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**Univerzita Karlova v Praze, Přírodovědecká fakulta
Katedra demografie a geodemografie**

Summary of the Ph.D. Thesis
Autoreferát disertační práce

Ph.D. study program in Demography
Doktorský studijní Demografie



**Regional population forecast for the Republic of
Kazakhstan**

Regionální populační prognóza Republiky Kazachstán

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Prague/Praha/2011

Regional population forecast for the Republic of Kazakhstan

Abstract

This dissertation has three objectives. The first objective is to present literature review about theoretical background of regional population forecast. The second objective is to analyze demographic situation with relation to past and current fertility, mortality and migration development in regions of Kazakhstan. The third objective is to demonstrate two practical implementations of regional population projections. The first example is a multiregional population projection with population horizon 2009-2029 for 16 administrative divisions of Kazakhstan using period data for the year 2008 and inferring required age-sex specific interregional transition data. The second example is a multiregional population projection for period 2004-2059 of four macroregions using period-observational plan 2004-2008 and imposing internal consistency relations. The second example follows generations of people born during period of recovering fertility when these generations will be approaching retirement ages.

Keywords: multiregional population projections, internal migration, consistency restraints

Regionální populační prognóza Republiky Kazachstán

Shrnutí

Tato disertace má tři cíle. Prvním cílem je představit přehled literatury týkající se teoretického základu regionální populační prognózy. Druhým cílem je analyzovat demografickou situaci ve vztahu k minulosti a aktuální plodnosti, úmrtnosti a rozvoji migrace v regionech Kazachstánu. Třetím cílem je demonstrovat dvě praktické implementace odhadu obyvatelstva v regionech. Prvním příkladem je multiregionální populační odhad obyvatelstva s horizontem na r. 2009 až r. 2029 pro 16 administrativních okruhů Kazachstánu pomocí dobových údajů za r. 2008 a vyvození požadovaných přechodných specifických meziregionálních dat ohledně věku a pohlaví. Druhým příkladem je multiregionální populační prognóza na období od r. 2004 až do r. 2059 pro čtyři makro-regiony s využitím

pozorovacího plánu od r. 2004 do r. 2008 a s přihlédnutím k vnitřním stálým vztahům. Druhý příklad se navazuje na generace lidí narozených v době obnovení plodnosti, kdy tyto generace se blíží věku odchodu do důchodu.

Klíčová slova: multiregionální populační prognóza, vnitřní migrace, stálá zamezování

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Introduction

Regional population prognosis are very import and can be used by governmental and local authorities in planning tasks, allocation and distribution of different types of resources. For example, pension system, insurance system, building of educational facilities and medical hospitals, all spheres of life oriented and depending on the dynamic and changing structure of population require regional population prognosis. Specially regional population projections are important for a country with low population density, like Kazakhstan, with taking into consideration past population decline and successful efforts made by authorities to reimburse this loss of population. After the breakdown of Soviet Union in 1991 Kazakhstan declared independence. Economic, social and ecological problems caused increase of mortality, fertility drop and significant outflow of emigrants, and resulted in population loss. In 1997 the existing at that moment 19 administrative regions were transformed into 14 regions plus two cities, Astana and Almaty, old and new capitals. In the same year, Kazakhstan announced profamily policy with baby bonus system that in combination with ethnic migration policy helped to increase fertility.

This dissertation estimates future populations in regions of Kazakhstan by applying multiregional population projection method and formulates assumptions about expected development of demographic components by analyzing previous and current regional data of Kazakhstan and using experience of other countries.

2. Objectives of dissertation

1. Review of current methods of forecasting demographic components and population, description of approaches to modeling systems of regions.
2. Analysis of demographic situation with relation to past and current fertility, mortality and migration development in regions of Kazakhstan
3. Demonstration of two practical implementations of regional population projections for Kazakhstan.

3. Major research questions

- What are current methods of regional population forecast?
- What are regional and temporal differentiation of fertility, mortality and migration in Kazakhstan?
- What could be future population development in regions of Kazakhstan?

4. Outline of the dissertation

Introduction

Chapter 1. Mathematical background

Chapter 2. Approaches to forecasting of demographic components

Chapter 3. Multiregional population forecast

Chapter 4. General information about Kazakhstan

Chapter 5. Fertility and mortality in regions of Kazakhstan

Chapter 6. Methodological aspects of multiregional approach

Chapter 7. Multiregional population projections for 16 administrative divisions of Kazakhstan

Chapter 8. Multiregional population projections of four macroregions of Kazakhstan

Conclusion

5. Multiregional population projections of 16 administrative divisions of Kazakhstan

- *Initial population:* 01.01.2009.
- *Projection period:* 2009-2029.
- *Software:* Population Development Environment Analysis (PDE) developed by the International Institute for Applied Systems Analysis.
- Interregional transition migration data are obtained by applying

Three Face algorithm to disaggregate by gender,

One Face One Edge algorithm to disaggregate by 19 age groups.

- *Flow input data for projection:*

Fertility, mortality and transition rates, as well as net migration numbers corresponding to the year 2008.

Variants of projections

- *Constant variant:*

constant fertility, mortality, transition rates and external migration numbers corresponding to the year 2008.

- *Medium variant:*

fertility and mortality rates of divisions changes according to fertility and mortality clusters to which every division belongs.

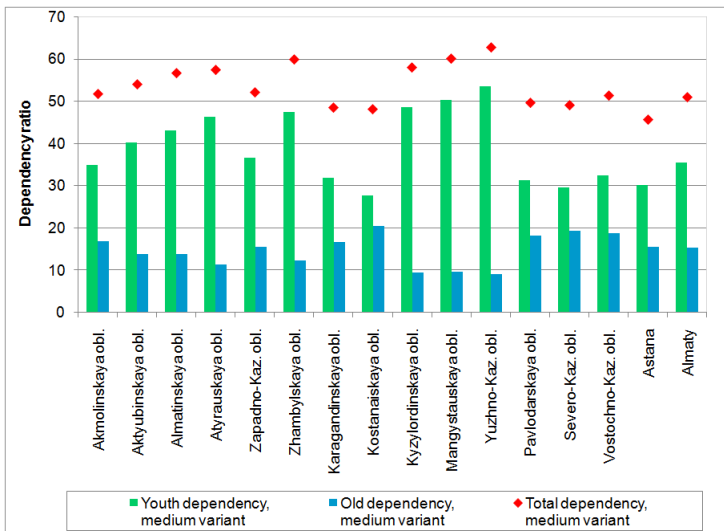
Results of projections

Estimation of future population development depends on the initial age structure of regions: how old or how young generations prevail in regions, besides in assumptions of medium variant it is suggested fertility shift to older ages, while it is clear from initial population structure that these generations are less numerous.

Regions in the south of Kazakhstan with relatively big populations at the beginning of projection and high past fertility show steady population increase under medium variant assumptions with anticipation of slight fertility and mortality changes.

Fig. 1 displays that in final population of medium variant old dependency is not bigger than youth dependence for all 16 administrative divisions.

Fig. 1 –Youth dependency, old dependency, and total dependency by regions, medium variant, 01.01.2029



6. Multiregional population projection for four macroregions of Kazakhstan

- *Initial population:* 01.01.2004.
- *Projection period:* 2004-2059.
- *Period-cohort observational period:* 2004-2009.
- *Software:* LIPRO (Lifestyle PROjections) application for multidimensional demographic analysis and projection developed by Netherlands Interdisciplinary Demographic Institute.

Preparing interregional migration data

- Interregional migration data for the year 2008 are obtained by applying

Three Face algorithm to disaggregate by gender

Three Face algorithm to disaggregate by 101 age groups.

- Interregional migration data for the years 2004, 2005, 2006, 2007 are derived from interregional migration data for the year 2008 after multiplying by corrective factors.

Four macroregions

16 administrative regions are transformed into four macroregions according to interregional migration flows:

1. Strong migration in-flows (*Astana, Almaty*);
2. Migration inflows (*Aktyubinskaya oblast, Almatinskaya oblast, Atyrauskaya oblast, Mangystauskaya oblast*);
3. Steady migration out-flows (*East-Kazakhstan oblast, Zhambulsкая oblast, North-Kazakhstan oblast, Kostanayskaya oblast, Kyzylordinskaya oblast*)
4. Migration out-flows (*Akmolinskaya oblast, West-Kazakhstan oblast, Karagandinskaya oblast, Pavlodarskaya oblast, South-Kazakhstan oblast*)

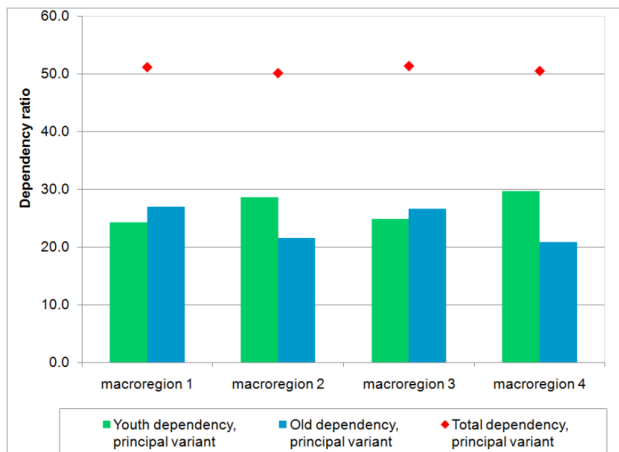
Methodology of projections

- Constant variant is based on data collected during period-observational period 2004-2008. This variant has fixed rates during 11 projection intervals.
- Principal variant assumes fertility will decrease in the future and life expectancy at birth will increase with taking into consideration assumptions for medium variant in 2008 revision of UN population projections for Kazakhstan.
- Internal consistency constraints are applied to put restrictions on births and deaths events in four macroregions of Kazakhstan. In these passive-dominant relations dominant level is presented by country level of births and death.

Results of projections

These projections anticipate ageing of population. According to Fig. 2 in macroregion 1 and macroregion 3 old dependencies prevail over youth dependencies.

Fig. 2 – Youth dependency, old dependency, and total dependency by macroregions, principal variants, 01.01.2059



7. Conclusions

The first example of population projection for 16 administrative regions with 20 years prediction horizon shows example of benefits of demographic bonus of recovering fertility.

At the same time projections for four macroregions for period 2004-2059 show what will happen when population of people born during period of recovering fertility will be approaching retirement ages. These generations are comparatively numerous, and old dependency will prevail over youth dependency in some regions.

Anticipation of population ageing allows to identify emerging problem than to simply deny it and be unprepared. Problem of population ageing raises many questions. What are demographic imperatives of increasing proportions of elders and decreasing proportion of children? Demographic and epidemiological transition will increase life expectancy at birth, what will be disability free life expectancy? Does it mean living longer, but better? What will be income of elderly population? How elderly population will sustain physical and mental health? How to provide long term care for people with chronic diseases, necessary drugs, surgical and technical procedures to treat age-related illnesses? And how elder women will survive? How to reduce poverty and poor health of widows? How frail older persons being left isolated in rural areas will have access to medical care?

Across the world developed countries are implementing active ageing policy, there are changes in governmental expectations and responsibilities, when states make efforts to reduce welfare expenditures by shifting them from public to private spendings. Other steps include increase of retirement age, sharing cost by the state, the employer and the employee, part-time work after official retirement. What lessons will be replicated in Kazakhstan? What solutions will be found on national and regional levels?

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