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France

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Table 5.A1. Regression analysis of various indices against time: linear and quadratic specifications

	Spatial variance of population residuals	Index of global mobility	Spatial variance of		Index of migration stress
			Utilities	Preferences	
Mean average ^a	0.2643 ± 0.1124	2.209x10 ⁻³ 0.079x10 ⁻³	0.394 ± 0.029	0.066 ± 0.012	0.922 ± 0.033
<u>Linear regression</u> ^b time ^c R ²	0.0138 (5.90) 0.64	-0.0178 (-3.5) ^d 0.38	-0.0057 (-2.78) 0.28	0.0032 (5.11) 0.57	-0.0082 (-4.08) 0.45
<u>Quadratic regression</u> time [time] ² R ²	0.0275 (3.18) -0.0007 (-1.64) 0.68	0.0370 (2.4) -0.0026 (-3.7) 0.64	-0.0133 (-1.70) 0.0004 (1.01) 0.32	0.0021 (0.85) 0.0001 (0.47) 0.57	-0.0053 (-0.67) -0.0001 (-0.37) 0.46

a. These are 95 percent confidence intervals for the mean average of the dependent variable over the 22-year observation period.
b. The coefficient of determination of each regression equation appears under the row headings 'R²'.
c. Time = T (observation year) - 1961.
d. The figures in parentheses are the t-statistics associated with the various regression coefficients.

6 France

Denise Pumain

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6.1 Population and the Regional System

A few specific features of French population and geography, which may be of consequence for migrations, have to be recalled first. France is a medium-sized country of 54 millions inhabitants for 550 000 km². Its density of population is particularly low, when compared to most of the neighbouring European countries: 100 inhabitants per squared kilometer. But this population is rather unevenly distributed over the French territory: about 18% is concentrated in the single urban agglomeration of Paris, which has 8.7 millions inhabitants, whereas the second largest urban unit, Lyon, has only 1.2 millions. Many rural or mountainous areas are sparsely populated: almost 60% of the French Communes (22 000 among 36 000) have less than 500 inhabitants each, which means, over a surface equivalent to half of the territory, a global density of less than 20 inhabitants per squared kilometer.

Those contrasts in settlement density are widely smoothed by the subdivision in 21 administrative “régions de programme” (the 22^d region, Corse’s island, has been excluded from the study because of its spatial discontinuity with the rest of the country) (see Figure 6.1 and Table 6.1). Since those regions were designed recently (1955), and mainly for planning purposes, they are more homogeneous in size than the regions of other countries in this book: the smallest, Limousin, has 0.7 million inhabitants and the second largest, Rhône-Alpes, has about 5 millions, while Ile-de-France which includes Paris, has 10 millions. They do not exactly correspond to functional regions, but most of them are roughly centred on their largest city. Their borders almost never separate a large town (the worst case is for Avignon belonging to Provence-Côte d’Azur, which has 175 000 inhabitants, and among them 10% belonging to the neighbouring region of Languedoc-Roussillon).

The regions are still rather highly differentiated by their economic structure and socio-cultural characteristics: the average gross regional product per inhabitant of the poorest region (Limousin) is half of the richest (Ile-de-France). The main geographical features are a north/south opposition for demographic indicators (higher fertility and younger population in northern regions than in southern ones), and a north-east/south-west opposition (along a line Le Havre-Grenoble) for economy: the regions in northern and eastern part, where the industrial revolution of the last century took place, are much more industrialized than the other. The urbanization has followed the industrialization but is also well developed in the region Provence-Côte d’Azur, where the tertiary sector is essential.

During the period under study (between the two censuses of 1954 and 1982), very significant changes have occurred in the geographical distribution of population. In 1954, France was still a rather rural country with only 57% of its population living in cities. In thirty years, the labour force engaged in agriculture has been divided three times (5.1 millions of working people in 1954, 1.75 in 1982), and the average urbanization rate raised to 73%. During the same time, population and economy were growing rapidly, at least until the early seventies. This growth and the substitutions in activities (decrease in employment of concentrated industries and growing importance of the tertiary sector, from 38% to 56% of the labour force), induced large redistributions of activities and population between



Fig. 6.1. The map of France with the 21 “régions de programme”

regions. After a first stage of increasing concentration in Paris and the most industrialized regions, reverse movements appeared and were encouraged by national public agencies, namely the decentralization from the Paris region since the beginning of the sixties. Population growth has then shifted from the “central regions” around Paris, the north, the east and also Rhône-Alpes, to the “periphery”, in the western part, south-eastern and even south-western recently. During the last ten years, the population of the most populated regions started to decrease, and the “shift to the south” has become more sensible.

Interregional migrations are then of particular importance to understand the recent evolution of French regions and to elaborate about their future. After a presentation of the available data and of the results given by the model, an attempt will be made to underline its specific contribution to the analysis of French migrations, as compared with a classical gravity-type model.

6.2 The Data

Since France does not have any register of population, information about spatial mobility is available from population censuses. For the first time in 1962 a question was asked concerning the place of residence at the date of the previous censuses in 1954. The same question was asked by the following censuses in 1968, 1975 and 1982. Answers were exploited to produce interregional migration tables, in an exhaustive way for the 1954–1962 period and from samples for the others (with various rates: 1/4 in 1962–68, 1/5 in 1968–75 and 1/20 in 1975–82; source: [6.1]).

Table 6.1. Symbols used in the figures for the utilities and the preferences of France

1. Regions 1 - 11		
symbol	region	name
+	1	Ile de France
o	2	Champagne Ardenne
Δ	3	Picardie
□	4	Haute Normandie
◇	5	Centre
.	6	Basse Normandie
*	7	Bourgogne
x	8	Nord Pas de Calais
=	9	Lorraine
>	10	Alsace
<	11	Franche Comte

2. Regions 12 - 21		
symbol	region	name
+	12	Pays de Loire
o	13	Bretagne
Δ	14	Poitou Charente
□	15	Aquitaine
◇	16	Midi Pyrenees
.	17	Limousin
*	18	Rhone Alpes
x	19	Auvergne
=	20	Languedoc Roussilon
>	21	Provence Cote d'Azur

This kind of statistical source does not allow to study year by year the variations in spatial mobility. Moreover, it provides information only about *migrants* (people having changed their residence between two dates and surviving at the last date—with their children counted as migrants even if they were born after the move) but not about *migrations*—that is, the total number of residential changes that really occurred during the period: multiple migrations, migrations of people who died between the two censuses and migrations ending by a return to the place of departure are neglected. Thus, there is a systematic underestimation of spatial mobility when studied from this source of data, and the intensity of underestimation increases with the length of the period between two censuses (eight, six or seven years). A model has been proposed by Courgeau [6.2] to estimate annual migration rates and to allow comparisons between the data from different periods. Its results are consistent with estimations of annual mobility derived from other sources (like surveys on the mobility of labour force). We will then use this model to provide some figures for comparison with the other countries. But there is no model allowing to correct this effect for each flow of migrants appearing in the interregional tables, which have been used as they were for the analysis.

6.3 Evolution of Global Mobility

The level of residential mobility in France, with about 10% of people changing their housing per year, is very near of the figures observed in other European countries or in Japan, but much less than the mobility rates of Canada or United States, which are twice as high.

The general level of mobility in France, which was increasing since the last century (Tugault [6.3]) started to decrease between 1975 and 1982 (Courgeau, Pumain [6.4]). This decrease was more pronounced for medium- and long-distance migrations (changes in department or region of residence) than for short-distance moves (changes in commune or housing). As it appeared in every age group, even for retired persons, this decrease in mobility cannot entirely be explained by the reduction in job opportunities due to the economic crisis. Despite the crisis may have accentuated the phenomena, it has more likely to be related to the general decrease in mobility levels which were observed sooner in other countries (in the sixties for United States, since 1962 for Belgium and 1970 for Scandinavia).

Figure 6.2 shows the evolution of a global mobility parameter calculated by the model between 1954 and 1982 at the regional level and Table 6.2 allows its comparison with estimations derived from the same source by the model of Courgeau [6.2]. Both illustrations underline the rapid increase in interregional mobility between 1968 and 1975 and its decrease after this date.

One hypothesis upon which our migration model is based is that this general mobility level should be considered as homogeneous for the whole country. However, this can only be hold as a first approximation: Tables 6.3 and 6.4, show

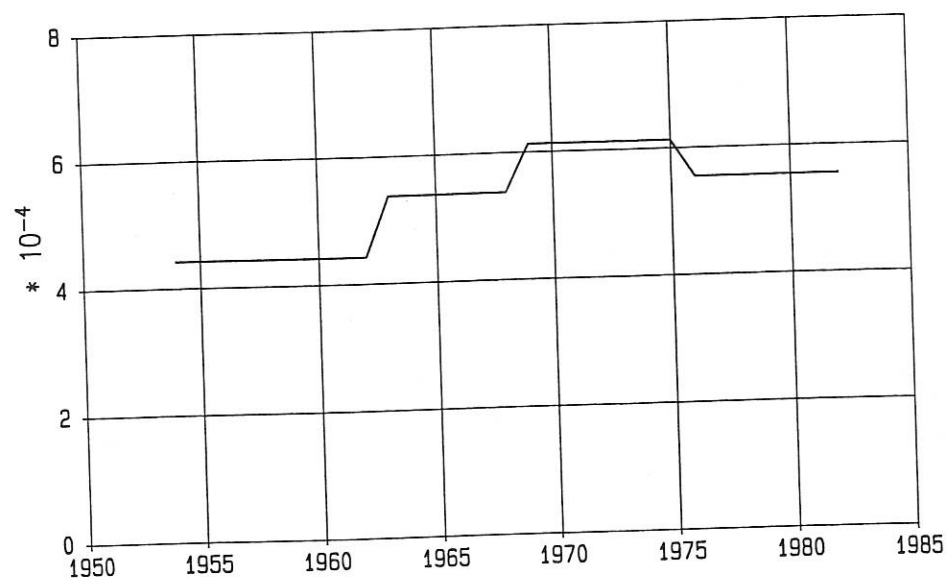


Fig. 6.2. The estimated global mobility $v_0(t)$ of France

Table 6.2. Evolution of global mobility from 1954 to 1982 at the regional level. (1) Source: Courgeau, Pumain [6.4]

Period	Annual rate of interregional migration (%) (1)	Global mobility parameter estimated by the model
1954-1962	1.42	4.41×10^{-4}
1962-1968	1.59	5.37×10^{-4}
1968-1975	1.90	6.12×10^{-4}
1975-1982	1.72	5.53×10^{-4}

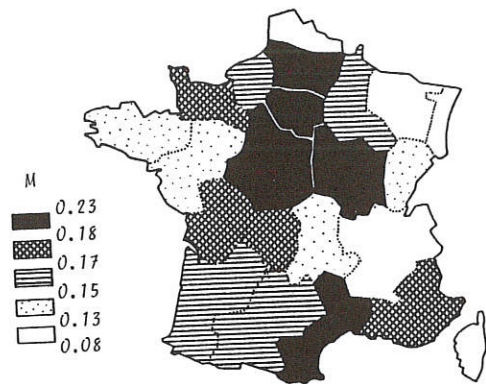
significant variations in interregional mobility for groups of people differing by age, with a strong decrease of the mobility level after 40 years, and by socio-professional status [6.5]. Long-distance migrations are about twice as frequent for professionals or managers and executives (and of course for categories liable to mobility as army or police) than for entrepreneurs, and three times when compared to the mobility of workers – the farmers being an even less mobile category. Interregional variations of a mobility index, as shown on Figure 6.3, are nevertheless of smaller amplitude than inter-group ones, but cannot be totally explained either by regional differences in age structure or in social composition of population.

Table 6.3. Variations in mobility rates according to the age of population. Source: Population et Sociétés, 1984, no. 179

Age (at census)	Proportion of people having changed their region of residence between two censuses (%)	
	1968-75	1975-82
less than 20 years	10.1	9.1
20-29 years	14.9	13.1
30-39 years	12.0	11.1
40-59 years	5.6	4.8
60 and over	4.5	4.3

Table 6.4. Variations in mobility rates according to the socio-professional status (after correction of the age effect). Source: INSEE, Survey on residential mobility [6.5]

Socio-professional status of head of household	Proportion of households having changed between 1973 and 1978:	
	their housing	their region of residence
Farmers	10.3	1.9
Agricultural workers	31.2	6.7
Entrepreneurs	26.3	14.4
Professional or managers	25.3	28.3
Executives	36.4	21.4
Employees	32.5	17.5
Workers	29.5	9.2
Domestic services	33.5	11.0
Army police	43.0	26.7
Non actives	32.0	15.6



$M = (I+O)/P$
 $I = \text{interregional immigrants (1975-1982)}$
 $O = \text{interregional outmigrants}$
 $P = \text{population of the region}$

Fig. 6.3. Inequalities in the interregional mobility level

6.4 Regional Utilities

Figures 6.4a and 6.4b show the temporal variation in regional utilities. Figure 6.5 maps the spatial distribution of these utilities for 1954–1962 (a) and 1975–1982 (b) and of their variations between the two periods (c).

During the fifties, the differences in utilities reflected mainly the inequalities in population size between regions. The most populated Ile-de-France, Rhône-Alpes, Nord-Pas-de-Calais and Provence-Côte d'Azur had the highest values, while at the other end Limousin, Franche-Comté, Champagne-Ardenne, Basse-Normandie and Auvergne, which were the five less populated areas, received four of the five smallest values. However, there are exceptions to this general relationship between utilities and population size: Alsace, Bourgogne, Lorraine seem to be more attractive than one would expect from their size and on the reverse Bretagne, Poitou-Charentes and Pays de la Loire look less attractive. For this 1954–1962 period, utilities express then the two main characteristics of spatial mobility in France after the war: the attraction towards large metropolis on the one hand, leading to an accentuation of the spatial concentration of population, and on the other hand the shift from the less industrialized zones of the western part towards the industrialized regions of the eastern part.

The graphs of Figure 6.4 and map c of Figure 6.5 illustrate clearly the two main tendencies in the evolution of these regional utilities between 1954 and 1982. First, the relationship between utility and population size of the regions has become looser. The three most populated regions undergo a continuous decrease in their utility level: rather strong for Ile-de-France and Nord-Pas-de-Calais, for which it has even become negative, a little less rapid but still sensible for Rhône-Alpes. It is a

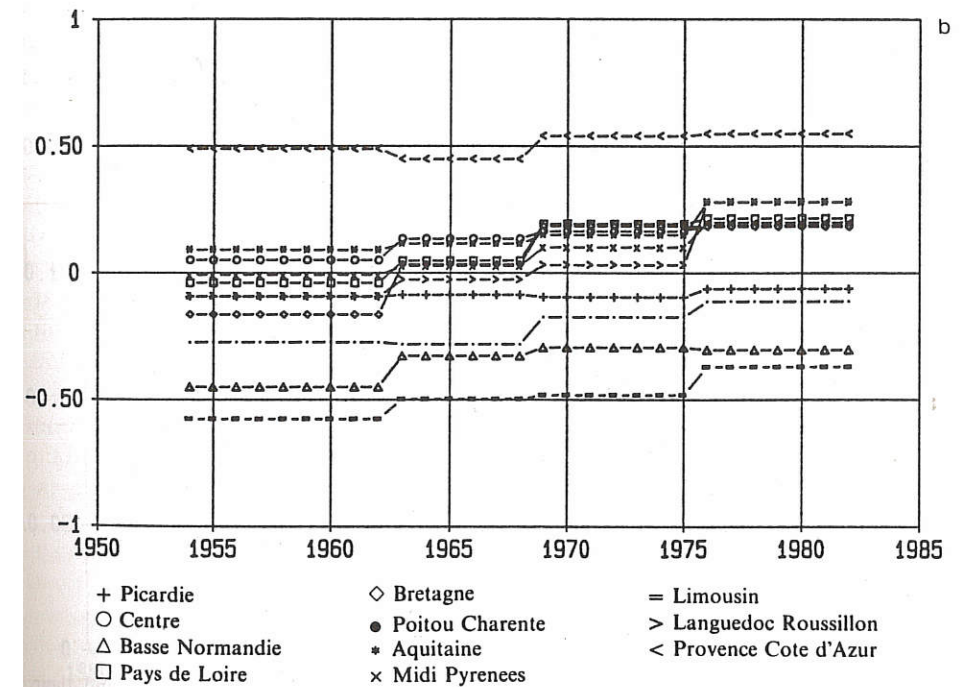
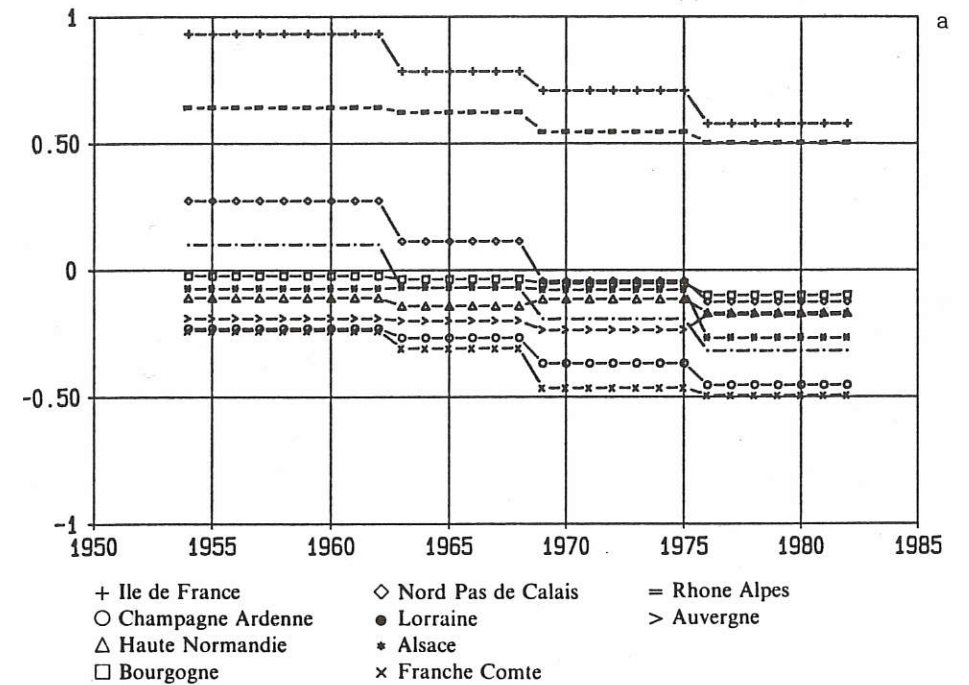


Fig. 6.4a,b. The temporal variation of regional utilities $u_i(t)$

major achievement of the model to show that the tendency towards population deconcentration from “central” regions to the “peripheral” ones, which was perceptible only in the last decade, for instance after the evolutions of the regional shares of total population (Pumain [6.6]) was actually predictable after the design of the interregional pattern of migration flows, at least since the fifties.

The second main tendency in the evolution of the spatial distribution of regional utilities is deducible from the comparison of Figures 6.5a and 6.5b, and is strongly exemplified by the mapping of the temporal variations in utility levels (Figure 6.5c). It underlines the shift in attractiveness from regions of the northern and eastern part of the country towards the regions of the western and southern part. It is rather rare that a map showing an evolution exhibits such a clear spatial autocorrelation, which allows to divide the whole territory into two homogeneous parts, according to a line Le Havre-Marseille. This line is nevertheless not an unknown feature for regional differentiation in France, since it has for a long time been used to summarize the nowadays secular dichotomy between the north-eastern

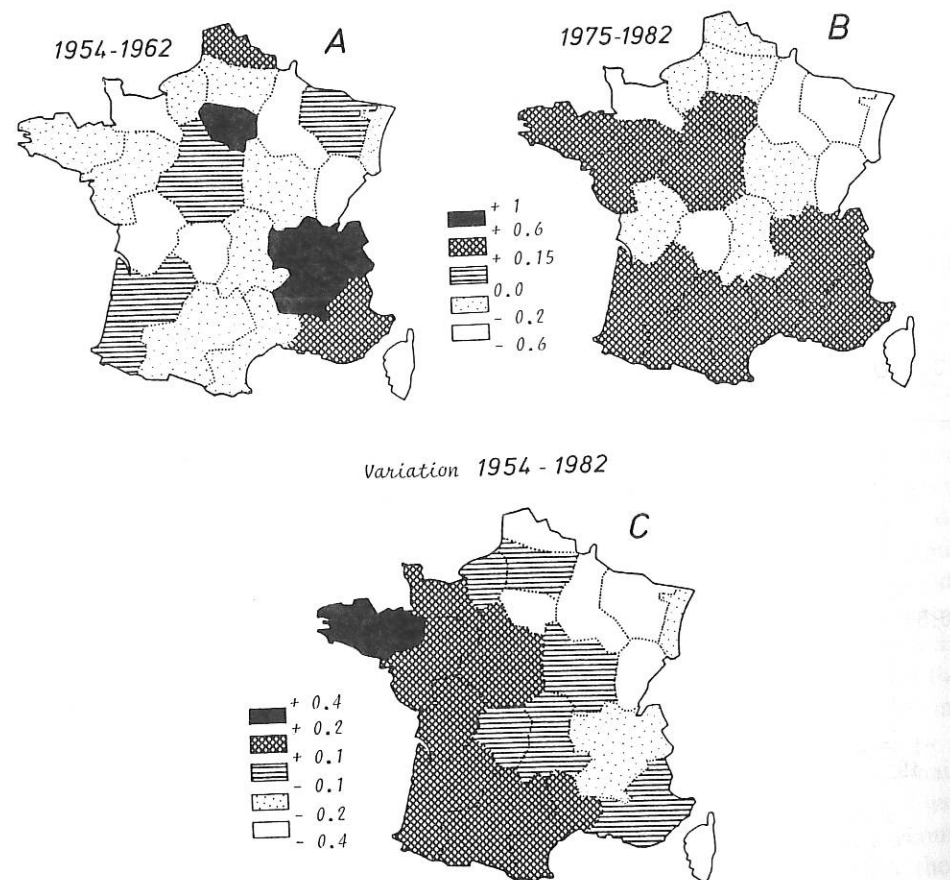


Fig. 6.5a-c. Graphical representation of the temporal mean values of regional utilities and their variation between 1954 and 1982

industrialized part of the territory, which was attracting population since the middle of nineteenth century, and the south-western part, still more engaged in agriculture and loosing population in an absolute and relative way until recently. The variations in regional utilities indicate then a tendency to a reversal in interregional gradients in attractiveness. One may wonder when this reversal started: just after or just before the second-world-war?

Those two main tendencies did not affect all regions in the same way. We noticed already that Rhône-Alpes resisted better than Ile-de-France and Nord-Pas-de-Calais to the decrease in utility of largest regions. Provence-Côte d’Azur, despite highly populated and urbanized, maintained also and even increased slightly its utility level. While most of the regions undergo a continuous increase or decrease of their utility level, a few of them exhibit fluctuations. They are mainly regions with negative values, as Picardie, Haute- and Basse-Normandie, Alsace, Auvergne. Among the regions of the western and southern part, if Bretagne, Pays de la Loire, Midi-Pyrénées and Languedoc-Roussillon succeeded in passing from a negative to a positive utility level, other remained with more or less negative values, as Basse-Normandie, Poitou-Charentes, Auvergne and Limousin.

Figure 6.6 shows that the inequalities in regional utilities, which are actually not very strong, did not vary much during those last thirty years. After a decrease between 1962 and 1968, they are increasing again but very slowly. As a matter of fact, the range of utility values has considerably decreased, with values ranking from -0.57 to 0.93 in 1962, and from -0.49 to 0.57 in 1982. This can be explained by the general spatial redistribution of utilities, with a regression towards the mean of the most extreme values corresponding to long-established attractive or repulsive situations, whereas new and less stronger disparities appeared among the other regions.

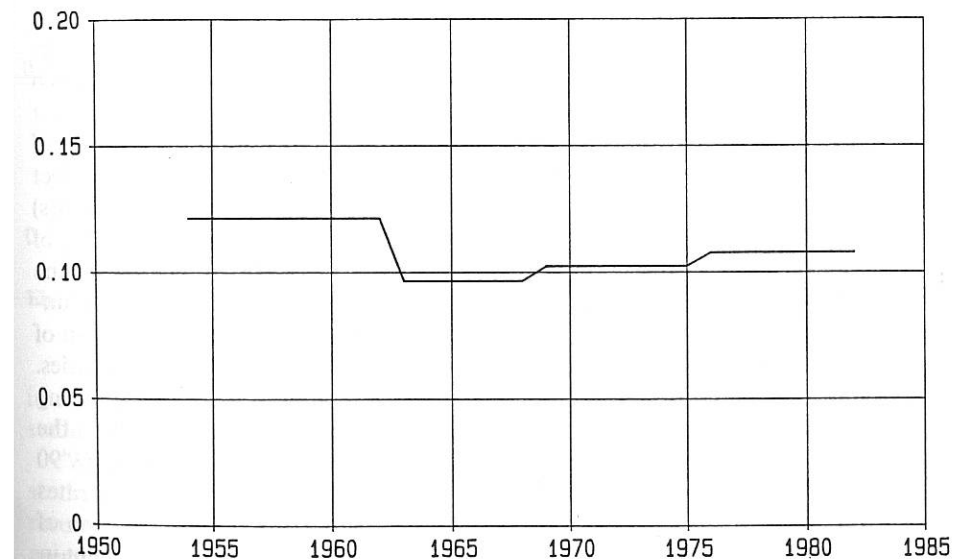


Fig. 6.6. The spatial variance of the regional utilities of France

6.5 Regional Preferences

Maps of the Figure 6.7 show the spatial distribution of preferences, which are derived from the utilities after excluding the size effect of the regions (they are residuals of a regression of utilities against population size and its square put as a saturation effect). Those maps lead to precise the general interpretation of migratory trends, which globally remain the same as previously described.

From Figure 6.7a it can be seen that, in the early sixties, migratory flows tended to avoid all the western regions from Basse-Normandie to Midi-Pyrénées as well as the Nord and Champagne-Ardenne. Provence-Côte d'Azur was the most preferred region, followed by Ile-de-France, Rhône-Alpes, Bourgogne and Alsace. In 1982, western and southern regions (the two Normandies excepted) are systematically preferred, while with the exceptions of Picardie and Bourgogne all the northern and eastern regions are less preferred, including Ile-de-France and Rhône-Alpes. As for utilities, the evolution of preferences between 1954 and 1982 has been most of the time a continuous one, attesting the deep roots of those tendencies in population redistribution over the French territory.

This last remark may be exemplified by Figure 6.8 showing a continuous increase in the "migratory stress", that is the correlation between the actual distribution of population among regions and the one which would be observed if the preferences detected for each period were maintained over time. The tendency out of equilibrium has been stronger since 1975, when the previous tendencies towards a reversal in migration flows became more obvious to all observers.

6.6 Socio-Economic Key-Factors

Socio-economic variables were chosen among available data, accordingly to the results of previous works which showed their interest for understanding French migrations. Such works are rather scarce, all of them used a multiple linear regression model. Laurent [6.7] trying to explain the relative migration balances of each couple of regions for the periods 1962-68 and 1968-75, found a positive effect of the structure of employment (repartition between growing and declining sectors) and of the salary level, whereas the proportion of young people and the density of population had negative effects. Puig [6.8] considered as significant factors for the interregional net migration rates of labour force between 1968 and 1975: unemployment rates, growth of total or non-agricultural employment, proportion of employment in the tertiary sector, skill of labour force in industry, and salaries. Puig obtained slightly different results for two sub-groups of people, young workers (less than 30 years) being more sensitive to unemployment rates than the older. Another author, Giard [6.9] working on migrations between the "90 départements" for the period 1954-62, explained that the outmigration rates increased with the intensity of previous outmigration and with the proportion of labour force still engaged in agriculture, whereas it decreased if the employment in other sectors was growing. The immigration rates could be also explained by the

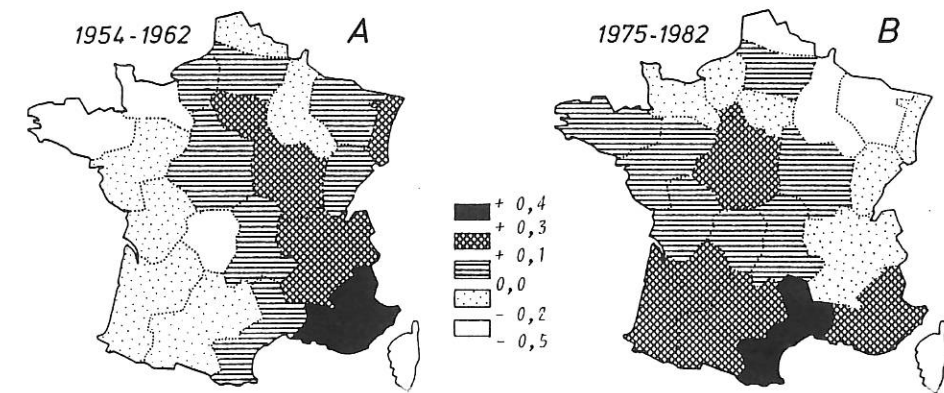


Fig. 6.7a,b. Graphical representation of the temporal mean values of regional preferences between 1954 and 1982

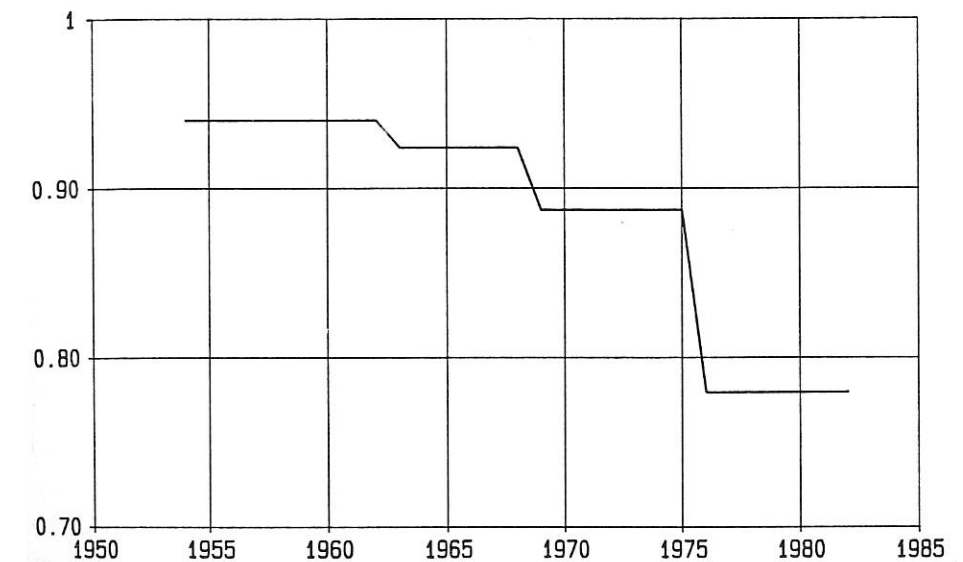


Fig. 6.8. The correlation coefficient $r(n, \hat{n})$ of France (migratory stress $= (1 - r(n, \hat{n}))/2$)

intensity of previous in and outmigrations. But this model failed to predict with a sufficient precision further migrations of the period 1962-68.

We collected then indicators related to the factors quoted by the two first studies. We added also a few variables which were put forward to explain the most recent migratory moves (for instance in [6.10], [6.11] and [6.12]) as environmental amenities (indicators of climate) and education level of the population (see Table 6.5 for the labels of variables).

Table 6.5. Selected socio-economic variables for regions. Source: Statistiques et Indicateurs des Régions Françaises

Nature of the indicators	Actually measured variables	Years
Environment	Average temperature Number of days with rainfall Number of hours with sun Number of days with frost	average 1931-1960 average 1931-1960 1981 1981
Demography	Reproduction rate (%) " " " " Birth rate (%)	1961-1963 1967-1969 1974-1976 1982
Education and skill of labour force	People aged over 15 years with diploma higher than baccalaureat (%) % of managerial staff in production % of managerial staff in services (among salaried persons employed in establishments whose size are over 10 salaried persons)	1968 1975 1982 1973,1979 1973,1979
Employment	Activity rate (%) % employed in tertiary sector	1954,62,68 1975,82 1962,68,75,82
Housing construction	Number of housings per capita completed at the end of the year	each year 1959 to 1983
Income	Average annual salary (francs) Average annual income per household (francs)	1963,67,75 1963,70,75,79
Productivity	Gross domestic product per unit of labour force weekly duration of work	1962,70,75,80 1975,1980
Unemployment	Number of unsatisfied job demands/labour force - monthly average - at the end of the month of march Unemployment rate (%)	1964 to 1970 1971 to 1983 1954,62,68,75

The temporal variations in the general mobility level happen to show no correlation with any of those variables, excepted with the housing construction rates (number of housings completed each year). This relationship mainly refers to the interaction between the long distance moves of people and the building activity. It would be hard to decide about a causal effect: does mobility increase when more housings are constructed, or does one construct more housings when more people move? More probably, the rate of housing construction and the mobility level are both tied to deeper changes in the location of population due to the conversion of economic activity (from agriculture to industry and then to services) and to changes in the settlement system (rural depopulation and urbanization). The intensity of those changes was rather high in France after world-war II and was then strongly reduced from the middle of the seventies: the depletion of the rural "reservoir" of

labour force, the urbanization rate coming near to its maximum level, the deceleration in the demographic growth (due to inferior natural increase rates and to decrease of the call to external immigration) and the economic crisis which reduces the number of available jobs and increases the uncertainty of moving, have all been put forward as factors of the recent decrease in mobility level, and may all have also affected in the same way the rate of housing construction. Two other factors acting since the beginning of sixties may also have had effects with longer delays (about ten years), and could contribute to this relative stabilization of populations: one is the tendency for industrial activity to locate nearer of the available labour force, because its costs were smaller in remote cities or in rural areas than in already industrialized regions; the other refers to the public regional policies which strived towards the decentralization of industry (since the early sixties) and then of some services (around 1970) from the Ile-de-France region towards the other regions, and mainly the most disadvantaged ones, in order to correct the disequilibrium between "Paris and the French desert" as quoted by Gravier [6.13]. Those measures tended then to reduce large interregional migrations in stopping the concentration process and in trying to bring nearer the jobs and the resident population.

However, our data, which are known only for a few large periods of time, do not allow to conclude more firmly about the lack of temporal association between the general mobility level and the socio-economic indicators that we have selected.

The regional differences in utility level are more directly explainable from those indicators. Table 6.6 shows the results of a multiple regression of regional utilities against those variables and the size of the regions (absolute number of inhabitants and square of this number). As we noted earlier, the size of the regions is the main factor explaining the utilities: the larger is a region and the higher is its utility for migrants. As expected, this attraction is not infinite but exhibits a saturation effect, as showned by the negative coefficient associated to the square of the size. It is as everywhere the second explanatory factor in the equation of regression, but for France its value is rather low as compared to other countries: the repulsiveness of the most populated regions is not (not yet?) very sensible.

Among the socio-economic variables, only five proved to be of some significance to describe the differences between the regional utilities. They all appear with the sign that one could intuitively expect: the housing construction rate, the environmental amenity, the proportion of workers engaged in the tertiary sector and the level of education tend to increase the regional utilities, whereas unemployment has negative effects.

Unemployment plays the major role. Since 1968 it has ceased to strike mainly the rural regions and it grows more rapidly industrial and urban ones (Ile-de-France, Nord-Pas-de-Calais, Provence-Alpes-Côtes d'Azur and Lorraine) and more recently in western regions. But the significance of the relationship between the unemployment level and the utility for migrants is not simple: for instance attractive regions of the southern part of France as Languedoc-Roussillon or Provence-Côte d'Azur have as high unemployment rates as the repulsive Nord-Pas-de-Calais or Lorraine: in the first group of regions the population increases more rapidly than the jobs are created, whereas in the second the population

Table 6.6. Results of the regression of utilities against socio-economic variables

variable	time lag	coefficient	t-value
Size (1)	0	0.913	181.6
Square of size	0	-0.181	-40.0
Unemployment rate	0	-0.228	-25.4
Housings completed per capita	0	0.269	16.6
Environmental amenity (2)	0	0.679	15.7
Tertiary sector (3)	0	0.788	14.6
Education (4)	0	0.634	7.7
correlation $R^2 = 0.92$			
Fishers $F = 139.7$			
(1) Number of inhabitants			
(2) Average annual temperature			
(3) Proportion in labour force			
(4) Proportion of people age over 15 years with diploma higher than baccalaureat			

decreases but less rapidly than the creations of jobs. Unemployment rate is then together a cause of the low utility of some regions and a consequence of the high utility of the others.

As for the general mobility level, the construction of housings can be seen as an indicator which accompanies the growth of population in regions with higher attractiveness (see Figure 6.9), but cannot be interpreted as a direct determinant of global mobilities: this causal interpretation would be more plausible at the geographical scale of an urban area, between center and suburbs, but it can hardly hold for interregional migrations.

A variable which is paradoxically more "explanatory" in character in the environmental amenity, as measured here by the average annual temperature: this component contributes to the higher utility level in southern regions, despite of their sometimes high level of unemployment. This "shift towards the south" has received many interpretations. It is true that considerations about the quality of the environment, and especially climatic ones, can express themselves when economic activities are more mobile and when managers can influence their choice in location. But to be really effective, the climatic advantages of the south had to be reinforced in a more complex process leading to improve the general "image" of

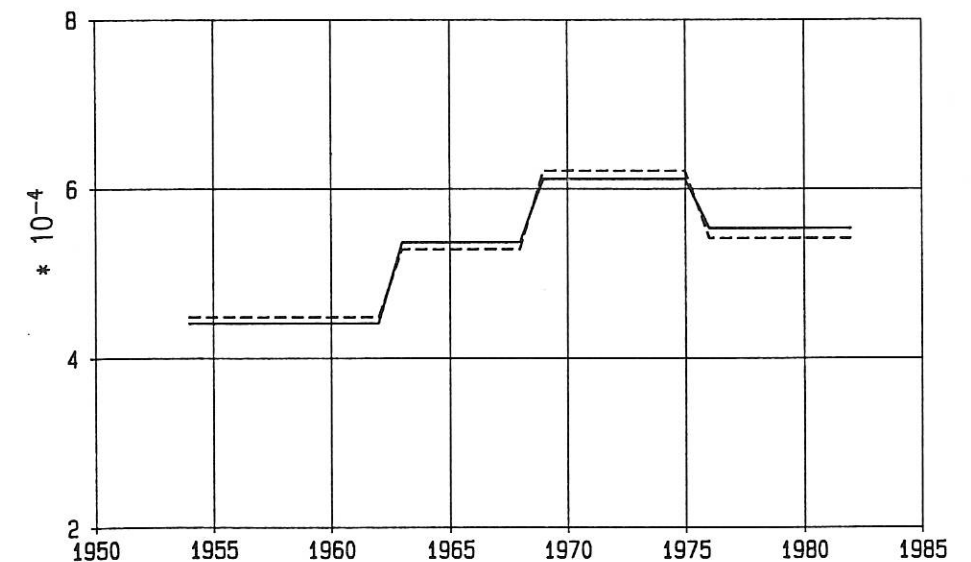


Fig. 6.9. Fitting of the global mobility of France with housing constructions as key-factor

those regions in the mental representations of entrepreneurs and of potential migrants. Advertising campaigns like the one for "Montpellier la surdouée" illustrate well the need to enlarge the basis of attraction and to give a more up-to-date image to this southern part, which was until recently a little backward, economically.

It is also not surprising to find as a fourth explanatory variable the relative importance of the tertiary sector. The share of the labour force employed in this type of activity has grown from 38% in 1954 to 58% in 1982. Ile-de-France and Provence-Côte d'Azur keep the highest proportions, larger than 67%, whereas it varies in the other regions between 47 and 60%, according to their still agricultural or industrial prevalent character. Despite a slight reduction in those interregional functional disparities, the relative positions of the regions have remained about the same over time and this can explain why the more tertiarized ones, where many jobs were still created in this sector of activity, had a greater utility for migrants.

The educational level of the population is more and more invoked as a location factor for the economic activities using the more advanced technologies. As it appears here in the equation, it plays only a minor role in the regional utilities. Perhaps will it become still more effective in the future. Perhaps also, as the French gradient for educational level is roughly spatially distributed from northern regions, with low values (Ile-de-France excepted), towards the southern ones, and is then rather highly correlated with the average annual temperature.

Shall one be surprised, not to find any effect of differences in salaries or income level in the explanation of the regional utilities? At a first sight, this could appear as a refutation of one of the theoretical proposal which is very frequently put forward to explain migrations: the search for a better salary. But such an interpretation

would fall in a trap usually called the “ecological fallacy”: a relationship or an explanation may exist at a given geographical scale (here, for the individuals) and many not appear at another geographical scale (here, the regions). As a matter of fact the interregional differences for the average salary level are not very high in France: the value for Ile-de-France is 50% higher than the one for the poorest regions, but there is only a difference of 10% among the 20 regions where Ile de France is excepted. Higher salaries are found in more urbanized regions (Rhône-Alpes, Provence-Côte d’Azur) and in regions which are together urbanized and industrialized (Haute-Normandie, Lorraine, Alsace, Nord-Pas-de-Calais). During the whole period those differences have been strongly reduced: the raising up of the lowest salaries and the industrial development of the western regions have contributed to this homogeneization.

So the lack of relationship between the salary levels and the regional utilities reflects again the main tendency of the evolution of economic development and migration flows during the last twenty years (at least since 1962), which has been a trend of territorial reequilibration towards the western and southern regions. Economic private interests and public policies combined themselves to achieve this ambition of territorial planners. However, one may wonder if this evolution as illustrated by the reversal in regional preferences between 1954–62 and 1975–82, will persist a long time enough to correct the previous regional disparities which still exist. Obviously, even during the economic crisis, large cities with a diversified economic basis keep a great advantage. But the now depressed regions of the old industrial cores in north and north-east of France may solve their problems and perhaps will soon rediscover the benefits of their excellent geographical position with respect to the hearths of economic activity of north-western Europe. So the future of the shift in population from the “core” regions to the western and southern “periphery” which has been observed in France as in other western highly developed countries (Vining, Pallone [6.14]) remains uncertain: is it a durable reversal in the location of economic development or is it merely a temporary stage of deconcentration in a still highly concentrated development process at the national level? More detailed studies of migration flows for significant subgroups of population may allow to progress a little further in this kind of prediction.

6.7 Comparison with a Gravity Model

The same matrices of interregional migratory flows have been treated by more classic and static migration models (Pumain [6.15]). Several kinds of models were experimented, to adjust the migration matrix of each period, using various functions of the interregional distances (the models were developed by Poulain [6.16]). We will use here the results for the model which gave the better fits, with a Pareto function and an expression of the average physical distance between regions. We will further refer to this model as to “the gravity model”

$$w_{ji} = kn_i n_j d_{ij}^{-a} \quad (6.1)$$

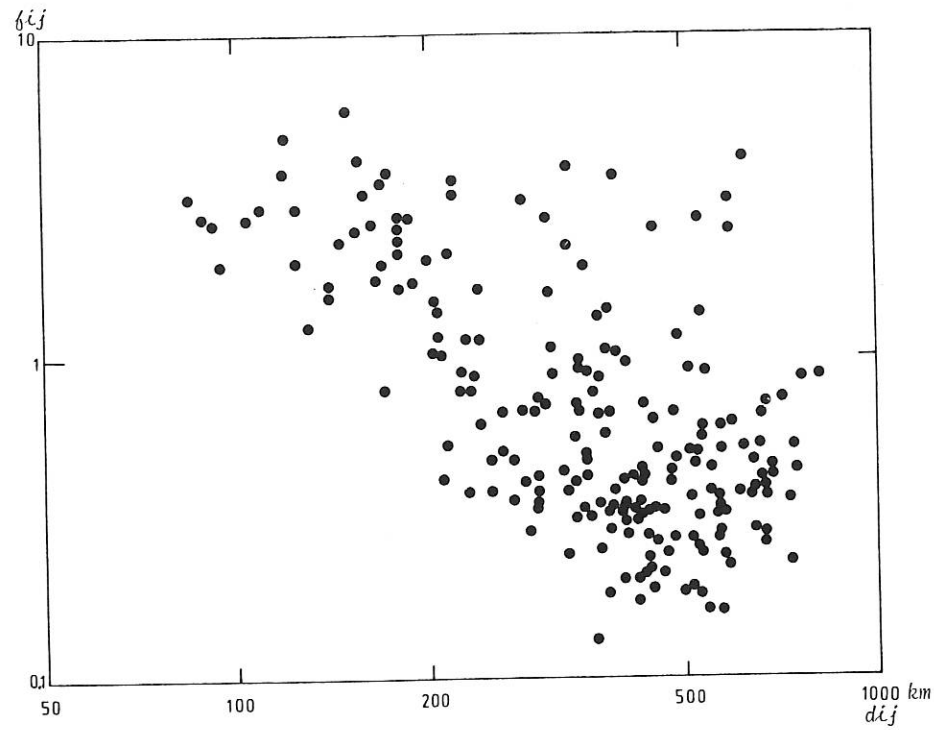
where w_{ji} is the number of migrant from region i to region j , n_i and n_j are respectively populations of regions i at time t and j at time $t + 1$, d_{ij} is the measure of the distance between the regions, a is a parameter. So the philosophy underlying the gravity model is quite different: one assumes that the number of migrants between i and j is proportional to the probability of finding the same person in region i at the beginning of the period and in region j at the end of the period (the probability itself is proportional to the product $n_i \cdot n_j$) and that the deterrence effect of distance is homogeneous over space and independent from the spatial distribution of populations. One assumes then that only the residuals between observed and computed flows should have to be explained by socio-economic variables.

We thought that a comparison of the results given by the two models could bring interesting insights on the specific contribution to the study of migrations of the new approach presented in this book. We will compare them on three points: i) the values that they use for the deterrence function between regions; ii) the global measure that they give in order to characterize the attractiveness of each region for each period; iii) the spatial distribution of their residuals.

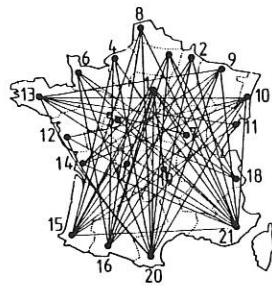
i) The *deterrence function* in our model is estimated after the actual flows of migrants, whereas it is exogeneously given in the gravity model, using a physical distance between regions. But both expressions are symmetrical for every couple of regions and can then be compared. We plotted on Figure 6.10 the values of the term f_{ij} (which is an average over time of the mobility factors v_{ij} weighted by the global mobility v_0), against the distance d_{ij} used in the gravity model. As both scales are logarithmic, a strict correspondence between the two measures of the deterrence functions does exist if all points are situated along a straight line with a negative slope. It is far from being the case. Thus, as compared with physical distance, f_{ij} is a more phenomenological measure of the separation between regions. When mapped, the discrepancies between the two measures reveal the greater frequency of exchanges between remote regions (mainly between Ile-de-France and the four southern regions and Provence-Côte d’Azur and the four north-western regions, but also between other distant regions situated at the periphery of the country) whereas the flows between the regions surrounding Paris and between them and Limousin, Auvergne, Nord, Lorraine, Alsace and Franche-Comté would generally be less according to f_{ij} than one could expect from the physical distance d_{ij} .

This comparison shows then that the physical distance is only a rough surrogate for an expression of the symmetric effect of the separation between each couple of regions on migration flows. The measure f_{ij} better incorporates other factors which combine themselves to the physical distance in order to facilitate or to reduce the migrations, as for instance the differences in regional mobility levels, or the effects of nation-wide attraction centers (as the capital, or an area for retirement), or the short-circuiting of flows between the regions surrounding the largest population center.

ii) The *attractiveness of regions* and its variations over time is an interesting output of the two models. In the gravity model a “push-pull” index is computed as a weighted average of the residuals between the observed and adjusted flows, ranking from positive values, when the region is more attractive, to negative values



Stronger deterrence effect of dij



Stronger deterrence effect of bij

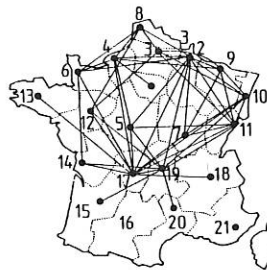


Fig. 6.10. Comparison of the effect of distance between the model of this book and the gravity model

when it is more repulsive. As the gravity model already incorporates the effect of the size of the regions of destination, this index is better to compare with the values that our model gives for "preferences" than with the "utilities" (Figure 6.11).

The ranking of the regions by the two indices do not differ too much. The similarity is higher for the first period (1954-1962) than for the last one (1975-1982).

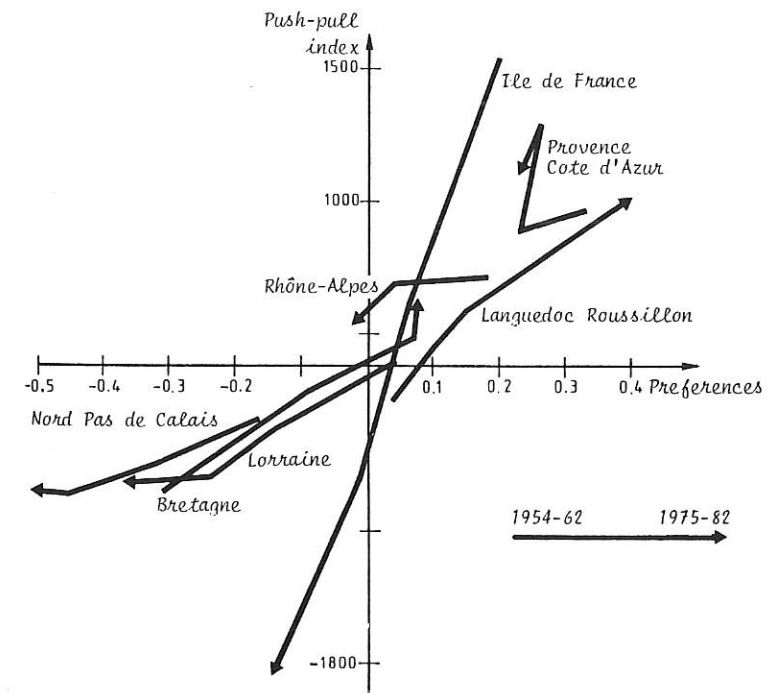
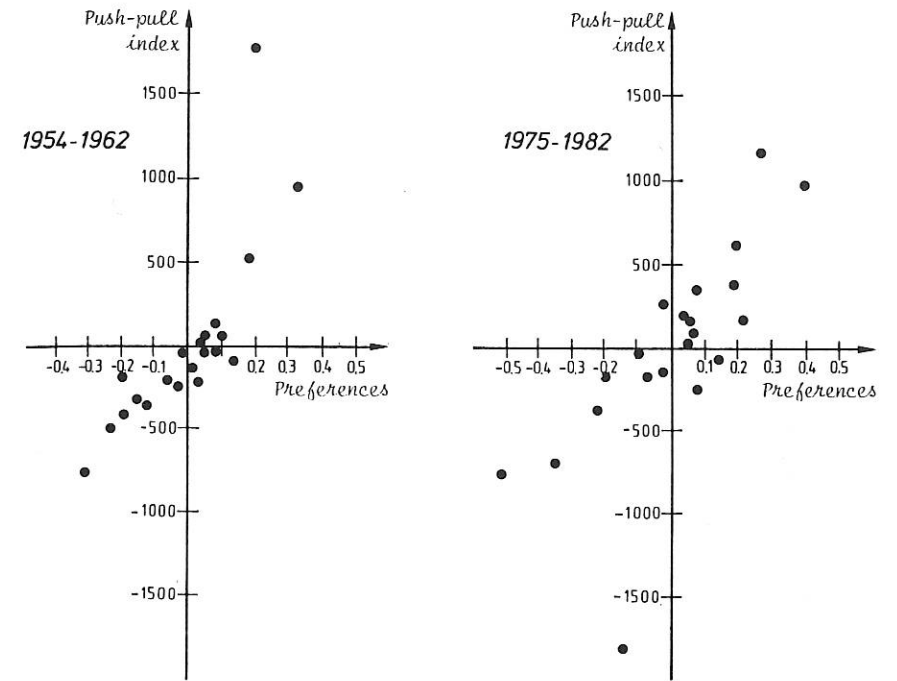


Fig. 6.11. Push-pull index of the gravity model versus preferences of the model of this book

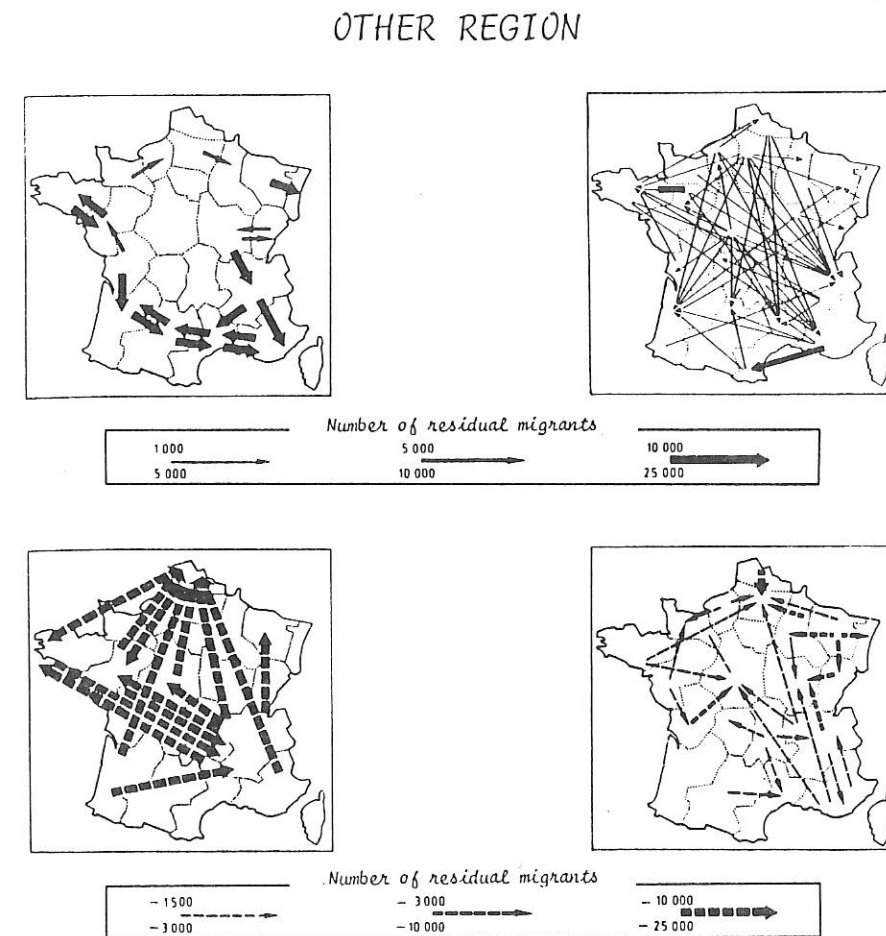
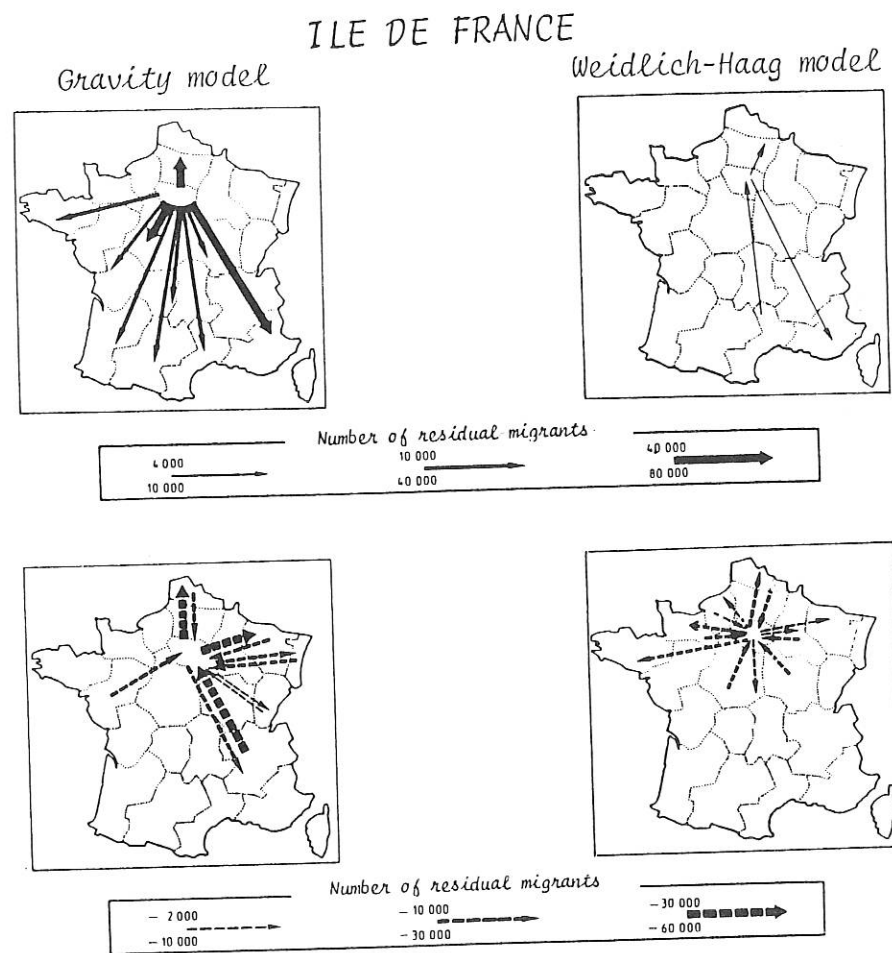


Fig. 6.12. Spatial patterns of residuals of the gravity model and the model of this book

This increasing discrepancy between the two models can be explained by variations in their explanatory power, since the migratory system of France is far from its equilibrium state (as measured by R^2 , 0.85 for the gravity model, 0.96 for the model of this book). But it may also be partially related to the change in significance of the two variables which are used by the gravity model: as we have seen, the regional utilities are less and less tied to the size of the regions, and the physical distance has also lost of its effect on migratory flows: the parameter a of the Pareto function in the gravity model has strongly decreased, from 0.77 for the period 1954–62 to 0.34 for the period 1975–82, which expresses a larger freedom of interregional migrants in consideration of the distance.

iii) The *spatial pattern of residuals* computed between observed and adjusted flows from both models tends to confirm these explanations. First, the most populated regions, and specially Ile-de-France, are always better adjusted by our model than by the gravity model. Second, the residuals given by the gravity

model exhibit specific spatial patterns which refer either to differences in the regional mobility level or to persistent spatial preferences or barrier effects between couples of regions. Neither of those regularities appear among the residuals which are given by our model. It is a paradoxical result that a model which does not include explicitly the spatial properties of the regions finally eliminates better spatial bias from the residuals to be explained by socio-economic variables than a gravity-type model (Figure 6.12).