

**STATISTICAL COMMISSION and  
ECONOMIC COMMISSION FOR EUROPE**

**STATISTICAL OFFICE OF THE  
EUROPEAN COMMUNITIES  
(Eurostat)**

**CONFERENCE OF EUROPEAN STATISTICIANS**

**Joint ECE-Eurostat Work Session on Demographic Projections**  
(Perugia, Italy, 3-7 May 1999)

Working Paper No. 39

### **Internal Migration in Population Forecasts: Necessity and Predictability<sup>1</sup>**

#### **Introduction**

1. Among those usually concerned with population forecasting very few topics have been so repeatedly discussed as the so-called "issue of migration". In the Czech demographic literature the role of migration in population forecasts has been extensively debated for more than fifty years - since the very beginning of research and the growth of public interest in this area. It seems that both "pure" academicians and practitioners dealing with population forecasting tended to ask themselves more and more often "now, what about migration?". The question, however, is not an easy one to answer and remains open up to now, even in its principal part: Whether we should "include" migration or not.

2. The process of searching for a satisfactory answer has, however, its specific features: scientists who are working in the field often shift the focus to other issues and questions instead of directly addressing the major dilemma. Each year an increasing number of new works appear that provides only a "smattering" consideration or move the discussion into an abstract methodological mode, unavailing from the practical point of view. Practitioners who are heavily pressured to present the real forecasts of the actual populations seem to be even more interested in finding the answer. Since in the public sphere the exclusion of migration is often considered as simply a lack of skill, practitioners mostly do forecasts using information "on-hand" and apply approaches that give a possibility to act within the limits of commonly available information and to keep a safe distance between the chosen theoretical framework and the particular practical steps.

3. Analysis of what should and could be done to "involve" migration into population forecasts, and why it is so important is developed in this paper drawing from the author's original extended experience in both theoretical and practical sphere of population forecasting. Paper's structure follows the axis of three principal related questions: First, is it so necessary to include migration into population forecasts? Second, if so, how and "what" migration should be involved? Finally, to what extent are predictable, if at all, the values of migration parameters? For practical reasons, the discussion is limited to internal migration, which is considered foremost in the context of regional (sub-national) population development.

#### **Necessity? Yes!**

4. In case of regional populations, the necessity to involve internal migration into population forecasts seems to be obvious. There are at least two important reasons for a positive answer. The first reason is connected to the issue of application. Some uncertainty is inherited by each forecast because "...in the case of demographic forecasting one cannot deny that a great deal of inspiration and hence

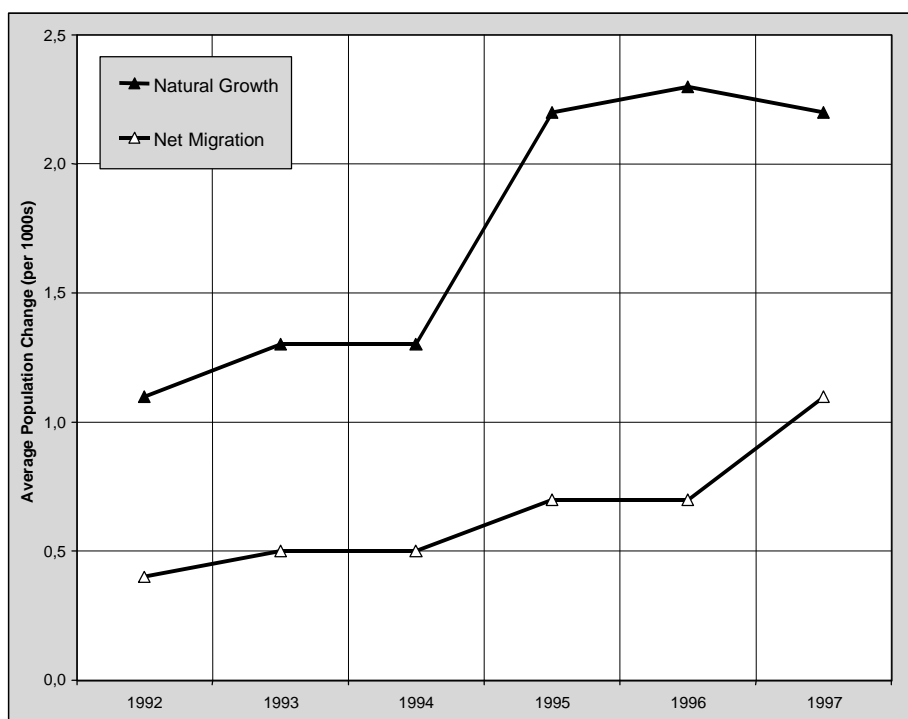
---

<sup>1</sup> Prepared by **Tomas Kucera**, Charles University of Prague, Faculty of Science Department of Demography and Geodemography Albertov 6. 128 43 Praha 2, Czech Republic

of subjectivity is involved ...” (Keilman, 1990). At the same time, there are not many clear indicators that could help forecasts’ users to identify the quality of provided forecast results through their formal presentation. As a perception of accuracy, this basic quality, known as reliability, cannot be directly measured - it can be only judged and estimated. The judgement usually is based on the names of the forecasts’ authors and/or institutions they represent, and on the accuracy of previous or similar forecasts. It should be based, however, foremost on the face validity (Long, 1987) of the product which reflects and directly derives from the quality of forecasting process, e.g. from the fact that applied approaches and methods are justified, and that none of the adopted assumptions are in contradiction, and also that nothing important was omitted.

5. The second reason relates to the role of migration in population change. There is no doubt that migration represents an important component of the overall population dynamics. Its significance varies, however, in each particular case. The direct impact of migration on population development primarily depends on the size and demographic structure of particular population, and on the number of migrants and structure of migration flows. In general, the role of migration increases with decreasing regional level, at which the population is defined, and *vice versa* (Fig. 1a and 1b). For the analysis of hierarchically outlined sub-national populations, in our view, this shift can be quite significant. Moreover, bearing in mind reproduction patterns prevailing in contemporary Europe, it could be argued that internal migration is becoming the very essential component of current population development and under particular circumstances could even play a more important role than a natural growth.

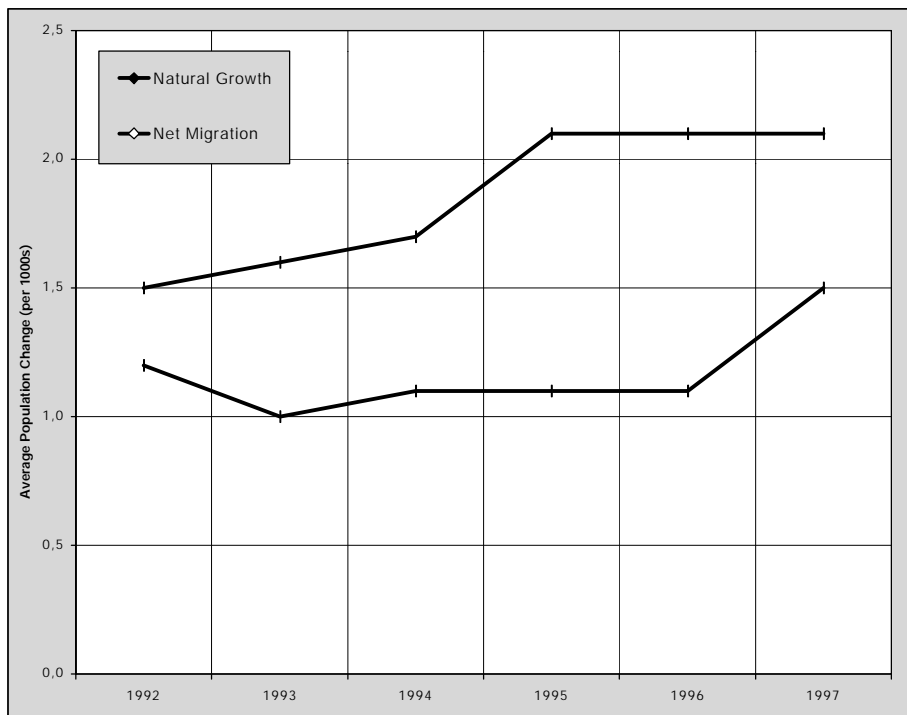
*Fig. 1a: Average population change caused by internal migration and natural growth in the Czech Republic between 1992-1997, regions (8) (See page 10)*



6. These examples show, however, only changes in total population. When dynamics of sex and age structures in connection with the sources of their change are monitored, one can discover that internal migration cannot be ignored even in cases when total in-migration and out-migration seem to

be balanced. Standard age patterns of mortality transform migration into almost an exclusive factor of change for most age groups, especially for population groups of children and economically active adults. Therefore, with the exception of very unusual situations - for example, when we face an extreme shortage of available information, or migration has been balanced across all age groups - we cannot justify the exclusion of migration from the analysis and forecast of regional population development.

*Fig. 1b: Average population change caused by internal migration and natural growth in the Czech Republic, between 1992-1997, districts (76)*



7. Logically, there should be no serious reasons and consequently no attempts to exclude internal migration from regional population forecasting. Moreover, neither the lack of sufficient information nor migration balance can serve as such “excuses”, because the other sources of knowledge may be used to forecast migration if the particular information is missing. Also, the complete migration balance, if it ever occurs, could be a short- or, what is less likely, long-term demographic event, but in any case it represents a time-limited phenomenon. In other words, the exclusion of migration can be seen at least as a serious shortcoming in forecast’s face validity, although the significance of migration might be preliminary assumed as not too high. Without face validity, the reliability of any forecast is, however, not warranted.

8. Through examination of the history of population forecasting, one might discover that exclusion of migration often was caused by lack of skill, e. g. inability to cope with migration, its dynamics and implications for other demographic processes. Certainly, there have been also a number of attempts to exclude migration in order not to bear the responsibility for low reliability of forecasts caused by highly uncertain perspectives of migration. According to the classic definition of forecast, it should represent the most probable picture of most likely future development. Forecasts, which are excluding migration can be envisaged as those assuming a complete restriction of inter-regional

movement or a complete balance of a given migration system. Because such conditions seem to be very unlikely and can hardly correspond with any slightest realistic assumptions, we can consider them only as a mere projections, not forecasts.

### **How and “what” migration?**

9. Inclusion of migration into population forecasts faces two distinct groups of issues. The first group consists of methodological issues, namely, what is the most effective way to include migration, and how to construct the most appropriate forecasting model, which are broadly discussed. The second group represents the issues of the very process of forecasting - estimation of values of migration parameters identified by the chosen model. The further discussion will focus on the first group of issues.

10. A search for an appropriate forecasting model is one of the standard procedures of population forecasting. Its realisation is limited to and predetermined by the forecast design, which in most cases requires detailed age structure for each sex and a one-year projection step. Required division of forecasted population according to age and sex can be done on *de facto* basis only for models that use cohort-component approach to population forecasting. Final selection of basic population categories representing separate elements of forecasting model also depends on the existence of relatively homogenous sub-groups of population from the point of long-term reproduction processes, availability of corresponding data and, importantly, on the size of proposed population categories and the intensity of given process. This intensity influences, indeed, the appearance of incidental fluctuations of parameters' values.

11. In practice, a model is usually constructed in a way that one has chosen for a particular type of forecasting model, adopting it further to the specific needs and possibilities of given forecasting task. For the purpose of migration inclusion, there is a possibility to choose between a classic uni-regional forecasting model and a multi-regional model. In the first case, we can include migration through separate calculation steps giving it absolute or relative values of migration balance or, if we decide for a “mixed” way, values representing intensities of out-migration and numbers of in-migration, all according to age and sex.

12. In relation to regional population forecasts, the major shortcoming of a classical model is its conditional character. Within a country or another large-scale national territorial formation, regional populations create a specific, influenced by migration flows, system in which separate sub-populations are interacting with each other. If this is ignored, we expose ourselves to encounter serious difficulties that might arise due to inconsistency of results obtained through separate forecasting of specific sub-populations. Such “threat” can be avoided by the use of a multi-regional forecasting model, which is based on long-term sub-population systems and employs - as basic parameters - intensities of out-migration according to specific streams (origin-destination), age and sex.

13. Generally, a value of net migration or, in best case, indicators of migration intensity represent the real inputs of projection model and allow connecting hypotheses on migration development with the current size and with sex and age structures of given population or specific sub-populations, all together constituting a regional population system. Nothing has to be changed even if we use a programme that enable us to enter some other indicators, including those of non-demographic nature. Importantly, these indicators are not parameters of projection model itself and do not influence therefore, at least directly, the forecast of migration impact.

14. If only occurrence-exposure rates are included, then all components distinguished in the model can be projected simultaneously in one single calculation step. In such case, events are also projected simultaneously since rates are correlated with total exposure time and so their values are inter-dependent. If some absolute values appear at the initial input stage, a forecasting model becomes sequential because the various components are projected one at a time, in a fixed sequence (van Imhoff, van Wissen and Spiess, 1994).

15. Recent history of official regional population forecasting gives a clear evidence of increasing role of multi-regional projections as a major tool used for introducing migration into regional population forecasts. For example, about half of all countries members of EEA use a multi-regional model to produce official regional population forecasts. This progress can be seen as one of the achievements of Eurostat's effort to develop the "European culture" also in relation to population projections done within the framework of official statistics (ISTAT, 1997).

16. Undoubtedly, a properly constructed projection model is an important element of effective and successful forecasting. The core of the process is, however, the forecasting of values attached to projection model parameters.

### **Predictability of internal migration**

17. The predictability can be either measured or judged. In population forecasting, one can measure the predictability of total size or sex and age structures with comparative ease since the corresponding values, both forecasted and observed, are usually published. Also, the predictability of total numbers of births, deaths, migration movements and total net-migration can be measured in a similar way. As to the predictability of individual processes, the numbers of events may play, however, just a very informative role due to their mutual dependency. The predictability of fertility and mortality can be also measured with some approximation through commonly available aggregate indicators, such as total fertility rate and life expectancy at birth. For migration, there is no such indicator available.

18. To determine to what extent a particular process is predictable requires the availability of accuracy evaluations of the forecasted parameters on hand. In case of migration, such evaluation is practically impossible. First, the values of parameters are not published. Secondly, producers of forecasts seem to have not been used to evaluate their past work in detail. Finally, the corresponding real values can be missing or be not available for evaluation due to very small numbers being affected by random fluctuations or due to legal protection of individual data.

19. If the accuracy cannot be measured at the level of parameters, the predictability has to be judged. Two major frameworks might be suggested here. The first is based foremost on the existing knowledge about internal migration - its nature, dynamics, major characteristics as well as relationship with other demographic processes. It is also linked to other principle elements such as the quality (reliability) of forecasting methods and availability and quality of data. The second framework entails approaches and methods used in practice when migration is forecasted.

20. Both the significance and specific features of internal migration make its forecasting to be one of the most problematic areas in the entire process of population forecasting on a sub-national level. In addition, comparatively to other demographic processes such as fertility and mortality, internal migration represents many more difficulties, which are hard even to define and/or to monitor. These difficulties arise from the existing broad spectrum of population definitions (present or resident population, permanent or temporal residents, etc.), from different concepts of migration relating to the

specificity of given data sources, or from different approaches to measurement and publication of migration data.

21. Migration is a part of a wider concept of spatial mobility and relates to a permanent change of residence. As such, migration has both temporal and spatial dimensions and its operational definition may depend on type of research or data, that are available, or both (Kosiński and Prothero, 1975). Migration is a declaratory event. To become a migrant, those who are crossing the border of a region usually need to declare their intention to establish a new permanent residence. In some cases and for some minimum periods of time, the residence is considered as a permanent one even when the person stays in a new residence.

22. The declaratory status of migration predetermines more or less substantial time shift between its occurrence and registration. The current registration isn't however the only source of migration data. Some migration statistics are based or derived from the census data. In latter case, not multiple individual moves but rather their final result by the end of the period between two censuses or between appearance in the observed population and next census is registered. The discrepancy between annual number of moves and number of transitions registered by census once in a five- or ten-year period is deeper also due to the fact that migration is a repeatable event and that propensity to migrate is generally higher among those who already had moved before.

23. Importantly, migration represents the only demographic process, which is attached to two geographical locations at the same time - origin and destination. Following Hampl's theory of complexity, migration can be identified as a geodemographic process that reflects the interaction of real sociogeographic systems (Hampl and Pavlík, 1976). These systems are characterised by a very high level of complexity of their structures, which explains the wide contingency of migration. Understanding of migration also demands gaining of an insight into its complex and highly variable nature and a deeper consideration of linkages between macro and micro processes involved, for example, between socially accepted preferences and individual preferences in migration decision-making behaviour (Mulder, 1993). Even when adopting idea that societal changes may cause changes in migration behaviour, there is still a number of, using the "push-pull" concept terminology, repulsing and attracting factors that can block or encourage migration in particular cases. Such complicated causality along with unstable factor weights results in a high sensitivity of the migration dynamics to its environment, which in turn expresses in a strong selectivity of migration. To add, a high complexity of sociogeographic systems induces their intensive dynamics, which sufficiently affects stability of migration patterns in time and space. In general, this stability is very low and far lower than analogous stability of fertility or mortality patterns.

24. As it was mentioned above, the specific character of migration, especially a relatively high uniqueness of every singular move or stream, strongly influences the level and quality of existing knowledge. It seems that across contemporary scholarship, migration patterns and migration behaviour are still considered mostly within descriptive rather than analytical approaches. Also, the study of causal structures appears to be unsystematic and does cover neither the scope nor the complexity of these structures and their relationship. Empirical descriptions supported by partial, deeper unjustified generalisations make such a study quite superficial (Hampl and Pavlík, 1987). In this context, it is not surprising that the existing theoretical body of knowledge has a very limited predictive value. It serves only as a general framework instead of providing guidance in migration forecasting.

25. Since a high complexity of migration decreases its predictability, many forecasts' producers consider models as a major and, in some cases, the only tool for dealing with migration. Methodology of migration research and forecasting currently offers several types of models, which are of different

nature. Their extensive overview is provided, for example, by Soboleva (1982), Stillwell and Congdon (1991), or Denisenko (1995). Proceeding from their general principles and specific characteristics, the following categories of models can be distinguished: macro and micro; deterministic and probabilistic; static and dynamic; system or factor; theoretical or empirical; etc. Unfortunately, most of these models also have serious shortcomings. The models could be often labeled as:

- static by nature (describe a situation relating to a single discrete time period);
- time and place specific (calibration usually is valid through a short period of time and in a given situation);
- selective (describe only selected characteristics of migration);
- incomplete (even a sophisticated model usually is not able to describe the situation in a greater detail);
- forecasts-neutral (in general, they are not forecast oriented).

This explains why the majority of models discussed in methodological and theoretical studies have been never applied in forecasting practice.

26. The experience of many developed countries in the area has also likely supported the “image” of low predictability of internal migration. During the first half of the 1990s, forecasts” producers in the countries of EEA paid a special attention to analysis and modelling of internal migration in the preparation of official regional population forecasts. Nevertheless, several of sixteen monitored countries had to adopt a zero net migration or ‘status quo” assumptions for some of the forecasts” variants (van Imhoff, van Wissen and Spiess, 1994). In addition, some migration forecasts with “moving” values of parameters introduced the dynamics rather mechanically using formal interpolation techniques for estimation of values between the starting and target year.

27. The similar practice, i.e. zero migration assumption, was implemented also in the Czech official practice when the last set of regional population forecasts was produced in 1996. In this case, the zero migration was unfortunately the only migration scenario adopted. Moreover, an *a priori* assumption of migration unpredictability was used as an official explanation and justification of this step.

### **Conclusion: Concerns and Perspectives**

28. There is no doubt that internal migration must be an immanent part of regional population forecasts. The conditions for its inclusion are heterogeneous: The migration module can be more or less incorporated in standard projection models but cannot be satisfactory operationalised since migration is difficult to predict. Variety of definitions and concepts of migration, different sources of data, a high complexity of the process and rather limited theoretical body of knowledge make migration so much more specific and complicated for prediction than fertility and mortality.

29. Forecasting internal migration, more than any other forecasting enterprise involves therefore difficult decisions about the most appropriate methodologies and the suitable ways of their implementation. To the moment, it is obvious that at least forecasts” producers must learn more about the processes by which migration is constructed, and particular about its social and cultural dimensions. How migration behaviour varies among given age, sex, ethnic and social groups? How and to what extent is internal migration connected with social and economic change including its regional differentiation? How much is the propensity for move in and out of region(s) related to such variables as general economic trends, labour market, social welfare, housing, quality of environment, life course strategies, health, but also individualisation, urbanisation, globalisation, the information

revolution, etc.? How are changes in individual migration behaviour related to changes in the system as a whole? What conditions encourage or inhibit change in migration system? Is the extraordinary, in comparison with other population processes, amount of changes found over time here typical for other spatial processes? All these questions suggest new directions and insights into conceptualisation and forecasting of migration processes but, at this point, represent rather possibilities that have not been realised and that must be pursued in future studies and in practice.

30. Clearly, those of us who specialise in population forecasting have a great deal of work to do as we develop our understanding and analysis of migration. Nevertheless, a forecasting oriented, inter-disciplinary discussion, that consider migration as a complex and dynamic system could be an important step in that development. There has been already a number of issues put on the agenda by the recent practice and among them, importantly, emerging issues in regional development. Creating mechanisms that will enable forecasts” producers to monitor the situation across regions and provide them with necessary information is one of them. Definitely, such a discussion can help us to reframe old questions and hypotheses, formulate new ones, and advance our understanding of migration as well as possibilities and limits of its forecasting.

## References

- Champion, T. and T. Fielding. 1992. (Eds.) *Migration Processes and Patterns*. Volume 1: *Research Progress and Prospects*. Volume 2: *Population Distribution in the United Kingdom*. London: Belhaven Press.
- Denisenko, M. B. 1995. "Matematičeskije modeli migratsii naselenija" [Mathematical models of migration]. In: Kvasha, A. J. and V. A. Iontsev. 1995. (Eds.) *Sovremennaja demografija* [Contemporary demography]. Moscow: MGU.
- Framskrivning av folkemengden 1996-2050. Nasjonale og regionale tall* [Population Projections 1996-2050. National and Regional Figures]. 1997. Oslo-Kongsvinger: Statistisk sentralbyrå.
- Hámpĭ, M. and Z. Pavlík. 1976. *Hierarchy reality a problem hodnoceni sirsih souvislosti populacniho vyvoje*. [Hierarchy of reality and the problem of evaluation of wider context of population development]. Praha: Charles University, Faculty of Science.
- Kosiński, L. A. and R. M. Prothero. 1975. (Eds.). *People on the Move: Studies on Internal Migration*.
- Long, J. F. 1987. *The Accuracy of Population Projection Methods of the U.S. Census Bureau*. Paper presented at the Annual Meeting of the PAA. Chicago.
- Mulder, C. 1993. *Migration Dynamics: A Life Course Approach*. PhD Thesis. Amsterdam: Thesis Publishers.
- Perspectives de population 1995-2050*. 1996. Bruxelles: Institut national de Statistique.
- Populacni prognozy. 1. dil* [Population Forecasts. Volume 1]. 1977. Prague: VÚSEI.
- Population Projections for Canada, Provinces and Territories 1993-2016*. 1994. Ottawa: Statistics Canada.
- Previsioni della popolazione residente per sesso, eta e regione. Base 1.1.1996* [Population projections by sex, age and region. Base 1.1.1996]. 1997. Rome: Istituto nazionale di statistica.
- Proyecciones de la Población de Espana calculadas a partir del Censo de Población de 1991. Total Nacional: 1990-2020. Comunidades Autónomas y Provincias: 1990-2005*. 1995. Madrid: Instituto nacional de estadística.
- Rees, Ph., E. van Imhoff *et al.* 1998. *Internal Migration and Regional Population Dynamics in the Netherlands*. Report no. 55. The Hague: N.I.D.I.
- Soboleva, S. V. 1984. "Demographičeskije aspekty sistemnogo issledovanija regionalnogo razvitija" [Demographic Aspects of System Approach in Regional Development]. Paper presented at *The Fourth Soviet-Bulgarian Working Meeting on Improvement of Territorial Organisation of Production*, Kemerovo and Novokuznetsk, March.
- Stillwell, J. and P. Congdon. 1991. (Eds.) *Migration Models: Macro and Micro Approaches*. London: Belhaven Press.

- ter Heide, H. and F. J. Willekens. 1984. (Eds.) *Demographic Research and Spatial Policy. The Dutch Experience*. London: Academic Press.
- van der Gaag, N., E. van Imhoff and L. van Wissen. 1997. *Long-term internal migration scenarios for the countries of the European Union*. Eurostat Working Paper. E4/1997-5. Luxembourg: Eurostat.
- van Imhoff, E., L. van Wissen and K. Spiess. 1994. *Regional Population Projections in the Countries of the European Economic Area*. Lisse: Swets & Zeitlinger.
- Volkov, A. G. 1988. (Eds.) *Metodologija demographicheskogo prognoza [ Methodology of demographic forecast]*. Moscow: Nauka.
- Wunsch, G. 1988. *Causal Theory and Causal Modelling. Beyond Description in the Social Sciences*. Louvain-la-Neuve: Leuven University Press.

-----