Working Paper

Theories on Interregional Migration: An Overview

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ABSTRACT

This paper gives an overview of theories on interregional migration. Conventional theories within economics and geography are discussed, and some new ideas are introduced. For example, the value of physical capital in a welfare society is now so large that it will slow down net migration.

Finally, contemporary progress in research is discussed. New methods will make it possible to understand macrofeatures of interlinked processes from models using microdata. New empirical findings show decreasing net migration figures in many countries which is in accordance with theories on the relation with migration on the one hand, and the value of physical capital and/or a more stable local demand for services on the other. The post-industrial society will, against earlier predictions, have low net migration rates.

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Sture Öberg

Migration between local labor markets is usually seen as either the result of individual decisions or a response to structural forces. This paper will deal with both ideas, but will concentrate on the latter, especially on how changes in the production system according to theory will influence migration. The ideas put forward will deal with contemporary Western European societies. Most ideas can be found in the literature--only a few originate from lesser-known research.

The approach in the first part of the working paper will be mainly *economic,* since theories from economic disciplines, including regional economics and economic geography, will be emphasized. It usually means that people are defined as rational in the sense that they are loyal to their preferences and maximize place utility functions in well-known market economies, in order to speculate in the outcome of decision processes. Several alternative approaches are possible based on e.g. microsociology (Rossi 1955; Holm and Öberg 1984), time-geography (Hägerstrand 1970; Öberg 1979a) or empirical generalizations. These will be studied in the second part of the paper.

1. ECONOMIC APPROACHES

1.1. Wage Differences

The following discussion on economic restructuring and migration is based on regional economics. Individuals use migration as a means to increase their standard of living or utility function. According to theory (and some empirical evidence) people migrate (net) to areas with a higher wage level. This is the basic "law" of migration in regional economics.

The macro interpretation of this law is that a state of equilibrium tends to emerge. Migration is one of the processes to reach this equilibrium. There can be either a push-effect in areas with low wages, a pull-effect in areas with high wages, or a combined effect due to the difference. The larger the difference, the more wage earners will migrate. When regional economists model migration, the choice of model will reveal how much they believe in push or pull factors (Alonso 1976).

The distinction between push and pull factors is usually unclear from a scientific point of view (Öberg 1994). High income in one region can be a pull factor attracting migrants from a less wealthy region, but the same phenomenon--lack of high income--could also be described as a push factor in the sending region. A researcher's choice to label a wage gap, or any other regional difference, as a push or pull factor is a matter of taste, not a choice based in theory or differentiating against the alternative.

Also when efforts are made to define a push factor in a region in relation only to internal changes over time, like a period of specific high demand for labor, it is difficult to distinguish between push and pull factors. A larger flow of migrants to a region during a period of high demand for labor in the receiving region is not necessarily an effect of that demand. It could also be the result of an earlier low demand for labor in the sending region. From a technical point of view, delayed effects are difficult to sort out. Depending on how researchers treat the time lags, they can conclude that either push or pull factors are more important, basing their conclusions on the same time series of data. There are examples of

this in the literature on international migration. For example, Thomas (1941) says that the migration flows between Sweden and the US were mainly determined by the economic conditions in Sweden, while Wilkinson (1967) says that the labor demand in the US was more important. Quigley (1972) shows that conditions both in the sending and the receiving country were important.

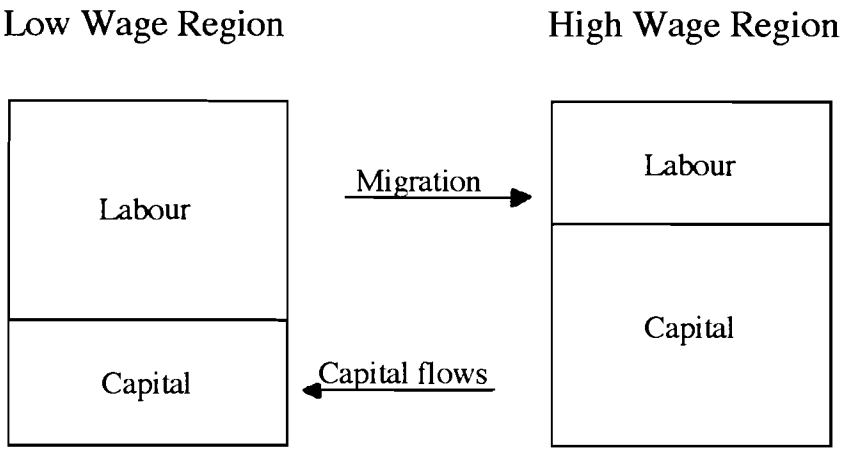


Figure 1. The basic law of migration in regional economics tells us that different wage levels, due to e.g. different labor/capital ratios, cause interregional migration flows. In the long run, if mobility of capital and labor is allowed, market forces tend to create a new equilibrium where wages have the same levels in all regions.

On the micro scale the decision to migrate will depend on the size of the wage increase and how long it will last. With a neoclassical approach (Becker 1993), the expected difference over time will be discounted to a present value and compared with the costs involved. Since young people can gain a higher salary during a longer time than people closer to retirement age, this will "explain" why young people migrate more often. This theory can be extended from individuals to households, where the man and the woman can have different wage functions over space and time, and the decision to migrate is a joint process on the household level.

How do these wage differences between regions emerge? According to conventional theory, they may be seen as disturbances in the equilibrium due to changes in e.g. technology or demand functions. Restructuring in the production system will cause imbalance between supply and demand for labor on different local labor markets and thus to different wage levels.

A disruption in an equilibrium would, still according to theory, normally lead to some adjustments and then a new equilibrium. If, for example, a large factory closes down on a local labor market, the first effects will be a surplus of labor which in turn will lower wages and thus create some net outmigration and attract some new firms. A new equilibrium will soon emerge. The disruption could also have very different consequences. If the closure of the factory leads to lower demand for services in the region, perhaps also this part of the labor market will have bankruptcies and closed firms. Still more people will have to outmigrate. Still more units will have to close down, until the whole region is empty. This spiral effect (Myrdal 1968) will emerge when a large proportion of the local production is dependent on local demand, and when there are many threshold effects due to indivisibilities and economics of scale in the service production.

An interesting question is how large a salary increase a person needs in order to migrate. As indicated above, theory tells us that this increase could be smaller for younger persons, since they can benefit

from the increase during more years. A Swedish study on men in the age group 30-39 (Springfeldt et al. 1977) showed that a wage increase of at least 20 percent was needed to attract interregional migrants.

International differences in wages (for an overview see, e.g., Greenwood and McDowell 1992) is not a direct concern for interregional migration within countries, but of course it has impacts for regional in- or outmigration. The very large international variations in wage levels as a driving force is one of the indirect explanations behind the regional redistribution of population within countries, since international flows often end up in larger cities.

1.1.1. Using wage differences to stimulate regional development

Usually market forces will transform economies into new types of production. A question for governments in both centrally-planned economies and in market-oriented economies is if governmental actions can make restructuring processes more efficient for the actors on the market. Should governmental policies encourage labor movement between sectors and regions in order to promote economic growth? Let us here use the discussion on movement of labor between production sectors of the economy (Scitowsky 1976) as an example, and draw some parallels to ideas on movement of labor between geographical areas. As discussed above, micro theory tell us that a wage difference will stimulate individuals to move. One could argue that the actual wage differences are too small for an efficient spatial relocation of labor between regions. Larger wage differences between regions would create the right structural environment for a sensible wage-earner to migrate--a rational act for both the migrant and the society as a whole. Governments should then support investments in e.g. public infrastructure in successful regions in order to increase their competitiveness so that they would attract more migrants. The idea behind this measure is to influence the behavior of people, to encourage them to migrate through increased regional production of service facilities in successful regions.

Of course, this policy aimed at economic growth is the opposite of the traditional regional policy mainly concerned with transfers of wealth from rich to poor regions. Distributional aspects can only partly be motivated by efficiency and welfare concerns for people. In the public debate welfare for regions is wrongly considered to be equal to welfare for individuals.

A totally different measure to create a higher geographical mobility, compared with the above-described method to stimulate individuals to move, could be developed if we base our ideas on macro theory. It could be argued that the actual wage differences are too large for an efficient spatial relocation of labor (Öberg 1989). A more equal wage level in expanding and contracting regions would speed up the restructuring process. If the firms in expanding regions paid less for labor than they were actually able, they would get higher profits, increase their ability to invest, and expand faster. If the firms in contracting regions paid more than they were able, bankruptcy would come about faster and then, of course, they would not be able to pay any employees at all. Following this idea, governments should then try to raise minimum wage levels and force local authorities in poor regions to increase their public sector to the same standard as the rich regions. The idea behind this measure is to influence the behavior of firms, which would have indirect effects on interregional migration.

The same idea can be carried through by demanding a too-expensive service level in poor regions--a service level that has to meet national standards but has to be paid by the local population. This would increase local taxes and force more people to migrate to rich regions where there are more occupational opportunities and where they could contribute better to economic growth.

1.1.2. Unemployment and migration

Unemployment due to an uneven regional slow-down in business cycles will cause migration. Available jobs in one region and few chances of employment in another could be seen as a special case of wage differences with 0 wage in one region and a wage in the other. As indicated earlier, the growth of cities during the recent history is a physical expression of a decline in rural-based agriculture, and a growth in urban-based industry and service.

Today, this force still exists in Western Europe, but it is weaker than on free markets due to social security programs for unemployed, large subsidies to agricultural production and heavy restrictions on imports of foods from countries in Eastern Europe or outside Europe. Another factor slowing down the migration effect of economic restructuring is a higher daily geographical mobility. Cars and public transportation make the urbanization process slower because a growing number of alternative jobs can be reached within a reasonable commuting time also from remote places in the countryside. Interregional commuting as a substitute for interregional migration is also becoming more common.

1.1.3. Wage differences in subsectors

If wages on average are the same in two regions, we can still explain interregional migration with a neoclassical microeconomic approach. One way to do this is to include occupational markets with different wages, adding up to the same average, and individuals grouped in families (Stark 1991). It is then possible to "explain" not only migration in one direction, but also return migration. We can see some relation between, on the one hand, the aggregated wage levels for the total labor markets and the disaggregated levels for occupations, and on the other, the famous idea of the *ecological fallacy* (Robinson 1950), developed more in detail by e.g. Alker (1969). Over the last decades there has been a debate in the literature between neoclassic economics, where individuals maximizing their utilities are matched against a production system based on marginal productivity theories, and new economic theories regarding dual or segmented labor markets (for an overview, see Cain 1976). The neo-classical approach is, however, still dominant in studies of migration.

1.2. Occupational Restructuring

Unemployment due to an uneven regional occupational restructuring will also cause migration. This is probably one of the more important causes behind interregional gross flows in Western Europe. Contemporary structural changes of the production system result in new stages which have been given many names, like postfordism, flexible production systems, economics of scope, the post-modern era, and the information society. Most of these concepts are used as ideas or as theoretical support for case studies. Here, empirical figures from a more traditional division of occupational statistics will be used in order to compare one of the old divisions of the production system with one of the most recent ones.

The old division has its roots in the 1930s, became popular in the 1950s, and is still used in modified versions in statistical offices all over the world. Divided into three groups, all production activities could be labelled agriculture, industry or service. We all know how the number of employed in agriculture has decreased from a large majority a hundred years ago to a small minority today. This "primary" sector usually also includes fishing and forestry. Industry had its peak some years or decades ago in most developed countries. Today we are living in service economies. The general pattern in several West European countries and the development during the last century in one country is shown in Figure 2.

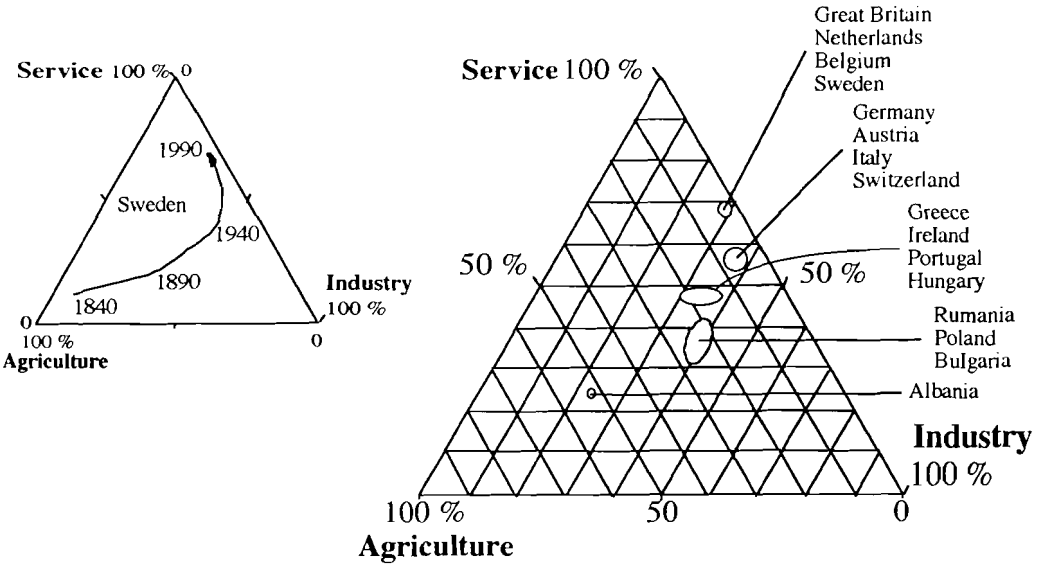


Figure 2. Occupation in sectors of the economy in some European countries in 1990 (right) and restructuring of employment between these sectors in Sweden, 1840-1990 (left).

A Swedish geographer (Holm 1988) has developed a classification system which determines how many working hours are devoted to the production and transportation of physical goods, personal services, and handling of information. All occupational groups can be classified individually with respect to the proportion of their time that was devoted to practical work with these three tasks. The results, applied to occupations in Italy, show that 50 percent of all working hours are still devoted to the handling of goods, agricultural products, building materials, industrial products, etc. The rest is distributed between the two new growth sectors of the economy--information and personal services.

Table 1. Restructuring of the labor market in Italy between traditional sectors 1935-1985 and divisions of labor in 1985, according to a traditional and an occupationally-oriented division of labor.

	1935	1985	1985	
Agriculture	28	10	58	Goods
Industry	29	21	23	Personal Service
Service	43	69	19	Information
Total	100	100	100	

We know that the demand for labor varies according to the economic structure of the region and the rate at which different economic sectors expand or contract. Changes in economic sectors will then affect the occupational structure and thus the demand for people with different skills. National averages on an aggregated level, like the ones shown for Italy in Figure 2, give us information about the general changes in the production system. Specific occupations change even more drastically over time. Further structural changes within and between regions are necessary and constantly occurring, and they will always lead to migration.

These imbalances within the regions in labor markets demarcated by occupations, create two types of gaps--occupational gaps within each occupation and a gap between total supply and demand for labor (see Figure 3). The latter, unbalanced regional development is discussed above. The former, where occupations are included in the theory, influences migration by the same mechanism but enlarges the flows. As indicated earlier, it will also create flows between regions, with a balance between supply and demand on the aggregated level.

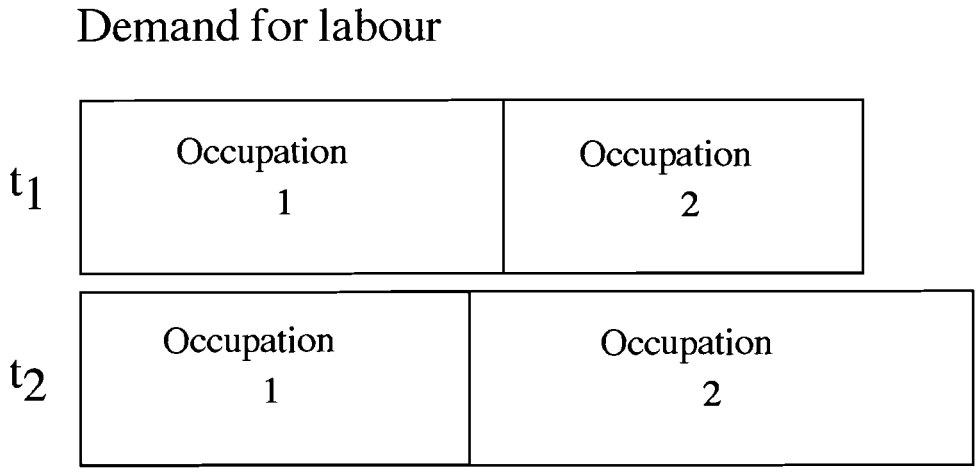


Figure 3. Structural changes in the production system will influence the total demand for labor in a region and also the demand within occupational sectors.

1.2.1. Balance on occupational submarkets but still migration

So far, we have discussed geographical and occupational imbalances. With a perfect long-term balance in these two dimensions and the same wage level for each occupation, migration can be a necessity. If we consider that there are barriers between occupations and small labor markets--observe the word "markets"--and that there is a time dimension, we will still get migration with a conventional neoclassic regional economic approach. The first, because there are costs involved when people change occupations and many of us thus have to change jobs within the same occupations. The second, because local labor markets--observe the word "local"--often are small. The third, because there is a time dimension which complicates the allocation process between supply and demand.

A seldom-discussed mechanism behind migration is the unplanned occurrence of new jobs and newly educated job-seekers. The problem can be shown by means of a straight-forward example. If a hundred people apply for jobs as teachers of mathematics on a small local labor market during a period of ten years, and a hundred vacancies of this kind occur in the same period, one's first inclination might be to suppose that none of the applicants would fail to obtain employment as a teacher. But the odds are that the vacancies will occur at irregular intervals throughout the period, and the people concerned may apply for jobs more or less randomly during the period. As a result of these random variations, there will sometimes be a queue of teachers looking for employment, while at other times there will be a shortage. Sometimes the line of applicants will be so long that a person looking for employment as a teacher will not be able to expect such a job to come his way until quite a long time has passed.

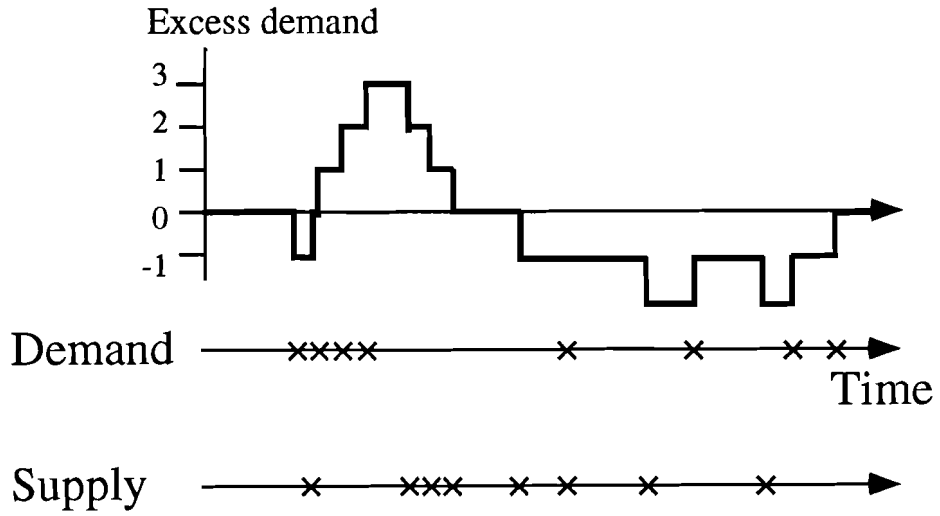


Figure 4. With the same amount of vacancies and job seekers on local labor markets in long-term balances, short-term imbalances will cause interregional migration.

Added to these actual imbalances is lack of information, seldom considered or modelled in migration theory. People searching for jobs cannot possibly judge how long it will be before a vacancy occurs, and therefore they cannot wait for one. They can choose between staying unemployed for a while, getting a different kind of job in the locality, or moving to another locality where there is an available job in the occupation they are trained for.

How important are these random variations as an explanatory factor behind migration flows? They are perhaps not as important as structural imbalances or business cycle variations, but in advanced economies and especially on submarkets with a large degree of specialization, they are substantial. They are, for example, important for most readers of this text. Well-educated people living in small local labor markets with few employed in their occupation belong to the most likely affected persons.

It is theoretically possible to determine the importance of random variations with some calculations (Öberg 1974; Öberg and Oscarsson 1979). They are based on ideas from time-geography and on a model which will calculate the emigration from local labor markets assuming a turnover of vacancies and a flow of people wanting employment within different occupational specialties. Here, an example will be given of the scale of migration due to matching problems among new entrants into different labor markets of different sizes.

One of the presuppositions of these calculations is that the supply and demand for labor remain constant over a longer period. However, owing to random variations over time, there will be temporary waiting lists or shortages. If anticipated unemployment exceeds six months, it is presumed in the model that a person wishing to obtain gainful employment will leave the area. And if the employer believes that he or she has to wait more than six months for "local labor", people from other local labor markets will be employed.

As indicated earlier, a large proportion of all migratory moves to and from minor local labor markets can be explained by the need for exact planning in time, concerning the junctures when jobs need to be filled and when people wish to enter the labor market (see Table 2).

As shown in Table 3, the occupations do not have to be very esoteric to be rather small in numbers, and therefore--probably--they are showing a rather high incidence of randomly caused migration. The

number of gainfully employed persons in a prominent occupation in the largest local labor market in Table 3 is not more than 2600. This number of workplaces corresponds to the theoretical limit where, according to the conditions of the example, allowance no longer needs to be made for random variations in the supply of labor as a factor influencing the situation of the individual in the labor market and thus influencing migration. Since the number is not significantly exceeded by any occupation in the areas, random variations do have a certain bearing on the situation of the individual and on migration and occupational changes in the majority of local labor markets in sparsely populated countries in Northern Europe.

Table 2. The proportion of job applicants not obtaining employment in their home region in differently sized labor markets in a long-term state of equilibrium between supply and demand within the various occupational sector. Calculated examples.

Size of local labor market = average number of persons employed in a certain occupational sector	Proportion of job applicants...		
	obtaining work at once	obtaining work after a waiting period (less than six months)	not obtaining work (potential migrants)
1000 (in average 50 vacancies and job applicants per year)	47	51	2
100 (in average five vacancies and job applicants per year)	40	40	20

Note: The calculated example rests on the following presuppositions. The average period of employment in the labor market is here supposed to be 20 years. If the anticipated period of unemployment exceeds six months the person concerned migrates from the local labor market. A vacancy will be filled by an in-migrant if the anticipated waiting period for an applicant from the local labor market will exceed six months. The local labor market is in equilibrium in the long term perspective (supply equals demand).

Table 3. Number of employed in some occupations in some local labor markets in Sweden in 1990.

Local labor market*	Gainfully employed	Drivers	Assistant nurses	Policemen	Dental nurses	Firemen	Opticians
Vindeln	7,000	344	341	12	20	2	0
Mora	15,000	549	427	55	45	9	8
Oscarshamn	18,000	561	529	48	39	25	7
Hässleholm	54,000	1,779	2,030	194	162	48	25
Örebro	68,000	2,212	2,635	284	238	79	34

* A local labor market is defined as a commuting area (within 30 kilometers from the local center).

To strengthen the theoretical argument, it is possible to compare with empirical data. Figure 5 shows the actual scale of gross migrations in differently sized local labor markets in Sweden. Larger labor markets have lower migration frequencies.

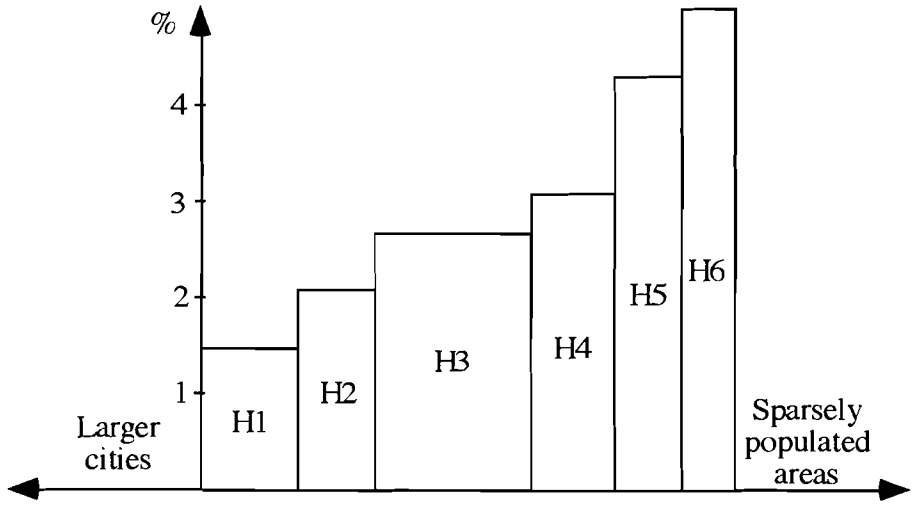


Figure 5. Outmigration frequencies for married couples who moved more than 50 kilometers in 1971. The husband's age is 30-39 years. The husband's income is higher than the median income for men in the same age group. The wife's income is higher than the upper quartile for corresponding women. Note: The H-regions are based on a classification of municipalities according to, among other things, the local labor market. (H1: Stockholm; H2: Göteborg and Malmö; H3: larger cities; H4: remaining parts of southern Sweden; H5: densely populated areas in northern Sweden; H6: sparsely populated areas in northern Sweden)

1.2.2. More jobs in the service sector--more interregional stability

Employment in agriculture is slowly disappearing in Western Europe. The same is true for industrial employment. An increasing productivity in these sectors makes them produce more with less people involved. The more we invest in modern industry the more machines, computers and robots we buy, the less workers are needed. It is the information and service sectors that are growing.

Much has been written on the role of the new information industry (Goddard et al. 1985) and of knowledge in general in the production system (Törnqvist 1990; Öberg 1990). We know that this industry is more common in rich countries (see Figure 6). Thus, it is either a driving force in the economic development or something only rich countries can afford.

The importance of the traditional sector--personal services--cannot be overemphasized. We often forget this sector because we take it for granted. This sector and its size is like the information sector, also depending on the economic performances. In rich countries there are more people working directly with personal services. One of the results of economic growth is that we can afford more personal services and thus growth will create more employment in this sector. We also know that it is not possible to increase productivity within this sector in the same way as in a sector where goods are produced. The standard joke is that a symphony cannot be played faster in order to increase productivity. Today, a large part of the economy in Western Europe is targeted towards personal services, consumed locally.

According to theory, when a larger part of the local production depends on local demand, this will stabilize regional development.

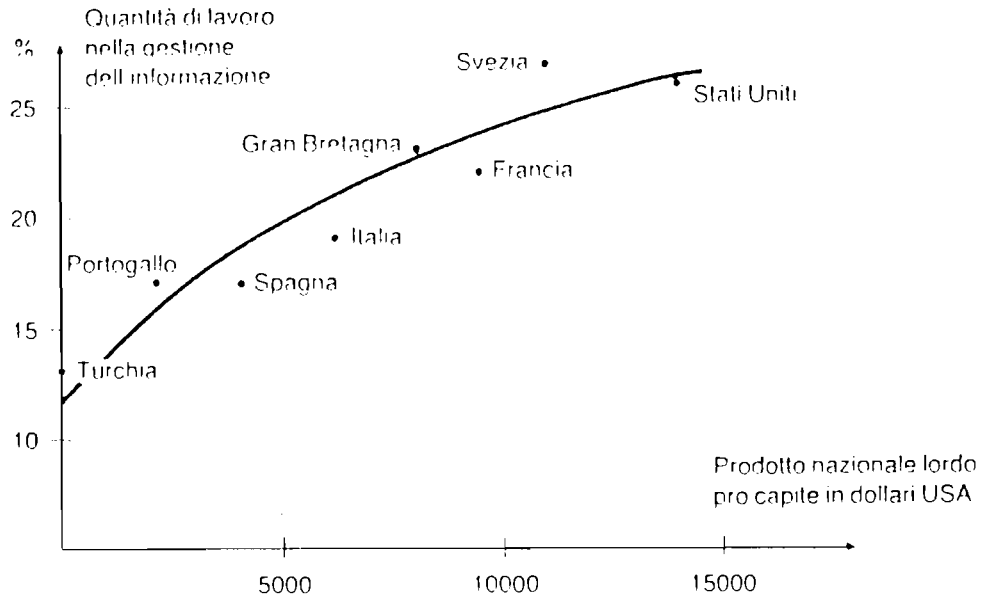


Figure 6. Proportion of working hours devoted to information handling and GNP per capita in some European countries and in the USA in 1985. Source: Öberg 1989.

1.3. Human Capital Theory

Human capital is a much more valuable asset in our society than physical capital. According to one idea, this capital will increase for individuals with the length of their education and experience in working life. This process could continue for individuals in most occupations until the age of 45-65. This is the essence of the human capital theory.

If we believe in this theory and in this age group being more valuable on the labor market, then it would be possible to deduct several ideas from that. One is that one part of the changes in economic growth over time has to do with demography and age structure. Changing proportions of older and experienced persons in the labor force will partly explain changes in economic growth. This could also be shown for Japan (Klein 1992) and OECD countries (Malmberg 1992). Indirectly, this will also influence the speed of economic restructuring and thus interregional migration.

Another idea is that if employers believe in the human capital theory, they are prepared to pay more for the older laborers and their knowledge. This will also lower their willingness to lose experienced laborers, especially in the dominant white-collar sector. At the same time they are hesitant to employ new laborers and train them for high productivity. Both attitudes will lower the mobility of older laborers and thus also the migration rates for them. As the population in Western Europe becomes older, there will be a tendency toward lower mobility because of this effect of the human capital theory.

The human capital theory is not self-evident. Many would argue that older people are less attractive on the labor market because their knowledge is not up to date with modern technology. In physical hard work, older laborers produce much less on average. However, more and more occupations are white-collar ones, where experience has an increased value over time.

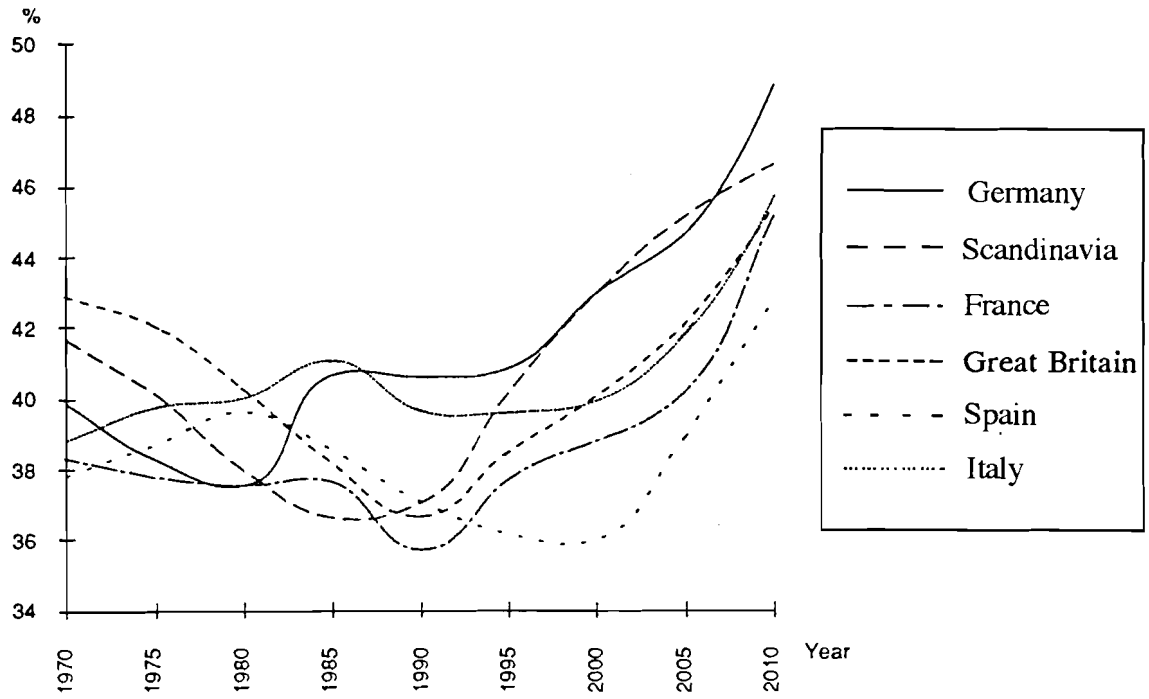


Figure 7. Percent of the population, age 20-64, in "most productive" age groups (45-64) in some European countries 1970-2010. Source: UN statistics.

1.4. Physical Capital Theory

A most interesting characteristic of rapid population changes due to interregional migration is that, in the short and medium run, the new demand for physical infrastructure must be satisfied within an already given amount of supply. In most countries the building sector will only contribute to e.g. the existing housing stock with around one percent per year. This figure, one percent, is a practical rule for possible changes in the physical infrastructure in a large region or a nation. There are not many exceptions from this rule. Based on this knowledge we can make some conclusions.

Most of our physical infrastructure is thus developed earlier for a population with another production system, another lifestyle, and another demographic composition. The physical infrastructure is "always" unmodern and not suitable for present lifestyles and demand. It is also located in regions which do not always fit into a modern production structure.

Also the changes we try to implement today, often based on a present need or demand, will imprison future generations in a physical structure, limiting their choice of location.

It is possible to somewhat exceed the one-percent rule if we compare the number of new dwellings with the existing stock. However, when we look at the value of all physical capital, it is a very hard restriction for the geographical mobility of capital. Very large housing programs have to rely on and adapt to existing infrastructure to be economical. This is why the one-percent rule limits the interregional reallocation process, making regional development time consuming.

The welfare state is accumulating physical capital and therefore, its value becomes larger for each decade. It was easy to desert a wooden mining town in the USA a hundred years ago, but it is impossible to empty a modern European mining town when the mine closes down. There are two

reasons for this. First, too much value is invested in the physical infrastructure and second, it would be too costly to build this infrastructure in another place. It is impossible to move Manchester to London.

The conclusion is simple: the higher the value of the physical infrastructure, the lower the net migration. This is probably one of the most important new factors behind the contemporary diminishing net migration figures in the Western European economies.

2. APPROACHES IN SOCIAL GEOGRAPHY

On average, geography is a more applied science than economics. It is less theoretical in the sense that it is not a coherent set of findings founded in axioms concerning individual behavior and systems rules. Theories in geography are more founded in empirical observations. While (political) economy is very much concerned with changes of national economic indicators over time, geography is concerned with social and economic processes in space.

As human geography is a young and small discipline, it is natural that geographers use several ideas and methods from economics as well as from other social science traditions when they study spatial and contextual determinants of behavior. When economists work with migration studies, they usually use theory and apply it on net flows between two regions. When geographers work with migration studies, they usually work with many regions and gross flows as well.

The following overview will start with some general macro ideas on migration commonly used in geography, and culminating in an overview of microgeography, including the way it is understood in the time-geography tradition. It is mainly this latter part which distinguishes the overview from others (Öberg and Wils 1992 or Öberg 1994).

2.1. Development Phases

A common way to understand changes and restructuring processes in a society is to compare them with corresponding contemporary or historical changes in other societies. Applied to population changes, we are familiar with the demographic transition where relations between demographic factors are arranged in time sequences and historical phases. The same approach applied on interregional migration is called *the mobility transition* (see Figure 8). According to Zelinsky (1971) it is possible to hypothesize relationships between different types of migration flows and general processes, like urbanization, industrialization and modernization. Five stages of change are recognized in the transition of a society from one depending on traditional agriculture to the super-advanced (post-industrial) one where migration flows are absorbed by modern telecommunication systems.

Like the demographic transition, the mobility transition with its development phases is a descriptive model with little explanatory power. It is based on vague empirical generalizations said to reflect processes in most countries. It is thus a deterministic and universal model and, as one can guess, it is regarded both as a brilliant summary of ongoing processes by some researchers, and as an uninteresting combination of intuitively-defined concepts by others.

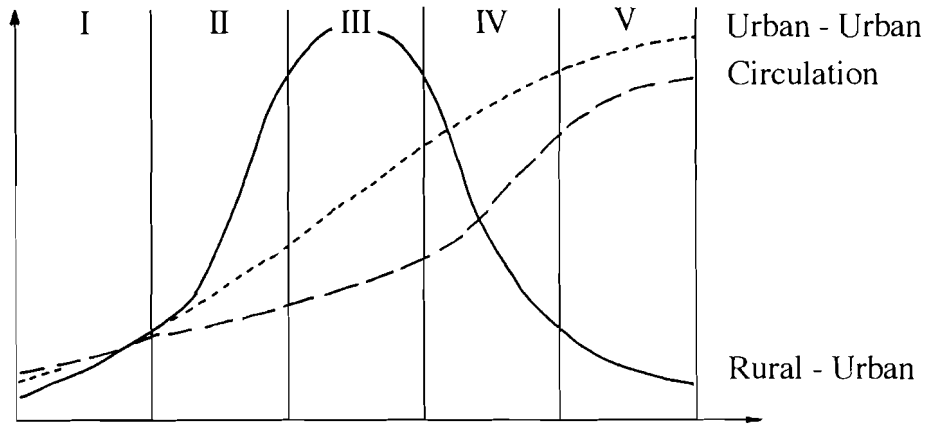


Figure 8. Zelinsky's hypothesis of the mobility transition and its five phases: a simplified version. Source: Zelinsky 1971.

2.2. Empirical Generalization

In many studies on migration, the main effort is to find empirical numbers on historical or contemporary flows. In most countries there is a shortage of information on migration flows and thus there are many indirect ways to try to estimate the numbers. In some countries, researchers work more with these estimates than with other matters related to interregional migration. When they are found, the next step is to put them in a theoretical framework. This is not easy. For example, if there is an outmigration from larger cities, then many causal links compete to give the best explanation for this. If there is an in-migration, other explanations are possible. This type of discussion is of course more popular than scientific. It reminds us of the ongoing discussion among economists where many clever ideas are put forward to explain history. Like among economists, geographers are seldom able to apply their ideas on real world situations when they do not know the actual figures. It could be quite embarrassing to explain why there is an ongoing movement into cities if suddenly new statistics show that there has been a turnaround since many years.

In geography as in other social sciences, a common approach to study stable relations between data is to make empirical generalizations. As an example of correlated data, Figure 9 shows how interregional migration covaries with the number of available jobs. Models based on empirical and quantitative data can be formulated more or less closely to theory. In the latter case, social sciences can still learn a lot from natural sciences where so-called data mining has been used with success in many research fields. Prognoses on future migratory flows most often use historical data treated with some kind of model. An example of a quite recent approach is dynamic migratory model connecting the microlevel of individual decisions with the macrolevel of the migratory process, making use of master equations (Weidlich and Haag 1988). Many new theories and large fields of knowledge have been introduced after successful data mining. With more scientists and better computing facilities, data mining will probably be more common during the coming decades. Already, its efficiency in predicting and in pattern recognition, e.g. with the help of computer-based neural networks, has shown interesting results.

A few persons have tried to generalize empirical findings into migration "laws". If one researcher from each century should be mentioned, the Kryger (1764), Ravenstein (1885, 1889) and Lee (1966) are good examples. The latter two work with ideas of how aggregated behavior follows a general pattern. For example, a primary migration flow from region *a* to region *b* will later be followed by a flow of return migrants.

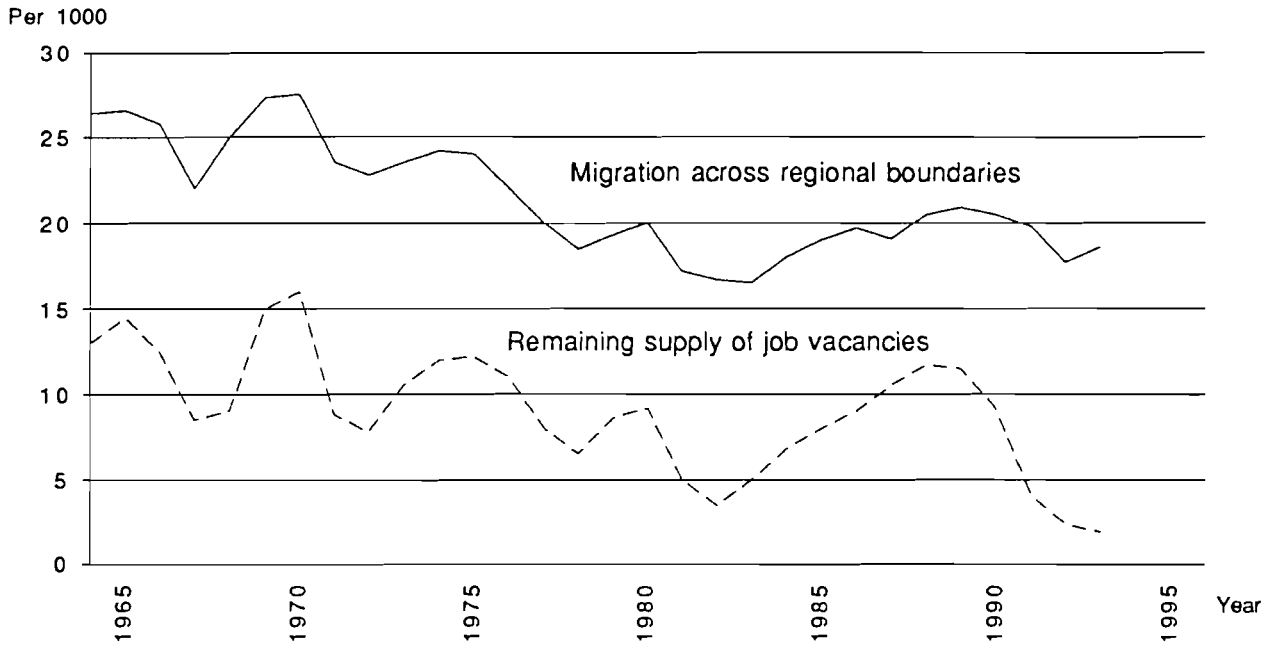


Figure 9. Some interregional migration is due to the supply of job vacancies. Data from Sweden 1965-1994. Source: Statistics Sweden and the Swedish Labor Market Board.

Forecasting interregional migration due to restructuring processes on local labor markets with econometric methods can be done in many ways, but for geographers it is common to use gravitation ideas when the models are specified.

2.3. Gravitation Models

One of the strongest theories in applied geography is the spatial gravitation model. It has its roots in Newtonian physics. The idea that the volume of migration is inversely related to distance was stated more than a century ago by a German geographer working in London, who was referred to in the last section, Ravenstein (1885, 1889). This idea became known in geography by the works of Zipf (1941). It was transformed and developed by Stouffer (1940), who stated that the number of persons going a given distance is directly proportional to the number of intervening opportunities; by Hägerstrand (1957), who modelled migration with gravitation principles and Monte Carlo principles; by Lee (1966), who broadened the theory from the notion that migration is determined only by distance and (economic) opportunities; and finally by Wilson (1974), who generalized and developed the mathematics of these ideas.

According to estimates in several countries, a large proportion of the interregional moves can be "explained" by the basic gravitation formula. In France, the explanatory power of the model, measured by R^2 is 0.85 for interregional migration flows (Pumain 1988). Few theories in other social sciences can be applied with the same accuracy on empirical figures.

It is always possible to debate whether spatial gravitation is a theory, a law, a model, an empirical generalization, or some type of idea. For some, it is only the aggregated outcome of microrules for behavior. In a recent article, Andersson and Persson (1993), showed how the idea corresponds to neoclassical micro theory.

2.4. Systems Approaches

In geography, as in other disciplines, systems approach has a tradition. An early, well-known migration study on rural-urban flows using a systems approach is carried through by Mabogunje (1972). The basic idea behind a systems approach is that it does not see migration in "over-simplified" terms of cause and effect. Feedback effects and circular effects, together with interdependent and self-modifying processes, guarantee that changes in one part of a system may have a ripple effect in other parts and thus in the whole. Mabogunje's studies of migration in Africa result in a theory/model/system made up of three elements. The potential migrant is encouraged to leave the village by stimuli from the environment. Institutional forces and adjustment mechanisms then influence the outcome of the process. The way people are informed, or misinformed, also plays an important role for the outcome.

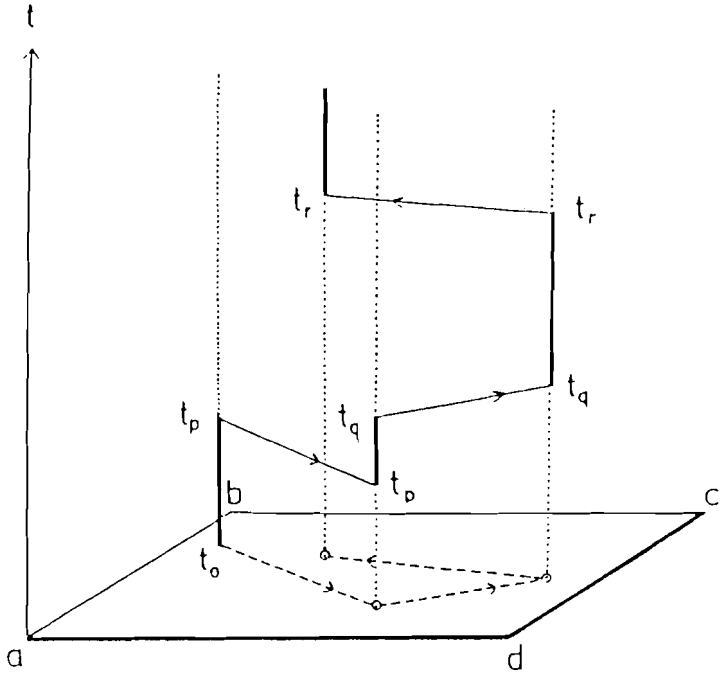
Vacancy chains also show how systems work. Vacancy chain analysis was developed by White (1970). He used empirical data from an organization as a base for the development of more general algorithms. The same ideas have been used to quantify aggregated effects of occupational changes (Öberg 1979b). This study was based on empirical studies of indirect effects of job recruitment. When a person is recruited, he/she often leaves a job that in turn must be filled by a new person. Furthermore, jobs are sometimes taken by workers employed in another local labor market. If this migrant has a husband/wife also leaving a job, still more people are involved in both job mobility and geographical mobility. The result of the study was that the relocation of 11,000 public jobs from the Swedish capital to other cities, in spite of the fact that only a minority of the civil servants moved with their jobs, caused 10,000 moves between local labor markets and 30,000 job changes in total.

Systems approaches can deal with both macro and micro theory. A micro approach--where individuals are always treated as persons related to two other persons and a physical environment, and where the location in time and space is important for an understanding of all ongoing parallel processes--has a special label in geography: time-geography.

2.5. Time-Geography

Time-geography is a set of ideas basically developed by Hägerstrand (1954, 1970). They have been applied to migration (Hägerstrand 1947, 1969), see Figure 10, as well as to other areas. Since most of the literature is in Swedish, some space will now be used to explain a time-geographical approach to migration. When a person migrates, this is seen as one of a whole set of actions carried through by interaction with other individuals and depending on structural conditions. Time-geography is a way of thinking, but it can also be used in a modelling context. In fact, computer facilities and object-oriented languages are prerequisites for a time-geographic approach on larger systems, as well as for other versions of applied social sciences, where theory and descriptions use complex interactions and work with parallel processes.

Techniques to model time-geographic approaches were used by Hägerstrand (1957) in his Monte Carlo approach to spatial innovation processes. Three decades passed until the technique to model dynamic interactive parallel processes was developed to fit the theoretical approach, see e.g. Öberg (1979a) or Holm et al. (1989). Ideas from Hägerstrand (1947, 1970), Simmons (1968), Rossi (1955), and others can now be used in dynamic models working with parallel processes. The difference between the representation chosen in time-geographic approaches and the more traditional mobility literature is the emphasis on a life-path perspective and cultural/demographic causes of moves, as opposed to the emphasis on conditions in the local labor markets as the most important cause of moves.



* Part of the time-space path of an individual. Dotted vertical lines represent stations. Movements take place between stations at times t_p, t_q and t_r. Dashed lines project movements on the landscape.

Figure 10. A time-geographic approach to migration from 1969. Source: Hägerstrand 1969.

Let us start the introduction to a time-geographic modelling approach by reading a short description of the life of Siv Petterson (Holm et al. 1989). The following quoted text was created by a computer. The language is poor and contains some expressions which depend on some specific conditions of the model aimed at keeping track of modalities, like *prefer and ought to,* but it is easy to see that the text outlines the story of a human life. For the computer to be able to write a text of this kind, it has to be given instructions. In this case, it has been fed about a thousand rules which state--in extraordinarily simplified terms--how the lives of different people are interconnected. The computer was thus not instructed by means of rules pertaining to the particular life of Siv Petterson. Her life history is the result of general rules of behavior and interaction. All events are dependent upon unique contexts but are determined by the system as a whole. The rules are general. The same rules with some variations also apply to other individuals. With these rules, the model will describe aspects of our lives. The emphasis is given to the ways in which people educate themselves, work, move from one place to another, and change their household status.

> In August, 1952, Siv Petterson was born in Stockholm. Her parents were Johan Petterson and Kerstin Svensson. In January, 1968, Siv Petterson and Artur Nilsson formed a couple, which they absolutely wanted to and ought to. They were then 15 and 18 years old, respectively. Siv Petterson left elementary school in June, 1968. During August, 1969, Siv Petterson moved to Malmö in order to start education. 1969, in August, Siv Petterson began an education, which she absolutely wanted to and perhaps ought to. It belonged within the educational sector. In February, 1971, Siv Petterson separated from Artur Nilsson. In February, 1971, Siv Petterson and Ivar Larson formed a couple, which they preferred and ought to. They were then 18 and 19 years old, respectively. In 1971 (in August) Siv Petterson formed a new household together with Ivar Larson, which she wanted to and perhaps ought not to. In August, 1975, Siv Petterson finished her education.

> She was then 23 years old, a cohabitee, and had a completed education within the educational sector. In November, 1976, Siv Petterson had a daughter called Barbro by Ivar Larson, which she preferred and ought to. In April, 1978, Siv Petterson did not find a single vacant job. In September, 1980, Siv Petterson had a daughter called Maria by Ivar Larson, which she preferred not to but ought to. Siv Petterson began a new job during August, 1981, which she preferred and perhaps ought to. It was within the educational sector at the college level. In January (1983) Siv Petterson moved away from Ivar Larson. Siv Petterson left her job in February, 1987. She was then 34 years old. Siv Petterson began a new job in February, 1987, which she preferred and ought to. It was at the college level within the manufacturing sector. She then changed jobs four more times before her retirement in 2018. In August, 2033, Petterson finally died aged 81 years.

This particular time-geographic approach is different from other models developed within the social sciences in that it handles a considerably greater number of rules. From a technical point of view, it is more advanced than its predecessors, as it is able to work with a complex system of parallel processes. Although the model is governed by general knowledge of human behavior, it is able to cope with and accommodate all persons as individuals. Hence, the life histories of different people become interdependent. Even rules for admissions to schools, or for recruitment to workplaces, affect the way in which lives are developed and described in the model. We might say that it is concerned with people who cooperate and compete for various resources in a temporal space.

When time-geographers and other social scientists resort to advanced techniques, this has the advantage of facilitating detailed accounts of what happens, or might happen, in a society. One drawback, though, is that outsiders find it difficult to understand, and therefore to accept, all those rules that are built into the model.

In complex interactive models, masses of knowledge--experiential as well as theoretical--are brought together to form pictures of matters we want to learn more about (Holm et al. 1988). Like many technical systems, the model that gave rise to the computer-written text above clearly produces an intelligible result. It does so despite the fact that it would take a skilled social analyst several working days just to peruse and comprehend the interaction between the thousand or so rules that govern the model.

As it is hard to gain an insight into more than parts of the model in a short time, one may well ask whether it can properly be said to express a theory for a discipline within the social sciences. After all, the purpose of a theory is to simplify and to provide a helpful perspective. However, everybody who wants to render the intricate interaction of human beings in one or a few rules can seldom use this simplification in applied research. Nor does the time-geographic approach live up to such ambitions. It is too complex in several dimensions. It is simple in another respect, though. The rules often apply to human actions in situations we have experienced ourselves, or are at least thoroughly familiar with. Since life histories of people can hardly be based on a small number of principles, we have to accept an understanding of more complex processes.

3. CONTEMPORARY PROGRESS IN RESEARCH

Regional restructuring of local labor markets is one of the causes behind interregional migration flows. Other causes are e.g. lifestyle changes and/or household changes. Economic restructuring of the production system and occupations is more important as a cause of net flows than of gross flows. As a theory, the idea of links between labor market performance and migration is stronger on the macro level than on the micro level.

Restructuring in the production system is mirrored in salaries and in the demand for different skills. In this chapter we have indicated that two regions with the same average wage level could still have interregional migration flows according to theory. Occupational imbalances or salary differences can exist within the aggregated figures. Furthermore, short-term imbalances over time can exist on labor markets in long-term balance.

In economic theory, a higher wage is better for an individual than a lower, *ceteris paribus*. In the real world, decisions are made as a response to several, only partly understood, complex and heterogeneous processes. If we only consider migration as a household-decision process and different types of physical movement to a new context, it is hard to apply our theory on actual situations. The basic theory can only be used to indicate the directions of net flows if we have a general understanding of other conditions in the interacting regions. With this in mind, the basic "law" of migration is still a strong theory.

The one and only possible candidate for an even stronger theory is the fact that we have preferences for lifestyles, such as urban lifestyle or rural lifestyle, available only in some regions. If lifestyle values are incorporated in the "wage" concept, it is still our old theory. However, if all utilities are included in the wage concept, it becomes a tutology to say that people move because they believe that they can increase their wages. No information will remain in the concept. If wage/income and lifestyle/quality of life are regarded as different dimensions of life, then the latter pair become strong theoretical concepts. They could compete with economic measures as strong driving forces behind interregional migration. We already know that they are strong forces behind intraregional migration, some prefer suburban life, others city centers when choosing dwellings within regions. Furthermore, a proportion of interregional moves is always caused by household changes, e.g. marriages between people from different regions (see Figure 11).

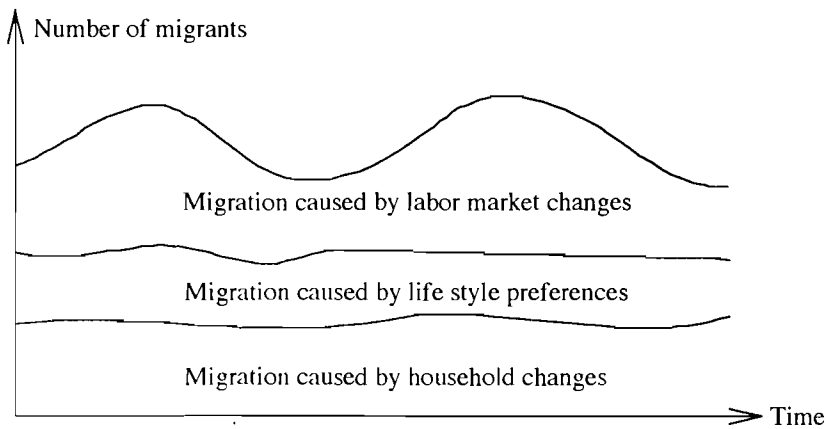


Figure 11. Interregional migration is caused by processes on the local labor market as well as by other causes.

Two other economic theories are also discussed. According to the human capital theory, less interregional migration will occur when a larger proportion of the labor force is in the age group 45-65. This is an idea which of course is more important in a post-modern service society where blue-collar workers are rare. According to the physical capital theory, net flows between regions seldom exceed one percent per year. This value of physical capital in regions in welfare states is so large compared to the production capacity that interregional net flows can only be larger than one percent in extreme situations. I will soon come back to this idea.

Developing parts of socio-scientific theory is not the sole purpose of this paper. It is also intended to introduce new forms of description in time-geography--forms that belong somewhere between the symbols of rigid mathematics and imprecise verbal presentation. This idea will be developed further.

3.1. New Languages Merging Theory and Reality

Time-geography as an idea can be used as a base for the development of scientific tools, or a "scientific language" to describe the mobility of individual actors and artifacts, their actions and physical movements in time and space according to a set of rules. If economic theory describes how actors would behave in a "hypothetical" world, e.g. on markets if they were rational, time-geography describes how actors behave in the "real" world. The description in time-geography is ideally made with a language which is not restricted to the verbal language, but uses e.g. graphics or better high-level computer languages. This time-geographic language enables us to model parallel processes.

A precondition for the development of time-geography from an idea or a way of thinking to a scientific language, to describe how actors behave in a dynamic system, is the present development in computer technology. At least during the last decade, the software tools have been sufficient. The time-geographic migration models described earlier in this working paper were developed more than a decade ago. Now the hardware seems to be sufficient for larger population systems. Contemporary development with parallel, fast processors will make it possible to develop the idea of a fine geographic language further. Large scale models, with very large numbers of individuals acting as individuals normally do, and a quite detailed physical environment, will be the future social science version of virtual realities.

3.2. Net Migration Stability in Welfare States

Some societal changes tend to increase interregional migration, while others have the opposite effect. Better education and more experience with non-native regions makes us mobile, while access to better transportation and higher female participation in the labor force makes us stable. In addition to these trends, we can think of two new tendencies for structuring forces. They will probably be discussed more during the coming decade because they will, to a large extent, stabilize future interregional migration flows.

The first is that inhabitants in welfare societies have become so rich and have accumulated too much real capital, that we now live in a physical structure which cannot be changed in its spatial distribution on a macro scale in a short- or medium-term perspective. In this working paper, the one-percent rule (see Figure 12) is a contemporary empirical expression for this more general stability condition for net migration. Any valuable, long-lasting, geographic, immobile, physical capital will stabilize interregional migration.

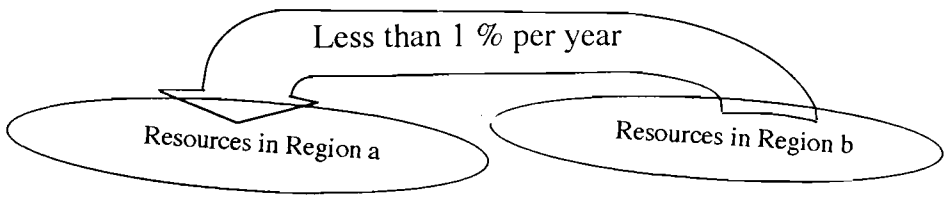


Figure 12. The one-percent rule indicates the maximum yearly transfer of physical resources between regions in welfare societies.

The second new structuring force is not fully recognized in the public debate. There is no return to a society where many people would work in industry. Already in the USA, the 500 largest service companies have as many employees as the 500 largest industrial companies. More investments into industries would mainly result in robots, computers and other equipment, not in employment. The growing employment sector is service activities targeted at individuals and households. A large number of people will not be employed, but they will still have an income through child allowances, public and/or private pensions, unemployment insurances, unemployment benefits, social insurances, assistance allowances, and other money transfers. These money transfers will create a steady basic demand for personal services in all regions in welfare societies.

Furthermore, public consumption, like day nurseries, schools, hospitals, road maintenance, etc., will also create a large number of jobs in the service sector, thus adding to a basic demand for labor on local labor markets. Financial problems in the public sector will force the production processes into efficiency improvements, and some of it will be privatized, but still it will be more reliable than industry when it comes to employment on local labor markets. Together with money transfers directly to individuals, public consumption of personal services will create a spatial decentralized employment in the service sector.

The two new structural conditions discussed here--a more valuable physical capital and larger substantial demand services--can partly explain changes in the net-migration pattern during the last decades. In only one generation, the migration pattern in most welfare states has changed dramatically. The quite strong urbanization process during the 1960s, and the migration turnaround during the 1970s, with net migration out from the larger cities, have transformed into a more stable phase with low figures for interregional net migration.

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