary measure to cope with the continuing lack of sufficient resources (not only financial but also material, e.g., construction facilities and building materials) for a more-ambitious housing program. These policies consisted of restricting the free access of migrants to these agglomerations through administrative measures such as the introduction of residence permits. A quota system for employment levels was adopted for the existing and the few new enterprises that were permitted to operate in these areas. Employment in government offices was severely reduced and a relocation of some less-important industries, especially those needing new buildings and equipment, was undertaken. These latter measures were also connected with a general program for the modernization of old factories throughout the country.

The policies were successful in the short term because they diminished somewhat the pressure on the large urban centers, but at the same time they created certain unforeseen side effects. These included the greatly reduced effectiveness of investment in these urban centers due to eventual underemployment in factories and rapidly developing distortions in the local age structures of the population (namely, a strong and accelerated aging of the urban population). The policies also proved to be a mixed blessing for the smaller urban centers to which the relocated enterprises were transferred but where the local infrastructure had not been sufficiently well prepared to cope with their arrival.

4.1.5 RECRUITMENT OF WORKERS FOR THE INDUSTRIAL REGIONS

During the seventies a system for the coordination of supply and demand in employment was established and special offices were organized at local and regional levels. Recruitment was mainly organized for those areas unable to find sufficient workers within their own region. Active recruitment was carried out in areas with significant manpower reserves, regardless of geographical distances involved. However, more recently greater attention has been paid to the needs of agriculture and to the effects on the age and sex structures of the population in the areas of recruitment. The recruitment is organized on the basis of a quota system, worked out with the help of the central-government labor offices and agreed between the various regional authorities. Young workers recruited move first to hostels at their future place of work where they undergo a period of initial training. Mining and building use this type of recruitment and training more extensively than do other sectors.

4.2 Indirect Policies

Over the last thirty years Poland's official policies of accelerated industrialization have formed the bases of all other policies. The preparation of plans for the industrialization of Poland was begun as early as 1946, but the plans really came into effect in 1950 with the adoption of the Six-Year Plan for Economic Development covering the years 1950–1955. To understand the policies on which the plan was based, it is necessary to remember that the proposed industrialization was to be carried out in a situation where there was a large quantity of unemployed or underemployed manpower in the rural areas and an evident and serious lack of capital and equipment in the fields of technical, economic, and social infrastructure. Under these conditions the decision was made to promote industrial investment at the expense of improving living conditions and by delaying the urbanization of the country. In terms of effects on population distribution, this led to the growth of large-scale commuting to work and favored the development of the existing industrial areas and urban centers. As a result, the implementation of the plan introduced a number of changes into the previous, very ambitious program for the more-even distribution of industry throughout the whole country, and in some cases delayed the intended investment and efforts in the less-developed regions. In addition, the priorities given to various specific industries during the successive stages of industrialization also influenced both industrial location policies and changes in the population distribution. Initially efforts were concentrated on metallurgy, machinery, and chemicals, that is, on the industries producing the basic productive tools and raw materials. The increasing scale of investment and size in heavy industry created a strong demand for increased production of mineral resources. Investments in this direction involved the exploitation of new deposits and the development of new mining areas, including the bituminous coal basin of Rybnik, the sulfur deposits at the confluence of the Wisła and San rivers, the copper mines in Lower Silesia, and the soft coal basins of Turoszów in Lower Silesia and Konin in central Poland. These areas (with the sole exception of Konin) are all in southern Poland, and their development extended and considerably enlarged the most important industrial region of Poland – the Upper-Silesian coal basin.

Next on the list was the energy program, with stress being laid on the provision of fuels (coal, gas, and others) and electric-power generating systems. In the following phase attention turned to the growth of industries producing consumer goods, and in particular consumer durables such as cars, refrigerators, washing machines, and furniture. This phase was prompted by increasing demands from the population for an improvement of living conditions, linked to an increase in the number and levels of skills of industrial workers and to feedback relationships between the degree of qualification and efficiency of workers and the standard of living which they expect.

One of the later elements in the changing structure of industrial investment was the development of industries manufacturing machinery (particularly

tractors) and fertilizers for agriculture, based on the demand and necessity for producing more and better food. The development of the electronics industry, in cooperation with other member countries of the Council for Mutual Economic Assistance, is another fairly recent aspect of industrial investment. A subsequent program aimed at the substitution of goods produced in Poland for imported goods; this program included the provision of such plants as steel mills and car factories, among others.

As a result of the postwar industrialization policy, industries and industrial populations formerly concentrated in the Upper-Silesian industrial district and a few of the largest urban agglomerations have spread into the south along the foothills of the mountains (Sudety and Carpathian mountain ranges) and have started to fill up the central and north-central regions toward the seaports of Gdańsk and Gdynia on the Baltic coast in the north.

The policy of forced industrialization itself turned out to be successful although it continually created additional, often unforeseen problems and difficulties, mainly in the form of greatly delaying investments in transport, housing, and other services. Some of these problems led to the formulation of additional policies and policy modifications introduced from 1956 onward.

Out of all the indirect policies that can be applied, the planning and coordination of investment (which is of course closely integrated with the overall industrialization program) seems to be the most important and the most effective. There is no doubt that investments form the foundation of new departures, new functions, and new activities. The rates of development and, in particular, of growth are directly dependent on the nature, magnitude, and timing of investment. Although investment policies may be, and sometimes are, formulated and decided without sufficient attention being paid to their implications for population dynamics, they are normally used as a tool for starting or activating the development and growth of particular regions. The new location patterns arising from investment decisions influence the related movements of labor and finally the distribution of population throughout the entire country. Recent sociological studies (Szczepański 1976) have indicated that there are several successive stages in the impact of investments when these are concentrated in a new area or region. First, the preparatory survey and plans are made, causing an "invasion" of the area by technical experts and workers, often preceded or followed by scientists and research workers. Next, the construction phase begins: skilled workers are brought into the area from outside, although unskilled workers are usually recruited locally. During this phase the new activities and organization can have a large impact on the area and often seriously transform local life-styles, social ties, and behavior patterns. In the next phase, the new investment projects begin to function in their productive or other final role; the building workers either form a fully-fledged community of their own or are superseded by the more complex community which grows up around the

investment projects. The process of integration with the local community now begins although there may still be large migratory movements of qualified staff from outside the region and of less-skilled workers from the surrounding rural areas. A large urban center, either completely new or based on an existing center but radically enlarged, grows up. The final stage is reached when these processes of integration mature and come to a new equilibrium.

Similar processes do of course occur when new and large investment programs are implemented within an already-developed area, but in such cases the transformation is not so easy to observe nor is it so clear-cut.

Somewhat different problems and phenomena, although probably with several analogous characteristics, may be encountered during efforts to maintain and modernize large existing enterprises, especially when these are relatively concentrated in urban centers. Conversely, if new investment in such enterprises is lacking for any extended period, negative phenomena are observed: with no modernization and only poor maintenance relatively rapid deterioration and decay can occur and this is followed by population outflow from the area concerned. This negative aspect, however, seems almost never to be consciously considered during the formulation of maintenance policies.

In Poland, investment planning is generally used for the furthering of regional development and as a guide toward changes intended. However, one element can sometimes seriously distort the intended and planned results: the modernization and extension of existing plants, when not properly controlled, often create unforeseen side effects that distort planned transformations and spatial patterns.

4.3 Implicit Policies

Within the centrally-planned economies there are three major branches of general economic policy which can lead to very profound changes in regional-development and population-distribution patterns but only very rarely are they considered when decisions are made. These branches are wage policies, price policies, and the specific priorities in a given period (for example, concentrating major efforts on mining). These factors can exert an extremely powerful influence on current trends of population concentration. On the other hand, the application throughout the whole country of a uniform standard for specific industries or services, without attention to local variations in the effectiveness and efficiency of labor, can lead to a reverse effect: a relative dispersal and reduction of concentration around the best-equipped industrial and urban areas.

The price policies – generally speaking – are intended to preserve a balance between the supply of and demand for consumer goods. As a result, an extremely complicated system of prices has developed, with state subsidies to some producers (for example, producers of grain). On the other hand, the wholesale prices of basic raw materials serve as a tool to regulate the internal economics of producing enterprises. Since raw-material prices are normally uniform for all

factories and producers they smooth out the economic differences which would ordinarily arise because of the varying distances between individual processing plants and their main suppliers of basic raw materials. In one sense the influence of transport costs on the location of industries is thus strongly diminished, greatly reducing the advantages of concentration around the largest mining and industrial centers. This may partly explain the relative success of the socialist economies in controlling the growth of the largest urban agglomerations.

The priorities given at certain periods to various branches of the economy, specific industries, or very often to particularly important industrial plants, are largely responsible for the advantages or disadvantages which characterize the development of specific regions or areas. The assignment of priorities is a two-edged sword. On the one hand, they permit the rapid implementation of an approved goal or program, or the speedy development of specific areas or regions. However, on the other hand, by concentrating all efforts on one, usually isolated goal with insufficient regard for the complex internal workings of a region, they can create various disturbances and difficulties in the harmonious and balanced growth of the region. Special coordinating bodies at high levels of government are usually established to resolve the various conflicts. In such cases much can depend on the intelligence, imagination, and energy of the person leading the coordinating team. Finally, research-monitoring bodies are sometimes organized to observe the progress of major projects and to give advance warning and advice on any problems (foreseen or otherwise) that may arise.

5 CONCLUSION

The multiregional model has been used in this case study of Poland to describe present-day demographic and migration trends and to examine their implications for future policy. Emphasis was placed on the analysis of the observed patterns of interregional migration and the probable future consequences of these patterns, particularly the effects of existing age distributions among migrants on the future spatial structure of population in Poland.

Examination of the urban–rural and metropolitan–nonmetropolitan components of the multiregional population system has shown the long-term limits to the process of spatial population concentration which prevails at present. Analyses of simulated migration patterns, varying in both their volumes and their directions, have concentrated on the possible implications of several policies for the future distribution of the population.

Future work should include the testing of more-comprehensive migration and fertility scenarios to examine the sensitivity of the system to changes in individual demographic components. Finally, and on a more conceptual note, it is suggested that the analysis would benefit by extending its scope to include spatial variations in the skills and educational levels of the population, and the impact of these factors on observed and projected migration patterns.

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APPENDIXES

Appendix A

OBSERVED POPULATION AND NUMBERS OF BIRTHS, DEATHS, AND MIGRANTS, DISAGGREGATED BY AGE AND REGION: 1977

APPENDIX A

Region: Warsaw

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	152,388	0	837	1,006	3,316
5-9	121,511	0	40	372	1,436
10-14	117,222	0	36	202	1,136
15-19	156,354	2,048	112	615	3,057
20-24	223,451	14,249	216	2,084	7,899
25-29	230,682	11,783	231	1,754	5,762
30-34	159,186	4,305	214	644	2,237
35-39	140,538	1,366	326	361	1,286
40-44	157,348	331	657	252	1,021
45-49	168,257	31	999	837	258
50-54	146,324	0	1,323	628	183
55-59	96,020	0	1,171	444	150
60-64	84,116	0	1,527	502	177
65-69	95,354	0	2,641	596	229
70-74	73,875	0	3,152	589	224
75-79	46,885	0	3,039	380	199
80-84	23,597	0	2,580	207	115
85+	14,053	0	2,357	110	79
Total	2,207,161	34,113	21,458	11,583	28,764

Region: Łódź

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	73,816	0	517	738	889
5-9	60,283	0	17	253	491
10-14	57,343	0	20	134	338
15-19	78,658	1,200	64	410	1,340
20-24	111,643	7,332	101	1,562	3,231
25-29	114,236	5,462	114	1,315	1,977
30-34	78,376	1,864	136	504	750
35-39	63,804	442	155	220	410
40-44	70,914	120	277	199	391
45-49	81,843	11	484	365	167
50-54	81,518	0	732	289	139
55-59	54,751	0	755	222	111
60-64	45,319	0	866	228	132
65-69	49,238	0	1,538	255	145
70-74	37,237	0	1,719	253	151
75-79	22,816	0	1,702	218	132
80-84	11,241	0	1,349	125	75
85+	6,096	0	1,159	55	30
Total	1,099,132	16,431	11,705	7,345	10,899

Region: Gdańsk

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	117,944	0	630	1,164	1,851
5-9	97,431	0	46	404	788
10-14	94,489	0	32	222	483
15-19	110,792	1,902	82	681	1,413
20-24	135,227	10,647	150	2,260	4,293
25-29	142,745	8,516	161	1,728	3,326
30-34	87,506	2,824	110	628	1,168
35-39	80,301	1,324	160	326	651
40-44	81,396	341	274	261	470
45-49	78,029	32	403	353	212
50-54	66,162	0	559	311	150
55-59	46,225	0	571	224	123
60-64	41,073	0	728	235	150
65-69	44,199	0	1,235	340	188
70-74	31,985	0	1,408	278	181
75-79	18,512	0	1,333	194	119
80-84	8,608	0	942	88	67
85+	5,065	0	860	103	56
Total	1,287,689	25,586	9,684	9,800	15,689

Region: Katowice

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	283,294	0	1,697	1,988	6,637
5-9	244,034	0	97	920	2,353
10-14	244,711	0	73	535	1,131
15-19	287,036	5,566	203	1,427	3,177
20-24	345,742	27,000	344	4,080	11,535
25-29	366,908	18,303	438	3,224	9,704
30-34	258,552	6,371	415	1,333	3,068
35-39	271,005	2,689	674	860	1,516
40-44	247,739	631	942	682	1,043
45-49	232,165	53	1,457	739	549
50-54	187,944	0	1,723	558	408
55-59	132,215	0	1,743	474	344
60-64	122,281	0	2,589	474	382
65-69	131,325	0	4,230	560	456
70-74	98,338	0	4,985	429	359
75-79	61,354	0	4,935	307	272
80-84	28,522	0	3,622	167	138
85+	14,096	0	2,827	78	88
Total	3,557,261	60,613	32,994	18,835	43,160

APPENDIX A *Continued.*

Region: Cracow

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	92,135	0	444	1,128	1,348
5-9	77,277	0	25	358	471
10-14	74,571	0	16	178	311
15-19	89,618	1,318	41	552	1,222
20-24	111,144	8,178	115	2,094	3,443
25-29	125,285	6,250	99	1,776	2,590
30-34	81,926	2,609	129	596	928
35-39	67,421	896	130	339	460
40-44	73,612	303	255	234	365
45-49	76,472	28	452	282	234
50-54	67,453	0	529	218	164
55-59	47,909	0	504	188	130
60-64	42,543	0	749	205	163
65-69	45,127	0	1,318	249	192
70-74	33,739	0	1,559	234	182
75-79	21,327	0	1,653	167	144
80-84	10,561	0	1,201	80	68
85+	5,744	0	899	47	40
Total	1,143,864	19,582	10,118	8,925	12,455

Region: East Central

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	262,281	0	1,694	4,520	3,008
5-9	229,388	0	91	1,781	1,204
10-14	230,244	0	101	1,078	750
15-19	277,834	4,588	233	3,675	1,921
20-24	284,687	25,802	374	9,947	5,577
25-29	220,503	17,094	387	7,086	4,100
30-34	157,920	6,123	311	2,448	1,546
35-39	152,609	2,416	409	1,350	983
40-44	171,884	761	635	983	692
45-49	185,839	69	1,039	545	733
50-54	173,314	0	1,364	425	586
55-59	134,495	0	1,491	410	528
60-64	121,028	0	2,119	441	572
65-69	128,340	0	3,669	491	739
70-74	95,080	0	4,439	467	662
75-79	60,989	0	4,807	350	506
80-84	29,551	0	3,737	185	279
85+	14,851	0	2,910	98	135
Total	2,930,837	56,853	29,810	36,280	24,521

Region: Northeast

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	227,285	0	1,313	3,042	1,914
5-9	202,461	0	92	1,331	812
10-14	212,661	0	78	911	485
15-19	247,866	3,658	198	2,870	1,510
20-24	235,464	20,985	336	7,061	4,124
25-29	185,220	14,861	297	4,640	2,860
30-34	123,778	5,311	250	1,493	973
35-39	134,463	2,679	363	954	645
40-44	146,219	859	543	726	449
45-49	154,644	72	854	334	608
50-54	129,934	0	930	231	429
55-59	86,600	0	881	201	381
60-64	74,594	0	1,190	225	366
65-69	87,025	0	2,312	322	458
70-74	69,429	0	2,860	285	402
75-79	46,364	0	3,181	238	284
80-84	22,092	0	2,490	101	128
85+	12,398	0	2,210	75	89
Total	2,398,497	48,425	20,378	25,040	16,917

Region: Northwest

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	205,865	0	1,362	3,543	3,279
5-9	168,248	0	89	1,698	1,423
10-14	167,411	0	62	1,088	792
15-19	213,403	4,346	149	2,668	2,285
20-24	238,286	20,642	291	6,592	6,824
25-29	218,665	13,584	326	4,806	4,781
30-34	128,480	3,870	212	1,947	1,730
35-39	119,064	1,614	329	1,211	905
40-44	132,271	543	533	1,049	674
45-49	135,571	33	872	536	758
50-54	118,470	0	1,013	367	598
55-59	73,796	0	937	300	408
60-64	55,382	0	1,138	318	431
65-69	52,665	0	1,595	439	515
70-74	37,938	0	1,890	392	441
75-79	24,275	0	1,822	296	341
80-84	11,022	0	1,260	176	162
85+	6,002	0	961	99	92
Total	2,106,814	44,632	14,841	27,525	26,439

APPENDIX A *Continued.*

Region: South

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	217,550	0	1,225	3,124	2,923
5-9	195,579	0	69	1,204	1,164
10-14	205,656	0	64	666	656
15-19	236,481	3,882	167	1,676	1,592
20-24	243,867	20,576	285	5,528	5,356
25-29	210,578	13,804	277	4,499	4,523
30-34	142,523	5,060	237	1,657	1,504
35-39	158,184	2,560	396	896	878
40-44	165,848	760	587	704	702
45-49	163,178	61	884	715	482
50-54	136,812	0	1,092	525	385
55-59	94,856	0	1,059	352	281
60-64	86,047	0	1,588	369	318
65-69	96,109	0	2,778	457	376
70-74	73,730	0	3,527	336	353
75-79	46,883	0	3,464	254	244
80-84	21,320	0	2,607	131	148
85+	10,521	0	1,994	99	70
Total	2,505,722	46,703	22,300	23,192	21,955

Region: Southeast

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	402,651	0	2,427	4,252	2,805
5-9	354,578	0	145	1,346	1,070
10-14	359,575	0	114	793	662
15-19	410,299	5,508	260	3,272	1,939
20-24	392,898	35,390	431	10,030	5,482
25-29	294,288	26,945	470	7,246	3,885
30-34	213,643	11,097	437	2,276	1,453
35-39	225,129	5,718	498	1,120	909
40-44	253,239	2,062	833	828	714
45-49	262,950	215	1,280	579	627
50-54	238,978	0	1,762	475	517
55-59	172,409	0	1,861	367	438
60-64	157,356	0	2,721	484	519
65-69	182,212	0	5,139	563	680
70-74	140,544	0	6,844	527	589
75-79	89,755	0	6,946	382	452
80-84	38,623	0	4,802	194	238
85+	19,358	0	3,536	92	113
Total	4,208,485	86,935	40,506	34,826	23,092

Region: East

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	221,973	0	1,259	2,781	1,753
5-9	191,048	0	80	973	722
10-14	193,250	0	54	619	468
15-19	226,550	3,281	1,630	2,201	1,329
20-24	230,438	21,039	306	6,806	3,677
25-29	187,020	14,838	307	4,651	2,580
30-34	133,358	5,538	251	2,444	932
35-39	132,489	2,460	312	753	585
40-44	146,316	706	500	531	488
45-49	165,505	74	829	370	504
50-54	152,711	0	1,060	312	414
55-59	114,782	0	1,189	218	317
60-64	100,334	0	1,667	293	351
65-69	110,439	0	2,961	350	492
70-74	83,544	0	3,820	289	437
75-79	51,830	0	3,946	238	296
80-84	25,333	0	3,263	147	157
85+	12,908	0	2,430	67	97
Total	2,479,828	47,936	25,864	23,043	15,599

Region: West-Central

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	432,323	0	2,566	4,425	3,405
5-9	367,974	0	143	1,840	1,426
10-14	361,136	0	101	1,052	872
15-19	437,398	7,331	294	2,522	2,377
20-24	478,419	40,373	520	8,704	6,782
25-29	431,779	29,711	557	6,582	5,071
30-34	281,145	10,214	438	2,324	1,880
35-39	255,622	4,100	595	1,207	1,049
40-44	270,676	1,285	909	966	882
45-49	277,465	110	1,444	735	716
50-54	252,264	3	2,027	549	497
55-59	188,312	0	2,247	481	418
60-64	176,768	0	3,231	539	485
65-69	195,952	0	5,590	668	636
70-74	147,804	0	6,952	544	564
75-79	90,792	0	6,658	374	413
80-84	43,753	0	5,271	215	243
85+	22,980	0	4,440	118	147
Total	4,712,562	95,127	43,983	33,845	27,863

APPENDIX A *Continued.*

Region: West

Age group	Population	Births	Deaths	Migrations Out	Migrations In
0-4	370,490	0	2,308	4,999	3,582
5-9	299,243	0	137	2,292	1,412
10-14	299,754	0	117	1,455	849
15-19	392,500	7,358	302	3,139	2,546
20-24	452,688	37,640	575	9,084	7,609
25-29	417,301	25,326	580	7,387	5,535
30-34	239,977	7,455	426	2,748	1,873
35-39	226,053	2,932	588	1,726	1,046
40-44	255,611	857	976	1,340	864
45-49	269,646	76	1,573	651	1,193
50-54	252,369	0	2,183	503	921
55-59	162,214	0	2,052	375	627
60-64	122,623	0	2,347	411	678
65-69	121,103	0	3,550	604	788
70-74	86,376	0	4,143	543	621
75-79	53,648	0	3,875	505	501
80-84	24,617	0	2,817	259	257
85+	13,511	0	2,234	150	155
Total	4,059,724	81,644	30,783	38,171	31,057

Appendix B

AGE-SPECIFIC FERTILITY, MORTALITY, AND MIGRATION RATES, DISAGGREGATED BY REGION: 1977

APPENDIX B

Fertility rates

AGE	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.–CENT.	N.–EAST	N.–WEST	SOUTH	S.–EAST	EAST	W.–CENT.	WEST
0	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
5	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
10	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
15	0.013008	0.015254	0.017167	0.019391	0.014707	0.016513	0.014758	0.020365	0.016416	0.013424	0.014482	0.016760	0.018746
20	0.063768	0.065674	0.078734	0.078093	0.073580	0.070639	0.089122	0.086627	0.084374	0.070074	0.091300	0.084188	0.083148
25	0.051079	0.047813	0.059659	0.049884	0.049886	0.077523	0.080234	0.062122	0.065553	0.071560	0.079339	0.068811	0.066090
30	0.027044	0.023783	0.032272	0.024641	0.031846	0.038773	0.042907	0.036121	0.035503	0.051942	0.041527	0.036330	0.031065
35	0.009720	0.006927	0.016488	0.009922	0.013290	0.015831	0.019924	0.013556	0.016184	0.025390	0.018568	0.016039	0.012970
40	0.002104	0.001492	0.004189	0.002547	0.004116	0.004427	0.005875	0.004105	0.004583	0.008143	0.004825	0.004747	0.003353
45	0.000184	0.000134	0.000410	0.000228	0.000366	0.000371	0.000466	0.000243	0.000374	0.000818	0.000447	0.000396	0.000282
50	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000012	0.000000
55	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
60	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
65	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
70	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
75	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
80	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
85	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
GROSS	0.834984	0.806398	1.044600	0.923537	0.938956	1.220350	1.266428	1.085702	1.114928	1.406797	1.252444	1.137423	1.051274
CRUDE	0.015456	0.014049	0.019870	0.017039	0.017119	0.019398	0.020190	0.021185	0.018639	0.020657	0.019330	0.019761	0.020111
M.AGE	26.4092	25.8590	26.6956	25.7720	26.4811	26.7122	27.1763	26.1913	26.7356	27.7402	26.0942	26.7412	26.2527

Mortality rates

AGE	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.–CENT.	N.–EAST	N.–WEST	SOUTH	S.–EAST	EAST	W.–CENT.	WEST
0	0.005493	0.007004	0.005342	0.005990	0.004819	0.006450	0.005777	0.006614	0.005631	0.006028	0.005672	0.005035	0.004230
5	0.000329	0.000282	0.000472	0.000397	0.000324	0.000397	0.000454	0.000520	0.000353	0.000400	0.000419	0.000389	0.000458
10	0.000307	0.000349	0.000339	0.000298	0.000215	0.000430	0.000367	0.000370	0.000311	0.000317	0.000279	0.000280	0.000300
15	0.000716	0.000814	0.000740	0.000707	0.000457	0.000830	0.000799	0.000698	0.000706	0.000634	0.000705	0.000472	0.000769
20	0.000967	0.000905	0.001109	0.000995	0.001035	0.001314	0.001427	0.001221	0.001149	0.001097	0.001328	0.001087	0.001270
25	0.001001	0.000998	0.001128	0.001194	0.000790	0.001755	0.001603	0.001491	0.001315	0.001597	0.001642	0.001290	0.001390
30	0.001344	0.001735	0.001257	0.001605	0.001575	0.001960	0.002070	0.001650	0.001663	0.002045	0.001882	0.001558	0.001775
35	0.002320	0.002420	0.001993	0.002487	0.001928	0.002680	0.002700	0.002763	0.002503	0.002212	0.002355	0.002328	0.002601
40	0.004175	0.003904	0.003366	0.003802	0.003464	0.003694	0.003714	0.004030	0.003539	0.003280	0.003417	0.003358	0.003818
45	0.005937	0.005914	0.005165	0.006276	0.005911	0.005591	0.005522	0.006432	0.005417	0.004868	0.005009	0.005204	0.005834
50	0.009042	0.008880	0.008449	0.009168	0.007842	0.007870	0.007157	0.008951	0.007982	0.007373	0.006941	0.008035	0.008650
55	0.012195	0.013790	0.012353	0.013183	0.010520	0.011086	0.010173	0.012697	0.011164	0.010794	0.010359	0.011032	0.012650
60	0.018154	0.019100	0.017725	0.021173	0.017606	0.017508	0.015953	0.020548	0.018455	0.017292	0.016615	0.018778	0.019140
65	0.027697	0.031234	0.027942	0.032210	0.029206	0.028588	0.026567	0.030284	0.028905	0.028203	0.024811	0.028527	0.029314
70	0.042667	0.046164	0.044021	0.050693	0.046208	0.046687	0.041193	0.049818	0.047837	0.048696	0.045724	0.047035	0.047965
75	0.064818	0.074597	0.072007	0.080435	0.077307	0.078817	0.068609	0.075057	0.073886	0.077388	0.076134	0.073332	0.077230
80	0.100336	0.120007	0.109493	0.126990	0.113720	0.126450	0.112710	0.114317	0.122280	0.124330	0.128804	0.120472	0.114433
85	0.167722	0.190125	0.169793	0.200553	0.156511	0.195944	0.178255	0.160113	0.189526	0.182663	0.188255	0.193211	0.165347
GROSS	2.371101	2.641710	2.413159	2.790780	2.398191	2.690494	2.425005	2.485034	2.613210	2.596186	2.644204	2.614625	2.471320
CRUDE	0.009722	0.010640	0.007520	0.009275	0.008845	0.010171	0.008496	0.007044	0.009900	0.009625	0.010430	0.009133	0.007583
M.AGE	77.3158	77.4340	77.4895	77.6936	77.4408	77.7741	77.6294	76.8654	77.8401	77.7734	77.2948	77.8083	76.9610

Out-migration rates

Migration from Warsaw to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.004602	0.000000	0.000164	0.000283	0.000315	0.000119	0.002172	0.000032	0.000302	0.000203	0.000322	0.001148	0.000354	0.000348
5	0.003061	0.000000	0.000082	0.000115	0.000148	0.000082	0.001042	0.000395	0.000181	0.000115	0.000165	0.000428	0.000165	0.000127
10	0.001723	0.000000	0.000051	0.000034	0.000060	0.000043	0.000700	0.000705	0.000128	0.000051	0.000077	0.000179	0.000085	0.000111
15	0.003933	0.000000	0.000109	0.000083	0.000128	0.000070	0.001330	0.000652	0.000185	0.000051	0.000184	0.000767	0.000217	0.000153
20	0.000326	0.000000	0.000219	0.000336	0.000349	0.000107	0.002721	0.001714	0.000501	0.000224	0.000465	0.001821	0.000430	0.000430
25	0.007604	0.000000	0.000238	0.000347	0.000347	0.000147	0.001985	0.001183	0.000499	0.000238	0.000429	0.001188	0.000529	0.000477
30	0.004046	0.000000	0.000004	0.000214	0.000163	0.000075	0.001212	0.000628	0.000346	0.000063	0.000226	0.000547	0.000251	0.000226
35	0.002569	0.000000	0.000093	0.000078	0.000114	0.000057	0.000833	0.000349	0.000178	0.000064	0.000093	0.000306	0.000249	0.000157
40	0.001402	0.000000	0.000057	0.000032	0.000038	0.000083	0.000483	0.000203	0.000089	0.000032	0.000005	0.000248	0.000140	0.000102
45	0.004075	0.000000	0.000166	0.000053	0.000202	0.000110	0.001094	0.000884	0.000297	0.000125	0.000178	0.001076	0.000386	0.000392
50	0.004292	0.000000	0.000103	0.000062	0.000116	0.000080	0.000964	0.000765	0.000314	0.000080	0.000178	0.000916	0.000342	0.000355
55	0.004624	0.000000	0.000083	0.000073	0.000135	0.000042	0.001385	0.000958	0.000208	0.000052	0.000167	0.001104	0.000147	0.000250
60	0.005068	0.000000	0.000155	0.000119	0.000226	0.000095	0.001644	0.001011	0.000238	0.000155	0.000309	0.001213	0.000404	0.000380
65	0.004250	0.000000	0.000210	0.000157	0.000178	0.000031	0.001609	0.001049	0.000273	0.000136	0.000430	0.001269	0.000409	0.000400
70	0.007973	0.000000	0.000244	0.000122	0.000217	0.000108	0.002146	0.001110	0.000311	0.000135	0.000514	0.001492	0.000853	0.000501
75	0.008105	0.000000	0.000256	0.000171	0.000299	0.000128	0.001877	0.001130	0.000384	0.000277	0.000533	0.001920	0.000619	0.000517
80	0.008772	0.000000	0.000339	0.000254	0.000339	0.000217	0.002627	0.001017	0.000339	0.000170	0.000339	0.001653	0.000848	0.000636
85	0.007828	0.000000	0.000285	0.000071	0.000071	0.000285	0.001921	0.000783	0.000427	0.000427	0.000356	0.001423	0.000925	0.000854
GROSS	0.496259	0.000000	0.014739	0.012718	0.017226	0.009450	0.139475	0.074851	0.026000	0.013038	0.025305	0.094486	0.034861	0.032102
CRUDE	0.005248	0.000000	0.000147	0.000156	0.000198	0.000093	0.001495	0.000845	0.000294	0.000130	0.000267	0.000968	0.000345	0.000311
M.AGE	50.1939	0.0000	53.0270	42.8085	45.3243	51.8914	48.0509	48.3814	47.5276	51.9218	50.7457	52.4728	56.1603	54.8967

Migration from Łódź to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.000098	0.000062	0.000000	0.000244	0.000813	0.000095	0.004511	0.000434	0.000704	0.000339	0.000217	0.000230	0.000718	0.000732
5	0.004197	0.000597	0.000000	0.000033	0.000282	0.000033	0.001702	0.000135	0.000216	0.000100	0.000100	0.000415	0.000365	0.000365
10	0.002337	0.000279	0.000000	0.000017	0.000209	0.000017	0.001151	0.000087	0.000087	0.000017	0.000087	0.000070	0.000087	0.000227
15	0.005212	0.000381	0.000000	0.000076	0.000191	0.000038	0.002581	0.000153	0.000292	0.000153	0.000267	0.000140	0.000547	0.000394
20	0.013091	0.001075	0.000000	0.000448	0.000833	0.000161	0.006413	0.000528	0.000949	0.000448	0.000699	0.000358	0.001308	0.000770
25	0.011511	0.001156	0.000000	0.000490	0.000727	0.000114	0.004377	0.000394	0.000814	0.000385	0.000359	0.000524	0.001217	0.001154
30	0.006431	0.000817	0.000000	0.000281	0.000383	0.000107	0.002577	0.000140	0.000357	0.000191	0.000230	0.000191	0.000625	0.000534
35	0.003448	0.000298	0.000000	0.000094	0.000188	0.000016	0.001426	0.000157	0.000235	0.000204	0.000125	0.000094	0.000298	0.000313
40	0.002806	0.000350	0.000000	0.000099	0.000226	0.000042	0.000874	0.000169	0.000226	0.000014	0.000071	0.000113	0.000226	0.000197
45	0.004460	0.000195	0.000000	0.000073	0.000122	0.000000	0.002028	0.000110	0.000318	0.000110	0.000171	0.000171	0.000586	0.000574
50	0.003545	0.000061	0.000000	0.000074	0.000086	0.000012	0.001681	0.000159	0.000294	0.000098	0.000172	0.000098	0.000429	0.000380
55	0.004055	0.000091	0.000000	0.000000	0.000137	0.000073	0.002100	0.000144	0.000183	0.000164	0.000183	0.000055	0.000658	0.000365
60	0.005031	0.000199	0.000000	0.000022	0.000022	0.000022	0.002846	0.000154	0.000265	0.000132	0.000199	0.000199	0.000485	0.000485
65	0.005179	0.000185	0.000000	0.000102	0.000061	0.000000	0.002965	0.000061	0.000142	0.000122	0.000305	0.000305	0.000548	0.000384
70	0.006794	0.000295	0.000000	0.000027	0.000134	0.000027	0.003921	0.000295	0.000161	0.000054	0.000269	0.000215	0.001074	0.000322
75	0.009555	0.000307	0.000000	0.000088	0.000351	0.000088	0.005128	0.000175	0.000570	0.000175	0.000307	0.000482	0.000964	0.000920
80	0.011120	0.000712	0.000000	0.000178	0.000000	0.000000	0.006227	0.000767	0.000445	0.000534	0.000801	0.000356	0.000712	0.000890
85	0.000022	0.000328	0.000000	0.000000	0.000164	0.000000	0.004429	0.000492	0.000492	0.000000	0.000820	0.000492	0.001312	0.000492
GROSS	0.593460	0.042428	0.000000	0.011726	0.024137	0.004203	0.285144	0.020277	0.033754	0.016200	0.026892	0.020126	0.061047	0.047527
CRUDE	0.006683	0.000545	0.000000	0.000174	0.000341	0.000050	0.003033	0.000232	0.000416	0.000197	0.000265	0.000201	0.000674	0.000545
M.AGE	46.3457	36.4380	0.0000	54.8846	50.4663	34.2577	48.9177	44.8888	42.3867	42.4240	53.8240	52.4601	49.2439	45.9472

APPENDIX B *Continued.*

Migration from Gdańsk to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.009869	0.000331	0.000187	0.000000	0.000305	0.000034	0.000466	0.000865	0.004333	0.000153	0.000407	0.000271	0.002001	0.000517
5	0.004147	0.000236	0.000103	0.000000	0.000205	0.000031	0.000113	0.000328	0.001817	0.000062	0.000133	0.000174	0.000770	0.000174
10	0.002349	0.000127	0.000000	0.000000	0.000127	0.000011	0.000085	0.000217	0.000963	0.000000	0.000095	0.000116	0.000434	0.000180
15	0.004147	0.000190	0.000090	0.000000	0.000208	0.000045	0.000289	0.000812	0.002419	0.000063	0.000171	0.000153	0.001363	0.000367
20	0.016713	0.000769	0.000281	0.000000	0.000555	0.000170	0.000902	0.001886	0.005790	0.000281	0.000658	0.000821	0.003527	0.001077
25	0.012106	0.000715	0.000301	0.000000	0.000504	0.000105	0.000680	0.001268	0.004154	0.000210	0.000455	0.000483	0.002536	0.000694
30	0.007177	0.000640	0.000263	0.000000	0.000331	0.000057	0.000207	0.000469	0.002343	0.000183	0.000297	0.000763	0.001406	0.000434
35	0.004060	0.000461	0.000075	0.000000	0.000224	0.000087	0.000224	0.000361	0.001258	0.000062	0.000224	0.000125	0.000697	0.000311
40	0.003207	0.000283	0.000061	0.000000	0.000098	0.000040	0.000135	0.000356	0.001020	0.000074	0.000147	0.000160	0.000663	0.000160
45	0.004524	0.000115	0.000077	0.000000	0.000154	0.000038	0.000192	0.000525	0.001461	0.000115	0.000179	0.000282	0.000987	0.000397
50	0.004701	0.000181	0.000171	0.000000	0.000181	0.000060	0.000333	0.000574	0.001542	0.000076	0.000136	0.000272	0.000831	0.000397
55	0.004846	0.000151	0.000043	0.000000	0.000087	0.000065	0.000389	0.000471	0.001385	0.000043	0.000216	0.000346	0.001040	0.000389
60	0.005722	0.000243	0.000073	0.000000	0.000292	0.000000	0.000536	0.001023	0.001169	0.000097	0.000365	0.000463	0.001169	0.000292
65	0.007692	0.000249	0.000181	0.000000	0.000271	0.000023	0.000430	0.001086	0.001357	0.000090	0.000475	0.000769	0.002149	0.000611
70	0.008692	0.000344	0.000156	0.000000	0.000031	0.000125	0.001032	0.001000	0.001782	0.000156	0.000719	0.001032	0.002001	0.000313
75	0.010480	0.000448	0.000534	0.000000	0.000216	0.000216	0.001296	0.001513	0.001675	0.000162	0.000756	0.000486	0.002809	0.000648
80	0.010223	0.000340	0.000116	0.000000	0.000116	0.000000	0.001510	0.001510	0.001278	0.000465	0.000929	0.000581	0.002440	0.000929
85	0.020336	0.002567	0.000000	0.000000	0.000197	0.000197	0.001579	0.002367	0.002567	0.000592	0.000790	0.001777	0.005133	0.001974
GROSS	0.714936	0.042990	0.010662	0.000000	0.020521	0.006570	0.052442	0.088075	0.191552	0.014424	0.035780	0.042873	0.159882	0.049165
CRUDE	0.007611	0.000397	0.000145	0.000000	0.000273	0.000068	0.000430	0.000847	0.002572	0.000128	0.000324	0.000363	0.001601	0.000471
M.AGE	49.6942	55.6841	39.3366	0.0000	39.3463	52.1418	50.1571	54.1235	38.4646	56.7270	55.5326	58.5662	52.2878	53.9355

Migration from Katowice to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.007017	0.000187	0.000056	0.000176	0.000000	0.000527	0.000392	0.000385	0.000385	0.001998	0.001107	0.000378	0.000554	0.000787
5	0.003770	0.000127	0.000049	0.000086	0.000000	0.000234	0.000234	0.000160	0.000156	0.001168	0.000619	0.000234	0.000311	0.000390
10	0.002186	0.000094	0.000020	0.000053	0.000000	0.000130	0.000114	0.000090	0.000074	0.000687	0.000400	0.000131	0.000143	0.000241
15	0.004972	0.000118	0.000031	0.000094	0.000000	0.000338	0.000317	0.000300	0.000254	0.001282	0.000979	0.000282	0.000355	0.000620
20	0.011801	0.000390	0.000136	0.000298	0.000000	0.000986	0.000602	0.000448	0.000685	0.003355	0.001915	0.000616	0.000804	0.001365
25	0.008787	0.000354	0.000106	0.000213	0.000000	0.000761	0.000458	0.000340	0.000420	0.002701	0.001306	0.000422	0.000638	0.001057
30	0.005156	0.000302	0.000073	0.000166	0.000000	0.000491	0.000255	0.000174	0.000255	0.001481	0.000777	0.000217	0.000387	0.000574
35	0.003173	0.000096	0.000030	0.000066	0.000000	0.000221	0.000184	0.000096	0.000203	0.001055	0.000520	0.000188	0.000170	0.000343
40	0.002753	0.000120	0.000028	0.000057	0.000000	0.000230	0.000149	0.000105	0.000105	0.000940	0.000379	0.000137	0.000190	0.000295
45	0.003183	0.000065	0.000047	0.000026	0.000000	0.000276	0.000211	0.000146	0.000151	0.000818	0.000449	0.000215	0.000228	0.000530
50	0.002969	0.000032	0.000016	0.000011	0.000000	0.000197	0.000197	0.000122	0.000154	0.000724	0.000521	0.000245	0.000223	0.000532
55	0.003585	0.000045	0.000030	0.000030	0.000000	0.000227	0.000250	0.000182	0.000122	0.000817	0.000711	0.000280	0.000318	0.000567
60	0.003876	0.000008	0.000057	0.000041	0.000000	0.000245	0.000311	0.000213	0.000147	0.000818	0.000957	0.000204	0.000294	0.000581
65	0.004264	0.000030	0.000015	0.000008	0.000000	0.000250	0.000388	0.000250	0.000175	0.001013	0.000947	0.000267	0.000373	0.000510
70	0.004383	0.000061	0.000051	0.000041	0.000000	0.000275	0.000183	0.000224	0.000173	0.001068	0.001119	0.000234	0.000356	0.000580
75	0.005004	0.000081	0.000016	0.000049	0.000000	0.000522	0.000277	0.000293	0.000147	0.001337	0.001272	0.000261	0.000310	0.000480
80	0.005855	0.000175	0.000140	0.000070	0.000000	0.000421	0.000210	0.000140	0.000210	0.001683	0.001613	0.000421	0.000386	0.000386
85	0.005533	0.000071	0.000000	0.000142	0.000000	0.000497	0.000213	0.000213	0.000071	0.001419	0.001064	0.000355	0.000284	0.001206
GROSS	0.441236	0.011837	0.004522	0.008131	0.000000	0.034184	0.024727	0.020480	0.019468	0.121855	0.083679	0.025429	0.031620	0.055294
CRUDE	0.005295	0.000166	0.000056	0.000111	0.000000	0.000414	0.000300	0.000251	0.000262	0.001508	0.000910	0.000291	0.000384	0.000647
M.AGE	42.8963	35.2366	41.9568	35.5269	0.0000	43.2114	42.1544	41.5211	37.4910	41.4366	47.0421	44.7382	41.9407	44.8881

Migration from Cracow to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.012243	0.000417	0.000033	0.000141	0.004341	0.000000	0.000228	0.000739	0.000152	0.001357	0.004428	0.000282	0.000250	0.000380
5	0.004633	0.000362	0.000026	0.000052	0.001721	0.000000	0.000091	0.000065	0.000104	0.000401	0.001436	0.000129	0.000139	0.000207
10	0.002387	0.000228	0.000027	0.000027	0.000939	0.000000	0.000013	0.000027	0.000013	0.000201	0.000724	0.000040	0.000154	0.000094
15	0.006159	0.000123	0.000022	0.000045	0.001459	0.000000	0.000145	0.000156	0.000134	0.000614	0.002700	0.000056	0.000279	0.000446
20	0.018840	0.000567	0.000099	0.000225	0.005407	0.000000	0.000459	0.000394	0.000450	0.002015	0.007261	0.000448	0.000441	0.000873
25	0.014176	0.000623	0.000080	0.000216	0.004613	0.000000	0.000239	0.000770	0.000319	0.001668	0.004701	0.000351	0.000407	0.000678
30	0.007275	0.000537	0.000110	0.000159	0.002307	0.000000	0.000146	0.000134	0.000110	0.000769	0.002258	0.000110	0.000232	0.000403
35	0.005028	0.000504	0.000015	0.000059	0.001483	0.000000	0.000104	0.000104	0.000089	0.000460	0.001646	0.000119	0.000163	0.000282
40	0.003179	0.000317	0.000041	0.000014	0.000879	0.000000	0.000041	0.000082	0.000095	0.000317	0.001073	0.000041	0.000054	0.000285
45	0.003688	0.000144	0.000105	0.000039	0.000405	0.000000	0.000105	0.000105	0.000105	0.000484	0.001465	0.000131	0.000157	0.000445
50	0.003232	0.000083	0.000000	0.000030	0.000400	0.000000	0.000119	0.000074	0.000074	0.000474	0.001260	0.000104	0.000252	0.000356
55	0.003924	0.000042	0.000021	0.000063	0.000626	0.000000	0.000042	0.000063	0.000063	0.000459	0.001879	0.000083	0.000125	0.000439
60	0.004819	0.000094	0.000047	0.000071	0.000799	0.000000	0.000145	0.000071	0.000094	0.000635	0.002280	0.000094	0.000094	0.000376
65	0.005518	0.000080	0.000022	0.000022	0.000820	0.000000	0.000155	0.000080	0.000177	0.000731	0.002526	0.000199	0.000133	0.000554
70	0.006936	0.000119	0.000030	0.000030	0.001067	0.000000	0.000237	0.000089	0.000089	0.000771	0.003557	0.000326	0.000207	0.000415
75	0.007830	0.000281	0.000047	0.000000	0.001219	0.000000	0.000328	0.000094	0.000141	0.000891	0.003704	0.000234	0.000234	0.000750
80	0.007575	0.000284	0.000000	0.000095	0.001231	0.000000	0.000095	0.000284	0.000284	0.000947	0.002935	0.000189	0.000379	0.000852
85	0.008182	0.000348	0.000000	0.000000	0.001741	0.000000	0.000000	0.000000	0.000522	0.001219	0.003482	0.000000	0.000174	0.000696
GROSS	0.628118	0.027590	0.003615	0.006424	0.156947	0.000000	0.013555	0.011743	0.013072	0.072040	0.246583	0.015217	0.018372	0.042758
CRUDE	0.007803	0.000330	0.000050	0.000094	0.002190	0.000000	0.000169	0.000155	0.000163	0.000865	0.002915	0.000201	0.000219	0.000457
M.AGE	41.9626	38.4503	38.2683	34.0027	34.4809	0.0000	42.8038	39.3690	49.8615	44.3764	44.4112	40.4481	45.1716	50.5320

Migration from E.-Cent. to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.017233	0.004000	0.002063	0.000454	0.007101	0.000130	0.000000	0.001323	0.000763	0.001144	0.001498	0.000053	0.001639	0.001167
5	0.007764	0.001800	0.001269	0.000240	0.000815	0.000044	0.000000	0.000454	0.000349	0.000471	0.000628	0.000458	0.000589	0.000449
10	0.004682	0.001320	0.000830	0.000157	0.000339	0.000048	0.000000	0.000321	0.000230	0.000248	0.000300	0.000313	0.000317	0.000265
15	0.013227	0.003166	0.003009	0.000324	0.001026	0.000101	0.000000	0.001001	0.000716	0.000569	0.001047	0.000511	0.001008	0.000752
20	0.034040	0.007545	0.006832	0.001166	0.003460	0.000327	0.000000	0.002490	0.001813	0.001953	0.002604	0.001563	0.002923	0.002174
25	0.032136	0.006907	0.005057	0.001184	0.003959	0.000376	0.000000	0.002091	0.001684	0.002018	0.002494	0.001596	0.002735	0.002054
30	0.015502	0.003882	0.002584	0.000589	0.001735	0.000177	0.000000	0.000937	0.000716	0.001108	0.001209	0.000709	0.000982	0.000874
35	0.008846	0.002077	0.001481	0.000334	0.000701	0.000092	0.000000	0.000727	0.000478	0.000498	0.000727	0.000564	0.000609	0.000557
40	0.005719	0.001460	0.001100	0.000169	0.000483	0.000047	0.000000	0.000797	0.000209	0.000273	0.000419	0.000436	0.000489	0.000337
45	0.002933	0.000323	0.000248	0.000043	0.000151	0.000027	0.000000	0.000425	0.000274	0.000113	0.000248	0.000183	0.000355	0.000543
50	0.002452	0.000283	0.000369	0.000052	0.000104	0.000020	0.000000	0.000387	0.000179	0.000104	0.000231	0.000121	0.000225	0.000360
55	0.003048	0.000305	0.000498	0.000082	0.000141	0.000030	0.000000	0.000400	0.000253	0.000104	0.000305	0.000141	0.000364	0.000416
60	0.003644	0.000327	0.000545	0.000099	0.000174	0.000074	0.000000	0.000438	0.000331	0.000182	0.000322	0.000182	0.000496	0.000479
65	0.003826	0.000420	0.000460	0.000156	0.000171	0.000030	0.000000	0.000421	0.000421	0.000210	0.000327	0.000257	0.000397	0.000538
70	0.004912	0.000568	0.000726	0.000179	0.000242	0.000053	0.000000	0.000578	0.000452	0.000231	0.000494	0.000231	0.000431	0.000724
75	0.005739	0.000885	0.000967	0.000115	0.000295	0.000049	0.000000	0.000623	0.000295	0.000377	0.000762	0.000525	0.000721	0.000721
80	0.006260	0.000844	0.001252	0.000169	0.000271	0.000102	0.000000	0.000440	0.000575	0.000372	0.000575	0.000338	0.000440	0.000880
85	0.006599	0.000673	0.000808	0.000337	0.000269	0.000067	0.000000	0.000741	0.000741	0.000269	0.000741	0.000471	0.000539	0.000943
GROSS	0.197309	0.043044	0.030479	0.029211	0.082183	0.009050	0.000000	0.071514	0.053933	0.050814	0.073187	0.046455	0.075309	0.071228
CRUDE	0.012379	0.002690	0.002123	0.003095	0.001223	0.000110	0.000000	0.000940	0.000667	0.000709	0.000987	0.000622	0.001039	0.000864
M.AGE	33.7317	28.7169	37.6689	34.1646	27.5570	36.2269	0.0000	34.6864	40.4155	31.6332	34.5070	34.2937	33.8199	41.4719

APPENDIX B *Continued.*

Migration from N.-East to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.013386	0.002466	0.000092	0.001043	0.001648	0.000180	0.001945	0.000000	0.001725	0.000568	0.000442	0.001087	0.001049	0.000880
5	0.006574	0.001267	0.000049	0.000696	0.000854	0.000054	0.000914	0.000000	0.001131	0.000257	0.000247	0.000504	0.000548	0.000370
10	0.004284	0.001082	0.000094	0.000249	0.000334	0.000047	0.000672	0.000000	0.000578	0.000099	0.000155	0.000334	0.000409	0.000235
15	0.011579	0.002994	0.000218	0.001186	0.000916	0.000141	0.001343	0.000000	0.001561	0.000307	0.000327	0.000474	0.001073	0.000830
20	0.029888	0.006930	0.000573	0.003105	0.003385	0.000352	0.003300	0.000000	0.003831	0.000973	0.000940	0.002073	0.002395	0.002102
25	0.025051	0.005340	0.000297	0.002656	0.003148	0.000378	0.002780	0.000000	0.003023	0.001042	0.000907	0.001776	0.002003	0.001701
30	0.012062	0.002448	0.000162	0.001204	0.001196	0.000234	0.001519	0.000000	0.001745	0.000396	0.000428	0.000961	0.000978	0.000792
35	0.007095	0.001606	0.000141	0.000707	0.000692	0.000097	0.000848	0.000000	0.000803	0.000231	0.000297	0.000439	0.000744	0.000491
40	0.004065	0.001081	0.000123	0.000431	0.000394	0.000075	0.000595	0.000000	0.000622	0.000150	0.000250	0.000445	0.000445	0.000404
45	0.002160	0.000226	0.000013	0.000123	0.000116	0.000010	0.000278	0.000000	0.000537	0.000010	0.000110	0.000129	0.000246	0.000347
50	0.001778	0.000185	0.000015	0.000108	0.000046	0.000008	0.000254	0.000000	0.000546	0.000046	0.000046	0.000100	0.000185	0.000230
55	0.002321	0.000139	0.000023	0.000150	0.000139	0.000012	0.000312	0.000000	0.000485	0.000115	0.000081	0.000219	0.000381	0.000264
60	0.003016	0.000362	0.000040	0.000241	0.000214	0.000027	0.000389	0.000000	0.000550	0.000121	0.000107	0.000282	0.000429	0.000255
65	0.003700	0.000414	0.000057	0.000207	0.000207	0.000011	0.000575	0.000000	0.000678	0.000115	0.000126	0.000483	0.000301	0.000437
70	0.004105	0.000360	0.000101	0.000245	0.000216	0.000072	0.000547	0.000000	0.000763	0.000207	0.000216	0.000475	0.000446	0.000461
75	0.005133	0.000561	0.000173	0.000518	0.000173	0.000022	0.000841	0.000000	0.000820	0.000022	0.000216	0.000518	0.000582	0.000690
80	0.004572	0.000770	0.000045	0.000588	0.000317	0.000000	0.000860	0.000000	0.000588	0.000091	0.000091	0.000407	0.000543	0.000272
85	0.006049	0.001120	0.000081	0.000565	0.000242	0.000000	0.001210	0.000000	0.000645	0.000000	0.000081	0.000484	0.000645	0.000968
GROSS	0.730080	0.147849	0.011591	0.069092	0.069887	0.008627	0.095909	0.000000	0.103164	0.023758	0.025785	0.056944	0.067644	0.058717
CRUDE	0.010440	0.002231	0.000161	0.000983	0.001078	0.000132	0.001283	0.000000	0.001424	0.000357	0.000366	0.000765	0.000905	0.000755
M.AGE	33.4284	29.8148	35.8923	33.4336	27.8083	27.7927	35.9776	0.0000	34.7033	28.9233	32.7270	35.9339	36.5277	39.2958

Migration from N.-West to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.017210	0.000470	0.000233	0.003128	0.001350	0.000134	0.001035	0.001038	0.000000	0.000486	0.000797	0.000792	0.003755	0.002890
5	0.010092	0.000458	0.000256	0.001688	0.000642	0.000172	0.000767	0.001088	0.000000	0.000321	0.000547	0.000681	0.002205	0.001468
10	0.006499	0.000299	0.000108	0.001171	0.000376	0.000064	0.000448	0.000854	0.000000	0.000197	0.000346	0.000775	0.001404	0.000954
15	0.012502	0.000515	0.000319	0.002305	0.000825	0.000117	0.000773	0.001743	0.000000	0.000351	0.000553	0.000423	0.002423	0.001959
20	0.027644	0.001204	0.000586	0.005044	0.002157	0.000285	0.001624	0.003260	0.000000	0.000894	0.001322	0.001213	0.005783	0.004352
25	0.021079	0.001171	0.000590	0.004020	0.001642	0.000238	0.001313	0.002314	0.000000	0.000745	0.000970	0.001070	0.004443	0.003444
30	0.015154	0.001183	0.000428	0.002172	0.001074	0.000224	0.000880	0.001494	0.000000	0.000568	0.000802	0.000778	0.003394	0.002154
35	0.010171	0.000613	0.000151	0.001722	0.000622	0.000134	0.000722	0.001285	0.000000	0.000353	0.000521	0.000554	0.002046	0.001428
40	0.007931	0.000484	0.000219	0.001331	0.000416	0.000151	0.000547	0.000794	0.000000	0.000227	0.000491	0.000370	0.001505	0.001285
45	0.003054	0.000133	0.000089	0.000443	0.000140	0.000052	0.000258	0.000568	0.000000	0.000148	0.000177	0.000258	0.000767	0.000922
50	0.003098	0.000068	0.000025	0.000346	0.000118	0.000008	0.000203	0.000364	0.000000	0.000101	0.000253	0.000262	0.000599	0.000768
55	0.004065	0.000140	0.000054	0.000488	0.000190	0.000041	0.000470	0.000556	0.000000	0.000136	0.000190	0.000339	0.000732	0.000772
60	0.005742	0.000163	0.000072	0.000488	0.000072	0.000072	0.000614	0.000884	0.000000	0.000108	0.000361	0.000578	0.001607	0.000921
65	0.008336	0.000133	0.000076	0.000665	0.000342	0.000095	0.001044	0.001158	0.000000	0.000228	0.000589	0.000711	0.001937	0.001158
70	0.010333	0.000264	0.000132	0.000949	0.000237	0.000053	0.001344	0.001502	0.000000	0.000132	0.000685	0.001133	0.002610	0.001292
75	0.012194	0.000418	0.000288	0.000783	0.000536	0.000089	0.001442	0.001277	0.000000	0.000412	0.001071	0.000947	0.003213	0.001524
80	0.015068	0.000363	0.000272	0.000544	0.000544	0.000181	0.001542	0.001542	0.000000	0.000363	0.001542	0.001433	0.004899	0.002540
85	0.016495	0.000500	0.000167	0.002999	0.000000	0.000000	0.001666	0.001666	0.000000	0.000833	0.000833	0.001833	0.003999	0.001999
GROSS	1.044029	0.044032	0.020120	0.151421	0.056414	0.010527	0.083308	0.120762	0.000000	0.033013	0.066248	0.070259	0.237251	0.159173
CRUDE	0.013065	0.000413	0.000276	0.002208	0.000884	0.000144	0.000865	0.001518	0.000000	0.000412	0.000656	0.000877	0.002742	0.002050
M.AGE	42.1091	37.5445	38.2812	35.3500	31.1859	36.8168	40.0959	41.5885	0.0000	42.5233	47.3638	52.1132	44.8413	40.7064

Migration from South to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.014360	0.000221	0.000170	0.000147	0.007134	0.000837	0.000924	0.000780	0.000280	0.000000	0.001393	0.000427	0.000630	0.001967
5	0.006156	0.000164	0.000076	0.000051	0.002853	0.000414	0.000304	0.000123	0.000164	0.000000	0.000491	0.000174	0.000297	0.001007
10	0.003238	0.000151	0.000015	0.000015	0.001444	0.000253	0.000156	0.000053	0.000088	0.000000	0.000282	0.000092	0.000160	0.000511
15	0.007087	0.000178	0.000076	0.000097	0.002854	0.000596	0.000431	0.000140	0.000190	0.000000	0.000854	0.000254	0.000364	0.001053
20	0.022668	0.000562	0.000361	0.000287	0.009882	0.001583	0.001431	0.000508	0.000709	0.000000	0.002251	0.000562	0.001054	0.003477
25	0.021365	0.000594	0.000237	0.000294	0.009811	0.001567	0.001325	0.000385	0.000622	0.000000	0.001814	0.000408	0.000917	0.003194
30	0.011626	0.000393	0.000140	0.000218	0.004940	0.001095	0.000631	0.000230	0.000344	0.000000	0.001010	0.000267	0.000547	0.001805
35	0.005664	0.000190	0.000070	0.000051	0.002339	0.000480	0.000443	0.000107	0.000139	0.000000	0.000518	0.000228	0.000278	0.000827
40	0.004245	0.000199	0.000042	0.000036	0.001773	0.000287	0.000247	0.000133	0.000103	0.000000	0.000476	0.000121	0.000181	0.000651
45	0.004382	0.000043	0.000055	0.000055	0.001250	0.000221	0.000204	0.000147	0.000184	0.000000	0.000642	0.000221	0.000244	0.000987
50	0.003837	0.000058	0.000029	0.000029	0.001184	0.000210	0.000300	0.000130	0.000139	0.000000	0.000440	0.000219	0.000141	0.000899
55	0.003711	0.000063	0.000032	0.000032	0.001181	0.000211	0.000205	0.000105	0.000074	0.000000	0.000549	0.000200	0.000200	0.000749
60	0.004288	0.000058	0.000035	0.000023	0.001302	0.000200	0.000384	0.000174	0.000163	0.000000	0.000709	0.000256	0.000201	0.000686
65	0.004755	0.000031	0.000042	0.000042	0.001259	0.000281	0.000312	0.000144	0.000156	0.000000	0.000905	0.000250	0.000302	0.001009
70	0.004557	0.000100	0.000048	0.000041	0.001302	0.000203	0.000475	0.000203	0.000109	0.000000	0.000705	0.000203	0.000271	0.000868
75	0.005418	0.000085	0.000107	0.000085	0.001365	0.000384	0.000640	0.000171	0.000235	0.000000	0.000748	0.000192	0.000341	0.001045
80	0.006144	0.000235	0.000047	0.000235	0.001595	0.000235	0.000516	0.000094	0.000141	0.000000	0.000985	0.000281	0.000375	0.001407
85	0.009410	0.000283	0.000095	0.000095	0.002946	0.000570	0.000665	0.000285	0.000380	0.000000	0.001521	0.000380	0.000760	0.001424
GROSS	0.714563	0.018085	0.008079	0.009161	0.282169	0.048187	0.049312	0.017167	0.021090	0.000000	0.081874	0.024472	0.034961	0.117814
CRUDE	0.009256	0.000233	0.000106	0.000112	0.003937	0.000640	0.000600	0.000204	0.000263	0.000000	0.000955	0.000291	0.000441	0.001462
M.AGE	37.8365	37.9493	39.2049	41.0183	35.1110	35.5844	41.3211	42.5078	40.7923	0.0000	43.8125	42.9840	42.1574	40.4605

Migration from S.-East to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.010560	0.000425	0.000055	0.000164	0.003397	0.001848	0.000780	0.000701	0.000348	0.001192	0.000000	0.000795	0.000353	0.001007
5	0.003796	0.000178	0.000039	0.000062	0.001055	0.000578	0.000302	0.000133	0.000169	0.000364	0.000000	0.000338	0.000158	0.000420
10	0.002205	0.000125	0.000039	0.000047	0.000417	0.000370	0.000186	0.000047	0.000114	0.000250	0.000000	0.000217	0.000097	0.000295
15	0.007975	0.000353	0.000151	0.000141	0.001757	0.001767	0.000485	0.000132	0.000322	0.000787	0.000000	0.000894	0.000239	0.000946
20	0.025528	0.001290	0.000441	0.000527	0.006564	0.005095	0.001743	0.000560	0.001100	0.002527	0.000000	0.002171	0.001021	0.002469
25	0.024622	0.001254	0.000285	0.000578	0.007200	0.004812	0.001648	0.000530	0.000972	0.002436	0.000000	0.001730	0.000934	0.002247
30	0.010653	0.000520	0.000136	0.000304	0.002982	0.001975	0.000810	0.000234	0.000421	0.000880	0.000000	0.000838	0.000449	0.001095
35	0.004975	0.000306	0.000093	0.000111	0.001168	0.000864	0.000551	0.000119	0.000200	0.000400	0.000000	0.000453	0.000200	0.000511
40	0.003270	0.000184	0.000075	0.000059	0.000652	0.000557	0.000276	0.000071	0.000130	0.000379	0.000000	0.000304	0.000146	0.000415
45	0.002202	0.000074	0.000030	0.000053	0.000274	0.000267	0.000171	0.000120	0.000152	0.000205	0.000000	0.000160	0.000193	0.000555
50	0.001988	0.000021	0.000050	0.000038	0.000255	0.000227	0.000180	0.000050	0.000176	0.000197	0.000000	0.000163	0.000096	0.000540
55	0.002129	0.000052	0.000029	0.000029	0.000394	0.000278	0.000215	0.000090	0.000203	0.000168	0.000000	0.000197	0.000064	0.000400
60	0.003076	0.000080	0.000032	0.000089	0.000566	0.000464	0.000172	0.000095	0.000235	0.000299	0.000000	0.000261	0.000108	0.000667
65	0.003090	0.000137	0.000016	0.000099	0.000560	0.000472	0.000351	0.000110	0.000154	0.000214	0.000000	0.000269	0.000137	0.000571
70	0.003750	0.000114	0.000044	0.000100	0.000605	0.000624	0.000342	0.000121	0.000249	0.000342	0.000000	0.000306	0.000171	0.000761
75	0.004256	0.000189	0.000111	0.000067	0.000501	0.000668	0.000345	0.000156	0.000323	0.000401	0.000000	0.000379	0.000089	0.001025
80	0.006023	0.000078	0.000181	0.000129	0.000621	0.000751	0.000518	0.000155	0.000285	0.000492	0.000000	0.000466	0.000414	0.000932
85	0.004753	0.000310	0.000052	0.000155	0.000827	0.000775	0.000362	0.000207	0.000155	0.000362	0.000000	0.000723	0.000103	0.000723
GROSS	0.610247	0.028515	0.009503	0.013761	0.148977	0.111935	0.047181	0.015727	0.028535	0.059523	0.000000	0.053319	0.024415	0.077856
CRUDE	0.008275	0.000390	0.000130	0.000174	0.002124	0.001546	0.000605	0.000192	0.000361	0.000816	0.000000	0.000694	0.000339	0.000935
M.AGE	34.7948	33.1263	39.1847	37.5319	30.0377	33.0420	36.9358	40.0980	38.6765	33.3843	0.0000	36.7266	35.8844	41.6320

APPENDIX B *Continued.*

Migration from East to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.012529	0.003496	0.000140	0.000414	0.001662	0.000140	0.001063	0.000035	0.000833	0.000703	0.001757	0.000000	0.000536	0.000842
5	0.005093	0.001502	0.000063	0.000089	0.000743	0.000052	0.000345	0.000198	0.000377	0.000277	0.000597	0.000000	0.000262	0.000387
10	0.003203	0.001221	0.000057	0.000103	0.000373	0.000026	0.000202	0.000202	0.000202	0.000114	0.000300	0.000000	0.000129	0.000274
15	0.004715	0.003589	0.000172	0.000287	0.001020	0.000128	0.000516	0.000444	0.000724	0.000335	0.001073	0.000000	0.000402	0.000825
20	0.020535	0.008883	0.000473	0.001337	0.003702	0.000542	0.002035	0.001031	0.002092	0.001324	0.003532	0.000000	0.001298	0.002387
25	0.024869	0.007315	0.000374	0.001160	0.003550	0.000390	0.001829	0.001647	0.001636	0.001363	0.002722	0.000000	0.001134	0.001748
30	0.010828	0.003592	0.000157	0.000630	0.001372	0.000195	0.000682	0.000467	0.000750	0.000517	0.001050	0.000000	0.000480	0.000735
35	0.005683	0.001804	0.000091	0.000234	0.000747	0.000083	0.000521	0.000415	0.000302	0.000242	0.000589	0.000000	0.000302	0.000355
40	0.003629	0.001230	0.000027	0.000130	0.000342	0.000082	0.000226	0.000230	0.000280	0.000294	0.000294	0.000000	0.000191	0.000294
45	0.002236	0.000218	0.000036	0.000073	0.000175	0.000042	0.000163	0.000381	0.000260	0.000066	0.000290	0.000000	0.000169	0.000363
50	0.002043	0.000196	0.000033	0.000013	0.000138	0.000026	0.000131	0.000164	0.000242	0.000131	0.000419	0.000000	0.000157	0.000393
55	0.001899	0.000253	0.000044	0.000044	0.000148	0.000026	0.000148	0.000727	0.000174	0.000087	0.000366	0.000000	0.000139	0.000244
60	0.002920	0.000350	0.000040	0.000110	0.000179	0.000040	0.000369	0.000760	0.000379	0.000179	0.000419	0.000000	0.000199	0.000379
65	0.003169	0.000444	0.000054	0.000063	0.000235	0.000081	0.000190	0.000317	0.000353	0.000190	0.000607	0.000000	0.000281	0.000435
70	0.003459	0.000515	0.000036	0.000168	0.000132	0.000060	0.000251	0.000263	0.000359	0.000287	0.000587	0.000000	0.000347	0.000455
75	0.004592	0.000617	0.000058	0.000232	0.000328	0.000077	0.000405	0.000386	0.000656	0.000358	0.000598	0.000000	0.000386	0.000791
80	0.005803	0.000820	0.000118	0.000158	0.000158	0.000118	0.000553	0.000474	0.000750	0.000237	0.001105	0.000000	0.000513	0.000789
85	0.005191	0.000697	0.000310	0.000155	0.000310	0.000000	0.000387	0.000930	0.000310	0.000155	0.000542	0.000000	0.000387	0.001007
GROSS	0.681982	0.183796	0.011415	0.026993	0.076571	0.010596	0.050086	0.052420	0.053395	0.032395	0.084227	0.000000	0.034562	0.043517
CRUDE	0.000292	0.002706	0.000140	0.000372	0.001133	0.000146	0.000683	0.000662	0.000683	0.000450	0.001116	0.000000	0.000449	0.000771
M.AGE	33.7689	28.2344	30.9615	33.1953	27.8543	34.0577	35.1713	38.3950	38.2255	32.2220	35.9650	0.0000	40.2572	41.4665

Migration from W.-Cent. to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.010235	0.000409	0.000187	0.000944	0.001360	0.000067	0.000960	0.000551	0.002197	0.000551	0.000319	0.000794	0.000000	0.002396
5	0.005000	0.000230	0.000170	0.000503	0.000663	0.000043	0.000402	0.000769	0.001155	0.000258	0.000130	0.000000	0.000128	0.001090
10	0.002913	0.000213	0.000122	0.000291	0.000291	0.000042	0.000302	0.000177	0.000606	0.000110	0.000100	0.000089	0.000000	0.000568
15	0.005766	0.000240	0.000314	0.000626	0.000551	0.000080	0.000505	0.000384	0.001171	0.000220	0.000145	0.000144	0.000000	0.001317
20	0.018193	0.000792	0.000700	0.001894	0.002195	0.000176	0.001459	0.001074	0.003530	0.000807	0.000562	0.000422	0.000000	0.004582
25	0.015244	0.000820	0.000479	0.001709	0.002015	0.000164	0.001195	0.000848	0.002853	0.000755	0.000438	0.000398	0.000000	0.003569
30	0.008266	0.000523	0.000260	0.000918	0.000978	0.000117	0.000708	0.000430	0.001771	0.000370	0.000288	0.000221	0.000000	0.001682
35	0.004722	0.000438	0.000160	0.000536	0.000450	0.000070	0.000309	0.000293	0.000841	0.000192	0.000203	0.000145	0.000000	0.000994
40	0.003569	0.000314	0.000233	0.000347	0.000336	0.000070	0.000310	0.000207	0.000658	0.000137	0.000151	0.000126	0.000000	0.000680
45	0.002649	0.000054	0.000050	0.000169	0.000123	0.000036	0.000234	0.000180	0.000577	0.000119	0.000119	0.000101	0.000000	0.000887
50	0.002176	0.000075	0.000040	0.000159	0.000099	0.000024	0.000182	0.000150	0.000432	0.000059	0.000087	0.000087	0.000000	0.000755
55	0.002556	0.000074	0.000032	0.000170	0.000112	0.000021	0.000313	0.000234	0.000504	0.000060	0.000080	0.000074	0.000000	0.000871
60	0.003049	0.000079	0.000057	0.000215	0.000141	0.000040	0.000226	0.000175	0.000617	0.000130	0.000170	0.000096	0.000000	0.001109
65	0.003409	0.000066	0.000087	0.000270	0.000209	0.000036	0.000378	0.000296	0.000648	0.000102	0.000148	0.000158	0.000000	0.000990
70	0.003681	0.000135	0.000095	0.000372	0.000189	0.000061	0.000386	0.000318	0.000737	0.000183	0.000156	0.000156	0.000000	0.000895
75	0.004119	0.000143	0.000187	0.000264	0.000176	0.000035	0.000430	0.000297	0.000782	0.000187	0.000253	0.000231	0.000000	0.001134
80	0.004914	0.000251	0.000091	0.000320	0.000274	0.000044	0.000434	0.000343	0.001051	0.000160	0.000274	0.000343	0.000000	0.001326
85	0.005135	0.000305	0.000131	0.000609	0.000131	0.000174	0.000522	0.000348	0.001001	0.000131	0.000305	0.000218	0.000000	0.001262
GROSS	0.527976	0.025900	0.016821	0.051583	0.051465	0.006547	0.046730	0.032907	0.105763	0.022783	0.019843	0.017149	0.000000	0.130481
CRUDE	0.007182	0.000351	0.000240	0.000726	0.000803	0.000080	0.000616	0.000429	0.001437	0.000326	0.000239	0.000202	0.000000	0.001734
M.AGE	36.6047	35.8000	38.0926	34.8980	28.2938	42.4100	38.0911	39.4414	36.3044	33.5510	43.0871	43.9024	0.0000	38.5624

Migration from West to

AGE	TOTAL	WARSAW	ŁÓDŹ	GDAŃSK	KATOWICE	CRACOW	E.-CENT.	N.-EAST	N.-WEST	SOUTH	S.-EAST	EAST	W.-CENT.	WEST
0	0.013493	0.000405	0.000143	0.000372	0.007721	0.000214	0.000907	0.000470	0.001671	0.002038	0.001220	0.000529	0.002802	0.000000
5	0.007659	0.000338	0.000114	0.000247	0.001373	0.000124	0.000602	0.000338	0.000892	0.001106	0.000739	0.000297	0.001490	0.000000
10	0.004854	0.000317	0.000080	0.000113	0.000634	0.000113	0.000334	0.000220	0.000564	0.000667	0.000584	0.000264	0.000944	0.000000
15	0.007097	0.000309	0.000201	0.000171	0.001106	0.000217	0.000604	0.000392	0.001124	0.000851	0.000866	0.000415	0.001743	0.000000
20	0.020067	0.000747	0.000340	0.000427	0.003314	0.000433	0.001170	0.000828	0.002965	0.002545	0.001772	0.000928	0.004429	0.000000
25	0.017702	0.000805	0.000288	0.000637	0.003252	0.000360	0.001014	0.000767	0.002166	0.002624	0.001443	0.000444	0.003474	0.000000
30	0.011451	0.000558	0.000242	0.000404	0.001813	0.000221	0.000804	0.000475	0.001254	0.001488	0.001146	0.000550	0.002496	0.000000
35	0.007635	0.000504	0.000148	0.000265	0.001102	0.000181	0.000597	0.000385	0.000885	0.000947	0.000854	0.000358	0.001389	0.000000
40	0.005242	0.000336	0.000149	0.000160	0.000669	0.000117	0.000442	0.000223	0.000516	0.000614	0.000657	0.000278	0.001080	0.000000
45	0.003414	0.000259	0.000063	0.000070	0.000215	0.000037	0.000178	0.000148	0.000438	0.000274	0.000247	0.000119	0.000545	0.000000
50	0.001993	0.000044	0.000052	0.000048	0.000151	0.000040	0.000135	0.000135	0.000309	0.000289	0.000238	0.000178	0.000376	0.000000
55	0.002312	0.000049	0.000025	0.000025	0.000197	0.000037	0.000173	0.000185	0.000376	0.000307	0.000277	0.000129	0.000536	0.000000
60	0.001352	0.000073	0.000098	0.000073	0.000253	0.000057	0.000294	0.000196	0.000408	0.000351	0.000449	0.000302	0.000709	0.000000
65	0.000987	0.000107	0.000116	0.000091	0.000522	0.000116	0.000495	0.000223	0.000570	0.000553	0.000751	0.000421	0.001222	0.000000
70	0.000286	0.000185	0.000116	0.000116	0.000394	0.000151	0.000544	0.000432	0.000640	0.000753	0.000880	0.000671	0.001346	0.000000
75	0.000413	0.000149	0.000149	0.000186	0.000727	0.000168	0.001081	0.000764	0.000857	0.000708	0.001920	0.000746	0.001957	0.000000
80	0.000521	0.000406	0.000244	0.000162	0.000853	0.000284	0.001097	0.000650	0.000812	0.001097	0.001584	0.000772	0.002559	0.000000
85	0.001102	0.000666	0.000222	0.000222	0.001036	0.000148	0.001036	0.000666	0.000962	0.000962	0.001258	0.000962	0.002961	0.000000
GROSS	0.742412	0.030291	0.014137	0.019962	0.100650	0.015141	0.057278	0.037582	0.087144	0.090845	0.084521	0.042917	0.161944	0.000000
CRUDE	0.000402	0.000388	0.000171	0.000282	0.001493	0.000194	0.000635	0.000421	0.001204	0.001242	0.000933	0.000449	0.001902	0.000000
M.AGE	40.6412	39.5760	43.4111	35.6675	32.2868	40.6833	45.7021	44.3397	37.1702	36.5995	44.2029	48.9810	42.1097	0.0000

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NATIONAL CASE STUDIES *(continued)*

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