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LIST OF ABBREVIATIONS

ASFR	Age-Specific Fertility Rate
ART	Active Antiretroviral Therapy
BAM	Baikal-Amur Mainline
CBR	Crude Birth Rate
CDR	Crude Death Rate
CIS	Commonwealth of Independent States
DHS	Demographical Health Survey
DTM	Development Transition Model
FDT	First Demographic Transition
GDP	Gross Domestic Product
GFR	General Fertility Rate
GRR	Gross Reproduction Rate
IMR	Infant Mortality Rate
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IUSSP	International Union for the Scientific Study of Population
Kazakh SSR	Kazakh Soviet Socialist Republic
NRR	Net Reproduction Rate
RK	Republic of Kazakhstan
The UN WPP	The United Nations World Population Prospects
The USSR	The Union of Soviet Socialist Republics
TFR	Total Fertility Rate
UNECE	United Nations Economic Commission for Europe
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USA	United States of America
WHO	World Health Organization
WWII	World War Second
XUAD	Xinxiang Uyghur Autonomous District

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Chapter 1

Introduction

I, for my part, am sure that by the year of 2030 Kazakhstan would have become a Central-Asian Snow Leopard and would serve a fine example to be followed by other developing countries.
(Nazarbayev, 1997:14)

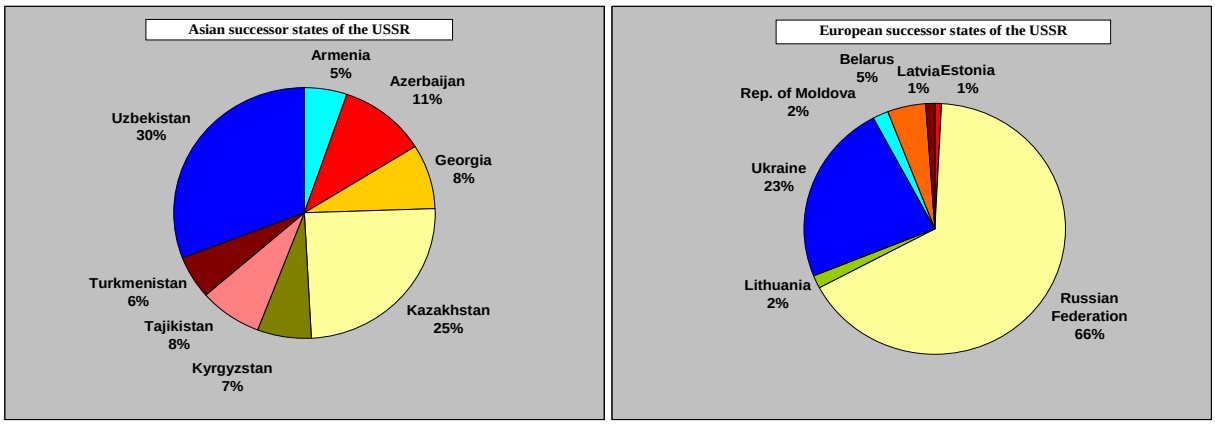
Since Kazakhstan has gained its independence and governed sovereignty in 1991 a lot of things have been changed in country's life. Hope for better times and different path of the destiny has been given to the nation, after the dark and turbulent times of 90's, after a nearly 70 years of communism and being just another 'warehouse-country' of sources and Motherland for millions of people who had to call Kazakh steeps new home. This work among pure demographical research questions will raise some problems of national population development strategy which has to be adjusted in a meanwhile in the context of population development with the regard to assessment of the UN forecasts. The thesis is a try to look on changing picture of Kazakhstan future population development according to the United Nations World Population prospects since the 1992 revision till the most recent 2008 revision. Also thesis will provide some basic definitions, calculated indicators, and explanations related to overall development of the population and its components in particular. Hereafter, main aim, research goals, objectives and questions will be raised. As well as practical relevance and the structure of the master's thesis will be presented.

1.1 Problem definition

Development of the Republic of Kazakhstan since 1991 were undertaking a transition from a centrally planned economy to a market economy, new times demanded new political orientation and less ideological pressure on development of economical sustainability. No longer had ideology stood on the main agenda of the national policy. However, formation of sovereign national policy was not only about the economical growth or political stability. It was also accompanied with entanglement situation with population development in Kazakhstan after the dissolution of the USSR. When in fact, borders yet not was formed and people who lived a day before in monolith country with some confidence into the future

realized themselves in a cruel reality of the beginning of 90's. Many of those people (mostly European origin) have been losing guarantees of stable future and initiated massive unbalanced migration which affected to the population development in general. Understanding that Kazakhstan "must" prevent further drain of people abroad and form mid and long-term population development concept has come in 1994, however its practical realization it [concept] saw in 1997 when "Kazakhstan-2030" strategy has been released (Long-term strategy of Kazakhstan "Kazakhstan-2030", 1998). Strategy aimed to inculcate the confidence into people by presenting future development path. It oriented in balanced socio-economical and political stability along with wise ethnical solidarity among the citizens. With adoption of the strategy "Kazakhstan 2030" in 1997 necessity of conducting the first independent census has become evident. However, the results of 1999 census were politicized which is seen from the chapter 7; it was critically important to know how many people were living in Kazakhstan. Along with the population transformation in Kazakhstan many countries of former Soviet Union republics felt same transformation of population change due to dissolution process. The following figure is the population distribution of successor states of the former USSR by the 1990 according to the UN WPP most recent 2008 revision. The pie figures divided into Asian and European successor states together compiling total population of the USSR according to the United Nations definition of the former USSR (United Nations World Population Prospects, the 1994 revision). For instance, Kazakhstan owned 25 per cent of total population share of Asian successor states of the USSR (Caucasian countries was defined as Asian successor states as well) while Uzbekistan nearly 30 per cent and Azerbaijan almost 11 per cent. In European part of the USSR Russia largely owned 66 per cent and Ukraine 23 per cent of European population distribution.

Fig. 1 – Population distribution in percentage: Successor States of the USSR by the end of 1990 according to the United Nations World Population Prospects the 2008 revision



Source: Author's calculations based on data of the UN WPP the 2008 revision

In 1989 All Soviet Union census declared that Kazakh SSR had 16,464 thou. people (The USSR State Committee on Statistics, 1990). However revised estimation of that very census by National Statistics Agency showed the number of 16,199 thou. people (Agency of Statistics of the Republic of Kazakhstan, 1999). In other words population of Kazakhstan differed for nearly 265,3 thou. people or 1.6 per cent. According to the United Nations World Population Prospects the most recent 2008 revision (UN WPP

furthermore) total population in 1990 population stood at 16,530 thou. people (25 per cent of the Asian successor states of the USSR). As it seen from these numbers total population of Kazakhstan remained highly sensitive number in the sense of estimation. First national census in 1999 was attempting to count for the first time total number of population after the independence in 1991. Census showed that there are 14,953 thou. people living in Kazakhstan. Table 1 below is the illustration of two censuses and is taking into account the ethnicity of residents.

Tab. 1 - Comparison of Soviet Union (1989) and the first national census (1999) in Kazakhstan by ethnical composition.

Major ethnicities	1989		1999		Index of change (in %)
	Inhabitants (thou)	Percentage	Inhabitants (thou)	Percentage	1989=100%
Kazakhs	6497	40.1	7985	53	123
Russians	6062	37.4	4480	30	74
Ukranians	876	5.4	547	4	62
Germans	947	5.8	353	2	37
Tatars	321	2.0	249	2	78
Other	1497	9.2	1339	9	89
Total	16199	100	14953	100	92

Source: Author's calculations based on data of National composition of population of the Republic of Kazakhstan. Volume I, pages 6-200.

Within next ten years in 2009 the second national census was conducted. It said that Kazakhstan reached "psychological level" of sixteen million people (16,149 thou. people) (The Agency of Statistics of the Republic of Kazakhstan, 2009). Population increase between intercensus years concluded more than a million people. However, many abuses of regulations were observed during both censuses (see chapter 7) thus, it [abuses of regulations] give us the chance to conclude that a nearly million people increase might be: 1) overestimated population increase due to some statistical errors or, 2) which is more likely revert tendency of total population to its 1989 level's. Statistically significant error of 5.3 per cent of estimation in 1999 census (Alekseenko, A., 2002; see chapter 7 for more details) and not yet estimated but assumed even bigger statistical error of 2009 census is the subject to reliability assessment of census data. To what extent we may trust into published national data? And therefore into the forecast results produced by the revisions of the UN WPP, once there is a statistically significant errors? From our point of view the reliability assessment of the national data and produced forecast results by the UN WPP forms our problem concept. Defined problem concept which is the reliability assessment and level of trust to gathered data allows us to involve the research goal, objectives and related to the topic questions below.

1.1 Research goal and objectives

The goal of this thesis is to provide better understanding of changing view on the retrospective and perspective demographic development of the Republic of Kazakhstan based on produced estimates and forecast results of the UN WPP through detailed descriptive analysis of population development changes observed during the period 1950-2050 with the aim to identify the past, existing and forthcoming trends in population development by components and by age and sex composition of the population. Implementation of the goal involves the following **objectives**:

- To identify and analyze retrospective factors in the process of declining overall fertility, natality, declining and further stagnating level of mortality and increasing role of migration to the age and sex composition of the population;
- To describe and analyze effect of transformation period (1990-2000) on overall population development and its decisive role in forming new future trends according to the UN WPP revisions since its 1992 revision;
- To evaluate produced forecast results and its internal deviation among the UN WPP revisions and national statistical data in the context of reliability assessment;
- To formulate prospective population development trends;

1.2 Practical relevance of the theme

Importance of future population development is a well-known theme in demographic research. However without detailed cognition and understanding of the past and present trends we cannot understand population development in the future. Forecasting the population development allows us to somehow foresee what would be the population development in the future; however population forecasting is a very complicated activity which requires suitable methodological tools for the calculation of projection and sufficient experience in formulation of developing scenarios and strategies. The knowledge on particular demographic processes and their joint impact on the development of population are also requisite (Vano, 2006:5). Especially nowadays changing situation in socio-economical sphere is afflicting to the population development in particular. It is true in general as well as in the case of Kazakhstan in particular. Moreover, in the context of population forecast and its outputs, view on how population will develop within projected period are highly significant while formation of wise and well-balanced national population policy at all levels of state administration. To increase their effectiveness, detailed cognition of the process in question is unavoidable.

The scientific novelty of this thesis and its theme is given by the above-mentioned fact that in depth analysis of overall population development involving all components and its impact to the age and sex composition in Kazakhstan during the period of its independence which initiated transformation period (1990-2000) is almost completely missing in scientific literature. Several aspects of future population development analysis presented in this work are very probably studied and presented for the first time in

the given spatial and historical framework. However they do not consider deep retrospective changes occurred since the 1950's up to the present days and do not make an attempt to foresee the future trends in a full volume of population development as a whole.

Another practical relevance to the thesis is given by the interdisciplinary relation between demography and economics and demography with geopolitics which can be judged in the context of its impact to the population development. As we mentioned before Kazakhstan society recently was undergoing the transition to a market economy had found that it had been largely unprepared for the host of problems deriving from this profound change. Economic output fell sharply, for most of the countries by 20-35% in the period 1989-1993 and characterized with dramatically risen unemployment level. The surge in unemployment was especially affecting women who had relatively high employment rates. Related to these trends were rising income inequalities and the increase of people in poverty, which turn affected the quality of life, health status and general opportunities. Actuality to the research goal and practical relevance of this work brings new look to the development of the country and economical success among not really successful neighbors like "closed-to the world" Uzbekistan, or revolutionary Kyrgyzstan, where "ethnical wiping" from Uzbeks and soon from Russians will lead country to even deeper problems than they might expect. The fact, that Kazakhstan has chosen stability over political inconsistency, economical liberality over closed and tight centralization policy give the chance to say that this route is good enough comparing to mentioned already Central Asian countries. The first few years of Kazakhstan's independence were characterized by an economic decline (mostly due to the destabilizing force of disintegration of the Soviet Union) by 1995 real GDP dropped to 61,4% of its 1990 level. This economic deterioration exceeded the losses experienced during the Great Depression of the 1930s. The wide-ranging inflation observed in the early 1990's peaked at annual rate of up to 3000% in mid-nineties. Since 1992, Kazakhstan has actively pursued a program of economic reform designed to establish a free market economy through privatization of state enterprises and deregulation and today is generally considered to be more advanced in this respect than most other countries of the CIS (Database of the Agency of Statistics of the Republic of Kazakhstan, 1999). Kazakhstan has enjoyed impressive economic growth over the past decade, buoyed by increased oil exports, as well as by bold economic reforms, prudent fiscal policies and economic initiatives that were instituted in 1999. This is another prone for economical and geopolitical interest to the population development in the country from the international audience and UN WPP reports on the other hand.

1.4 Structure of the work

The master thesis consists of eight chapters including introductory part and conclusion. In the first chapter the problem definition, goals and objectives, cognitive and practical relevance of the theme are introduced. After all basic description to the terminology is given applied formulas indeed are displayed. The second chapter is focused on literature review and illustrates the attained level of population development cognition in Kazakhstan and abroad by many well-know authors and research publications

as well as by many other available recourses. The following chapter is dealing with data availability and data quality: a critical review. As it was mentioned before assessment of national statistical data and the UN WPP forecast results brings some critical doubts to the quality or to the sources of data gained. The UN WPP produces most probabilistic population projections based on data retrieved from the statistical agencies. However sometimes it needs to be adjusted. For example: In the former USSR is widely believed to have underestimated the true level of infant mortality rates by as much as 25% (Anderson, Silver, Ksenofontova 1986). The Chapter four is the population forecasting methodology dealing with theoretical and empirical framework which can be divided into two imaginary blocks. The first one devoted to the general methodology, definitions and practical needs/use of population forecasts, attention in this context is paid to the process of population forecasting its stages as the main thematic skeleton structuring the relation between the first block and the second one. The second block is devoted to the UN specific forecasting methodology: cohort-component method which is applied to Kazakhstan, however in the same time it is considered to explore different kind of available forecasting techniques applied by the UN WPP. Further an attempt was given to judge on the background of the general population forecasting methodology applicability of the UN forecasting methodology its need/use and practical relevance. The core of the work is represented by the following three chapters. Chapter five is one of the key chapters of master thesis analyzing changes in population development by components: fertility, mortality, migration. This chapter can be also divided in the context of time frame into two main time periods. The first one is historical development or the retrospective estimation period between 1950-2000, observing the past trends in components of population development. The second one devoted to future population development or the perspective projection period between 2000-2050. An important attempt was given to determine and prove the existence of specific period involving both estimation and projection periods, defined as the transformation period (1990-2000) which in fact affected to the population development and clearly evident from the figures and tables presented. Chapter six appeals to be another key-chapter of the thesis and it aims to analyze and further discuss principal results of UN estimates and projections by total population, age and sex structure and some other demographic indicators. It follows the same time frame as chapter five. Therefore there is no need to duplicate the meaning of the previous chapter except the noteworthy fact that transformation period is also evident here, however impact of past disastrous events are clearly visible. An attempt was given to interpret and explain them in the context of other demographic indicators an increasing median age as the main evidence of starting aging process and low population density under the aegis of interdisciplinary relation of demography with geopolitics and demography with modern sociology. Reliability assessment of UN forecasts for Kazakhstan produced between the year 1992 and 2008 is the discussion chapter seven, where some opinion will be given to the reliability of UN forecasts and evaluation is done. Also conducted censuses results (1999, 2009) are criticized from the background of over or underestimation which led to relatively large statistically significant errors. In the conclusion of the thesis the main findings are recapitulated and discussed. Bibliography [reference] and appendices ends the work.

1.5 Basic terminology

There are wide specters of terminology used in this work which can be explained by many sources. However, it is good idea to combine and extract basic definitions from the multilingual demographic dictionary, (United Nations, 1958) and Glossary of Demographic Terms of United Nations World Population Prospects done by Department of Economic and Social Affairs Population Division. The terminologies in alphabetic order are listed together with short definitions as follows:

Births – is the average annual number of births over a given period. It refers to five-year periods running from 1 July to 30 June of the initial and final years. **Live birth** is a complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached. Each product of such a birth is considered live born (World Health Organization, 2009). (Still births are not considered)

Crude birth rate – is the number of births over a given period divided by the person-years lived by the population over that period. It is expressed as number of births per 1,000 population.

Crude death rate - is the number of deaths over a given period divided by the person-years lived by the population over that period. It is expressed as number of deaths per 1,000 population.

Deaths by sex- is the average annual number of deaths over a given period for particular sex. It refers to five-year periods running from 1 July to 30 June of the initial and final years.

Deaths under age 1 - is the average annual number of deaths under age 1 over a given period.

Deaths under age 5 - is the average annual number of deaths under age 5 over a given period.

Dependency ratio - the total dependency ratio is the ratio of the sum of the population aged 0-14 and that aged 65+ to the population aged 15-64.

The child dependency ratio is the ratio of the population aged 0-14 to the population aged 15-64.

The old-age dependency ratio is the ratio of the population aged 65 years or over to the population aged 15-64.

All ratios are presented as number of dependants per 100 persons of working age (15-64).

General Fertility rate – relates to all birth of the women at reproductive age over a given period.

Gross reproduction rate is the average number of daughters that would be born to a woman during her lifetime is she conformed to the age-specific fertility rates of a given year.

Fertility refers to phenomena connected with human reproduction. The **fertility rate** refers to the rate or incidence of births mostly in a female population or its part only.

Infant mortality - probability of dying between birth and exact age 1. It is expressed as deaths per 1,000 births

Life expectancy by sex – is the average number of years of life expected by a hypothetical cohort of individuals who would be subject during all their lives to the mortality rates of a given period. It is expressed as years.

Median age - is the age that divides the population in two parts of equal size, that is, there are as many persons with ages above the median as there are with ages below the median.

Migration is a form of geographical mobility or spatial mobility between one geographical unit and another, generally involving a change of residence from the place of origin or place of departure to the place of destination or place of arrival.

Mortality under age 5 - is the probability of dying between birth and exact age 5. It is expressed as deaths per 1,000 births.

Natural growth or natural increase is the excess of births over deaths

Net reproduction rate - is the average number of daughters a hypothetical cohort of women would have at the end of their reproductive period if they were subject during their whole lives to the fertility rates and the mortality rates of a given period. It is expressed as number of daughters per woman.

Net migration rate - is the number of immigrants minus the number of emigrants over a period, divided by the person-years lived by the population of the receiving country over that period.

Percentage urban - urban population as a percentage of the total population

Population - *de facto* population in a country, area or region as of 1 July of the year indicated.

Population density - is the population per square kilometer.

Population by five-year age group and sex - de facto population as of 1 July of the year indicated classified by sex (male, female, both sexes combined) and by five-year age groups (0-4, 5-9, 10-14,….., 95-99, 100+).

Population sex ratio - is the number of males per 100 females in the population.

Population change - is the population increment over a period that is the difference between the population at the end of the period and that at the beginning of the period. Refers to five-year periods running from 1 July to 30 June of the initial and final years.

Population growth rate - is the average exponential rate of growth of the population over a given period.

Rate of natural increase - is the difference between crude birth rate and the crude death rate. Represents the portion of population growth (or decline) determined exclusively by births and deaths.

Sex ratio at birth - is the number of male births per one female birth.

Total fertility rate - is the average number of children a hypothetical cohort of women would have at the end of their reproductive period if they were subject during their whole lives to the fertility rates of a given period and if they were not subject to mortality. It is expressed as children per woman.

Women aged 15-49 - is the number of women aged 15-49 as of 1 July of the year indicated, and that number as a percentage of the total female population as of 1 July of the year indicated. The number of women is presented in thousands.

Chapter 2

Overview of literature

2.1 Overview of literature

There is a wide choice of literature related to theory of population forecasting and future population development. However very few of them are Kazakhstan-specific. Meaning all works and published literature has rarely aimed to discuss forecasts results or future development of Kazakhstan population. Moreover in this context we can say this work may be used as a pilot version of first attempts to evaluate the UN WPP forecasting results within the Kazakhstan. Furthermore the necessity of such works will gradually rise with the upcoming understanding of future development route. Among theoretical works on the theme we have to mention works of Nathan Keyfitz: “The Limits of Population Forecasting” (Keyfitz, N.1981) where author points that future population is based on many factors as social, economic; technological that cannot be taken into account in population projection. Along with these factors there are limits of our knowledge between interrelated variables. Therefore such limitations will always bring uncertainty into the projections. “Can knowledge improve forecasts” (Keyfitz, N.1983) is another article focusing on separation between of scholarship and forecasting, where the knowledge of forecasting shall be carried under the scientific framework and not by the lay writers; “Long-range projections: models, pitfalls, possible break-throughs” (Keyfitz, N. 1979) aware readers of possible failure while forecasting based on our current knowledge. An interesting article which was published in Journal of *American Statistical Association* in early 1972: “On future population” (Keyfitz, N. 1972) describing the importance and necessity of population forecasting. Another well-known author Nico Keilman: “Why population forecasts should be probabilistic illustrated by the case of Norway up to 2050” (Keilman, N. 2002) is bright example of population forecast which should include two elements: first, a range of possible outcomes, and second, a probability attached to that range. Another work which shall be mentioned: “Uncertainty in National Population Forecasting: Issues, Backgrounds, Analyses, Recommendations”

(Keilman N., 1990). An interesting in this context is opinion of Demeny (1984) published in the article "A perspective on long-term population growth" where author pretends to stress attention on importance of long-term population growth and its projection. Conference paper of the ad hoc group of experts among whom (Brass, W. 1979) on "How to improve the United Nations Population projections" suggests the fact that projections must involve more assumptions underlying them, so that projection variability increase; these works can be classified as classic study of theoretical view on population forecast. However, there are also well-recognized authors dealing with contemporary issues of future population development. "The impact of forecasting methodology on the accuracy of national population forecasts: Evidence from the Netherlands and Czechoslovakia" (Keilman, N., Kucera, T. 1990) suggests the fact the different methodology applied may lead to different results gained, other article "Czech Republic Population Development Forecast until 2050" united in "*Population Development in the Czech Republic 1990-2002*" (Kucera, T., Burcin, B. 2002) represents deep analysis of the future population development in the Czech Republic based on the data since 1990 till the 2002 and forecasting the development until the 2050. It is showing very good explanations on the contribution of population components to the total population, life expectancy and aging process indeed. For better understanding of development by components presented in chapter 5, works of Lee, R: "New methods for forecasting fertility: an overview" (Lee R. D, 1979), "Future outlook for mortality decline in the world" (Bourgeois-Pichat J. 1979)**,** "Future prospects of magnitude and trends of international migration" (Wander H. 1979) were used. Regarding mentioned "componential development" literature it will be discussed furthermore in detail in chapter 5, because importance of these articles can not be omitted. Eventhough these and many other not mentioned authors such as: Frejka, T. (1981), Alho, J. M. (1990), Lee, R. D. (1992) Cohen, J.E. (1995) dealing with conceptual framework, there are none of them touching the problem of evaluation of forecasting results by Kazakhstan.

There is one work of Morgan Philips Price: "Dispatches from the Revolution-Russia 1916-1918" which also should be mentioned from the point of historical population development and future trends of Kazakh ethnicity taking into account shattered by disastrous historical events age and sex composition of Kazakhs. Author assumes that caused tremendous events as: famine of 1929-1932, collectivization and leading industrialization after all shortened the population as twice as it was in 1897 census by adjusting level of natural increase. Herein he uses data of Soviet demographical encyclopedia (Big Soviet Encyclopedia, Demographic encyclopedia/Kaz.SSR, 1985) "Thus, the dynamics of population "growth" of Kazakhs in 1897 was about 3.440 million people or 80% of Kazakh ethnicity, in 1926-3.171 million person or 57% of Kazakhs, finally 1959 presented-2.787 million person or nearly 30% of Kazakhs (Morgan, P., 1998). Of course this information can be judged in heat discussion. One would say this is just because of huge flows of Russians and Ukrainian ethnicities came in early XX cent. among the first settlers, where Kazakhs would be dissoluted, others would say lowering level of fertility, however the earliest available data of UN WPP estimates fertility level shows that in 1955-1960 TFR was 4.5 (The United Nations World Population Prospects, the 1994 revision, 1995) the rest would be doubting the gained numbers, all of these hypotheses have right to be discussed.

However our intension by presenting such information was not to discuss such literature in overview part but somehow to assume that shattered age and sex composition of modern Kazakhstan has deeply roots in the past and even foreign authors recognizes the fact of such problem.

Regarding Kazkahstani authors existing research literature about forecast is not wide-spread. There is a work of Musabek E. published under demographical forecast in Population of Kazakhstan periodical edition however this article considers forecasting in the context of "*Demographical and migratory processes*" (Musabek, E. 2000). However it is poor-supported with some conceptual framework. Not describing basic principles of forecasting methodology used.

Presented above literature overview clearly proves there is lack of literature in the context of evaluation of the UN WPP for national forecasting purposes. That is why such work will be best-suited for further analysis and assessment of changing picture of future population development according to the UN WPP.

Chapter 3

Data availability and quality: a critical review

Demographical data and vital statistics in Kazakhstan are based on decennial population census and it provides information about the size, age and sex structure of the population at the census dates. Of course there is something to say before describing this chapter. Something like prone's and cone's of occurring censuses. Censuses in most developed countries are yesterday. Or at least most of those countries already took decision to switch from "typical old-fashioned" censuses to "easy-in-use" thematic population registers (United Nations Publication, 1969).

At the beginning creation of such registers is also time-consuming and very expensive, however after all has set and done, in principle, there is no need to input more money and expect more expenditures because such databases will work on their own after some time and all is what they need is to update an information and extent network. However, there are some critical remarks on current census model in Kazakhstan has to be mentioned, because it is expensive, time-consuming, during census period mostly week-controlled, low-reliable, and corrupted. Eventhough Kazakhstan struggle with such unpleasant processes the result still remains under the reliability question.

Demographic Health Surveys is another data source which can be judged positively on the subject of data reliability. DHS in Kazakhstan was conducted in 1995, 1999 and estimated numerous indicators of population health condition. Available data is the description of general births growth level, neonatal and post-neonatal mortality statistics, nutrition facts, birth delivery by facility order (98% of total birth delivery is occurring in the health facilities, WHO/DHS-Kazakhstan, 1995-1999), teenage pregnancy level, total fertility rate and its change, family planning and etc.

3.1 Data sources

The first national census was conducted in 1999, followed by next in 2009. However we shall not to forget about All Soviet Union Census (1989), which was the very last counting in the Soviet Union. As we mentioned before reliability of the census in 1989 (taking into account underestimation of infant deaths and so on) are doubted. However for the next censuses like 1999 and 2009 the international standards recommended by the Conference of European Statisticians (1997 and 2006), UNECE, Eurostat, UNFPA, UNICEF and the Statistics Division of the United Nations Secretariat (UN, 2008) were followed. Availability of the data is one of the "key-problems" of Kazakhstan official statistics. And is a big "head-ache" for interested audience such as demographers, general public, and media resources. Even though required data are stored in statistical database it is "pay-per-view" based. Users often face this problem while gathering the interested data. The demographic Yearbook of the Republic of Kazakhstan is another data resource for vital statistics. This is seldom available if you don't have so called "relatives or friends in system" and not released till the 1999.

Study period covers since the 1992 till the most recent 2008 revision based on the United Nations World Population Prospects done by Department of Economic and Social Affairs Population Division. They are prepared population estimates and projections for all countries of the world since the early 1950s. These prospects come out once in two years. Study period covers nine revisions accordingly: The 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006, and 2008. These World Population Prospects (UN WPP) are now used throughout the whole UN system and by many international organizations, as well as academic researchers. They have become a standard input for development planning, monitoring and global modeling. And there is little need to emphasize the importance of future population estimates for Kazakhstan attempting to plan its economic and social development for at least several decades.

Reliability and accessibility can not be judged directly because some of the results based on national data are impugned. As we mentioned above they are divided into three volumes: comprehensive tables volume I, sex and age structure volume II and analytical report based on these volumes.

3.2 Data quality

Accurate baseline data on population size and age structure, as well as on fertility, mortality, and net migration rates, are critical to producing accurate population projections (Keilman 1990) Assessment of quality of available data from UN WPP as we mentioned above faces some difficulties in the context of its reliability which we discussed above. In early WPP revisions since the 1992 till the 1996 emergencies of newly independent states, Kazakhstan in particular complicated estimates and created as a result of only limited estimates. However, UN WPP used below sources which we can use in evaluation of data quality:

Total population (1990) – is based on official estimate consistent with 1989 census.

Total fertility rate – is based on registered births, by age of mother to 1990.

Life expectancy at birth – estimated from registered deaths adjusted for underestimation and underlying populations, both by age and sex to 1990.

Infant mortality – Based on registered births and infants deaths to 1990, adjusted upward by 25% due to omitted infant deaths.

International migration – is based on estimates of international migrations to 1990. Including migration between the Republics of the USSR and assumed future trends (The United Nations World Population Prospects the 1994 revision, 1995).

Further revisions from the 2002 till the 2008 used updated information on total population (census 1999), other indicators such as **Total Fertility Rate** used (1995, 1999 DHS), **Life Expectancy at birth** (1991 death register), **Infant Mortality Rate** (1995 adjusted upward by a factor 1.2 decreasing to 1.1), **International migration** used derived net migration rates as a difference between the actual growth of population and its estimated natural increase through 1995, 2000, 2005 accordingly. Once again necessary indicators were adjusted (case of Infant Mortality Rate).

Existed system for accurate recording of statistics on population size, age composition, births and deaths and to some extent migration flows give us the chance to say that the accuracy of the data is varied and can not be definitely evaluated. Fragmentary demographic data are available and its accuracy difficult to verify; judging from experience elsewhere, accuracy is sometimes likely to be quite poor.

Chapter 4

Population forecasting methodology

We can not plan without looking ahead, and we can not look ahead except in so far as the light of experience illuminates the future for us" (Toynbe, A. J. 1963:135)

4.1 General methodology of population forecasting

The present sub-chapter attempts to describe some aspects of the current state of the art in the field of demographic forecasting under aegis of general methodology of population forecast as the background to judge the United Nations forecasting methodology further. Therefore herein some brief ideas about definition of population forecast, its basic concept of population forecasting methodology based on stages of the process of population forecast are presented. Forecast is using a model, which represents a simplified abstraction of the real world. Such construction of population forecasting model involves several stages describing the behavior of a system (Keilman, Cruijsen, 1992) presented in figure 2. This is what we mentioned in the structure of the work is bridge between imaginary blocks from the general population forecasting to the specific the UN forecasting methodology.

Stage 1 – implements producing process of a population forecast. Population system identification, where population is the subject has to be defined; population categories are system elements, as well as demographic events (relations of system elements).

Stage 2 - is called population system description. According to Keilman, 1990 and Cruijsen, 1992 it uses basic tools: demographic measurement concepts, time series methods (usually high-medium-low), multivariate models and curve-fitting techniques.

Stage 3– is the model construction which is strongly related to the stage one. Constructing the model assumes some predictable behavior. For example: interaction between infant mortality and natality.

Stage 4 – one of the key stages involving the extrapolation of the model parameter values (Ascher, 1978) which will be discussed further in following sub-chapter. Assumption-making process usually based on systematic approach. It distinguishes several levels at which those assumptions were made (Keilman and Cruijsen, 1992):

1) Detailed assumptions about future trends in age-specific fertility rates and deaths probabilities by age and sex.

2) Summarizing assumptions are formulated for summary indicators which aggregate the detailed parameters for fertility, mortality and migration.

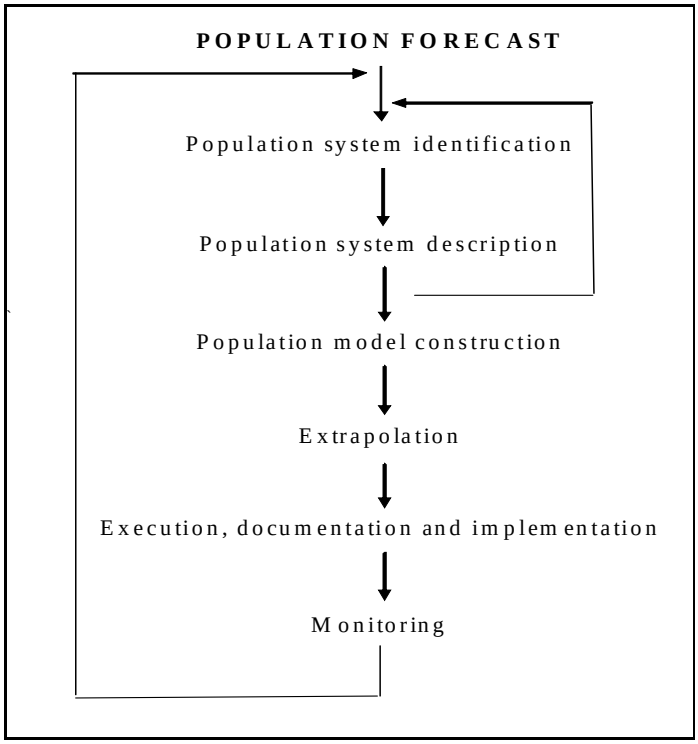
3) General assumptions regarding to socio-demographic, economic, political, legal, cultural nature. For example, assumptions that law regulations has limited impact on immigration.

4) Extraordinary events: famine, wars, disastrous political-economical crises may affect to forecast.

Stage 5 – is the execution, documentation and implementation. Execution of calculations and the assumptions which are recorded on tables. Implementation of the results is very important to the general public in the context of assessing the final results.

Stage 6 – is called monitoring. It is a comparison between predicted and observed population systems. The results of the monitoring process may lead to changes in model parameters. The flow diagram in Figure 2 below is describing the steps of population forecast.

Fig. 2 – Schematic view for the construction of a population forecast



Source: Keilman, 1992.

Formerly, many scholars believed that a relatively simple "law" of population growth might be found which would suffice to predict future changes in almost any circumstances. The attempt to find such a formula has now been generally abandoned, since the accumulation of observations has shown that experience generally conflicts with any such theoretical expectations. As recently as the 1930's and early

1940's, it was nevertheless believed that future trends in any given area could be fairly reliably predicted on the basis of a careful study of detailed statistics relating to the current situation and past experience in that area. Unforeseen changes in the birth rates of many countries during the 1940's greatly undermined this confidence, and for a time caused many persons to question the utility of any future population estimates. It is now more generally realized that while there can be no certainty in estimates of future population trends, they can serve a useful practical purpose by indicating the approximate numbers that appear most likely to be attained, in view of the information available. (United Nations publication, 1970). A population forecast provides estimates of the most likely future trends in population size and in demographic indicators such as population distribution by age and sex. A forecast is based on the current understanding of the roles played by various factors affecting population growth and on an appropriate, accepted methodology for calculating the effects of future changes in these factors.

The terms “forecast” and “projection” are often used synonymously or better say interchangeably (O’neil et al., 2001), though they have slightly different technical meanings. The distinction between projections and forecasts therefore are important because:

1) Analysts often use projections when they should be using forecasts.

2) Projections are mislabeled as forecasts.

3) Analysts prepare projections that they know will be accepted as forecasts without evaluating the assumptions implicit in their analytic results.

Thus, **Projection**: are calculations of future conditions that would exist as a result of adopting a set of underlying assumptions or according to the IUSSP Multilingual Dictionary: “are calculations which show the future development of a population when certain assumptions are made about the future course of population change, usually with respect to fertility, mortality and migration”.

Forecast is “a projection in which the assumptions are considered to yield a realistic picture of the probable future development of a population” (IUSSP, page 90) therefore its judgmental statement, and forecasting is a guess of what is the most likely future (Keilman, N. 1990) From the given above definition it follows that projections are conditional, developing the consequences of the assumptions that are made, while a forecast is unconditional: based on current scientific knowledge.

A variety of methodologies are available for making forecasts, ranging from the simple extrapolation of past trends to complex multiple-equation models involving dozens of demographic, socioeconomic, and environmental variables. Such techniques and models for population forecasting have been already well developed over last century. According to the (O'Neill, Brickman, 2001) there are “Mathematical”, “Economic” and “Component” projections along with mentioned there are also “Time series”, “Microsimulation”, “Structural models are exists. Short description of each is presented below:

“Mathematical” - the simplest method of estimating the future size of a population is to take the number of individuals as determined at a more or less recent date in the past and to apply to it an assumed rate of increase, as a function of time." The rate may be derived from observations on the past growth of the population itself or by analogy with rates observed in other populations in similar circumstances. The calculations can be carried out directly with reference to the net rate of population growth, or the assumed

birth rates, death rates, and rates of immigration and emigration may be calculated separately and added to obtain the rate of growth for each future period.

"Economic" - Population growth can seldom, if ever, be expected to be completely independent of changing economic circumstances. Within limits, mortality and fertility are responsive to economic conditions. The same is true of migration; immigrants are attracted to areas of economic opportunity, while emigrants depart from areas where opportunities are more restricted. Within limits, a government may be able, by means of economic incentives and deterrents, to relate migratory movements and even the natural growth of the population to an economic plan.

"Component" - The "component" method of population projections is usually understood to consist in the separate projection of numbers of males and females in each age group of the population. Separate projections for each of several ethnic or linguistic groups, of urban and rural populations, or any other segments into which the population can be divided, might also be regarded as "component" projections.

"Time series" - is based on analyses of time series of either aggregate population size, or of vital rates. Aggregate time series models do away with the cohort component method entirely. For example, Pearl and Reed (1920), working before the cohort component method had been formalized and widely adopted, sought to apply a simple law of population growth such as the logistic (S-shaped) curve to extrapolate past changes in population size. Leach (1981) re-examined the approach using data from several countries and found it useful in describing historical changes in population size and for short-term projections. Marchetti et al. (1996) found that historical trends in total fertility and life expectancy, as well as population size, are well-approximated by logistic curves. However, in both of these more recent studies it was concluded that the logistic model provides little basis for extending trends into the long-term future. The fundamental difficulty is that a single logistic curve assumes a fixed limit to the variable being modeled, and in human populations those limits can be altered through changes in technology (e.g. changes in agricultural productivity, or health care) or social factors (e.g. changes in family size norms). Thus while a particular curve may fit historical observations, it does not provide any guidance on how the assumed limit may be altered in the future. Furthermore, a logistic function does not allow the direction of change to be reversed. For example, it does not allow for a decreasing population size, or a reversal in the direction of modeled fertility change. Nonetheless, arguments have been advanced that simple extrapolation and more sophisticated aggregate time series methods still have much to offer projection methodology (Lee et al 1995, Pflaumer 1992). Such methods may in fact be more accurate than the cohort-component method over short time horizons (i.e., up to a few decades; Pflaumer, 1992; Rogers, 1995), and over longer horizons are useful in defining a minimum accuracy that more disaggregated methods should achieve to justify their use (for example, if a cohort-component projection can't do any better than a simple extrapolation of growth rates, it may not be worth the additional effort it requires).

"Microsimulation" - in contrast to the cohort-component method (which descriptively will be discussed herein), which treats each cohort as a homogenous group and uses average probabilities of birth, death, and migration, microsimulation treats each individual independently and uses repeated random experiments instead of average probabilities (van Imhoff and Post, 1998). This technique

simulates life events (marriage, divorce, the birth of children, leaving home, etc.) for each individual, and is usually based on a sample rather than an entire population in order to reduce computational demands; results are then scaled to the size of the total population. A drawback of the microsimulation method is that data requirements can be prohibitive, since probabilities for each life event must be estimated from event-history data. One main advantage of microsimulation is its ability to perform well even with large numbers of "states," or attributes of individuals. In a cohort-component model, the computational requirements for the projection quickly become unmanageable as the number of states increases, since the model must track every possible combination of states. In contrast, a microsimulation model tracks states for each individual in the sample, which is generally a much more manageable task. Since long-term global population projections incorporate only two states (age and sex), microsimulation is unnecessary. However, this method could play a role in studies of the environmental impacts of household consumption, which might require projections with much more detail in household characteristics.

"Structural models" - Long-term global population projections - and most projections over shorter terms or smaller regions - do not project vital rates based on formal models of how these rates may be related to socioeconomic factors. Trends in socioeconomic factors are thought to be harder to predict than the demographic processes themselves (Keyfitz, 1982), and relations between demographic and other variables are not generally considered well known enough to quantify reliably (Cohen, 1998). The best known example of an attempt to formulate a comprehensive, causal model of demographic processes is the World3 model that served as the basis for the Limits to Growth study in the early 1970s (Meadows et al. 1971). The model projected future trends in population, economic growth, and natural resource use, and concluded that global society was likely to collapse in the future due to resource scarcity and environmental degradation. The model assumed fertility and mortality were complex functions of many factors, including population size, birth control effectiveness, health services, life expectancy, income, and industrial output per person. It was strongly criticized for having little empirical or theoretical basis to substantiate the forms used for these and other relationships in the model (e.g., Nordhaus, 1973).

Concluding this sub-chapter we have to give critical remarks on the UN forecasting methodology on the basis of the general population forecasting methodology. From the point of retrospective estimation and short-term projections "Time series" method would probably fit better than cohort-component method. Because S-shaped logistic curve better extrapolates past changes in population growth. As we mentioned above Time series technique uses aggregated population size or vital rates therefore it is useful in describing historical changes in population size and for short-term projections of total fertility and life expectancy (Marchetti et al. 1996). For long-term projections partially "Microsimulation" method might be used. However, it deals with the individuals repeatedly using them as the sample rather than an entire population, afterwards results scales to the size of total population. Main disadvantage is that data requirements can be prohibitive, since probabilities for each life event must be estimated from event-history data. This is useful technique in the sense of supplementary studies as environmental impacts of household consumption etc. So we have explored that "Time series" could be better used for the short-term projections and retrospective estimation, while "Microsimulation" technique

might be used in the sense of supplementary attainment in the individual levels. The UN methodology since the 1992 and 2008 has been revised and changed in the sense of the process of population forecast and its stages described in table 2. Main changes in the methodology occurred within the stage one: Population system identification; where population size as the population element was revised. Since many countries with small populations gained their independence the necessity to decrease population size as the element of population identification rose gradually. In 1985 the UN methodology took into consideration all countries with a population size of about 300 000 or more. Since the 1992 revision population size is decreased to 200 000 and since the 1996 revision stood at 100 000 of total population. Projections were made for the total population only by applying assumed rates of growth. Stage four: involving the extrapolation of the model parameter values were revised due to objective cause. As we mentioned in the description of extrapolation stage assumption-making process is based on systematic approach at which future trends in age-specific fertility rates and deaths probabilities by age and sex are changing over the time. Thus, total fertility rate in Kazakhstan was assumed in the 1992-1996 revisions to remain above replacement level (2.1 children per woman) while further revisions projected its decline towards at or below replacement level (2.0-2.1 children per woman). Summary indicators therefore have been also revised due to general assumptions regarding to socio-demographic, economic, political, legal, cultural nature. Stages two Population system description initially used cohort-component method so changes here are less likely due its reliability and strong interaction between population categories, stage three Model construction strongly related to stage one and was revised in the sense of the size of total population defined. Stage five execution, documentation and implementation are among the best applied stages of population forecast by the UN WPP. All results on forecast well-documented preserved and published through the system of the United Nations. The following sub-chapter 4.2 mainly focuses on the UN specific methodology: cohort-component method used for producing forecast results for Kazakhstan. Therefore, descriptive analysis of cohort-component method its parameters are indeed.

4.2 The United Nations forecasting methodology

Going back to the United Nations forecasting methodology we have to look upon the use of the following definitions and distinctions prior to the specifying the UN methodology.

Estimates are an indirect measure of a present or past condition that can be directly measured. Definition of **projections** is followed by the IUSSP Multilingual Dictionary and identical to the presented above definition in general population forecasting. A forecast for a population can involve more than one projection. For example, the most likely future trajectory is usually called the medium variant, while alternative higher and lower projections can give an indication of the uncertainty surrounding this trend. In the contemporary demographic literature, "forecast" is typically used to refer to medium variant projections. However, this can be criticized because as we know forecast are based on at least three variants of projections: medium, high and low **Assumptions** – fertility 3 variants plus constant-fertility scenario, mortality 1 variant, international migration – usually 1 variant (The United Nations World

Population Prospects the 1996 revision, 1997). Assumptions postulated in national population projections are considered but, in general, cannot be adopted when undertaking the United Nations projections. A major reason that national projections cannot simply be adopted is that they are prepared independently of each other and lack the international comparability that United Nations projections must attain. An often-cited example of this point is for international migration. The sum of international migrants to and from every country must be zero for the world, since every person that leaves one country must enter another. However, such figures from national projections usually indicate a gain to the world of several million persons each year due to migration, as in-migrants are better documented than out-migrants. The preparation of each new revision of the official population estimates and projections of the United Nations involves two distinct processes: (a) the incorporation of all new and relevant information regarding the past demographic dynamics of the population of each country or area of the world; and (b) the formulation of detailed assumptions about the future paths of fertility, mortality and international migration.

The most updated and the last published study revision "The 2008 Revision" includes eight projection variants. The eight variants are: low; medium; high; constant-fertility; instant-replacement-fertility; constant-mortality; no change (constant-fertility and constant-mortality); and zero-migration. The first five variants, namely, the low, medium, high, constant-fertility and instant-replacement-fertility, differ among themselves exclusively in the assumptions made regarding the future path of fertility. The sixth variant, named "constant-mortality", differs from the medium variant only with regard to the path followed by future mortality. The seventh variant, denominated "no change", has constant mortality and constant fertility and thus differs from the medium variant with respect to both fertility and mortality. The eight variant, denominated "zero-migration", differs from the medium variant only with regard to the path followed by future international migration. Generally, variants differ from each other only over the period 2010-2050 (The United Nations World Population Prospects the 2008 revision). Table 2 below presents tabular view of the projection variants.

Tab. 2 - Projection variants or scenarios in terms of assumptions for fertility, mortality and international migration as of UN WPP the 2008 revision

Projection variant	Assumptions		
	Fertility	Mortality	International migration
Low	Low	Normal*	Normal
Medium	Medium	Normal*	Normal
High	High	Normal*	Normal
Constant-fertility	Constant as of 2005-2010	Normal*	Normal
Instant-replacement fertility	Instant-replacement as of 2005-2010	Normal*	Normal
Constant-mortality	Medium	Constant as of 2005-2010	Normal
No-change	Constant as of 2005-2010	Constant as of 2005-2010	Normal
Zero-migration	Medium	Normal*	Zero as of 2010-2015

Note: * Including the impact of HIV/AIDS in 58 countries, as described in section B.2

Source: World Population Prospects: The 2008 revision population database

To describe the different projection variants and scenarios, the various assumptions made regarding fertility, mortality and international migration are presented below.

A. Fertility assumptions: convergence toward total fertility below replacement level

The fertility assumptions are described in terms of the following groups of countries:

High-fertility countries: Countries that until 2010 had no fertility reduction or only an incipient decline;

Medium-fertility countries: Countries where fertility has been declining but whose level was still above 2.1 children per woman in 2005-2010;

Low-fertility countries: Countries with total fertility at or below 2.1 children per woman in 2005-2010.

1. Medium-fertility assumption:

Total fertility in all countries is assumed to converge eventually toward a level of 1.85 children per woman. However, not all countries reach this level during the projection period, that is, by 2045-2050. Projection procedures differ slightly depending on whether a country had a total fertility above or below 1.85 children per woman in 2005-2010.

Fertility in high and medium-fertility countries is assumed to follow a path derived from models of fertility decline established by the United Nations Population Division on the basis of the past experience of all countries with declining fertility during 1950-2010. The models relate the level of total fertility during a period to the average expected decline in total fertility during the next period. If the total fertility projected by a model for a country falls to 1.85 children per woman before 2050, total fertility is held constant at that level for the remainder of the projection period (that is, until 2050). Therefore, the level of 1.85 children per woman represents a floor value below which the total fertility of high and medium fertility countries is not allowed to drop before 2050. However, it is not necessary for all countries to reach the floor value by 2050. If the model of fertility change produces a total fertility above 1.85 children per woman for 2045-2050, that value is used in projecting the population.

In all cases, the projected fertility paths yielded by the models are checked against recent trends in fertility for each country. When a country's recent fertility trends deviate considerably from those consistent with the models, fertility is projected over an initial period of 5 or 10 years in such a way that it follows recent experience. The model projection takes over after that transition period. For instance, in countries where fertility has stalled or where there is no evidence of fertility decline, fertility is projected to remain constant for several more years before a declining path sets in.

Fertility in low-fertility countries is generally assumed to remain below 2.1 children per woman during most of the projection period and reach 1.85 children per woman by 2045-2050. For countries where total fertility was below 1.85 children per woman in 2005-2010, it is assumed that over the first 5 or 10 years of the projection period fertility will follow the recently observed trends in each country. After that transition period, fertility is assumed to increase linearly at a rate of 0.05 children per woman per quinquennium. Thus, countries whose fertility is currently very low need not reach a level of 1.85 children per woman by 2050.

2. High-fertility assumption:

Under the high variant, fertility is projected to remain 0.5 children above the fertility in the medium variant over most of the projection period. By 2045-2050, fertility in the high variant is therefore half a child higher than that of the medium variant. That is, countries reaching a total fertility of 1.85 children per woman in the medium variant have a total fertility of 2.35 children per woman in the high variant at the end of the projection period.

3. Low-fertility assumption:

Under the low variant, fertility is projected to remain 0.5 children below the fertility in the medium variant over most of the projection period. By 2045-2050, fertility in the low variant is therefore half a child lower than that of the medium variant. That is, countries reaching a total fertility of 1.85 children per woman in the medium variant have a total fertility of 1.35 children per woman in the low variant at the end of the projection period.

4. Constant-fertility assumption:

For each country, fertility remains constant at the level estimated for 2005-2010.

5. Instant-replacement-fertility assumption:

For each country, fertility is set to the level necessary to ensure a net reproduction rate of 1 starting in 2010-2015. Fertility varies over the rest of the projection period in such a way that the net reproduction rate always remains equal to unity thus ensuring, over the long-run, the replacement of the population.

B. Mortality assumptions: increasing life expectancy except when affected by HIV/AIDS

1. Normal mortality assumption:

Mortality is projected on the basis of models of change of life expectancy produced by the United Nations Population Division. These models produce smaller gains the higher the life expectancy already reached. The selection of a model for each country is based on recent trends in life expectancy by sex. For countries highly affected by the HIV/AIDS epidemic, the model incorporating a slow pace of mortality decline has generally been used to project a certain slowdown in the reduction of general mortality risks not related to HIV/AIDS.

2. The impact of HIV/AIDS on mortality:

In the 2008 Revision, countries where HIV prevalence among persons aged 15 to 49 was ever equal to or greater than one per cent during 1980-2007 are considered as affected by the HIV/AIDS epidemic and their mortality is projected by modeling explicitly the course of the epidemic and projecting the yearly incidence of HIV infection. Also considered among the affected countries are those where HIV prevalence has always been lower than one per cent but whose population is so large that the number of people living with HIV in 2007 surpasses 500.000 (i.e., Brazil, China, India, the Russian Federation and the United States of America). In total, 58 countries are considered to be affected by the HIV/AIDS epidemic in the 2008 Revision.

The model developed by the UNAIDS Reference Group on Estimates, Modeling and Projections 2, 3 is used to fit past estimates of HIV prevalence provided by UNAIDS for each of the affected countries so as to derive the parameters determining the past dynamics of the epidemic for each of them. For most countries, the model is fitted assuming that the relevant parameters have remained constant in the past. Beginning in 2007, the parameter PHI, which reflects the rate of recruitment of new individuals into the

high-risk or susceptible group, is projected to decline by half every twenty years. The parameter R, which represents the force of infection, is projected to decline by half every thirty years. The reduction in R reflects the assumption that changes in behavior among those subject to the risk of infection, along with increases in access to treatment for those infected, will reduce the chances of HIV transmission.

In the 2008 Revision, interventions to prevent the mother-to-child transmission of HIV are modeled on the basis of estimated country-specific coverage levels that, in 2007, averaged 36 per cent among the 58 affected countries, but varied from 0 to 99 per cent among them (with 22 countries having less than 20 per cent coverage of pregnant women in 2007, and only 8 countries with more than 75 per cent coverage). These coverage levels are projected to reach 60 per cent on average by 2015, varying between 40 per cent and 99 per cent among the affected countries. After 2015, the coverage of interventions to prevent mother-to-child transmission of HIV is assumed to remain constant until 2050 at the level reached in each of the affected countries in 2015. Among women receiving treatment, the probability of transmission from mother to child is assumed to vary between 2 per cent and 19 per cent depending on the particular combination of breastfeeding practices (mixed breastfeeding, replacement feeding, exclusive breastfeeding), its duration in the population and the type of treatment available (single-dose nevirapine, dual-prevention, or triple-prevention antiretroviral treatment). These assumptions produce a reduction in the incidence of HIV infection among children born to HIV-positive women, but the size of the reductions varies from country to country depending on the level of coverage that treatment reaches in each country.

The survivorship of infected children takes account of varying access to pediatric treatment. In the 2008 Revision, HIV-infected children are divided into two groups: those infected in-uterus, among whom the disease progresses rapidly and whose average survival is set at 1.3 years, and those infected through breastfeeding after birth, among whom the disease progresses slowly and whose average survival is set at 15.2 years without treatment. Explicit inclusion of pediatric treatment is done via country-specific coverage levels which average 34 per cent in 2007 but vary between 0 and 99 per cent among the 58 affected countries (with 15 countries having less than 10 per cent coverage in 2007 and only 12 countries having a coverage level above 75 per cent). By 2015, the projected coverage is expected to reach 60 per cent on average in the 58 affected countries, varying from 40 per cent to 100 per cent. Coverage levels are assumed to remain constant from 2015 to 2050 at the level reached in each country by 2015. The annual survival of children receiving treatment is 80 per cent during the first year, 90 per cent the second year, and 95 per cent thereafter, so that their mean survival time is 31.1 years and the median survival time is 20.5 years in the absence of other causes of death.

The 2008 Revision incorporates a longer survival for persons receiving treatment with highly active antiretroviral therapy (ART). The proportion of the HIV-positive population receiving treatment in each country is consistent with estimates prepared by the World Health Organization, which averaged 36 per cent in 2007 among the 58 affected countries, but varied between 8 per cent and 99 per cent. Coverage is projected to reach between 40 per cent and 100 per cent by 2015, averaging 60 per cent for the affected countries. Between 2015 and 2050, coverage levels are assumed to remain constant at the level reached in each country by 2015. It is assumed that adults receiving treatment have, on average, an

85 per cent chance of surviving on the first year of treatment, and a 95 per cent chance of surviving each year thereafter in the absence of other causes of death. Under this assumption, mean survival time after the initiation of therapy is 19.3 years and the median survival time is 10.9 years, in the absence of other causes of death. Therapy is assumed to start at the time full-blown AIDS develops. Without treatment, infected adults have a mean survival time of 3.2 years (and a median survival time of 3.0 years) after the onset of full-blown AIDS.

3. Constant-mortality assumption:

Under this assumption, mortality is maintained constant in each country at the level estimated for 2005-2010.

C. International migration assumptions

1. Normal-migration assumption:

Under the normal migration assumption, the future path of international migration is set on the basis of past international migration estimates and consideration of the policy stance of each country with regard to future international migration flows. Projected levels of net migration are generally kept constant over most of the projection period.

***Zero-migration assumption*:**

Under this assumption, for each country, international migration is set to zero starting in 2010-2015.

Demographic projections rely on model life tables to describe the age-specific pattern of mortality corresponding to assumed levels of life expectancy at birth. The standard tables, Coale-Demeny and United Nations, show mortality in five-year age bands that are suitable for demographic projections made in five-year intervals. The rapidly changing dynamics of an AIDS epidemic require single-year projections. Previously Spectrum produced single-year projections by dividing the five-year mortality into equal amounts by single age. In order to improve the estimates of non-AIDS survival ratios by single years of age, the new Spectrum uses a modification of the Beers oscilatory interpolation method to convert abridged model life-tables into complete life-tables. The Beers method has been used for many years by actuaries and demographers to interpolate curves or populations based on five-year age groups to single years of age. The problem is that the rapid change in the survival curve as a result of the relative level of infant-to-child mortality makes it difficult for a generalized procedure to reproduce that change. It has been observed that the Beers estimate of the stationary population in a life-table (Lx) for age 1 is usually close to an independently derived value, but the problem is the relative values of the age 0 (that is, under age 1) and ages 2–4. In cases where an independent estimate of age 0 is available (as in the case of model life-tables) the Beers estimate for age 1 can be used and a polynomial can be fitted to the independent age 0, the Beers age 1, residual 2–4, and Beers 5–8, 9 and 10. This results in a smooth curve of 1Lx that fits the original 0, 1–4, and 5–9 and blends smoothly to the Beers estimates for ages 10 and over. The resulting 1Lx values are then used to estimate the survival ratios.

Concluding this sub-chapter we must say that underlying the projections assumptions are based on specific projection parameters, therefore they will be discussed hereinafter.

4.2.1 Projection methods used

The cohort component method was used in preparing the revisions of population projections (see Appendices for furthermore details, note: closed populations are not considered). That technique, which had been used in previous revisions, considers the levels and trends in each of the three major components of population change – that is, fertility, mortality and migration, together with the base-year population by age and sex. Although the method will be explained comprehensively in detail further using as a source: "Projection Methods for Integrating Population Variables into Development Planning, Volume I. Conceptual issues and methods for preparing demographic projections. United Nations, 1989" the major steps involved are summarized below:

First, age and sex-specific survival rates are successively applied to the base-year population in order to determine the number of survivors in each age and sex category at the end of each five-year period. The survival rates are derived either from appropriate model life tables (West Model of Coale and Demeny Life Table, 1983) selected in consideration of the age patterns of mortality in national life tables, if available, or by extrapolating the latest national life table to an age pattern of mortality assumed for the future.

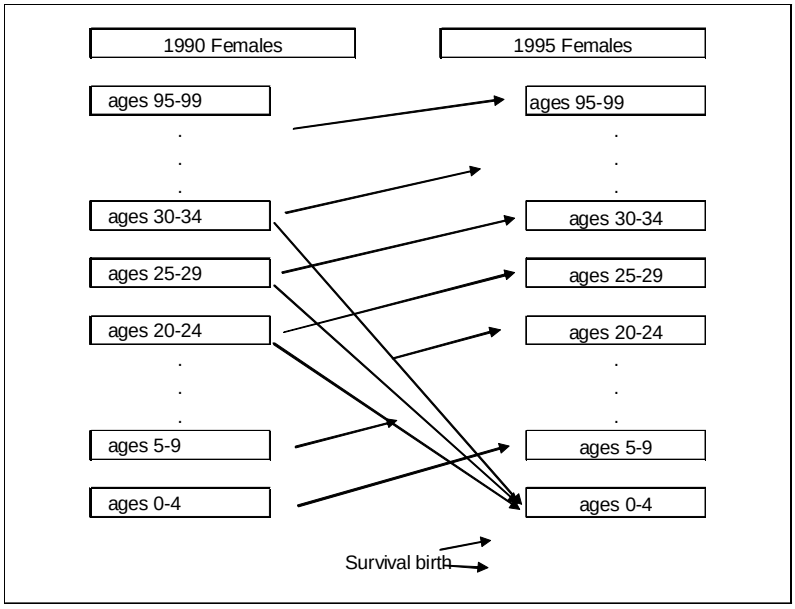
Secondly, the number of births expected to take place during each five-year period (in five-year time step) is estimated from the assumed total fertility rate, age patterns of fertility and the corresponding number of females in the reproductive age groups. The births are distributed by sex on the basis of an assumed sex ratio at birth. Finally, the number of survivors from those births at the end of each quinquennial period is calculated by applying the survival rates derived as described above.

Thirdly, the assumed number of net migrants during each quinquennial period of the projection (i.e. immigrants minus emigrants), classified by age and sex, is added to or subtracted from number of projected survivors to produce the projected population at the end of each five-year period.

Thus, at the end of each quinquennial period, there are at hand the projected population, by age and sex, and for each such period, the assumed mortality, fertility and migration rates, also by age and sex. From that information, a set of demographic indicators is derived, and many of those indicators are presented in this report. The UN projection method is based as it was mentioned above on combination of cohorts and components. The total population of a Kazakhstan consists of numerous numbers of cohorts of people. Each cohort represents males and females born during one period of time (one calendar year) within the boundaries of the country or migrated from abroad and joined to a given observed cohort lately. The cohort-component method in projection model produces future hypothetical population by moving these cohorts from one year to another year (e.g. time point A $\longrightarrow$ to time point B). Main goal of such time movement is to draw a generalized trend line of future population development, which is crucial for forecasting process (and for Kazakhstan particularly) by assuming certain changes in "componential development". In this context it is worth to mention works of Edward Cannan, 1895; quantitative prediction of the future growth of the population of England and Wales. Later on, this method was once again acquainted by Whelpton, 1936; Laslie, 1945; and finally employed in producing a global population forecast by Notestein, 1945. Prior to the mid-20th century, the few global population projections that had been made were based on extrapolations of the population growth rate applied to

estimates of the total population of the world (Frejka 1981, 1994). Following figure 3 illustrates an example of one time step of the cohort-component method for a female population.

Fig. 3 – One time step of the cohort component method for a female population (Cohen, 1995)



Source: Demographic Research - Volume 4, Article 8

The cohort-component model is a discrete-time model of population dynamics. The projection period is usually divided into time intervals of the same length as the age intervals that are employed. Method basically contributes to three following steps:

1) Project forward the population in each subgroup at the beginning of time interval in order to estimate still alive at the beginning of the next interval;
2) Compute the number of births for each subgroup over the time interval, add them across groups and compute the number of those births who survive to the beginning of the next interval;
3) Add immigrants and subtract emigrants in each subgroup during the interval; compute the number of births to these migrants during interval and forecast forward the number of migrants and the number of their births that will survive to the beginning of the next interval.

In simplest view, the cohort-component method used in projection is expressed by the following equation:

$$P_{t+1} = P_t + B_{t,t+1} - D_{t,t+1} + M_{t,t+1} \quad \textbf{(1)}$$

Where, P_t is the population at time t;

P_{t+1} is population at time t+1;

$B_{t,t+1}$ are births, in the interval from time t to time t+1;

$D_{t,t+1}$ are deaths, in the interval from time t to time t+1;

$M_{t,t+1}$ is net migration, in the interval from time t to time t+1;

For projection method used in UN WPP the components of population change are forecasted separately and applied to equation (1). The interval from t to t+1 may be of any duration (e.g. Kazakhstan population in five years time interval). It is based on similar logic as for individual five-year age groups, having baseline population for a given age group as the population at time t. For example, lets purpose that we take Kazakhstan population, thus the time unit is one years, and then next year is t+1. The equation adds two additional supplementary equations depending on whether age group is zero (less than one age) or may be any other age as of the last birthday, denoted by x.

$$P_{t+1}(0) = B_{t,t+1}(0) - D^{I}_{t,t+1}(0) + M^{I}_{t,t+1}(0) \quad \textbf{(2)}$$

$$P_{t+1}(x) = P_{t}(x-1) - D^{II}_{t,t+1}(x-1) - D^{I}_{t,t+1}(x) + M_{t,t+1}(x) \quad \textbf{(3)}$$

Each of the terms in equations (2) or (3), whether defined as a population or a number of events, relates to people born in a particular year – the birth cohort. While it is essential that age sad time in equations (2) be measured in the same unit, there is no requirement that the interval be one year. The population forecast within this study takes into account five years age group.

The projection forward of women still alive one (or n) years later, proceeds by applying survivorship ratios to each group. For any age group, excluding the youngest and the oldest ones, basic formula is:

$${}_{n}P^{F}_{t+n}(x) = {}^{n}P^{F}_{t}(x-n) * {}_{n}L^{F}(x) / {}_{n}L^{F}(x-n) \quad \textbf{(4)}$$

where, ${}_{n}P^{F}_{t}(x)$ is the number of women aged x to x+n at time t and the ${}_{n}L^{F}(x)/{}_{n}L^{F}(x-n)$ is the survivorship rate (s_x), the proportion of the person aged x-n to x that will be alive n years later in a stationary population (using suitable life table) and n is the interval of age group.

For the open-ended age group, we need to combine survivors from two previous age groups:

$$\infty P^{F}_{t+n}(x) = [{}_{n}P^{F}_{t}(x-n) * {}_{n}L^{F}(x) / {}_{n}L^{F}(x-n)] + [\infty P^{F}_{t}(x) * T^{F}(x+n)/T^{F}(x)] \quad \textbf{(5)}$$

The first product is the number of surviving women who were in the n-year age group immediately before the open-ended age group at time t. The second product is the number of survivors among women already in the open-ended age group at the beginning of the forecast interval.

Finally, we need to estimate the number of surviving females in the first age group. Meaning, necessity to forecast the number of births during the forecast period using age-specific fertility rates (F_x):

$${}_{n}F(x*n)[{}_{n}P^{F}(x) + {}_{n}P^{F}_{t+n}(x)/2] = {}_{n}F(x*n)[{}_{n}P^{F}_{t}(x) + {}_{n}P^{F}_{t}(x-n) * {}_{n}L^{F}(x) / {}_{n}L^{F}(x-n)] \quad \textbf{(6)}$$

The number of births to woman is obtained by:

$${}_{n}B_{t,t+n}(x) = {}_{n*n}F(x)[{}_{n}P^{F}_{t}(x) + {}_{n}P^{F}_{t}(x-n) * {}_{n}L^{F}(x) / {}_{n}L^{F}(x-n)/2] \quad \textbf{(7)}$$

Then it is necessary to sum births across age groups of the mother:

$${}_{n}B_{t,t+n}(x) = {}_{b-n}\sum^{x=a} {}_{n}B_{t,t+n}(x) \quad \textbf{(8)}$$

Where, a and b are the lower and upper bounds of the childbearing ages. The number of female births is then obtained by applying the sex ratio:

$${}_{n}B^{F}_{t,t+n}(x) = {}_{n}B_{t,t+n}(x) * 1/1 + \text{sex\_ratio} \quad \textbf{(9)}$$

Finally, the number of females will be:

$$ {}_{n}P^{F}_{t,t+n}(0) = {}_{n}B^{F}_{t,t+n}(x) * {}_{n}L^{F}(0)/n * l_0 \quad \textbf{(10)} $$

The male population could be projected in a similar manner using a male life table. Resulting,

$$ {}_{n}P^{M}_{t+n}(x) = {}_{n}P^{M}_{t}(x-n) * {}_{n}L^{M}(x)/{}_{n}L^{M}(x-n) \quad \textbf{(11)} $$

where, ${}_{n}P^{M}_{t}(x)$ is the number of men aged x to x+n at time t and the ${}_{n}L^{M}(x)/{}_{n}L^{M}(x-n)$ is the survivorship rate, so called the proportion of the person aged x-n to x that will be alive n years later in a stationary population (using suitable life table) and n is the interval of age group.

$$ \infty{}_{n}P^{M}_{t+n}(x) = [{}_{n}P^{M}_{t}(x-n) * {}_{n}L^{M}(x)/{}_{n}L^{M}(x-n)] + [\infty{}_{n}P^{F}_{t}(x) * T^{M}(x+n)/T^{M}(x)] \quad \textbf{(12)} $$

The number of male births will be:

$$ B^{M}_{t,t+n}(x) = B_{t,t+n}(x) * \text{sex\_ratio}/1 + \text{sex\_ratio} \quad \textbf{(13)} $$

Finally, the number of males:

$$ {}_{n}P^{M}_{t+n}(0) = B^{M}_{(t,t+n)} * {}_{n}L^{M}(0)/n * l_0 \quad \textbf{(14)} $$

Such complex formulas allow to project population growth using cohort-component methods, which is basic method used by the UN WPP. For further description and examples of projection method used see appendices (closed population is not considered). Besides, these methods are discussed in various demographic texts, e.g., (Shryock H., Jacob Siegel J., 1996).

4.2.2 Estimation of projection model parameters

There is little published methodological literature addressing this common practical concern to integrate estimates and targets in a population projection, beyond a concern to make consistent sub-regional and regional projections (Smith et al., 2001; King, 1990). Keilman (1985: 1482) usefully describes a three stage strategy that is used here for the general case: "(1) formulate initial values of model parameters; (2) check and adjust for consistency; (3) translate consistent model variables into adjusted parameter values". He distinguishes between internal and external constraints. Internal constraints are needed to ensure consistency because of the incomplete specification of a model. For example where marital status is projected, the number of men and women leaving marriage must be equal in each time interval. Similarly, where migration between regions is modeled in a multi-regional projection, the sum of interregional out-migrants must equal the sum of inter-regional in-migrants. External constraints, involving consistency with data outside the model, are the focus of this paper. Keilman discusses only the case where a multi-regional projection is made consistent with an independent aggregate all-region projection, using the example of the Netherlands' regional population projections. This *projected* population constraint is formally the same as the *estimated* population constraint treated, as both provide direct information about the population after the base year. Keilman proposes two solutions. The first, applies the same proportional adjustment to all regions, an adjustment that may be age and sex specific and may be applied directly to components of change. His second solution minimizes the deviation between initial and post-constraint age-specific patterns of fertility, mortality and migration rates, given national sums of births, deaths and net migration. We shall consider the situation where the birth and death components are considered to have been measured with insignificant error and therefore are not changed in the adjustment

to reach consistency. Evert Van Imhoff (1992) provides a more general mathematical framework for consistency in multi-dimensional models. A system of demographic parameters results in numbers of events; these are to be adjusted to meet a constraint expressed as a linear combination of some of those events. In 1978 work of Ascher William: "Forecasting: an appraisal for policymakers and planners" at John Hopkins University Press was published. He stressed the importance of forecast methodology either then a sophisticated model. The standard method is the extrapolation of the rate growth. For practical purposes, polynomial forms, including linear extrapolation, have little application over the long term. Various exponential forms are widely used; however these include the geometric curve with annual or continuous expounding and the logistic curve (Shryock and Siegel, 1971). In previous sub-chapter the basic formulas of cohort-component method as the main the UN forecasting method was described.

In order to clarify the projection method prepared by the United Nations, particularly those purporting to have close nexus with computer programming, the major methodological steps are expressed below in algebraic equations. The population is subdivided into three age groups: beginning, 0-4; central, 5-79; and open-ended, 80 and over. Accordingly, three equations are shown as representing each of the major methodological steps in population projections. In these equations, the symbol **I** signifies age in terms of an integer equal to the i-th order of the age group (five-year age groups here). The symbol **J** indicates sex, and the symbol **T** denotes time in terms of a quinquennial integer ending in either 0 or 5. The symbol **K** represents the period between **I** and **T+1**. For the age group 5 to 79 (Prospects of population: methodology and assumptions, United Nations Publication, 1979):

$$P(I+1, J, T+1) = P(I, J, T) * S(I, J, K) + M(I+1, J, K) \quad \textbf{(1)}$$

For the age group 80 and over:

$$P(17, J, T+1) = P(16, J, T) * S(16, J, K) + P(17, J, T) * S(17, J, K) + M(17, J, K) \quad \textbf{(2)}$$

For the age group 0-4:

$$B(3, K) = \sum_{I=4}^{10} * ½ [P(I, 2, T) + P(I, 2, T+1)] * 5ASFR(I, K) \quad \textbf{(3)}$$

Where, if necessary, the ASFR is derived from

$$ASFR(I, K) = GRR(K) * (1 + SRB) * PASFR(I, K) * 1/500 \quad \textbf{(4)}$$

Finally, $P(1, J, T+1) = B(3, K) * PRB(J) * SB(J, K) + M(1, J, K)$ **(5)**

Identification of symbols

P(I, J, T): Number of persons in age I, of sex J, at the date T.

The symbol I cover from 1 to 17,

1 = age group 0-4

2 = age group 5-9

3 = age group 10-14

4 = age group 15-19

5 = age group 20-24, etc.

16 = age group 75-79

17 = age group 80+

The symbol J naturally covers only 1, 2 and 3.

1 = males
2 = females
3 = both sexes combined
The symbol T covers 1, 2, 3, 4, 5, 6 and 7.
1 = 1970 5 = 1990
2 = 1975 6 = 1995
3 = 1980 7 = 2000
The symbol K is T to T+1 and covers 1, 2, 3, 4, 5 and 6.
1 = 1970-1975 4 = 1985-1990
2 = 1975-1980 5 = 1990-1995
3 = 1980-1985 6 = 1995-2000
(Note*: Estimation of projection parameters was developed in mid-seventieth).

S (I, J, K) – survival ratios for the persons from age group I to age group I+1 of sex J during the period K. These ratios are p(x) found in life table.

SB (J, K) – Survival ratios from the number of births of sex J born during period K to population aged 0-4 at the end of the period K.

M (I, J, K) – Number of net migrants who survive until T+1 (it may be negative) in age group I, of sex J, during period K.

ASFR (I, K) – Age-specific fertility rate for women in age group I, during period K.

PASFR (I, K) – Percentage of age-specific fertility rate for women in the age group I, during period K.

GRR (K) – Female gross reproduction rate during period K.

PRB (J) – Proportion of births for sex J.

SRB – Sex ratio = PRB(1)/PRB(2)

During extrapolating of past trends of mortality projection according to the UN in most countries with good series of data (not case of Kazakhstan), future mortality is estimated by extrapolating the trends in age-specific death rates or life expectancies at birth, by means of more or less explicitly fitted curves. This is usually by means of exponentials, in order to avoid the possibility of negative rates or unreasonable levels of future mortality, and sometimes done to improve the compatibility among changes in the contiguous age group (Brass W., 1974).

In many population projections, particularly for developing countries such as Kazakhstan, the model life tables which have been constructed as a means of estimating age-specific mortality rates for countries lacking adequate and usable data have also been used for projecting future levels of life expectancies, age-specific mortality rates and survival rates. The United Nations model life table prepared in 1955 were also designed on the assumption that an annual gain of 0.5 years in expectation of life at birth would occur whenever the expectation was less then 55 years over each five-year time period and covering a time span of 115 years (United Nations publication. 1970). For involved basic steps of estimation of projection model parameters see appendix. The Coale-Demeny regional model life tables do not consider implied timing of the progression of mortality improvement, as did the United Nations model which is shown in table 3 below.

Tab. 3 - Transformation of life expectancy at birth from West Model of Coale and Demeny Life Table to General Model of United Nations Life Table (transposed view)

q(0-1)	0.9108	0.9104	0.9100	0.9096	0.9092	0.9088	0.9084	0.9080	0.9076	0.9072
e(0)*	52.36	53.15	53.94	54.74	55.54	56.34	57.15	57.95	58.76	59.57
$e_{c(0)}$**	51	52	53	54	55	56	57	58	59	60

Note*: Transformation from West Model compatible to General Model;

Note**: General Model Computed by B. D. S. Dongol

Source: Projection Methods for Integrating Population Variables into Development Planning, Volume I. Conceptual issues and methods for preparing demographic projections. United Nations, 1989

However, they may none the less be used for projecting mortality in developing countries such as Kazakhstan. Estimated projection model parameters of the latest United Nations projections were illustrated in the report on the 1973 world population prospects. However, it might be worth mentioning that for practically all of the developing countries, the mortality projections were based on either the United Nations model life tables or the presented Coale-Demeny regional life tables but used a modified series of model progressions of mortality improvement which was considerably slower than the scheme of the time paths set out in the United Nations model life tables. This was done as a result of the fact that mortality improvements registered in those countries with relatively reliable death statistics have suggested that rapid increase in life expectancy occurred during the 1950 was not repeated during 1960. According to estimated model parameters life expectancy at birth was assumed a quinquennial gain of 2.5 years. Thus, further maximum value of United Nations model life tables stood at 77.5 years for females and 72.6 years for males respectively.

In estimating the **parameters of fertility** decline paths according to the United Nations two groups were mentioned to derive two hypothetical curves, each resembling a reverse logistic curve and serving as lower and upper boundaries. The model was established in the 1968, based on principles of fertility decline in certain countries of East Asia, furthermore this model were used for all developing countries and its utilized patterns of fertility decline where fertility was high at 3.0 or more as measured by gross reproduction rate. The first curve describes a decline of fertility from a gross reproduction rate of 2.9 to replacement level in 30 year, and the second describes a decline from a rate of 3.5 to replacement level in 70 years. A multitude of intermediate curves could be drawn by combining different onset levels, for example, 3.5, 3.3, 3.1, and 2.9, in terms of gross reproduction rate, with different number of years, for example, 30, 40, 50, 60 and 70 to reach the gross reproduction rate of unity. If there are four onset levels and five durations corresponding on the Y and X axes just as mentioned above, there would be 20 possible combinations connecting each of the onset levels with each of the durations, It should be mentioned in this connection that in this model the number of years required to attain replacement level does not necessarily depend upon the onset level. It is schematically possible, for instance, that over a 50-year period fertility would decline from any of the levels (3.4, 3.3, 3.1 or 2.9) to replacement level. Such fertility decline was observed in Kazakhstan having 4.5 in mid 50's and gradual decline during next two decades brought to the level of 2.5. In the beginning of 90's it stood at 2.1. Value can be interpolated on both the onset level and the duration to obtain, for example, a series of gross reproduction rates which

decline from an onset level of 3.2, to 1 in 55 years. Our evaluation of the importance of various demographic parameters in regulating the tempo of evolution comes more from theoretical models than from observations derived from natural populations. (Brass, W. 1981).

Method of **migration model** construction is based on model age-sex patterns of net migration. These model parameters are constructed by combining age profiles of gross immigration and emigration, which are based on model schedules of gross migration developed by Castro and Rogers (1983a and 1983b). Castro and Rogers analyzed data on migrants by age in a number of countries, found similarities in those age profiles. In this sub-chapter we will try to describe the procedure of combining Castro and Rogers model schedules of gross migration into model schedules of net migration.

Definitions of a few special terms used need to be clarified first: a **net immigration** country means a country that has more immigrants than emigrants, and a **net emigration** country means a country that has more emigrants that immigrants. The migration ratio is defined as the ratio of emigrants to migrants in a net emigration country, or the ratio of immigrants to emigrants in a net emigration country. Identification of symbols: i – immigration, e - emigration, m – males, f – females.

The proportion of all immigrants who are aged x is given by (Castro and Rogers 1983a and 1983b):

$$I(x) = w_i c_i(x) + (1 - w_i) * a_i(x) \quad \textbf{(1)}$$

where $\mathbf{a_i(x)}$ is the proportion of adult immigrants aged x, $\mathbf{C_i(x)}$ is the proportion of child immigrants aged x and $\mathbf{W_i}$ is the proportion of all immigrants who are children. Similarly, the proportion of all emigrants who are aged x is given by:

$$e(x) = w_e c_e(x) + (1 - w_e) * a_e(x) \quad \textbf{(2)}$$

where $c_e(x)$, $a_e(x)$ and w_e are defined for emigrants.

It may appear puzzling in equations (1) and (2) that the same age x is used both as an age of adults and as an age of children. The same set of gross migration schedules, a(x) and c(x) developed by Castro and Rogers is used for both immigration schedules $a_i(x)$ and $c_i(x)$, and emigration schedules $a_e(x)$ and $c_e(x)$:

$$a(x) = [1/(ma - 23)] * \exp - [(x - 23)/(ma - 23)] \ \exp[-0.2(x - 23)] \quad \textbf{(3)}$$

$$c(x) = (1/mc) \exp(x/mc) \quad \textbf{(4)}$$

where *ma* is the mean age of adult migrants and *mc* is the mean age of child migrants.

The difference between males and females, however, needs to be introduced here and two sexes will be treated separately hereafter. The proportion of female migrants who are children, w_f, is fixed to be 0.1 for all migration flows, and the proportion of male migrants who are children is given by:

$$W_m = D/(1 + D) \quad \textbf{(5)}$$

where D is the ratio of male child migrants to male adult migrants, which in turn is calculated as:

$$D = (w_f \ SRC)/[SRA(1 - w_f)] \quad \textbf{(6)}$$

where SRC is the sex ratio of child migrants and SRA is the sex ratio of adult migrants. It is assumed that sex ratio of child migrants is 1 and that all children migrate with their mothers.

Well analytical discussion about each of these model parameters will be in following chapter presenting principle results of UN WPP by components.

Chapter 5

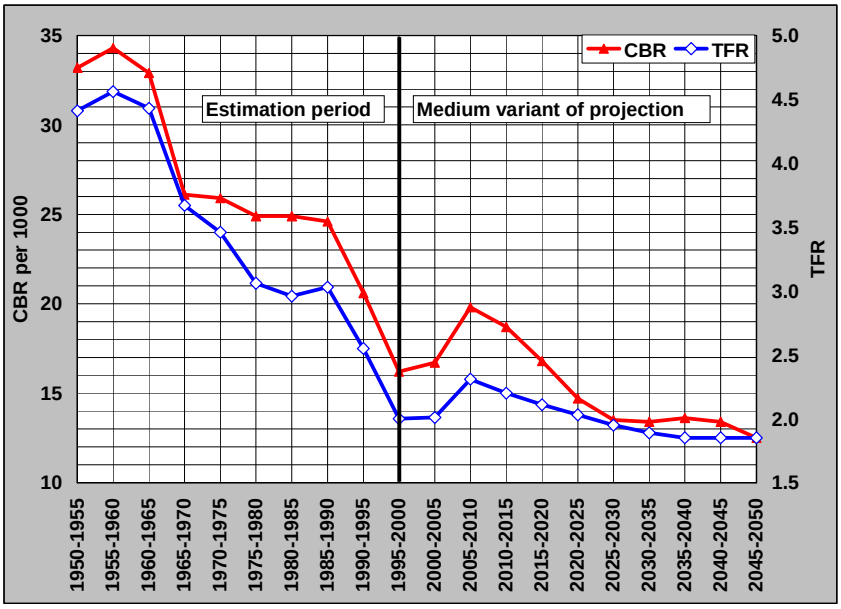
Changing view on population development of Kazakhstan by components

Children's children are the glory of old men, and the glory of children are their father's
(Proverbs 17:6)

5.1 Fertility

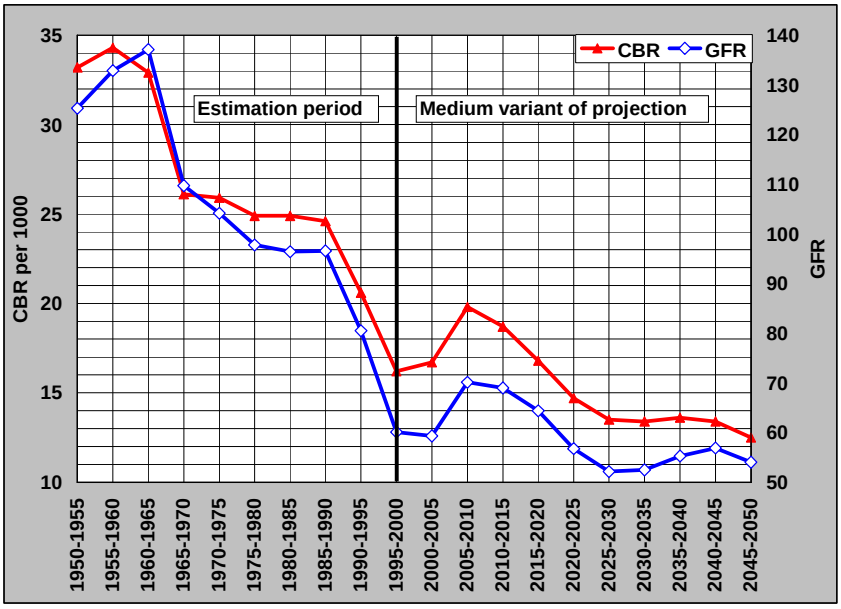
Fertility is an important component which is in fact affecting population growth in most contemporary populations and Kazakhstan is no exception for such postulate. The level of birth rates in a population affects not only its current size, but also has a significant impact on its future growth, as well as the population age structure. That is the reason why projecting fertility trends by various scenarios are very important in evaluating its effect on future growth. According to the United Nations World Population Prospects there are four variants of the projections were carried out (i.e. Medium, High, Low, Constant-Fertility) and basic assumptions for these projections is the continuation of the fertility decrease resulting in the level of crude birth rates decrease within all projected period. The following figure 4 and 5 is the illustration of such decrease.

Fig. 4 - Development of crude birth rate and total fertility rate in Kazakhstan according to the United Nations World Population Prospects the 2008 Revision for the Period 1950–2050



Source: Author's calculations based on data of UN WPP the 2008 revisions.

Fig. 5 - Development of crude birth rate and general fertility rate in Kazakhstan according to the United Nations World Population Prospects the 2008 revision for the period 1950–2050



Source: Author's calculations based on data of UN WPP the 2008 revisions.

Figures 4 and 5, represents development of fertility within a hundred years, attempting to evaluate the overall picture of fertility change in Kazakhstan from retrospective and perspective point of view. It basically divided into estimation period (1950-2000) and projected period (2000-2050) based on medium variant of fertility development.

These figures retrieved an interesting fact of substantial fertility decrease which can be explained by the evidence of the third stage of the First Demographic Transition (Notestein, 1945) (see figure 11). However, the process of decline was accelerated by other factors which we will be discussing herein. Figure 4 takes into account crude birth rate and total fertility rate and its development, within the estimation period it can be divided into two main stages. The first wave of decrease corresponds to sharp decline in TFR (0.7 children decrease) and CBR (6.8 births decrease) between 1960-1965 to 1965-1970 due to fertile behavior of women born during the "war generations" of 1941-1945 (see figure 46, age and sex composition of females in 1960-1970) who could possible have had lower number of children. However, having in mind that total fertility rate is irrespectful to the age structure due to not exposed population in denominator we have to eliminate this not exposed to childbearing population effect, using the general fertility rate which is based only on women at reproductive age at denominator at figure 5. After the mentioned period of sharp decline in both crude birth rates and total and general fertility rates it is a cease of the fertility decrease is observed. Since 1965-1970 up to 1985-1990 it is characterized by relative stabilization due to the starting baby-boom or so called "golden age of Kazakhstan", when socio-economical improvement affected to cease of the decrease of total fertility rate in figure 4 between 1965-1970 and 1985-1990; For instance the highest harvesting years when Kazakhstan picked up more then a 12-13 million poods of grain (1 pood equal to sixteen kilograms – authors note) was exactly during this stabilization period (1972's level of harvest) (The History of Kazakhstan, 2000), better economical situation of families and therefore more space for family planning were the reasons for that relative improvement. Using the general fertility rate for the same period at the figure 5 it is possible to say that another reason for relative stabilization of fertility was due to larger number of women at reproductive age in the denominator. Afterwards it is followed by the second stage which covered period between 1985-1990 up to 1995-2000 (transition period) when TFR felt sharply (1.0 children decrease) and CBR (8.4 births decrease) (Figure 4) and (37 children per 1000) decrease in GFR (Figure 5). The detailed analysis of TFR and CBR changes over the estimation and projection periods will be carried below.

Taking into account the changes in crude births rates since the Second World War which reached the maximum level of 34.3 births per 1000 population in 1955-1960 we may observe further steady decline afterwards which is seen from the following table 4.

Tab. 4 - Estimated crude birth rates per 1000 population in Kazakhstan according to the United Nations World Population Prospects for the period 1950-2000

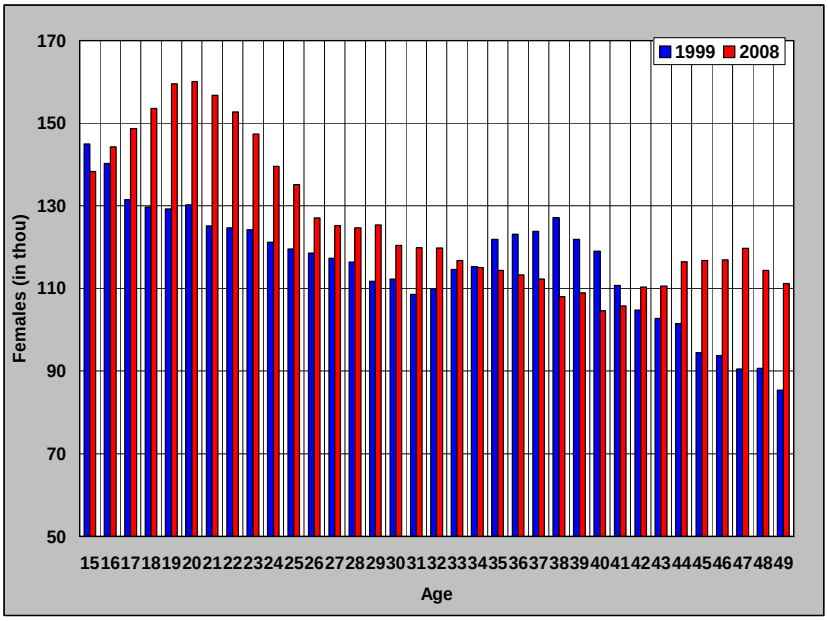
Revisions/Period	1950-1955	1955-1960	1960-1965	1965-1970	1970-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
1994	33.2	34.3	32.9	26.1	25.9	24.9	24.9	24.6	x	x
1996	33.2	34.3	32.9	26.1	25.9	24.9	24.9	24.6	19.9	x
1998	33.2	34.3	32.9	26.1	25.9	24.9	24.9	24.6	19.9	x
2000	33.2	34.3	32.9	26.1	25.9	24.9	24.9	24.6	19.7	16.9
2002	33.2	34.3	32.9	26.1	25.9	24.9	24.9	24.6	19.9	16.9
2004	33.2	34.3	32.9	26.1	25.9	24.9	24.9	24.6	19.8	16.8
2006	33.2	34.3	32.9	26.1	25.9	24.9	24.9	24.6	20.8	16.6
2008	33.2	34.3	32.9	26.1	25.9	24.9	24.9	24.6	20.6	16.2

Note*: Estimates of CBR is available since the revision 1994. .

Source: Based on data from UN WPP the 1994–2008 revisions.

It's worth to mention that CBR is affected by variations in the demographic composition of the population, particularly its age and sex composition. In fact its crude measure of childbearing because the denominator contains a large population not exposed to childbearing: males, children and elderly persons. A major weakness of this measure is that it is not very sensitive to small fertility changes, frankly speaking, it tends to minimize them. As the result of such shattered generations crude birth rates over the period 1950-2000 were decreased for a half or nearly by 52.4% and in 1995-2000 constituted the minimum value 16.2 births per 1000 according to the UN WPP the 2008 revision, whereupon crude birth rates projected to increase again for a short time after which its again projected to fall due to composition of age and sex structure of smaller women cohorts. Conducted census of 1999 and the Demographic Yearbook of Kazakhstan (2008) allows us to see the age structure of females for the 1999 and 2008 corresponding to the first independent census and the most recent UN WPP 2008 revision. Which displayed the opposite situation in 2008 to the 1999: the absolute number of potential mothers between 18 and 25 years, at the age of lower order childbearing, has grown most visibly whereas the absolute number of women between 30 and 40 years of age decreased (see Figure 6).

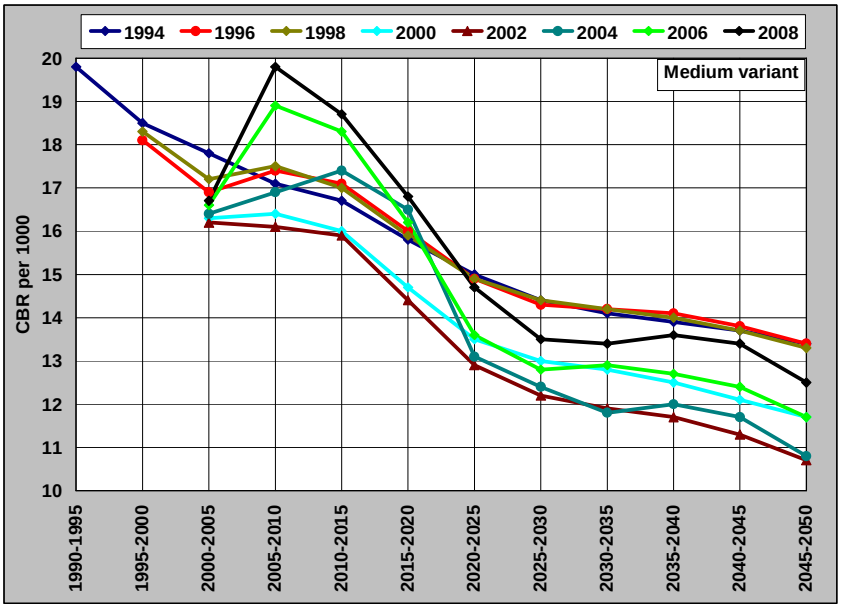
Fig. 6 - Age structure of females in reproductive age in Kazakhstan, 1999 and 2008



Source: Author's calculations based on data from the Agency of Statistics of Kazakhstan

So we may conclude that using the national statistical data that in 2008 comparing to the 1999 we observe increase of number of women in lower birth order childbearing groups (18-25) due to improved impact of socio-economical development in Kazakhstan, strengthening economical stability which caused increasing confidence in the future. Another point is realization of accumulated reproductive potential related to massive postponement of maternity during the 1990´s of higher birth order childbearing groups (40-49). However it is still unclear whether it will be a trend or just a compensation effect of 1990's postponement. To reach an answer for this question we have to look on overall projected development of crude birth rates. The following figure 7 corresponds to the future scenarios of CBR by medium, high, low and constant-fertility variants accordingly after the estimated period. A steady decline of crude births rate is projected in all variants of projection including the high variant after 2010-2015 till the end of projecting period.

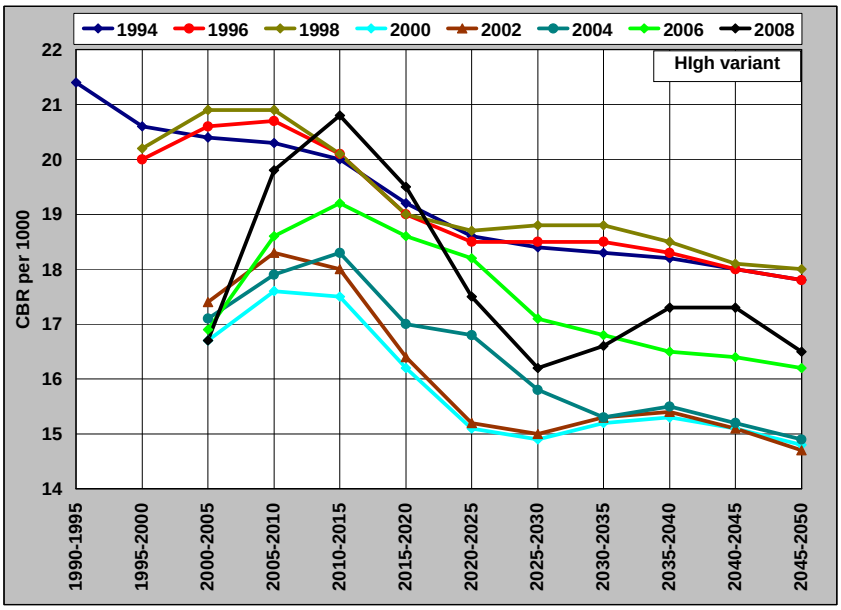
Fig. 7 - Projected crude birth rate in Kazakhstan according to United Nations World Population Prospects for the period 1990-2050



Note: Each curve presents the year of revision

The earliest available revision 1994 at medium variant which is the most probable scenario (comparing to high, medium and constant-fertility variants) of CBR within projecting period from 1990-1995 to 2045-2050 saying that CBR should fall from 19.8 births in 1990-1995 to 13.4 births per 1000 population in the end of projection period (nearly 32% decline) having in mind transformation period of that time we may conclude that age and sex structure was affected by changes in size and its composition in denominator. The latest 2008 revision projects decline from 16.7 births in 2000-2005 to 12.5 births per 1000 in 2045-2050 by medium variant (one-quarter decline). Sudden fluctuation of the line by the revision 2008 for the period 2000-2005 to 2005-2010 from 16.7 to 19.8 births per 1000 (18.5 % increase) can be explained as adjusted age and sex structure for projected period based on last gathered data (increasing denominator of not exposed population: males, children, elderly people). Same situation in high variant of projection, where the CBR continues the trend to decline from maximum value of 20.8 births per 1000 in 2010-2015 to 16.5 births per 1000 (20.7% decline) in the end of projection horizon in 2045-2050. There are bigger variations between revisions due to changes in assumptions underlying each revision by high variant. Assumptions about fluctuations in the period 2000-2005 to 2010-2015 by the revision 2008, high variant are similar and corresponding to low variant assumptions.

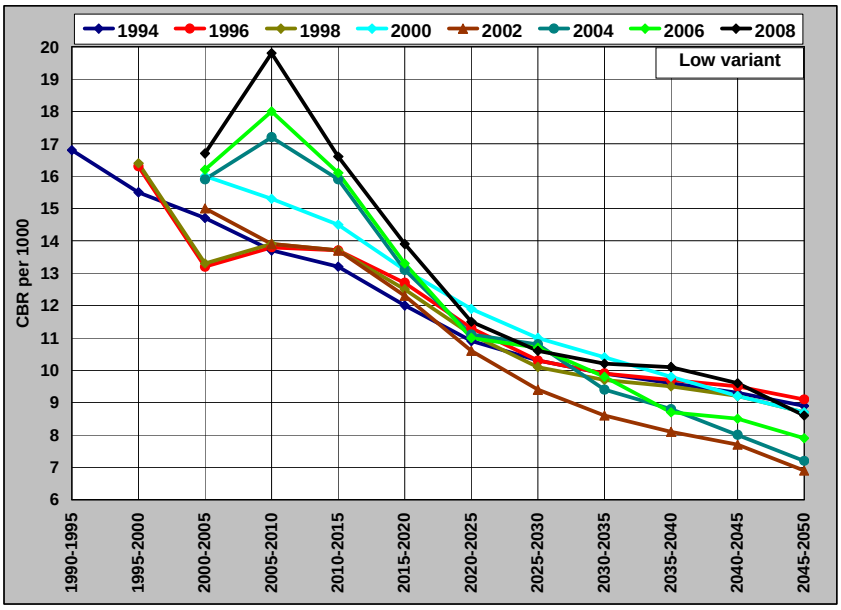
Fig. 7 – continued



Note: Each curve presents the year of revision

Low variant of projection the CBR still confirms the diversity of dynamics among the different revisions. If revisions till the 2004 are more or less have common trend without obvious fluctuations throughout all projected period meaning that for projected period no changes or adjustments were done in the sense of sex and age structure composition. Than, starting from the revision 2006 and 2008 we may observe same sudden increase in CBR till 2005-2010 as in medium and high variant projection.

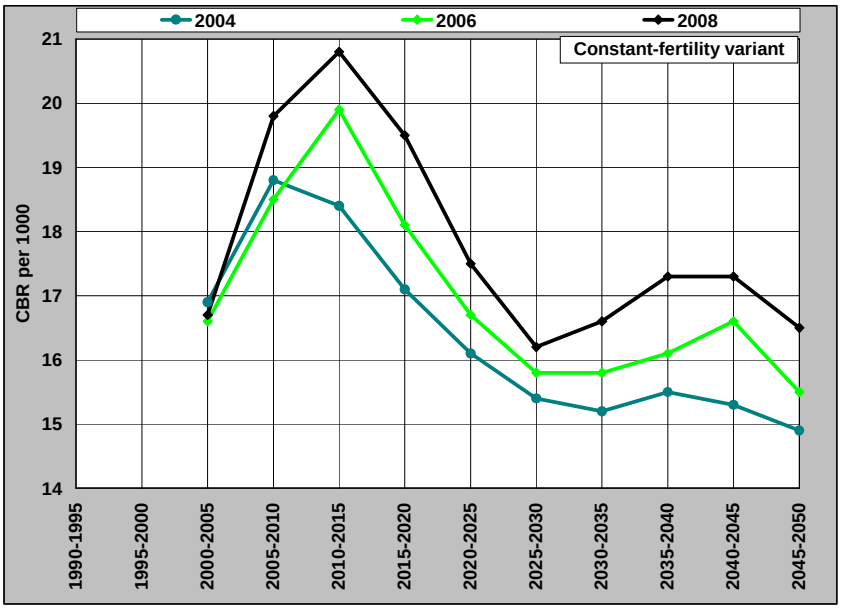
Fig. 7 – continued



Note: Each curve presents the year of revision

Fall from 19.8 births in 2005-2010 to 16.6 births per 1000 in 2010-2015 (16% decline). Constant-fertility variant was available for three consecutive revisions and it is assumed that fertility in Kazakhstan will remain above or near replacement level within all projecting period at the level 2000-2005. Same situation is observed here, where sudden fluctuations across the five-year time interval from 2000-2005 to 2010-2015.

Fig. 7 – continued



Note: Each curve presents the year of revision

Note*: Constant-fertility scenario was available only since the 2004 revision.

Source: Author's calculations based on data of UN WPP the 1994 – 2008 revisions.

However, in the beginning of projecting period CBR was equal to 16.7 births according to the revision 2008 then in the end its stood at 16.5 births per 1000 which is said to be almost unchanged. So we may conclude on the basis of these presented four graphs that the development of births rates in Kazakhstan has steady dynamics to decline nevertheless the fact fertility remains above or at replacement level. It becomes more apparent that started in the developed countries changes in births rates are likely spread over the Kazakhstan within last fifty years and it is a part of larger portion of changes in reproductive behavior.

The United Nations classified countries and areas into three categories according to their level of fertility: high, intermediate and low. According to this classification, Kazakhstan is in the list of low fertility countries where TFR ranges from 2.1 and lower. The fertility transition had begun in low fertility developing countries since the beginning of the second half of the twentieth century, followed by a significant decline thereafter. During that period, Kazakhstan experienced fall in TFR to 3.5 in the period 1970-1975, down from a level of 4.4 in the period 1950-1955 and continued to experience a further decline in fertility, reaching 2.1 or 2.0 by the last 2008 revision in the period 1995-2000 (see Table 5).

Tab. 5 - Estimated total fertility rate in Kazakhstan according to the United Nations World Population Prospects for the period 1950-2000

Revisions/Period	1950-1955	1955-1960	1960-1965	1965-1970	1970-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
1992	…	…	…	…	…	…	…	2.8	x	x
1994	4.4	4.5	4.4	3.7	3.5	3.1	3.0	3.0	2.5	x
1996	4.4	4.6	4.4	3.7	3.5	3.1	3.0	3.0	2.5	x
1998	4.4	4.6	4.4	3.7	3.5	3.1	3.0	3.0	2.5	x
2000	4.4	4.6	4.4	3.7	3.5	3.1	3.0	3.0	2.5	2.1
2002	4.4	4.6	4.4	3.7	3.5	3.1	3.0	3.0	2.5	2.1
2004	4.4	4.6	4.4	3.7	3.5	3.1	3.0	3.0	2.5	2.1
2006	4.4	4.6	4.4	3.7	3.5	3.1	3.0	3.0	2.5	2.1
2008	4.4	4.6	4.4	3.7	3.5	3.1	3.0	3.0	2.6	2.0

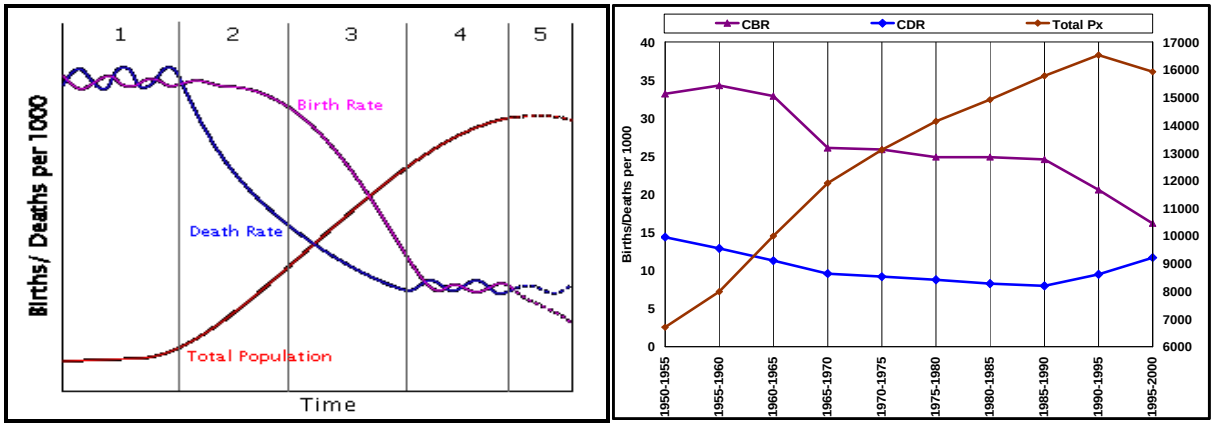
Note*: Estimates of TFR is available since the revision 1994.

Note**: Three dots represents missing value of the revision.

Source: Based on data from UN WPP the 1992–2008 revisions.

However, Kazakhstan was among the fewest countries with economy in transition which still exhibited fertility above or at replacement level (see Table 5). The long-term trends of basic general indicator of women's fertility i.e. total fertility rate (the average number of live-born children per woman of reproductive age within a calendar year) indicates that the recent changes signify a clear turning point in reproductive patterns and they also lessen the likelihood that there will be a return to the pattern of higher reproduction, i.e. to the average of four or three children per woman of reproductive age like in mid 50-60's. This is seen from estimated trends of total fertility rate in Kazakhstan during period of 1950 till 2000 in table 5 above. Where rapid total fertility rate decline occurred within fifty years brought this rate to the twice smaller number as it was at the beginning of estimated period 4.4 versus 2.0 in the end of the estimation period. There is specific and same time classical fertility transition theory stages had occurred in Kazakhstan which had been emphasizing such rapid decline. Specific is in the sense of strong fertility differentiation among rural and urban women, their level of literacy and shift in mean age at childbirth (see Figure 9) etc. However it is still followed by the classical pathway of fertility transition where sweeping modernization and increasing urbanization are changing the traditional values placed upon fertility and the value of children in rural society and the increasing female employment and other forms of emancipation are lowering the uncritical acceptance of childbearing and motherhood as measures of the status of women. Lowering level of fertility in such way gives us the possibility to say that Kazakhstan is somewhere between third and the fourth stages of the first demographic transition (Notestein, 1945). The general view of the demographic transition is presented below at figure 8.

Fig. 8 - A diagram of the demographic transition model including stage 5 and Kazakhstan within the stages of Demographic Transition.

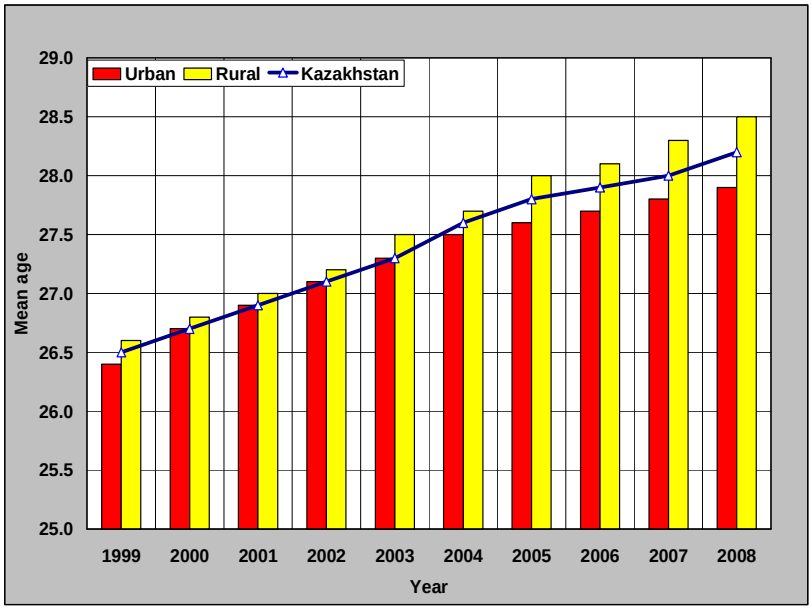


Sources: Wikipedia, Demographic transition model (General view)
Constructed based on data from the UN WPP the 2008 revision

Which is characterized in stage 3 by fall in birth rates (figure 7) due to access to contraception, increases in wages, urbanization, a reduction in subsistence agriculture, an increase in the status and education of women, a reduction in the value of children's work, an increase in parental investment in the education of children and other social changes. During the fourth stage a possible threat creates an economic burden on the shrinking working population (will be discussed in detail in Chapter 6, age and sex structure projections and estimates). Death rates may remain consistently low or increase slightly due to increases in lifestyle diseases due to low exercise levels and high obesity and an aging population in developed countries. Such changes of course influenced by socio-economical strata creating the bridge between one stages to another driven by population growth. Positive population growth occurred during the turbulence period (1990-1995 and 1995-2000), which translated into much younger populations, especially of women at reproductive age than those in most European countries (World Population Prospects the 1994 revision, 1995). The mean age at childbearing was not available by estimation of UN WPP so using the Demographic yearbooks we retrieved this data which is shown below. As Boris Vano pointed in his work: “The higher the fertility growth is the lower is the postponement of births to the higher age i.e. the lower is the increase of the mean age of mother at childbirth” (Vano B., 2002). Controversially, to this statement is situation in Kazakhstan today, where surprisingly rural women start childbearing later then urban women. And this trend tends to continue and even get higher values then previous years. As an explanation we may use the following postulate regarding the generally well-known earlier motherhood in rural areas, which is directly related to lower age at marriage. “The average rural women get married earlier than the average women living in cities. This is due to educational attainment and one of the effects of different approach to higher education. Participation in tertiary education is relatively very high among both rural and urban young females in Kazakhstan; however, rural females are more frequently studying in a combined form which gives opportunity to attend the university twice a year only. There are also higher proportions of females who have no opportunity to participate in tertiary education and are

getting married immediately after finishing school in rural areas. Earlier marriage leads to earlier motherhood and consequently to higher number of children which is clearly observable among rural women" (Meldesheva, 2010:35). On the other hand, significantly increased average time spent by them in tertiary education shifts fertility of the first three or even four birth orders into higher ages. So higher mean age at childbirth, higher birth order having in mind such unusual postulate for "traditional women of Kazakhstan" let's look upon the following figure 9.

Fig. 9 - Estimated mean age of mother at childbirth by place of settlement in Kazakhstan, 1999-2008



Note: Data was not available since the 1992 till the 1998.
Source: Author's calculation based on data from Demographic yearbooks 2005 and 2008 of the Republic of Kazakhstan

Increasing age of mothers at childbirth is another sign that fertility in Kazakhstan started or already processing the transition of fertility towards to Western European pattern. Since the mean age of childbearing has been increasing in many industrialized countries like in Kazakhstan over the past several decades, it is noteworthy to see how European countries had experienced the decline in TFR due to this timing effect and not to a change in the completed fertility of women. Bongaarts and Feeney (1998) therefore argue that TFR is likely to increase in the future once the mean age of childbearing stops rising, as happened in the 1980s in the United States when fertility rose to its current value just below replacement level. An additional argument against continued very low fertility is that in surveys conducted in much of Europe women consistently say they want about 2 children (Bongaarts 1999). There are many reasons why women may fail to reach this target (e.g. competing career plans, divorce, infertility), but this finding suggests that fertility is unlikely to remain extremely low, especially if societies made it easier for women to combine careers and childbearing. However, it may be unlikely that

TFR in European countries will return to near replacement level, even after postponement of childbearing has ceased. This will depend in part on the extent to which younger women who are currently postponing births will recuperate some of this delayed fertility at older ages, which will influence their cohort fertility (Lesthaeghe and Williams 1999). Cohort fertility was already below replacement level in most European countries for women born between 1945 and 1960 (the most recent cohorts for whom reliable estimates of completed fertility can be made) (UN 1997a).

Another important fact corresponds to natural increase (difference of births and deaths) and population change per year in absolute numbers from 1990-1995 to 1995-2000. The overall trend of population decline started to accelerate due to losses in population from migration exceeded gains from natural population change (herein we will partially consider population change per year in absolute numbers which is more topic of migration, to show how deep population change responded to socio-economic situation and number of deaths to the contribution of total births during given period). So let's look up for some basic estimation according to UN WPP produced regarding the absolute total number of births, deaths, natural increase and population change per year, to get the basic idea of what was the combination of events shaped the country profile since as early as 1950 through 2010 in the following table 6.

Tab. 6 - Total number of live births, deaths, natural increase and population change per year in Kazakhstan (in thousands) estimated by United Nations World Population Prospects for the period of 1950-2010

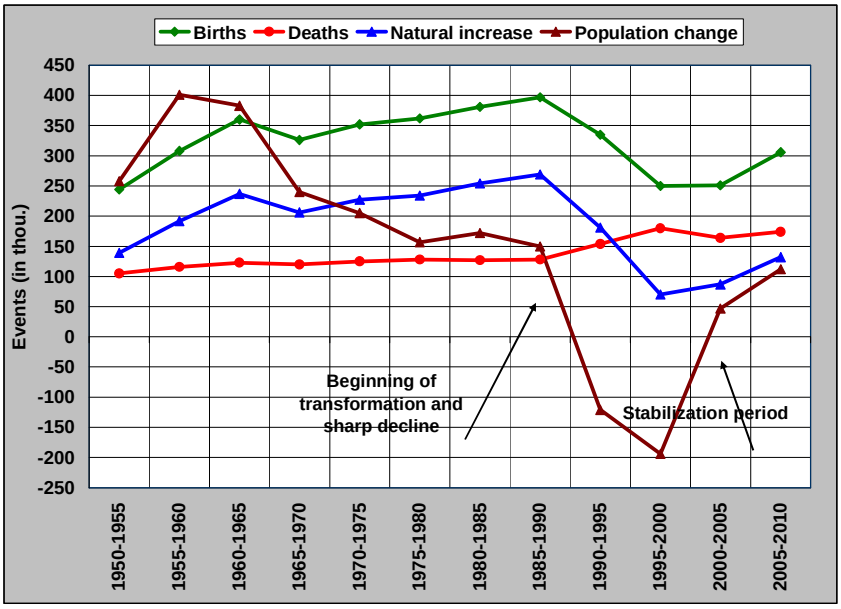
Period	1950-1955				1955-1960				1960-1965			
Events Revisions	Births	Deaths	Natural increase	Population change	Births	Deaths	Natural increase	Population change	Births	Deaths	Natural increase	Population change
1996	244	105	139	258	308	116	192	401	360	123	237	383
1998	244	105	139	258	308	116	192	401	360	123	237	383
2000	244	105	139	258	308	116	192	401	360	123	237	383
2002	244	105	139	258	308	116	192	401	360	123	237	383
2004	244	105	139	258	308	116	192	401	360	123	237	383
2006	244	105	139	258	308	116	192	401	360	123	237	383
2008	244	105	139	258	308	116	192	401	360	123	237	383
Period	1965-1970				1970-1975				1975-1980			
Events Revisions	Births	Deaths	Natural increase	Population change	Births	Deaths	Natural increase	Population change	Births	Deaths	Natural increase	Population change
1996	326	120	206	240	326	120	206	240	362	128	234	157
1998	326	120	206	240	326	120	206	240	362	128	234	157
2000	326	120	206	240	326	120	206	240	362	128	234	157
2002	326	120	206	240	326	120	206	240	362	128	234	157
2004	326	120	206	240	326	120	206	240	362	128	234	157
2006	326	120	206	240	326	120	206	240	362	128	234	157
2008	326	120	206	240	326	120	206	240	362	128	234	157
Period	1980-1985				1985-1990				1990-1995			
Events Revisions	Births	Deaths	Natural increase	Population change	Births	Deaths	Natural increase	Population change	Births	Deaths	Natural increase	Population change
1996	382	127	255	182	401	126	275	183	334	139	195	15
1998	382	127	255	182	401	126	275	183	331	138	193	-47
2000	382	127	255	182	401	126	275	183	329	155	174	-26
2002	383	127	256	195	402	127	275	183	332	150	182	-51
2004	379	127	252	172	401	127	274	145	356	153	203	-79
2006	382	127	255	164	391	128	263	149	345	155	190	-110
2008	381	127	254	172	397	128	269	150	335	154	181	-121
Period	1995-2000				2000-2005				2005-2010			
Events Revisions	Births	Deaths	Natural increase	Population change	Births	Deaths	Natural increase	Population change	Births	Deaths	Natural increase	Population change
1996	x	x	x	x	x	x	x	x	x	x	x	x
1998	x	x	x	x	x	x	x	x	x	x	x	x
2000	277	164	113	-88	x	x	x	x	x	x	x	x
2002	272	158	114	-183	x	x	x	x	x	x	x	x
2004	265	163	102	-145	x	x	x	x	x	x	x	x
2006	240	172	68	-171	248	158	90	23	x	x	x	x
2008	250	180	70	-194	251	164	87	47	306	174	132	112

Note: Estimation of births, deaths, natural increase and population change per year were not available for the revision 1992 and the 1994.

Source: Author's calculation based on data from the UN WPP all revisions.

As it seen from the table above numbers estimated total births, deaths and population change in Kazakhstan according to UN WPP were not too much deviated or different from each revision to the next one till definite point. However since 1985-1990 United Nations started to revise previously set estimation corresponding to the changes occurred in Kazakhstan while independence years. As we mentioned above during one decade from 1990-2000 population decline due to social and economic disadvantages afflicting Kazakhstan sharply is often vividly expressed in basic demographic indicators. The following figure 10 is based on the most updated data of UN WPP the 2008 revision and illustrating the deep consequences of transformation.

Fig. 10 – Estimated absolute number of births, deaths, natural increase and population change per year in Kazakhstan according to the United Nations World Population Prospects the 2008 revision



Source: Author's calculation based on data of UN WPP, the 2008 revision.

Sudden fluctuations on the graph are nothing more then historical events occurred in Kazakhstan during given period and directly afflicting to the events on the figure 4. For instance, increase in population change during the 1950-1955 to 1955-1960 is related to reclamation of virgin lands in central and north regions. In absolute numbers increase from 258 thousand to 401 thousand person per year or nearly 55.4% contributed to migratory flows of European ethnics into Kazakh steps in mid 50-60's. Number of births 244 thousand versus 105 thousand of estimated deaths could draw typical developing transiting country with TFR about 4.4 children per one woman. However since transformation in all spheres started to accelerate events presented on the graph since 1985-1990 right upon the "Perestroika" population development in absolute forms substantially felt down. Total number of born children in the beginning of transformation era was about 397 thousand with 128 thousand of deaths within next two five-year time interval number of total births felt from 397 thousand to 335 thousand or almost 18%. Within next decade declining number of ever-born children stopped at 251 thousand children or almost 86 thousand children less then in the 1985-1990 compared to 2000-2005. Since the 2000-2005 situation in the sense of natural increase and population change started to improve. This is corresponds to general economical flourishing and social development. Such changes on the graph affected by socio-economical situation were the cumulative effects of the events like:

- Territorial dissolution of one before monolith country as the USSR caused ethnic migration of non-title ethnics from Kazakhstan so fertility of them decreased.
- Declining fertility compared to the Soviet Union period due to shift in mean age of mothers (see Figure 9).

- Transfer from quantitative to qualitative childbearing with the respect to improving economical well-being of women, frankly speaking increasing average salary per month, when women as a future mother can plan birth of her own child with more respect to the expenditures to medical care and school enrollment (corresponds to the third stage of FDT).
- Female literacy levels (higher levels of literacy and advanced education, including education about methods of birth control and the planning of families, enable women again to better plan for what kind of family structure and number of children she would like to have happen.
- Desire to build a carrier and create a family later at higher age etc.

Above hypothesis suggests the fact that Kazakhstani family is changing from traditional family type to likely western family type, with fewer children, moving towards to "two-child per family" type.

This can be proven by words of Rychtarikova J. who pointed that: "The reproductive behavior of young and middle-aged people today is significantly different from the reproductive patterns of their parents, both in terms of the average number of live births per woman (total fertility rate) and in terms of structural characteristics (especially age and marital status)" (Rychtarikova, 2009). In other words, schedule of having children in Kazakhstan nowadays differs from what our mothers and grandmothers had previously. Women started to get married and deliver births (use better associations) later caused by shift in mean-age of mother and other indicators. Thus, it has been considered as major factor in reduction of fertility involving the length of the interval between births. When a child is born that survives infancy, however, the interval to the next pregnancy is almost uniformly at least 35 months (Lee 1971, Sussman 1972). Thus, some logical questions rise: 1) is this really a matter of a decrease in fertility quantum or it is more known as the tempo effect? 2) Can fertility intensity be expected to decline further or at least remain at the same level of 2.0 in the future? To answer these questions we need to go back to total fertility rates and its interpretation in the context of timing and births by order. Although from a cohort perspective every woman can have only one first birth, the TFR can nevertheless be greater than one. In particular, this can be observed in periods when the mean age at first birth is decreasing (inversely to our case). Thus a tendency towards a younger age at birth brings about an increase in the TFR. Inversely, a deferral of births leads to a decrease in the observed TFR. The change in the period fertility level that is due to changes in the timing of births is known as the **tempo effect (**Philipov, D. 1999).

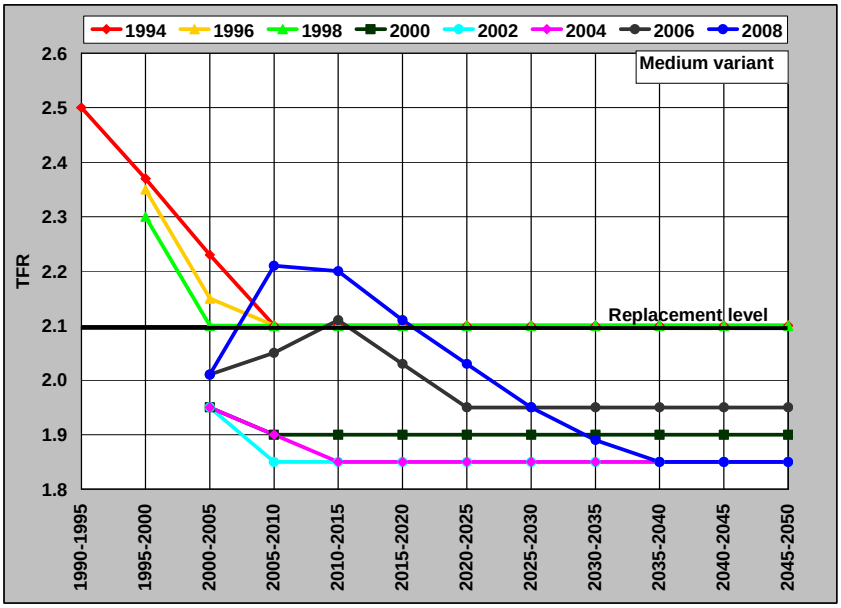
From the cohort perspective, changes merely in the timing of births have no effect on the level of fertility. Completed fertility remains unchanged, because it depends only on the number of live births per woman, not on the age at which these births occur. The level of completed fertility changes only when the number of children born to a woman over her entire reproductive period changes – an effect that is known as the **quantum of fertility**.

So if tempo effects are the primary reason for the recent decline, rather than quantum effects, then the fertility behavior is characterized by a postponement of births, rather than a permanent reduction of births. If this is indeed the case, a modest recovery to somewhat higher fertility levels is more likely than the long-term persistence of these historically low fertility levels (Bongaarts and Feeney, 1998).

Considering the second question regarding the projected fertility level and its future pathway it is good idea to rely on UN WPP projections by medium, high, low and constant-fertility variants which are

presented below at the following figure 10. However, we must say that accelerated in the 1990's fall of fertility intensities is a reaction of families and population in general on deterioration of social and economic transition and decrease of well-being the country inhabitants. Moreover, a gradual spreading of fertility regulation patterns and modern methods of contraception influenced on the fertility decline.

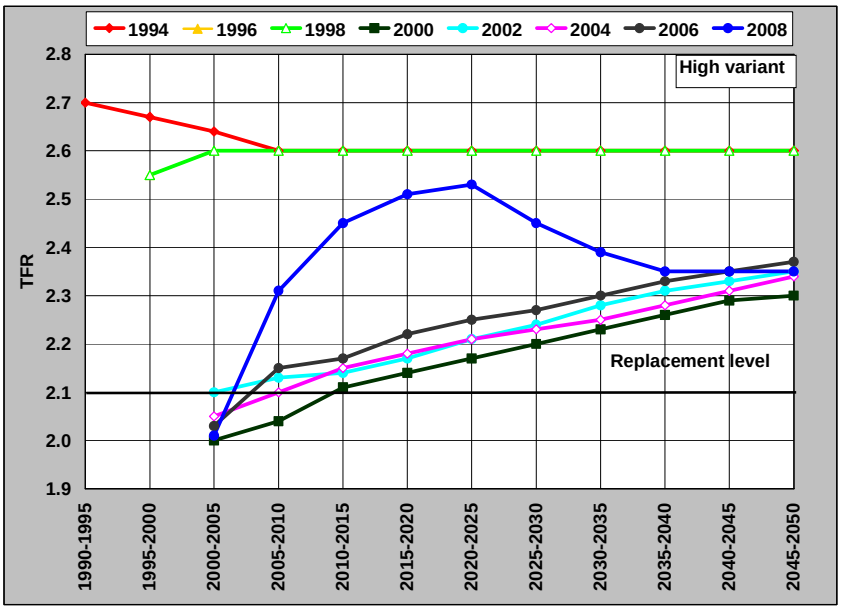
Fig. 11 – Projected total fertility rate in Kazakhstan for the period 1990-2050



Note: Each curve presents the year of revision

The projected TFR by medium variant in the beginning of projection period using the earliest available revision 1994 recorded 2.5 children per woman assuming that Kazakhstan will stay above replacement level within all projected period. Since 1995-2000 period indicator had ranged between 2.4-2.3 children per woman for the revisions 1994, the 1996 and the 1998 respectively. Since the remaining revisions carried out projections from 2000-2005 we will mainly focus on this period because reference year for these projections was taken 2000 which is relatively "fresh" reference year for our discussion. TFR at 2.2 children per woman was recorded by the earliest 1994 revision and it's ranged up to 2.0 in the most recent the 2008 revision. Where besides TFR in Kazakhstan was projected above replacement level for one decade from 2005-2015 only, and then steady decline till the end of projection period is observed. Noteworthy to mention that Kazakhstan where social and economic development was relatively rapid had experienced more rapid fertility declines as well. This relatively fast decline is seen from the medium variant (blue colored line the revision 2008). Basically TFR by medium variant starting from 2015-2020 tends to be below replacement level, ranging from 2.1 to 1.8 children per woman. This is 0.3 children per woman decrease. And basically it was assumed that Kazakhstan within projected period will face decline between 0.3-0.5 children per woman. It is clear reflection to the precipitous fall in fertility after 2005-2010 till 2020-2025 where TFR more or less shall stabilize.

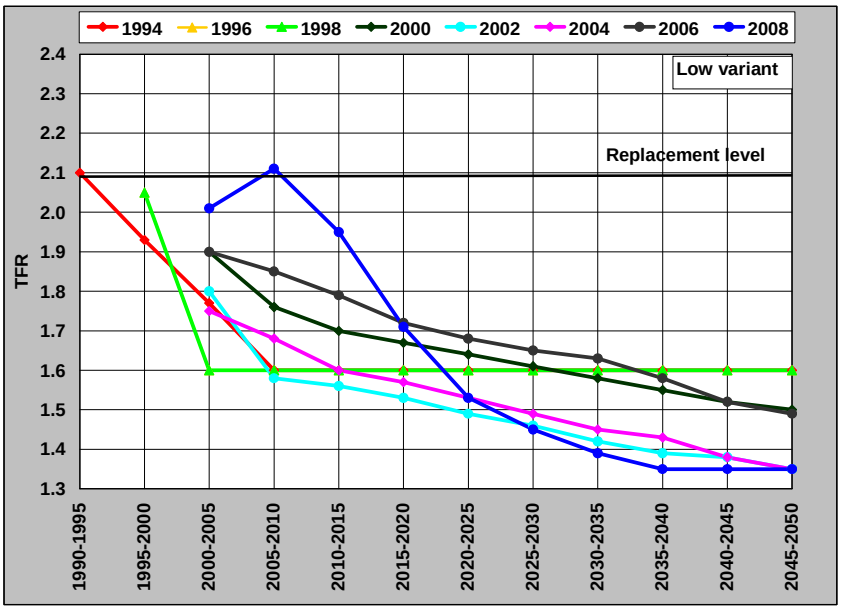
Fig. 11 – continued



Note: Each curve presents the year of revision

High variant of projection is upper boundary of TFR variation. It ranges between 2.7 children per woman for the 1990-1995 in the 1994 revision till the 2.0 children per woman for the 2000-2005 in the 2000 revision. The most recent revision 2008 suggests that TFR would be between 2.0-2.3 children per woman within all projected period. It rises accordingly from the level of 2.0 in 2000-2005 till the 2.5 children per woman in 2020-2025 and afterwards tends to steady decline. Moreover one of the most important evidences is that the pace of fertility changes is positively associated with the level of fertility: the higher the TFR the higher the pace of change. For instance, high variant projections assumes that within all projecting period from 1990-1995 till the 2045-2050 the pace of fertility change will vary between 0.3 to 0.14 and tends to slower at the end of projecting period. Once TFR will be lowering with slower speed, pace of fertility change will be slowing down as well. Higher values in the revision 2008 comparing to the remaining revisions can be explained from the position of gathering newer data available based on DHS conducted in 1999 and officially registered births by age of mother.

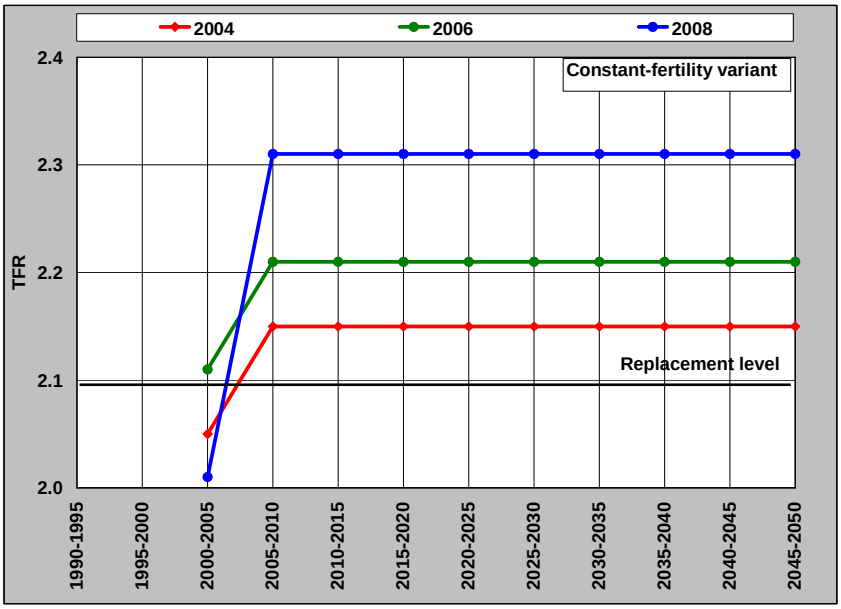
Fig. 11 – continued



Note: Each curve presents the year of revision

Low variant of TFR projection is the lower boundary of variation, ranges from 2.1 to 1.3 children per woman. And it draws a dramatic view on TFR development within projection period.

Fig. 11 – continued



Note: Each curve presents the year of revision

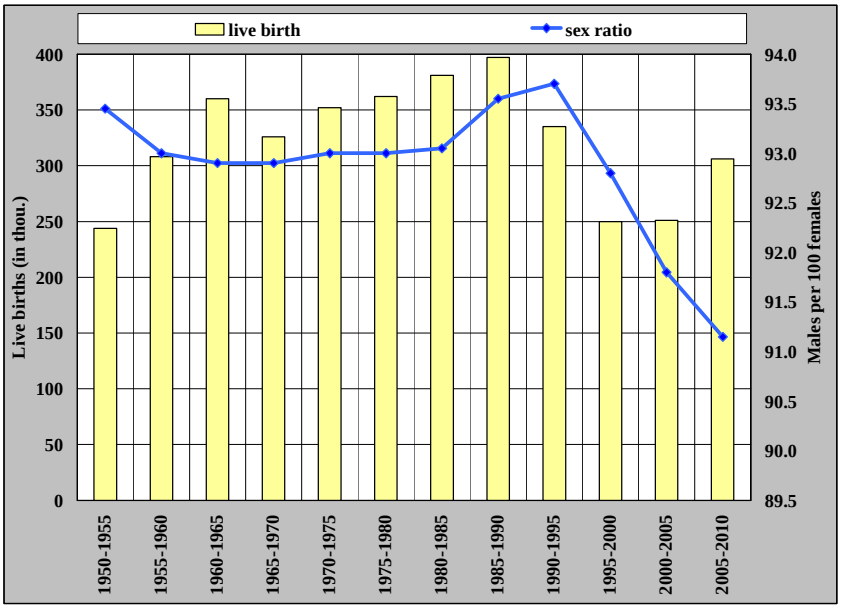
Note*: Constant-fertility scenario was available only since the 2004 revision.

Source: Author's calculations based on data of UN WPP the 1994 – 2008 revisions.

By the end of projection period in 2045-2050 it is assumed that Kazakhstan would catch the train of "lowest-low" fertility countries which is defined as 1.3 live births per woman. Development of this scenario is less desirable neither for government nor for population development in particular. It may cause a lot of socio-economical and geo-political problems within this century due to shrinking structure and increasing proportion of elderly population. Of course, no objections to the words that this is complex problem involving aging process, mortality development, migration flows etc. However, fertility remains one of the "key-wagon in this train platform". Constant fertility suggests the fact that fertility level will be as of level 2005-2010 and remains constant till the end of projection period for the 2004 at 2.1, for the 2006 at 2.2 and for the 2008 at 2.3 children per woman. It is less possible scenario of developing the total fertility rate but not unrealistic at all.

Generally speaking, a steady decline from high fertility rates started to appear in the middle of 1960's so projections of TFR was a continuation of this process. The downward trend with further tendency to stabilization (since 2035-2040) at the level which may be not enough to population reproduction reflects to a recently started gradual transition to controlled fertility and family planning, especially among those groups of population which considered it unnecessary before. This finding suggests that the fertility decline was dominated by quantum effects in the years prior to 1994, and that tempo effects emerged as an important factor only afterwards and will be important factor furthermore. Analysis of current fertility trends in the country will be incomplete without touching upon population sex ratio and its development over last fifty years. This development taking into account the number of live births in absolute terms is presented in the following graph 12 below.

Fig. 12 – Estimated live births and population sex ratio in Kazakhstan according to United Nations World Population Prospect the 2008 revision for the period 1950-2010



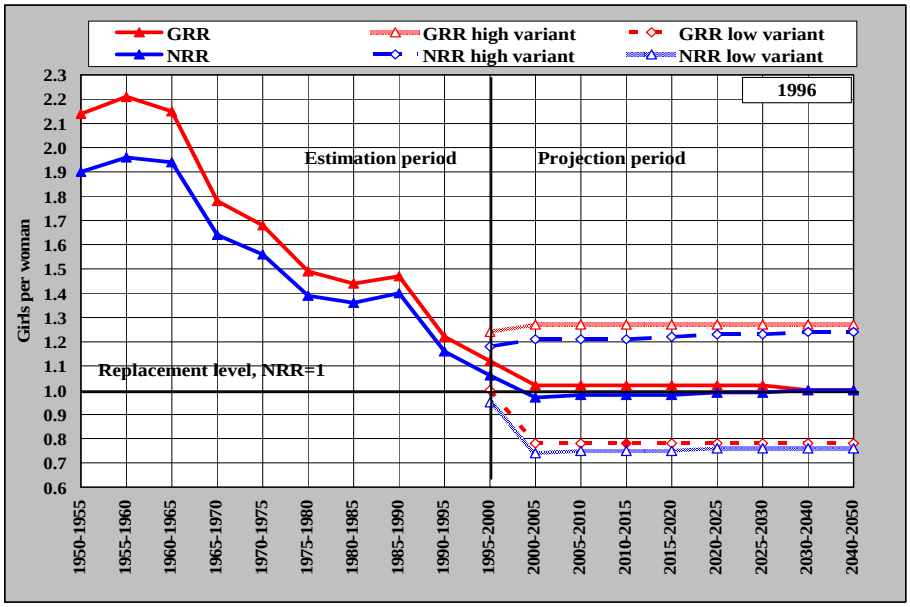
Source: Author's calculations based on data of the UN WPP the 2008 revision.

Changes in the population sex ratio towards to its increase significantly contribute to the retrospective population development due to famines of 1930‘s, collectivization and huge male loss as a part of the USSR during the Second World War (see figure 34, age and sex composition of Kazakhstan population, 1960). However, underestimation of this indicator as well as kept at this level sex irregularities can lead to men deficit and problems in socio-economic sphere within next fifty years. As it seen from the graph conditions of relatively decreased absolute numbers of live born children a downward trend of population sex ratio becomes more evident. Nevertheless the fact that number of live born children increased in the period of 2005-2010 it is still doubtfully a trend and more likely due to cohort of women went through their reproductive age and started to deliver births. Taking into account survival probabilities which will be more tangible for male population especially in higher ages we may conclude that natural selection will somehow regulate such sex disproportion by having higher number of women in higher ages. Consequences of lower portion of men born per 100 women will be revealed through their life course and particularly at the age of union formation: girls being outnumbered will easily find a future partner. This fact of decreased population sex ratio in fact is driven by normal biological rules, where number of girls’ outcomes number of boys born per woman. However, from the point of future shrinking sex composition it is alarming negative impact of the population sex ratio in current trends of reproduction rates.

Important measures used to summarize reproduction level of the population are presented by the values of Gross Reproduction Rate (GRR) and Net Reproduction Rate (NRR). Observed from the figure 13 a decrease in the difference between the GRR and NRR values means that mortality risks among females were permanently declining over the whole period.

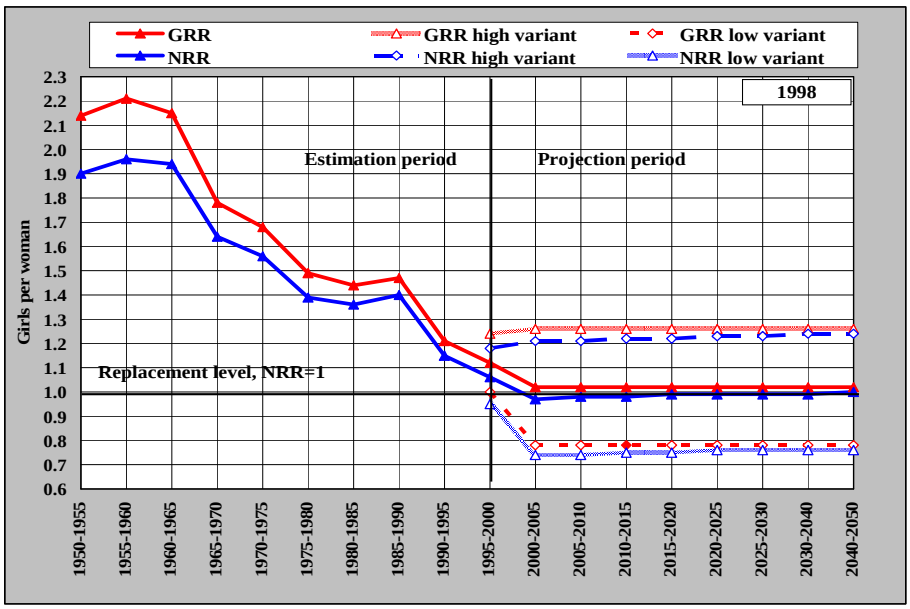
According to the UN WPP, GRR indicator was available till the revision 1998 (basically it is 1996, 1998 only). Hence, the next figure relates to the most recent 1996 and the 1998 revisions.

Fig. 13 – Development of gross reproduction rate and net reproduction rate in Kazakhstan according to United Nations World Population Prospects the revision 1996 and the 1998



Note: Medium variant is set by default as the middle corridor of projection

Fig. 13 – continued



Note: Medium variant is set by default as the middle corridor of projection

Source: Author's calculations based on data of the UN WPP the 1996 – 1998 revisions.

The GRR and NRR are similar to the TFR except that they measure only female births, since reproduction is largely dependent on the number of females in a given population. As it is generally known, if the NRR

equals to 1 (one), then it compiles with the requirements of the replacement level of generations. For the case when the NRR is larger than 1 (one), it means that a newly born girl will on average produce more than one daughter and will replace more than herself. The populations with NRR values below 1.0 do not meet the requirements of the generational replacement and a long term insufficient fertility can lead to population decline. Consequently, it might be considered that fertility level expressed through values of NRR and GRR leads to more pessimistic prospective about future population development than in terms of the TFR in Kazakhstan. The range of NRR projections on presented graph 13 (high-low) varies between 0.23 up to 0.48 girls per woman in the end of projection period. Medium variant of projections starts right after the estimation period ends. It is dash red and blue lines on the graph. By medium variant, NRR stays near 1 (0.97), meaning an average Kazakhstani woman will still be able to replace herself. However, it is followed by simple reproduction and not enough for substantial growth. Since 2000-2005 it's characterized with stable development of NRR and GRR without any fluctuations till the end of projection period. The 1998 revision projections of NRR and GRR has slightly different range of high and low variants of NRR however, we may conclude they are not sufficient to say that observing trend is different then in the 1996's. However, there is a risk of mortality for women for the last decade (2040-2050) is observed. Herein table 7 is estimated NRR taking into account the 2000-2008 revisions. We can observe identical level of NRR till the years 1980-1985 which is from the point of forecast is very good, because it proves that assumptions carried, were conformed throughout the estimation period. Afterwards it is slightly deviates among the remaining years. However, internal deviation among the revisions after the 1985-1990 stays within 0.05-0.06 which is statistically insignificant.

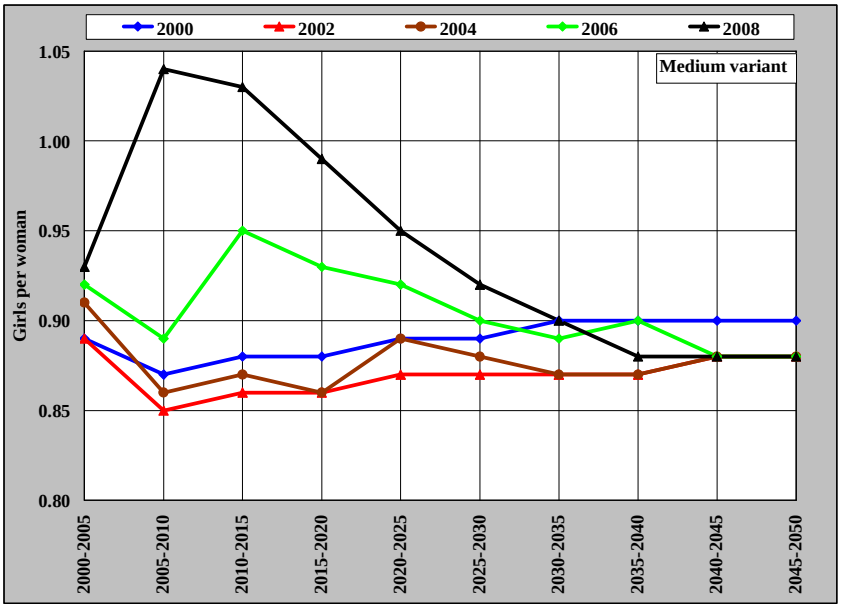
Tab. 7 – Estimated net reproduction rate per woman in Kazakhstan by United Nations World Population Prospects the 2000-2008 revisions for the period 1950-2000

Revisions/Period	1950-1955	1955-1960	1960-1965	1965-1970	1970-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
2000	1.90	1.96	1.94	1.64	1.56	1.39	1.36	1.40	1.12	0.96
2002	1.90	1.96	1.94	1.64	1.56	1.39	1.36	1.40	1.11	0.95
2004	1.90	1.96	1.94	1.64	1.56	1.39	1.36	1.42	1.17	0.96
2006	1.90	1.96	1.94	1.64	1.56	1.39	1.36	1.38	1.16	0.90
2008	1.90	1.96	1.94	1.64	1.56	1.39	1.36	1.40	1.15	0.91

Source: Based on data of the UN WPP the 2000 – 2008 revisions.

The next following graphs relates to Net Reproduction Rate projections, once Gross Reproduction Rate were not considered furthermore by UN WPP. Study period from the 2000 up to the most recent the 2008 revision among three variants: medium, high and low variants.

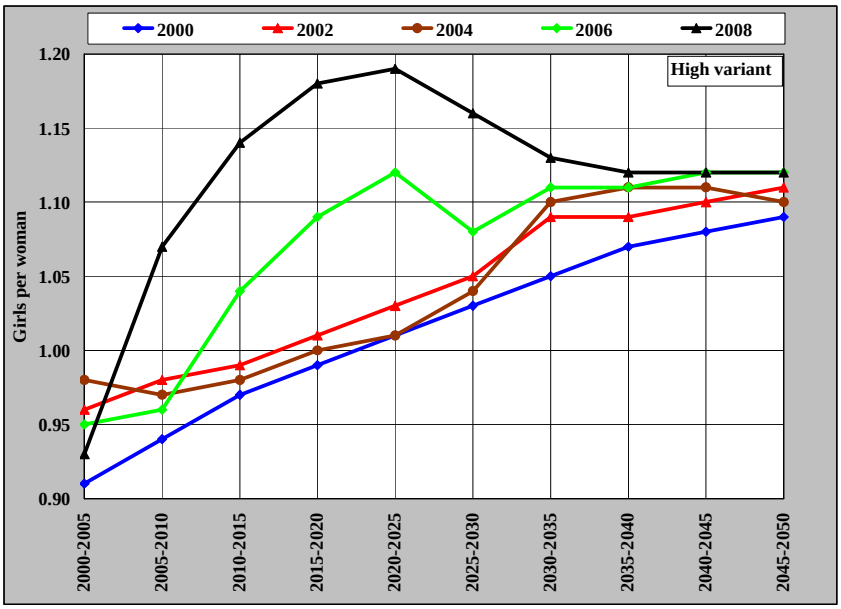
Fig. 14 – Projected net reproduction rate by medium, high and low variants in Kazakhstan for the period 2000–2050



Note: Each curve presents the year of revision

Medium variant is presenting some interesting view on developing the NRR within upcoming fifty years. Nevertheless the fact that the revisions 2000-2006 are tight and pretty close in variation of NRR, the 2008 has some fluctuations within 2000-2005 and 2005-2010 for 0.11 girls per woman.

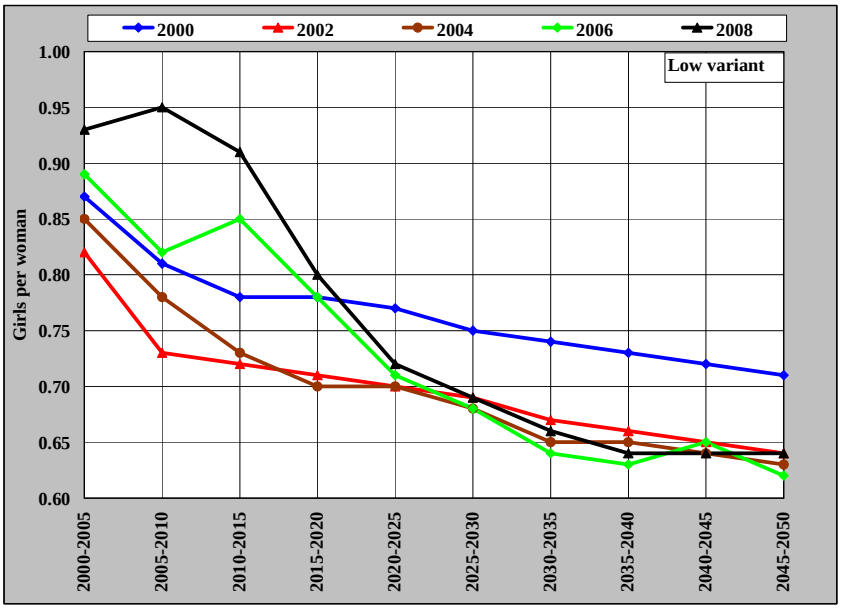
Fig. 14 – continued



Note: Each curve presents the year of revision

This fact corresponds to gathering newer data based on TFR and registered number of births by age of mother hence it has been adjusted for underlying the 2008 revision with the assumption that gap of 0.5 girls per woman will be conformed. (However, data of births by age groups and age of mother were not available through the UN WPP). In other words, medium variant says that this range between 0.11 up to 0.16 within all revisions are confirms the 0.5 girl's variation. High variant of projecting NRR has rapid increase within the first twenty-five years between the 2000 and 2025 after which is characterized by steady decline till the end of projection period (the 2008 revision). The 2006 revision has some steady increase which drops after 2020-2025 than a little increase for the next five-years interval is response probably to tempo effect in period TFR. After that all revisions tends to steady decline.

Fig. 14 – continued



Note: Each curve presents the year of revision

In low variant, pace of decline within all revisions is equal to 0.29 girls per woman, meaning that the fastest decline is evident in this figure than in the rest two. After 2020-2025 steady decline will be observed in all the revisions. The UN WPP projects for the end of 2045-2050 - 0.64 girls per woman, having in mind the replacement level equal to 1, we may conclude based on this variant, that every second women only would replace herself during her life-time. Of course, such pessimistic view on development of this indicator shall not fear anyone, but aware of that fact that simple reproduction at level 1 may not be fulfilled without proper attention to this matter. Yet it is not fairly clear will eventually Kazakhstan face such unprecedented low levels of Net Reproduction Rate.

Another indicator is population growth rate in percentage draws a dramatic change in profile due to socio-economical shift. Once crude birth rates are involving into this indicator we decided to consider it in. Population growth rate ordinarily refers to the change in population over a unit time period, often expressed as a percentage of the number of individuals in the population at the beginning of that period.

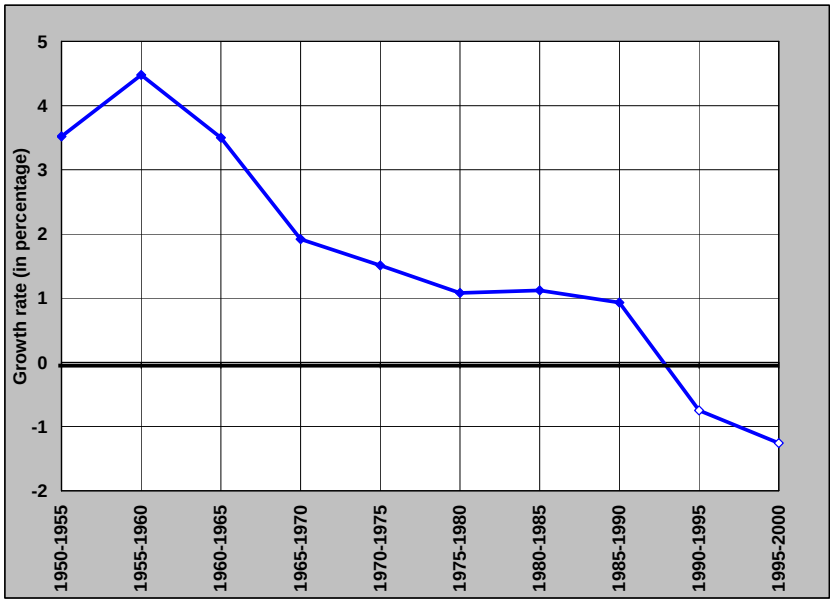
Tab. 8 – Estimated population growth in percentage in Kazakhstan by United Nations World Population Prospects the 1996–2008 revisions for the period of 1950-2010

Revisions/Period	1950-1955	1955-1960	1960-1965	1965-1970	1970-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
1996	3.5	4.5	3.5	1.9	1.5	1.1	1.2	1.1	0.1	x
1998	3.5	4.5	3.5	1.9	1.5	1.1	1.2	1.1	-0.3	x
2000	3.5	4.5	3.5	1.9	1.5	1.1	1.2	1.1	-0.3	x
2002	3.5	4.5	3.5	1.9	1.5	1.1	1.3	1.1	-0.3	-1.1
2004	3.5	4.5	3.5	1.9	1.5	1.1	1.1	1.0	-0.5	-1.2
2006	3.5	4.5	3.5	1.9	1.5	1.1	1.1	1.0	-0.6	-1.2
2008	3.5	4.5	3.5	1.9	1.5	1.1	1.1	0.9	-0.8	-1.3

Source: Based on data of the UN WPP the 1996 – 2008 revisions.

As it was said before 1990's brought a huge changes into population growth rates, where population growth started to decline due to migratory flows affected by wide range of factors such as fall in living conditions, uncomfortable language environment (since the mid 90's not ethnic Kazakhs started to fell pressure due to language barriers, especially in south part of Kazakhstan, which led Slavic ethnic to leave out the country, which in its turn affected population growth rate). Figure 15 is the most recent revision the 2008 shows the negative development of population growth rate since 1990-1995 to 1995-2000 which felt from -0.75 up to -1.26 per cent per annum respectively. The negative development is pointed with white marker background. The most updated revision assumes that population growth rate are estimated negatively, moreover it is continues within projections.

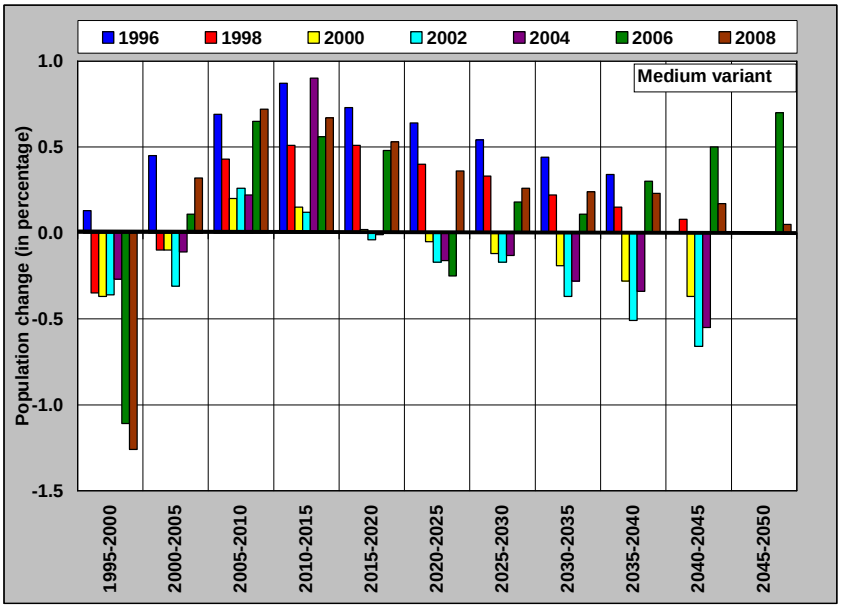
Fig. 15 - Estimated population growth rate in percentage in Kazakhstan according to the United Nations World Population Prospects the 2008 revision for the period 1950-2010



Source: Based on data of the UN WPP the 2008 revision.

The next figure is presenting projected population growth rate by medium, high low and constant-fertility scenarios. There are rapid felt in population growth during the second part of transition period 1995-2000 are observed.

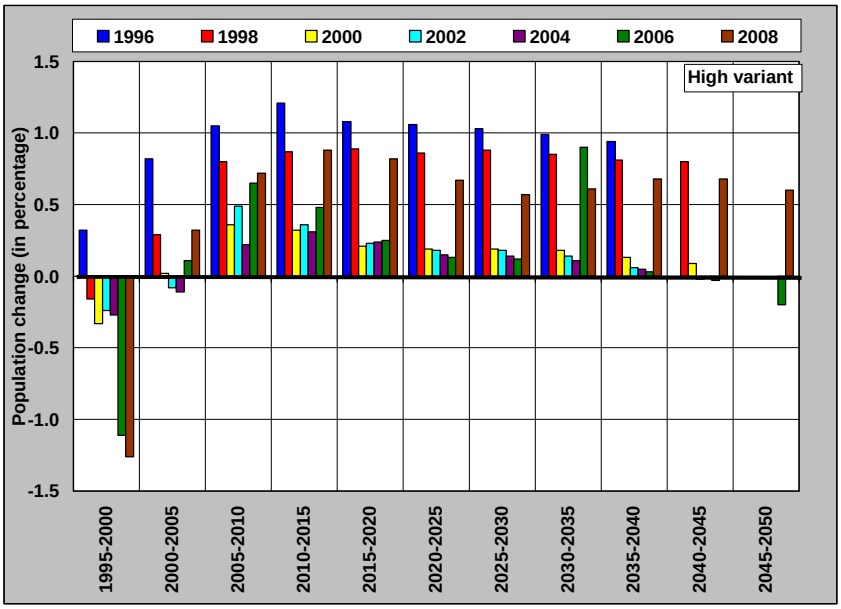
Fig. 16 – Projected population growth rate in percentage in Kazakhstan according to the United Nations World Population Prospects for the period 1995-2050



Note: Each period interval (horizontal x axis) consists of number of subsequent revisions

Each period interval consists of seven consecutive revisions; medium variant displays sharp fell in population growth rate in 1995-2000 between 0.23% in early revisions up to -1.26% in the revision 2008. Furthermore population growth rate tends to stabilize due to shortening of migratory flows (end up of migration potential) and positive natural increase (see figure 10). Interesting fact, that the revision 1996 has the highest positive values within all projected period it is though the earliest available revision so we may assume data gathered for this projections did not counted updated results on births, deaths and migratory flows. Period between 2005-2010 and 2015-2020 is characterized by positive growth up to 1%. Afterwards steady decline are observed in the 2002 and 2004 revisions.

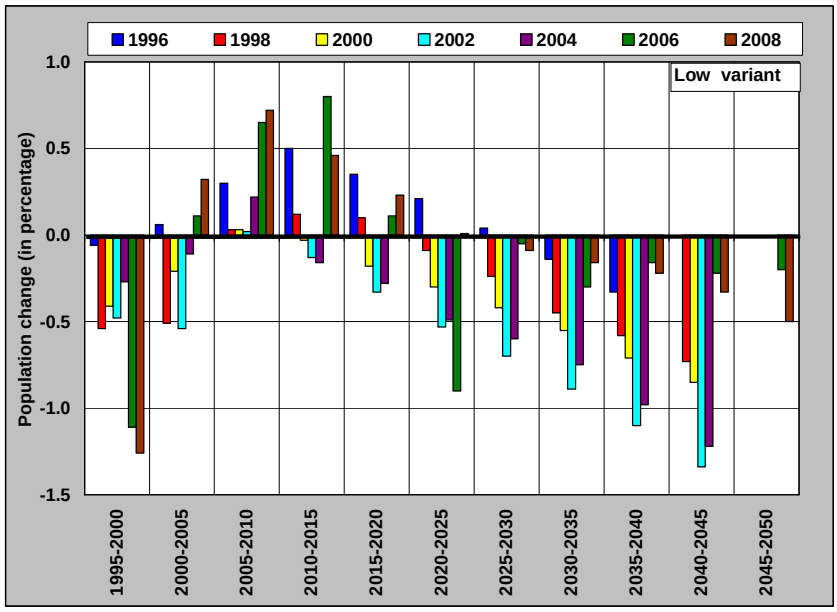
Fig. 16 – continued



Note: Each period interval (horizontal x axis) consists of number of subsequent revisions

While the revision 2006 and the 2008 already assumes positive population growth up to 0.72%. High variant mainly has upward values for population growth except the first time period between 1995-2000 where migratory flows peaked the most and natural increase dropped.

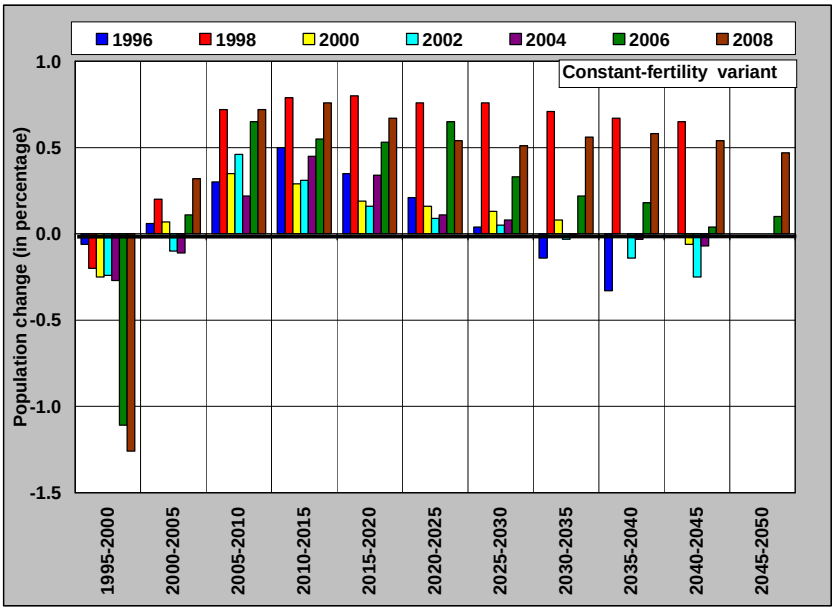
Fig. 16 – continued



Note: Each period interval (horizontal x axis) consists of number of subsequent revisions

A little decline is observed in the 2002 and 2004 revisions within next five-year interval. Afterwards it tends to stabilize and ranges from 0.3 to 0.82%. Low variant draws dramatic changes in case if certain assumption on migration and natural increase would be fulfilled. Dramatic start of projections follows with similar negative development after 2015-2020. The peak of such negative growth hits 2040-2045 ranging from -0.33% up to -1.34%. Hopefully, Kazakhstan will never reach such extreme negative growth rates in the future. And let this variant to be a lower boundary of hypothetical future projections. Constant-fertility scenario assumes that level of TFR would remain at the replacement level within all projected period. Same base–period of projection 1995-2000 characterized by negative growth, afterwards it is almost all positive population growth between 0.3% and 0.76% within the remaining projection period.

Fig. 16 – continued



Note: Each period interval (horizontal x axis) consists of number of subsequent revisions
Source: Author's calculations based on data of the UN WPP the 1996–2008 revisions.

So, based on all mentioned facts we have discussed in this chapter we may conclude that estimation and followed projecting of fertility development still are partially uncertain and some assumptions are doubted. We may assume that it is due to 1) Not up dated information gathered from the National Statistics Office 2) either to errors based on projection horizon. Both of these assumptions have right to be enlightened.

5.2 Mortality

An evaluation of mortality trends for the successor states of the former the USSR has been and still is complicated because of various problems with regard to data availability and data quality. Under registration of deaths in general and the use, until recently, of a definition of infant death that does not conform to World Health Organization guidelines have significantly affected the statistics on mortality levels and trends.

Over the period after World War II the development of mortality in Kazakhstan was characterized by relatively stable crude death rates at about 15 per mil (e.g. in 1950-1955 at about 14.4 per 1000). In fact, within this period crude death rate tended to decline till the restoration of independence in the early 1991 when crude death rate once again rose up due to a wide range of social and economic problems daily affected everyday life of almost every citizen (see table 9).

Tab. 9 - Estimated crude deaths rate per 1000 population in Kazakhstan according to the United Nations World Population Prospects for the period 1950-2000

Revisions/Period	1950-1955	1955-1960	1960-1965	1965-1970	1970-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
1996	3.5	4.5	3.5	1.9	1.5	1.1	1.2	1.1	0.1	x
1998	3.5	4.5	3.5	1.9	1.5	1.1	1.2	1.1	-0.3	x
2000	3.5	4.5	3.5	1.9	1.5	1.1	1.2	1.1	-0.3	x
2002	3.5	4.5	3.5	1.9	1.5	1.1	1.3	1.1	-0.3	-1.1
2004	3.5	4.5	3.5	1.9	1.5	1.1	1.1	1.0	-0.5	-1.2
2006	3.5	4.5	3.5	1.9	1.5	1.1	1.1	1.0	-0.6	-1.2
2008	3.5	4.5	3.5	1.9	1.5	1.1	1.1	0.9	-0.8	-1.3

Note: Estimates of crude death rate is available since the revision 1994.
Source: Based on data from the UN WPP the 1994–2008 revisions.

More important in this sense the pace of crude death rate change, which confirms the hypothesis that higher the levels of crude death rate faster the pace of change would be. For instance, pace of change for consecutive five-year interval starting from 1950-1955 is: 1.5; 1.6; 1.7; 0.4; 0.4; 0.5; 0.3; -1.5; -2.2 respectively. Negative values of crude death rate development caused by that very turbulence period we mentioned above correspond for the period1990-2000. Nevertheless the fact that major trends in mortality development were not changed regardless temporary deviations among the revisions the principal decline of mortality observed since the 1950's was predominantly influenced by improvements in medicine and wider access to public health elements. (Introduction of antibiotics, new ways of treatment widened preventive measures). This decline is partially accompanied by improved sanitation and extending practice of healthier behaviors (Bloom, 2001). Following the epidemiologic transition, the mortality decline occurred firstly due to reducing numbers of deaths from infectious and parasitic diseases (Omran, 1971). Omran gives three possible factors tending to encourage reduced mortality rates and we may assume they are relevant to Kazakhstan as well:

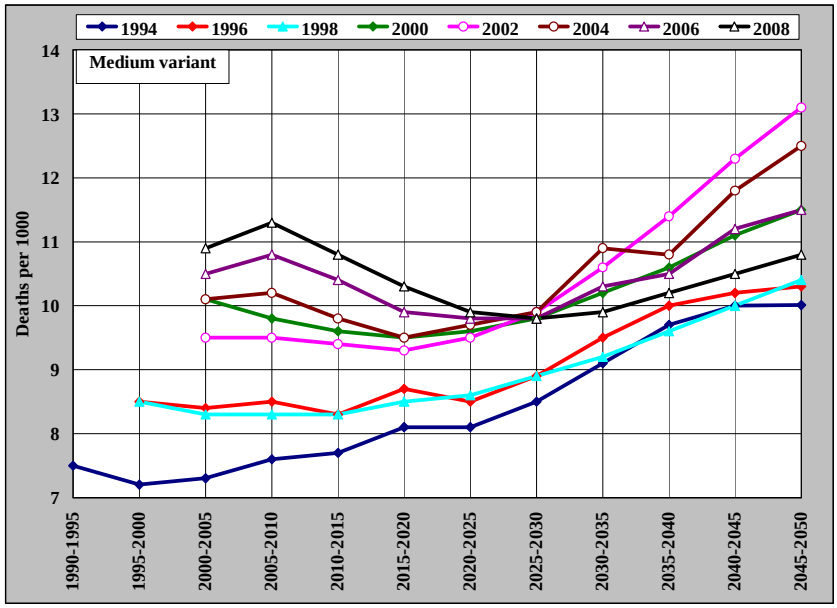
- Bio-physiologic factors, associated with reduced infant mortality and the expectation of longer life in parents,

- Socioeconomic factors, associated with childhood survival and the economic perceptions of large family size
- Psychologic or emotional factors, where society as a whole changes its rationale and opinion on family size and parental energies are redirected to qualitative aspects of child-raising.

As these causes (infectious and parasitic diseases) affected on young population over time mentioned above factors gradually implied a change from a regime of high infant and child mortality to lower rates and led to gains in life expectancy. It is worth to say that Kazakhstan in the context of Omran's theory fits the fourth model, so called "transitional variant of delayed model" of changing the mortality and morbidity pattern. The main features of the transition include a decline in mortality, an increase in life expectancy and a shift in the leading causes of morbidity and mortality from infectious and parasitic diseases to non-communicable, chronic and degenerative diseases. Based on his theory we may conclude that Kazakhstan has already approached the end of the third stage, where crude death rate stabilizes at a level of 20 deaths per 1000 inhabitants (Omran, 1971). Of course, this theory lacks some reference to violent and accidental deaths due to behavioral cases however, this is not the part of our work, to discuss see (Rogers and Hackenberg, 1987, Mackenbach 1994).

The crude death rate depends on the age (and gender) specific mortality rates and the age (and gender) distribution of the population. The number of deaths per 1000 people can be higher for developed nations than in less-developed countries, despite life expectancy being higher in developed countries due to standards of health being better. This happens because developed countries typically have a completely different population age distribution, with a much higher proportion of older people, due to both lower recent birth rates and lower mortality rates. An estimation period 1950-2000 was characterized by slight decline of mortality rates from 14.4 to 11.7 deaths per 1000 inhabitants which is a little decline. The following figure 17 corresponds to the future scenarios of crude death rate by medium, high, low and constant-fertility variants accordingly after the estimated period.

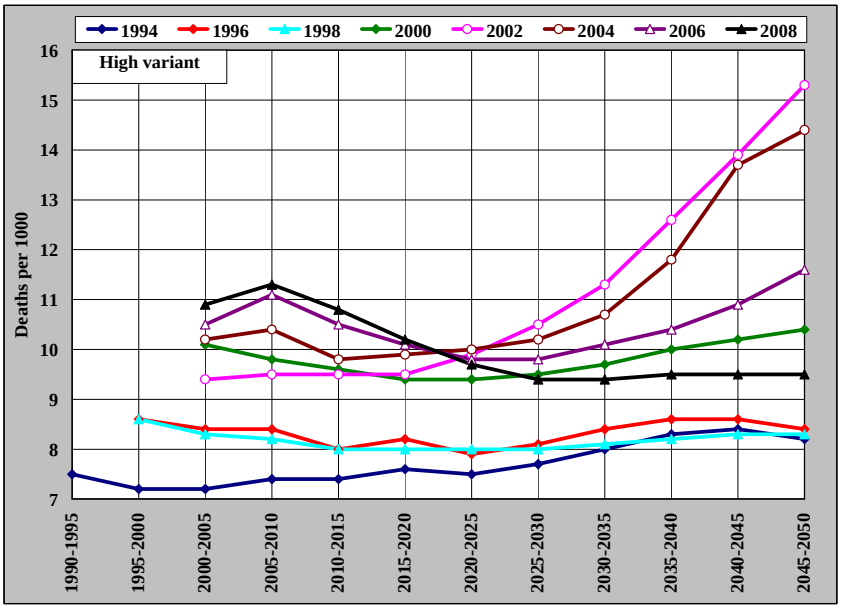
Fig. 17 - Projected crude death rate in Kazakhstan according to the United Nations World Population Prospects for the period 1990-2050



Note: Each curve presents the year of revision

Surprisingly a steady increase of crude death rate is projected in all variants of projections including the high variant after 2020-2025 till the end of projecting period. Medium variant is presenting a tendency of rising mortality. The range at the end of projection period between revisions is from 10 to 13 per mils nearly per 1000 inhabitants.

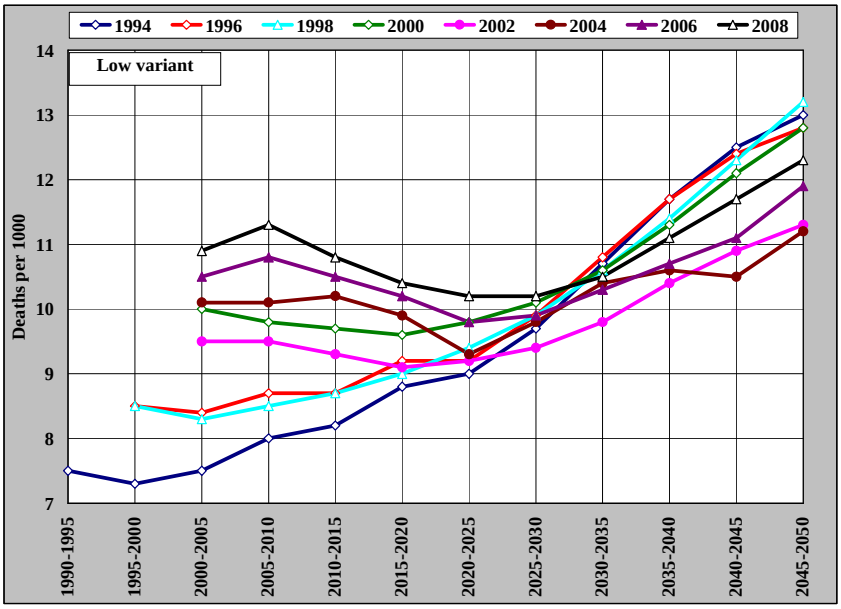
Fig. 17 – continued



Note: Each curve presents the year of revision

It is more surprising in the context of consequently achieved improvements in health care system caused by political stability which initiated in its turn economic growth, of course there are still unsolved problems on the agenda staying, however none of them are determinant for such steady increase in crude death rate.

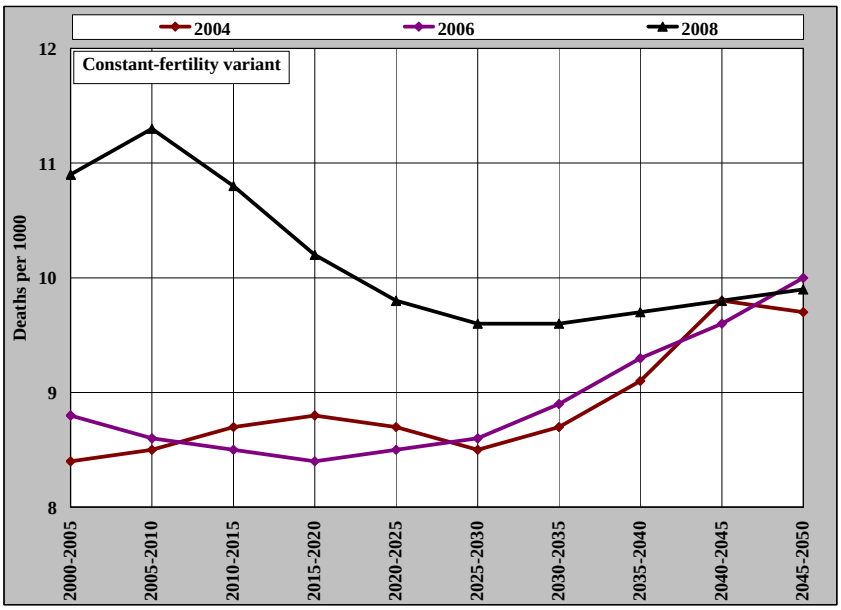
Fig. 17 – continued



Note: Each curve presents the year of revision

As we know already crude death rate illuminates age structure effects. But, inspecting medium variant we may see enough about future development of crude death rate. Mortality rates began to revert to previous levels of 1960's. A critical remark to this projected numbers shall be said. One fact that crude death rate felt under 10 per mil per 1000 inhabitants in the beginning of 1990's having in mind starting turbulence period is likely doubted. Because general development of mortality had tendency to stagnation and substantial increase due to worsening socio-economical factors. The latest 2008 revision projects 10.9 deaths in 2000-2005 to 10.8 deaths per 1000 in 2045-2050 by medium variant. This is not too much change about the future development except the fact crude death rate tends to stabilize somehow at the level 9.8-10.8 deaths per 1000 inhabitants. High variant ranges from 7.2 up to 13.1 deaths per 1000. Interesting in this graph is that the earliest revisions 1994, 1996 and 1998 have lowest values. While the revisions 1998, 2000, 2002 and 2004 have highest values. This suggests the fact that these two groups of revisions are based on different level of crude death rate. Revisions till the 1998 based older register of deaths therefore level of deaths are lower than in the revisions since 1998. The revision 2008 takes into account the newest data on number of registered death and total population at mid-year. It is projected a little decline of crude death rate over the projected period. Pace of change is slow and approximately 0.4-0.5.

Fig. 17 – continued



Note: Each curve presents the year of revision

Note*: Projections of CBR is available since the revision 1994.

Source: Author's calculations based on data of the UN WPP the 1994–2008 revisions.

Low variant projection on the graph 17 has some relative dispersion over projected period characterized by steady increase of crude death rate. Pace of change even slower in this figure, because values between revisions are tight and basically changes between 0.5-0.4. Constant-fertility variant are available for three consecutive revisions the 2008 revision starts to project the crude death rate with much higher values than the remaining revisions. It tends to steady decline in corridor between 9.6 up to 11.3 deaths per 1000. Taking into account presented graphs we may conclude that crude death rate tends to slightly increase in the second half of projected period in all revisions are observed.

However, to get an overall improvement situation in mortality we shall look at life expectancy at birth changes to a certain extent illustrated in table 10 below. In the course of the discussion about general mortality changes it should be stressed that gathered data has revealed very high sex differentiation of life expectancy at birth (one of the highest in the world). Till 1980-1985, estimated life expectancy at birth was differentiated by sex throughout all revisions. An average gap of 10.2 years has distinct women and men's life expectancy at birth in 50-80's it is enormous number of years for any country not affected by wars or any other extraordinary events. Well, interpretation to this situation shall be briefly given.

Since the dissolution of the USSR rapid changes in socio-economic sphere accelerated stagnation and further cease of improvement of life expectancy in Kazakhstan. Many people in other words lost their jobs, earnings and people who was about to retire lost their savings. All this together with increasing level of mortality due to external and alcohol related causes downwarded the trend of narrowing gap between the sexes. This problem will be discussed below, however it is noteworthy to say that an issue of

stagnating mortality pattern and changing structure as well as intensity was studied by many well know authors: (e.g. Shkolnikov, Becker, Urzhumova 2004). It is also obvious that enormous sex differentiation than in many countries in the world today is one of the fundamental features of mortality in Kazakhstan (Musabek, Skokbayeva, 1999).

Tab. 10 - Estimated life expectancy at birth in Kazakhstan according to the United Nations World Population Prospects for the period 1950-2000

Revisions/Period	1950-1955				1955-1960				1960-1965			
	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes
1992	n/a	n/a	n/a	69.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1994	51.6	61.9	10.3	56.5	53.6	63.9	10.3	58.6	55.6	65.9	10.3	60.7
1996	51.6	61.9	10.3	56.5	53.6	63.9	10.3	58.6	55.6	65.9	10.3	60.7
1998	51.7	61.9	10.2	56.5	53.7	63.9	10.2	58.6	55.7	65.9	10.2	60.7
2000	51.7	61.9	10.2	56.5	53.7	63.9	10.2	58.6	55.7	67.9	12.2	62.9
2002	51.7	61.9	10.2	56.5	53.7	63.9	10.2	58.6	55.7	65.9	10.2	60.7
2004	51.7	61.9	10.2	56.5	53.7	63.9	10.2	58.6	55.7	67.9	12.2	62.9
2006	51.7	61.9	10.2	56.5	53.7	63.9	10.2	58.6	55.7	67.9	12.2	62.9
2008	50.2	60.6	10.4	55.0	52.2	62.6	10.4	57.2	54.2	64.7	10.5	59.3
Revisions/Period	1965-1970				1970-1975				1975-1980			
	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes
1992	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1994	57.6	67.9	10.3	62.9	59.1	69.4	10.3	64.4	60.1	70.4	10.3	65.4
1996	57.6	67.9	10.3	62.9	59.1	69.4	10.3	64.4	60.1	70.4	10.3	65.4
1998	57.7	67.9	10.2	62.9	59.2	69.4	10.2	64.4	60.2	70.4	10.2	65.4
2000	57.7	67.9	10.2	62.9	59.2	69.4	10.2	64.4	60.2	70.4	10.2	65.4
2002	57.7	67.9	10.2	62.9	59.2	69.4	10.2	64.4	60.2	70.4	10.2	65.4
2004	57.7	67.9	10.2	62.9	59.2	69.4	10.2	64.4	60.2	70.4	10.2	65.4
2006	57.7	67.9	10.2	62.9	59.2	69.4	10.2	64.4	60.2	70.4	10.2	65.4
2008	56.3	66.7	10.4	61.5	57.8	68.2	10.4	63.1	58.8	69.3	10.5	64.2
Revisions/Period	1980-1985				1985-1990				1990-1995			
	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes
1992	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	x	x	x	x
1994	61.7	71.9	10.2	66.9	63.6	73.1	9.5	68.6	x	x	x	x
1996	61.7	71.9	10.2	66.9	63.6	73.1	9.5	68.6	62.8	72.5	9.7	67.7
1998	61.7	71.9	10.2	66.9	63.6	73.1	9.5	68.6	62.8	72.5	9.7	67.6
2000	61.7	71.9	10.2	67.0	63.6	73.1	9.5	68.6	60.5	70.3	9.8	65.4
2002	61.7	71.9	10.2	67.0	63.6	73.1	9.5	68.6	60.5	70.3	9.8	65.2
2004	61.7	71.9	10.2	67.0	63.6	73.1	9.5	68.6	60.3	70.2	9.9	65.2
2006	61.7	71.9	10.2	67.0	62.7	73.1	10.4	67.9	60.5	70.3	9.8	65.5
2008	60.4	70.9	10.5	65.8	62.4	72.1	9.7	67.4	60.5	70.3	9.8	65.5
Revisions/Period	1995-2000											
	Males	Females	Sex difference	Both sexes								
1992	x	x	x	x								
1994	x	x	x	x								
1996	x	x	x	x								
1998	x	x	x	x								
2000	58.6	70.0	11.4	64.1								
2002	58.9	71.1	12.2	66.9								
2004	58.7	70.3	11.6	63.1								
2006	57.9	70.5	12.6	64.2								
2008	57.5	68.9	11.4	63.0								

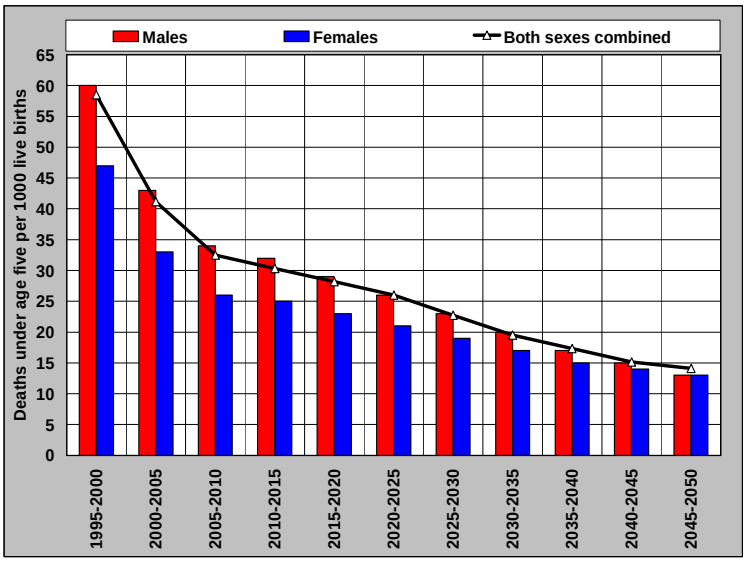
Note*: n/a – not available

Source: Based on data from the UN WPP the 1992–2008 revisions.

Survival rates of males are lower than females. But in general, selectivity or better say natural selection of males and females are not the same. Women most of the time survives till exact age 1-4, through the age 0 with better chances than men. It is naturally ordered by default that women survive with better chances than men due to many factors affecting this process. The time of greatest biological vulnerability is widely held to be the extremes of age, when mortality caused by biological differences would be expected to be greatest. Paradoxically, this is also the time of least disparity in mortality between the genders (Bonhomme, J. 2009).

The available data for 2008 revision allows us to see the general trend of mortality under-five years by sex and sexes combined in figure 18 below.

Fig. 18 – Projected under-five mortality by sex in Kazakhstan according to the 2008 revision for the period 1995-2050



Note*: Number of infant deaths is included

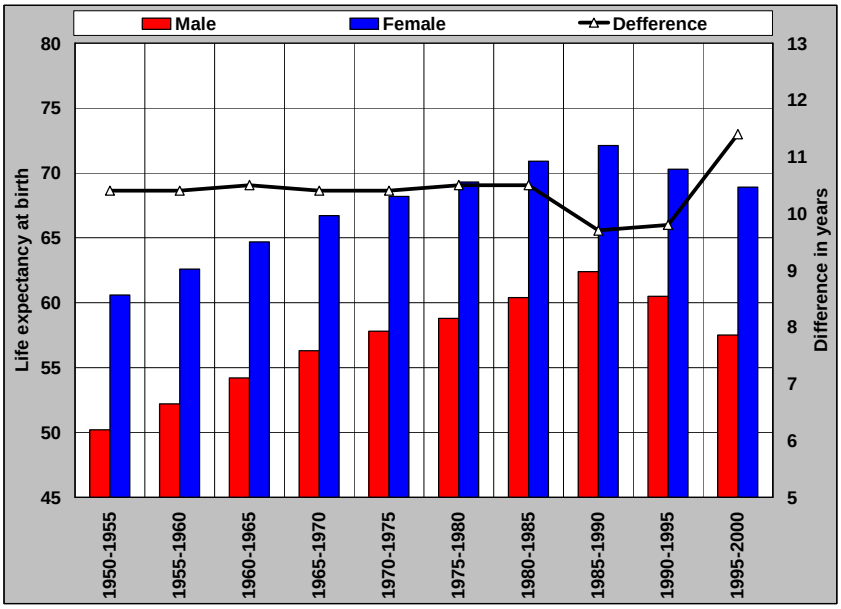
Source: Author's calculations based on data from the UN WPP the 2008 revision.

We will speak about infant mortality rates further but it is noteworthy to see on the graph future development of mortality under-five age where (red bars) males have lower survival rates than females which is seen from the graph. However, overall trend to minimize the gap between sexes are observing within all projected period. It is also relates to the life expectancy improvement discussed herein.

In 1950-55 estimated males life expectancy at birth varied between the revisions from 50.2 up to 51.7 and for females constituted from 60.6 up to 61.9 years, respectively. By the year 1995-2000 these figures have increased significantly varying from 57.5 up to 58.9 for males and from 68.9 up to 71.1 for females respectively. Increase of life expectancy within this estimated period for males consisted 7.3 years and for females 7.7 years. In this respect, its worth to say that pace of change for males were faster than for females due to improvement in sanitation and better care in working environment of males. Most importantly, this trend felt down after 1991 due to socio-economic crisis and dramatic worsening of life

conditions, which have become substantially worse than those in other transiting countries (excluding Russia, where mortality patterns had their own specificities, Shkolnikov M, Leon D 2006). This is also can be proven by Burcin who pointed in his work that: "Mortality rate and structure decisive shifts are thus connected to particularly significant socio-economic changes following 1990 which have affected population health state as well (Burcin B. 2002). Furthermore, the 90's also brought widened gap between sexes caused by mentioned factors (see table 10). There is socio-economic response affected to this extraordinary increase of sex differentiation in life expectancy at birth, which is pointed in "Mortality recovery and stabilization in Kazakhstan 1991-2001" (Becker C. M., Urzhumova D. S. 2004) that: the economic collapse in Kazakhstan was stunning, though its recovery has been impressive as well. Kazakhstan became independent at the end of 1991 under conditions of complete economic dependence-for capital, inputs, markets, and a financial system-on ruble zone partners and, especially, on Russia. With the collapse of trade among the formerly Soviet Republics, the simultaneous transition to a market economy, the starting point of which was the liberalization of prices early in 1992, inflation took off; demand and production collapsed, and registered employment fell dramatically. In 1992 alone, consumer price inflation exceeded 3000%, and GDP decreased by 11.3%. Worse was yet to come, though, as in 1993 Russia ended the ruble zone and stopped supplying other former Soviet Republics with rubles, necessitating the creation of local currencies. Trade was further disrupted as fluctuating exchange rates added greatly to uncertainty over the value of transactions, especially as government spending exceeded revenues, leading to rapid nominal money supply growth in the absence of developed financial markets and tax collection processes, and hence to near hyperinflation. Thus, stagnation in the late Soviet period transformed into a rapid economic implosion, with real GDP declining from its 1991 level by roughly 40% by 1995 (Smailov et al., 2002). 1996 through mid 1998 was a period of stabilization and nascent recovery, followed by stagnation following the shock waves of the Russian debt default in August 1998. Recovery resumed in the latter part of 1999, when real GDP rose by 2.7%, and then accelerated to 10% real growth in 2000. Extraordinary real GDP growth of 13% in 2001was realized, followed by 2002 and 2003 real GDP growth of roughly 9% per annum, so that as of 2004 Kazakhstan's per capita real GDP has regained late Soviet levels. The era of economic collapse was mirrored by deteriorating life expectancy, while a comparably symmetric rise in life expectancy has not accompanied economic recovery. The following figure 19 presents estimated and projected development of life expectancy according to the UN WPP 2008 revision.

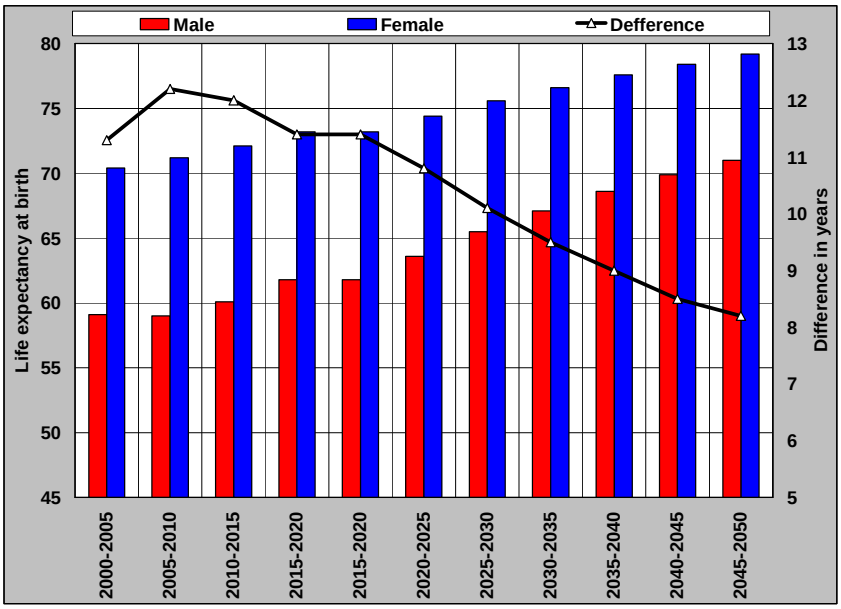
Fig. 19 – Life expectancy at birth and sex differentiation in Kazakhstan, 1950-2050



Source: Author's calculations based on data from the UN WPP the 2008 revision.

The estimated development of life expectancy from early 50's till 90's was characterized with over 10 years of sex differentiation. A little improvement started during "Glasnost" in 1985-1990 where gap between sexes narrowed and consisted lower than 10 years of difference.

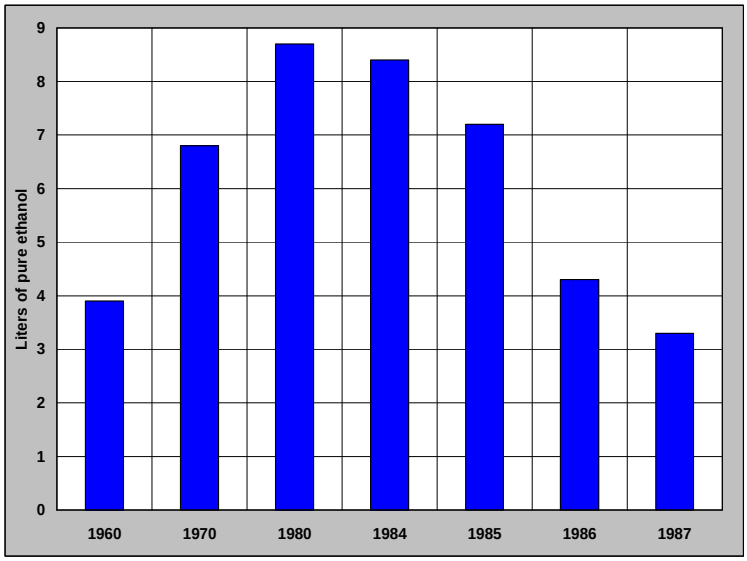
Fig. 19 – continued



Source: Author's calculations based on data from the UN WPP the 2008 revision.

There is a hypothesis that such relative improvement was due to “anti-alcohol program” established in 1986. This has stricted the usage of alcohol beverages almost as half as its previous level (Ivanets N, Lukomskaya M. 1990). This especially affected males’ population in most cases. Herein additional information to this topic is presented (however to discuss see Ivanets N, Lukomskaya M. 1990).

Fig. 20 – Annual per caput consumption of alcoholic beverages (litres of pure ethanol) in the USSR

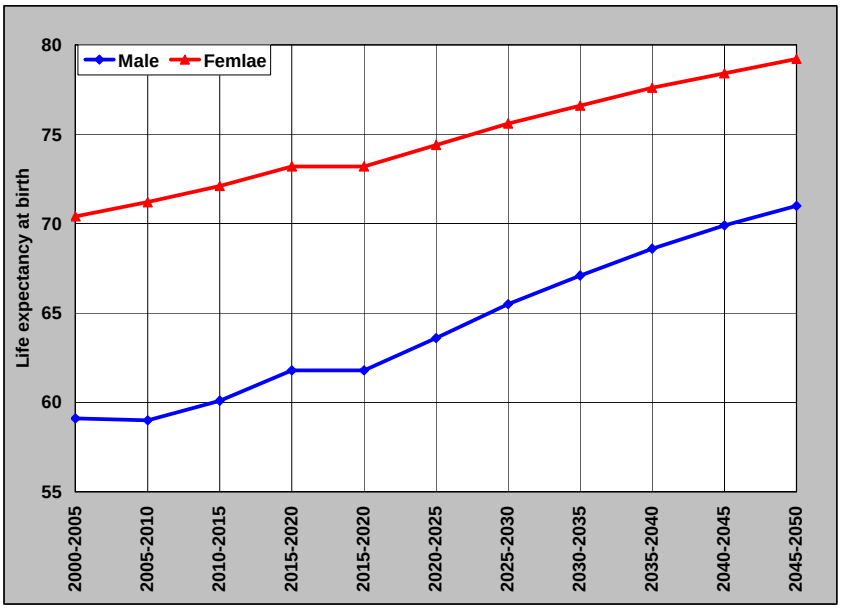


Source: Based on the USSR State Committee on Statistics. (National economy of the USSR in 1985)

Well, based on this facts we may assume that Kazakhstani male’s life expectancy were affected by usage of alcohol taking into account ethnical composition (see table 1) in the 1989 Kazakhs constituted 40.1% of total population (along Russians, Ukrainians, Germans, Tatars etc.). We will not go deep into the details. But the presented material may be accepted as a partial explanation for the relative improvement of life expectancy and narrowing the gap between sexes. As it was mentioned above worse was yet to come which is seen from widened sex differentiation in 1995-2000 (estimation period) on the graph 19 which brought range of sex difference between 11.4 up to 12.6 years within the all revisions. The graph about projection period is the continuation of life expectancy development. Projecting the life expectancy at birth where higher values of black curve is higher difference between sexes which reached the maximum value of difference 12.2 years in 2005-2010 afterwards this peak tends to steady decline ranging from 4.7 up to 8.2 years in the end of projection period. The next table 11 presents in tabular form projected life expectancy where stabilization of a situation and development of all spheres of life since 2000-2005 had an impact on morality decrease as well as on narrowing the sex differentiation. Thus within the period of 2000-2050 projected indicator suppose to rise up by nearly 6-10 years from 65.0 years up to 71.0-75.3 years for males and up by nearly 3-7 years from 73.9 years up to 77.8–81.5 years for females. This finding brings us to the point when we may conclude that projected improvement in life

expectancy at birth for males (6-10 years) go likely twice faster of projected improvement in life expectancy at birth for females (3-7 years). It fits general idea about pace of change for transiting countries see (mentioned above stage of epidemiological transition Omran, 1971.) that developing countries usually lags in improvement of life expectancy however their pace of change higher than for developed countries which needed almost a century to reach such results. Of course their path was much more smother than Kazakhstan's sharp fall in crude death rate and increase speed in improvement of life expectancy at birth. To clarify the trend of life expectancy improvement we may look upon the next figure relating the projected life expectancy by sex for fifty years time horizon by the most recent 2008 revision.

Fig. 21 – Projected life expectancy at birth by sex in Kazakhstan according to the United Nations World Population Prospects the 2008 revision for the period 2000-2050



Source: Author's calculations based on data from the UN WPP the 2008 revision.

Eventhough sex differentiation is expected to be very high among the men and women it is evident that life expectancy will rise up gradually within next fifty years. However, there are some cease of increase would occur; first one is in the beginning of projection period for males in 2000-2010, second one will be common for both men and women in 2015-2020. This cease shall be considered alarming; however it is only for quinquennial period afterwards it is a steady increase without any fluctuations or drops. A hypothesis for such cease could be either residual problem in socio-economical sphere which still be echo the transformation period (1990-2000) for that time or increasing mortality pattern among population, mostly infant deaths (however, there is no clear proneness of that, see figure 22). Anyway it is only possible to assume some reasonable explanations for this cease. In the end of projected horizon men

would live 71.0 year and women 79.2 years compared to the beginning of projection (men 59.1 and women 70.4 years accordingly). To assess internal deviation between revisions itself it is worth to look upon next table with projected life expectancy for men and women and both sexes combined.

Tab. 11 - Projected life expectancy at birth in Kazakhstan according to the United Nations World Population Prospects for the period 1990-2050

Revisions/Period	2000-2005				2005-2010				2010-2015			
	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes
1992	x	x	x	x	x	x	x	x	x	x	x	x
1994	68.0	75.8	7.8	72.0	69.0	76.6	7.6	72.9	70.0	77.4	7.4	73.7
1996	64.8	73.4	8.6	69.2	66.3	74.5	8.2	70.4	67.8	75.4	7.6	71.7
1998	64.8	73.5	8.7	69.2	66.3	74.5	8.2	70.4	67.8	75.5	7.7	71.7
2000	59.6	70.7	11.1	65.0	61.6	71.9	10.3	66.7	63.6	73.1	9.5	68.3
2002	60.9	71.9	11.0	66.3	62.9	73.1	10.2	68.0	64.9	74.1	9.2	69.6
2004	61.4	69.8	8.4	63.2	63.7	73.4	9.7	68.6	65.3	73.5	8.2	69.4
2006	63.9	68.3	4.4	66.0	65.0	69.5	4.5	67.2	66.3	70.8	4.5	68.5
2008	59.1	70.4	11.3	64.6	59.0	71.2	12.2	64.9	60.1	72.1	12.0	66.0
Revisions/Period	2015-2020				2020-2025				2025-2030			
	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes
1992	x	x	x	x	x	x	x	x	x	x	x	x
1994	70.8	77.9	7.1	74.4	71.6	78.4	6.8	75.0	72.4	79.2	6.8	75.8
1996	68.8	76.2	7.4	72.6	69.8	77.1	7.3	73.5	70.8	77.9	7.1	74.4
1998	68.8	76.3	7.5	72.6	69.8	77.1	7.3	73.5	70.8	77.9	7.1	74.4
2000	65.6	74.1	8.5	69.9	67.1	75.1	8.0	71.2	68.6	76.1	7.5	72.4
2002	66.9	75.1	8.2	71.1	68.4	75.9	7.5	72.3	69.4	76.7	7.3	73.2
2004	67.3	74.3	7.0	70.8	68.5	74.5	6.0	71.5	69.5	75.5	6.0	72.5
2006	67.5	72.1	4.6	69.8	68.6	73.2	4.6	70.9	69.6	74.3	4.7	71.9
2008	61.8	73.2	11.4	67.6	63.6	74.4	10.8	69.1	65.5	75.6	10.1	70.7
Revisions/Period	2030-2035				2035-2040				2040-2045			
	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes	Males	Females	Sex difference	Both sexes
1992	x	x	x	x	x	x	x	x	x	x	x	x
1994	73.2	80.0	6.8	76.6	74.0	80.5	6.5	77.3	74.8	81.0	6.2	77.9
1996	71.8	78.7	6.9	75.2	72.8	79.5	6.7	76.1	73.6	80.3	6.7	77.0
1998	71.8	78.7	6.9	75.3	72.8	79.5	6.7	76.2	73.6	80.3	6.7	77.0
2000	69.8	77.1	7.3	73.5	71.0	78.1	7.1	74.6	72.0	78.9	6.9	75.5
2002	70.4	77.5	7.1	74.1	71.2	78.0	6.8	74.7	72.0	78.5	6.5	75.4
2004	70.3	76.4	6.1	73.4	71.3	77.7	6.4	74.5	72.1	77.5	5.4	74.8
2006	70.5	75.2	4.7	72.8	71.4	76.1	4.7	73.7	72.2	77.0	4.8	74.6
2008	67.1	76.6	9.5	72.1	68.6	77.6	9.0	73.3	69.9	78.4	8.5	74.4
Revisions/Period	2045-2050											
	Males	Females	Sex difference	Both sexes								
1992	x	x	x	x								
1994	75.3	81.5	6.2	78.4								
1996	74.4	80.7	6.3	77.6								
1998	74.4	80.8	6.4	77.6								
2000	73.0	79.7	6.7	76.4								
2002	72.8	79.0	6.2	76.0								
2004	73.0	78.6	5.6	75.8								
2006	73.1	77.8	4.7	75.4								
2008	71.0	79.2	8.2	75.3								

Note*: n/a – not available

Source: Difference was calculated based on data from the UN WPP the 1992–2008 revisions.

Future development of life expectancy at birth and overall mortality significantly depends upon changes in mortality among infants and children. Over the estimated period 1950-2000 infant mortality significantly dropped twice as of level of 1950's from 85-110 up to 43-62 deaths per 1000 inhabitants. It

should be noted that the greatest portion of such positive downward trend is due to improvement of medical technologies, wider access to them and better lifestyles which in fact contributes to mortality reduction from infections and parasitic diseases (Omran, 1971).

The following table presents estimated number of infant mortality rate confirming the stages of epidemiological transition which is seen from the table below. Its noteworthy to mention that underestimation of infant mortality rate were re-calculated by as much as 25% (see Anderson, Silver, Ksenofontova 1986)

Tab. 12 – Estimated number of infant death rate in Kazakhstan according to the United Nations World Population Prospects for the period 1950-2000

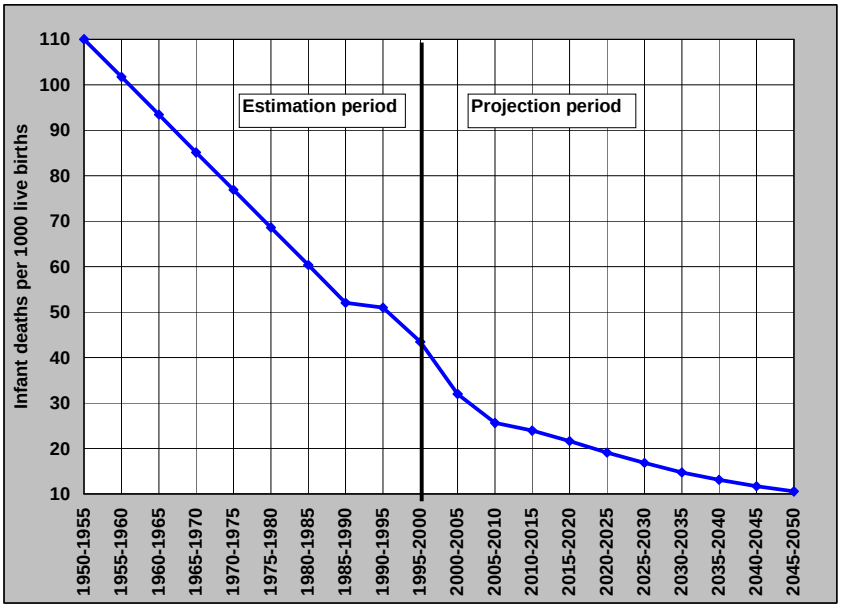
Revisions/Period	1950-1955	1955-1960	1960-1965	1965-1970	1970-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-2000
1994	85	75	66	56	50	45	36	32	x	x
1996	85	75	66	56	50	45	40	36	34	x
1998	85	75	66	56	50	45	40	36	35	x
2000	85	75	66	56	50	45	40	36	41	45
2002	85	75	66	56	50	45	40	36	55	58
2004	85	75	66	56	50	45	40	36	55	62
2006	105	103	97	87	76	67	60	55	55	63
2008	110	102	93	85	77	69	60	52	51	43

Note: Underestimated infant mortality rates were adjusted by the UN WPP methodology
Source: Based on data from the UN WPP the 1994–2008 revisions.

In the given context nevertheless the fact infant mortality rate was re-calculated by true level as of 25% it should be mentioned that estimation of infant mortality rate and reliability of data on infant mortality remains still under the question. The World Health Organization definition is saying that any fetus showing signs of life at birth is considered to be a live birth. In contrast, all the data of the official Kazakhstani statistics was based on the old (Soviet Union definition) of live births (till 2008), which excluded from calculation of the infant mortality rate infants being born after less than 28 weeks of gestation, weighting less than 1000 grams, or having less than 35 centimeters in length and dying after the first seven days of life. Moreover we have to add that even in case of adjusting the infant mortality rate as of 25% it is not enough. Conducted cluster analysis by Reproductive Health Survey (Atlanta 2001) presented that even adjusted information on the level of infant mortality rate was three times lower then analysis retrieved.

The following figures present the retrospective and perspective development of infant mortality rate both sexes combined within the period 1950-2050 according to the UN WPP the 2008 revision.

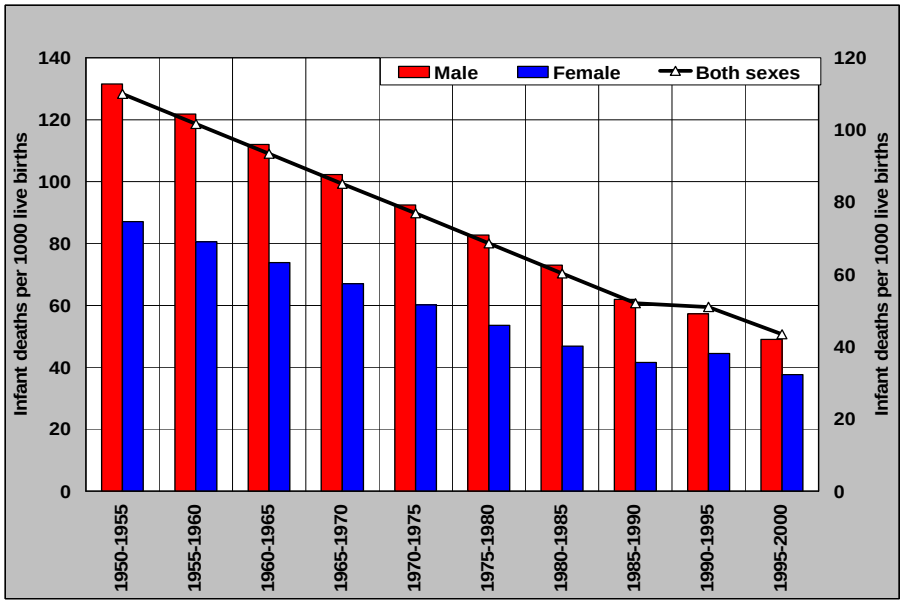
Fig. 22 –Infant mortality rate in Kazakhstan, 1950-2050



Source: Author's calculations based on data from the UN WPP 2008 revision.

According to the stages of mortality decline Kazakhstan on figure 22 transits from the second stage (the age of receding pandemics) to the third (the age of man-made and degenerative diseases) and on the projection period (left-hand side) from the third stage to the beginning of the fourth stage (hubristic stage) of epidemiological transition (see Rogers and Hackenberg 1987 for details). The most recent revision the 2008 allows seeing the development of infant mortality rate distinguished by sexes. However, remaining revisions do not let to do that. Because there only total number of infant mortality rate were recorded. So herein we present development of IMR by sexes compared by the total number of both sexes combined. Once again infant males deaths exceeds number of infant female deaths. However, pace of change of infant mortality rate faster for males than for females within all estimated period, level of infant mortality decreasing as well afterwards in projected period in 2000-2050. An interesting fact that after period 2035-2040 level of infant mortality rate is getting almost equal for males and females. Mentioned above pace of change has catch the level of female infant mortality rate in the end of projection period.

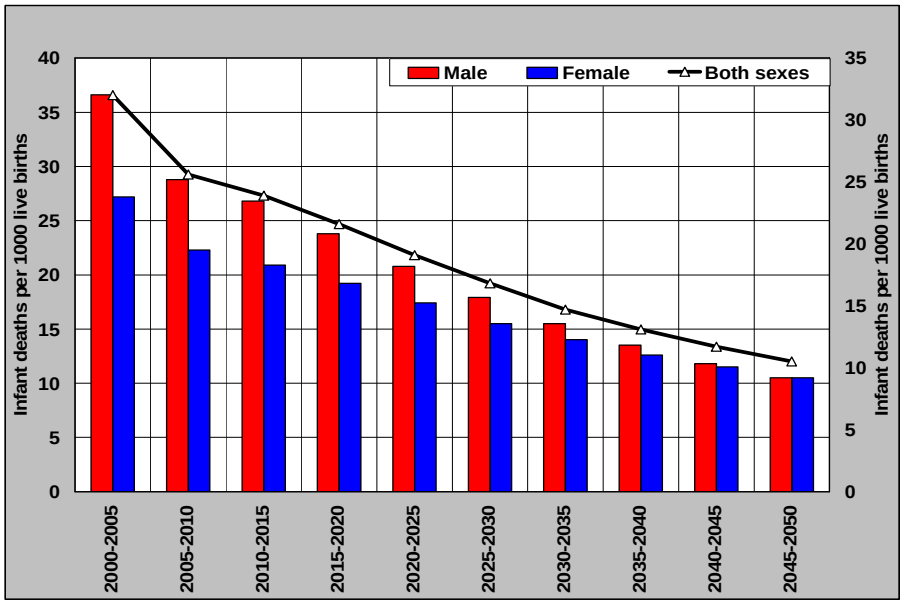
Fig. 23 –Infant mortality rate by sex in Kazakhstan, 1950-2050



Source: Author's calculations based on data from the UN WPP 2008 revision.

Same scaling was used here; projection graph is identical to the previous 22 figure's projection scale. Changing in infant mortality rate values within estimated and projected period to some a certain positive extent affects on life expectancy at birth.

Fig. 23 – continued



Source: Author's calculations based on data from the UN WPP 2008 revision.

Concluding the future changes of mortality based on mentioned above indicators we may say that these findings imply that Kazakhstan's transition to a market economy upheaval caused by the unexpected collapse of the USSR and the deterioration of public health and curative health care provision had disastrous effects on mortality risk, but it appears that these times are gone now.

However, residual effects of that collapse will be echo for at least several decades. Relative improvement in life expectancy at birth suggests the fact that country surpass the 90's turbulence times however, its effect have not yet abated everywhere.

5.3 Migration

The XX century has brought to life mass changes in population development and international migration has started to play a significant role being a component of such changes. Moreover, globing scale where ties of wide variety of rapidly changing economic, social, political and ecological factors may change the boarders of one country and establish the other's boundaries made the migratory processes more dynamic and complex. Nevertheless the fact that countries being affected by such complex factors data as usually presented on past trends of people movement across the international boarders is often exiguous, relatively limited or incomplete. Estimation of this volatile process most of the time complicated by difficulties in analyzing the volume of migratory flows due to lack of reliable data and unsatisfactory theoretical base (Coleman, D. 2008). However, we may argue such proposal by mentioning such works as "Gravity model of migration" (Rodriguez et al. 2009) which is based on a model in urban geography derived from Newton's law of gravity, and used to predict the degree of interaction between two places. **"**Buffer theory**"** which was mentioned in International Migration Review Journal (Huntoon L, 1998) established in early 1950's by some European countries (mostly by West Germany and France) aimed to get "Gastarbeiter" (from German "guest workers") labor force to regenerate the ruins of Europe after the WWII. Another theoretical basement lies in Stouffer's "Theory of intervening opportunities" which says that "The number of persons going a given distance is directly proportional to the number of opportunities at that distance and inversely proportional to the number of intervening opportunities" (Stouffer, 1940)**.** Stouffer argued that the volume of migration had less to do with distance and population totals than with the opportunities in each location. This is in contrast to Zipf's Inverse distance law which is based on empirical law formulated using the mathematical statistics that refers to volume of migration are crucial for the distance they prefer to move (Zipf G. K., 1949)**.** Another interesting theoretical back up is a Zelinsky's Mobility Transition Model (1971) which claims that the type of migration that occurs within a country depends on how developed it is or what type of society it is. A connection is drawn from migration to the stages of within the Development Transition Model (DTM):

- **Stage 1 of the DTM: Pre-industrialized economies** - Economies that have not yet developed are made up of rural countries and subsistence farmers. There will only be Rural – Urban migration between the settlements, if at all, as there are few urban areas.

- **Stage 2 of the DTM:** Industrializing countries - As countries start to industrialize (for example: UK in the 18th and 19th century) there is increased migration from the countryside to the cities where there were better wages and an increase in the standards of living.
- **Stage 3 of the DTM**: Post industrial economies - Advanced countries that rely on tertiary industry more than secondary industry show an increase in Urban-Rural migration. Technological and transport movement improvements mean that people do not have to live close to where they work. Inter-urbanization occurs as people move to the suburbs (Zelinsky, 1971).

According to this model Kazakhstan is approaching the end of the second stage and moving towards to the third stage. But the main interest for us will be well-known finding among the theoretical scientists the creator of first Systematic Atlas Ernst Georg Ravenstein's work "Laws of migration" (Ravenstein, 1876, 1885, 1889) where he formulated the basic laws as follows:

- Most migrants move only a short distance.
- There is a process of absorption, whereby people immediately surrounding a rapidly growing town move into it and the gaps they leave are filled by migrants from more distant areas, and so on until the attractive force [pull factors] is spent.
- There is a process of dispersion, which is the inverse of absorption.
- Each migration flow produces a compensating counter-flow.
- Long-distance migrants go to one of the great centers of commerce and industry.
- Natives of towns are less migratory than those from rural areas.
- Females are more migratory than males.
- Economic factors are the main cause of migration.

This work serves inherently as the basement for any serious disputes, discussions and models of migration behavior today. Author pointed that migratory process is followed by the push-pull factors mentioned above. Unpleasant conditions "push" people out the one country and favorable conditions of another country "pull" them in. In fact, this concept was later on employed by many other authors, and many of those derived theories explaining the migration processes more or less thought a variety of push and pull factors. In this context Lee's push-pull theory (Lee Everett S., 1966) serves a good ground for further discussion. Author divided factors causing migrations into two groups of factors: Push and pull factors. Push factors are things that are bad about the country that one lives in and pull factors are things that attract one to another area. They are presented in next table as follows:

Tab. 13 – "Push-pull" factors of Lee's "A theory of migration"

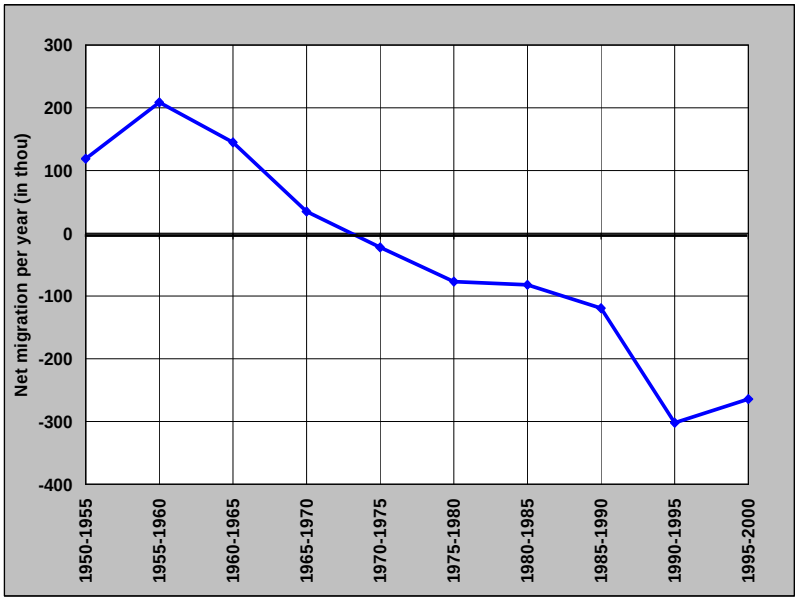
Push Factors	Pull Factors
Not enough jobs	Job opportunities
Few opportunities	Better living conditions
Primitive conditions	Political and/or religious freedom
Desertification	Enjoyment
Famine or drougth	Education
Political fear or persecution	Better medical care
Poor medical care	Attractive climates
Loss of wealth	Security
Natural disasters	Family links
Death threats	Industry
Lack of political or religious freedom	Better chances of marrying
Pollution	
Poor housing	
Landlord/tenant issues	
Bullying	
Discrimination	
Poor chances of marrying	

Source: "A theory of migration" Lee E. S., 1966

The analysis of the dynamics of migration flows is a complex phenomenon, the dynamics of which demand a systems analysis which goes beyond demographic, economic and spatial considerations to include the facts of individual behavior and factors in decision-making, and at the same time takes into account how these change with time and affect each other (Leloup X., 1996). Compared to fertility and mortality, migration is a more complex and difficult demographic process to record, model and forecast accurately (Zlotnik, 1987; Plane and Rogerson, 1994). For example, birth and death occur only once in a person's lifetime, but migration can occur repeatedly.

Coming back to the United Nations World Population Prospects and their estimation and projection view on development of migration component in Kazakhstan, we have to remember the fact that Kazakhstan was among the fewest countries in the world where migration affected population growth per year in absolute numbers and population growth rate in percentage so much. We have already started the discussion in the chapter before previous (see Figures 10, 16) mentioning that contemporarily migration processes in Kazakhstan are characterized by intensive out-flows in the beginning of the 1990's and decreasing magnitude of migration flows hereinafter. Estimates of net migration rate in absolute numbers were available for the most recent 2008 revision and they draw dramatic change in country's profile. The negative values were appealing after 1970-1975 when those people who came to meliorate virgin lands started to go back. This is seen from the estimations of net migration in the following figure 22 where steady increase of out-flows are observed since 1970-1975 up to the end of estimation period 1995-2000.

Fig. 24 – Estimated net migration (in thou) both sexes combined in Kazakhstan, 1950-2000



Source: Based on data from the UN WPP 2008 revision.

The figure 24, is net migration (difference between number of immigrants and emigrants) for both sexes combined displays clear negative trend which started to accelerate 1985-1990 when it reached -119 thousands of people who were motivated leave the country due to the socio-economic and other factors (see push factors table 13). In 1990-1995 this number almost tripled and was equal to -302 thousand people. Important fact in this regard which we "must" mention is that this period was characterized by out-flows of deported ethnics.

In 1956, April 28 by the XX Communist Party Congress the law number №135/142 "About removing curfew regime and restrictions from the Special Settlements and their inhabitants" was accepted. So, many ethnical Caucasians (Chechens, Ingush mostly) and Jews, Greeks, Tadjiks started to go back home. However, Jews and Greeks had their specific way to returning home. The following table 14 brightly proves this hypothesis of increasing number of out-flows due to the 1956 law for some "restricted" nationalities* lived in Kazakhstan.

Another noteworthy fact related to the early out-flows which were motivated by the end of meliorating the virgin lands and economical benefits for people going for another Soviet Union's "Big construction projects" like: "BAM" (1970 start of construction the Baikal-Amur Mainline, last part was finished in 2003-authors note)

Tab. 14 - Comparative table of nationalities* in Kazakhstan (1959-2009) in thousands according to the Agency of Statistics of the Republic of Kazakhstan data based on Soviet Union State Statistical Committee

Comparative table of nationalities* in Kazakhstan (1959 - 2009)	1959	1970	Index per 100 1970/1959	Change in % 1970/1959	1999	2009	Index per 100 2009/1999
Kazakhs	2794966	4161164	149	49	7985039	10098600	126
Russians	3974229	5449826	137	37	4479620	3797000	**85**
Ukranians	762131	930158	122	22	547052	333200	**61**
Uzbeks	136570	207514	152	52	370663	457200	123
German	659751	839649	127	27	353441	178200	**50**
Tatars	191925	281849	147	47	248954	203300	**82**
Uigurs	59840	120784	202	102	210365	223100	106
Belorussians	107463	197592	184	84	111927	…	…
Korean	74019	78078	105	5	99665	…	…
Azerbaijans	38362	56166	146	46	78295	…	…
Polish	53102	61335	116	16	47297	…	…
Turkish	9916	18397	186	86	75900	…	…
Chechens	130232	34492	**26**	**-74**	31799	…	…
Greeks	55543	39241	**71**	**-29**	12703	…	…
Bashkirs	8742	21134	242	142	23224	…	…
Moldovians	14844	25711	173	73	19458	…	…
Dungans	9980	17283	173	73	36945	…	…
Mordovians	25499	34129	134	34	16147	…	…
Tajiks	8075	7166	**89**	**-11**	25657	…	…
Kurds	6109	12299	201	101	32764	…	…
Chuvashes	11255	22690	202	102	…	…	…
Ingushes	47867	18356	**38**	**-62**	16893	…	…
Jews	28048	26954	**96**	**-4**	…	…	…
Others	101379	136606	135	35	…	…	…
Total	9309847	12848573	138	38	14953126	16004800	

Note*: Term “Nationalities” were used in this table corresponds to the Soviet Union ethno-historiographical definition. Ethnicities or Diasporas may also be considered.

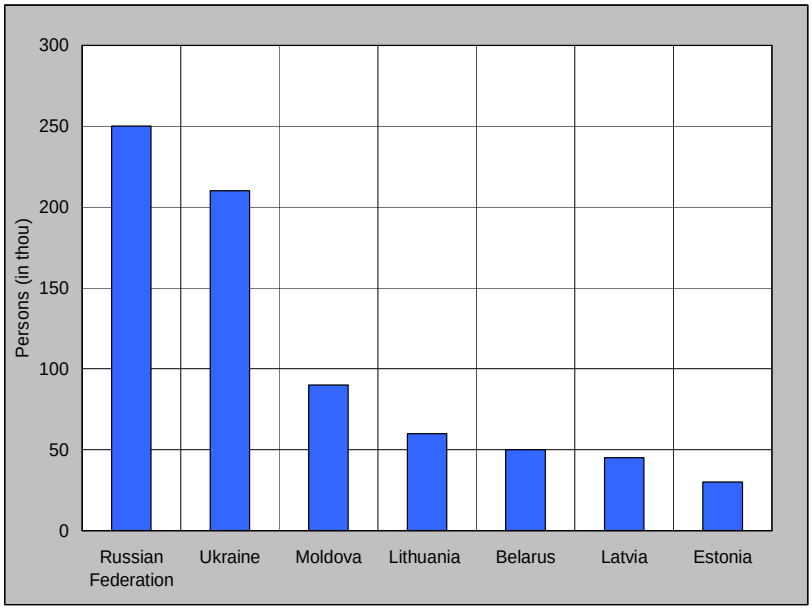
Note**: Nationalities less than 20 thousand of people were not considered

Note***: Three dots represent missing values.

Source: Author’s calculations based on data from http://ru.wikipedia.org/wiki/Население_Казахстана

Red colored indexes shows negative change in population growth to the level of 1970 census. They are presented in percentage change as well. Almost a hundred thousand Chechens, sixteen thousand Greeks, nearly twenty thousand Greeks went home during this period. Contemporary outflows of 90’s were due to political instability, national and ethnic motives, language environment disadvantage. Basically, this period 1990-1995 was difficult period for many former Soviet Union countries. International migration has become a new and decisive factor for population trends in this group of countries. Figure 25 presents the picture of absolute loss of population due to net migration in former European states of the USSR.

Fig. 25 – Estimated absolute total size of population loss due to net migration in European Successor States of the former USSR, 1990-1995



Source: Based on data from the UN WPP 1996 revision.

However absolute loss of population for the period 1990-1995 due to migration for the Baltic countries was relatively small 30,000-90,000 people comparing to the same loss in Russian Federation for instance. Mostly people were migrated to: Western Europe, Israel, USA. However the net-migration gains experienced by countries are relatively small when expressed in terms of the net migration rate:

Russian Federation: (-0,3 per 1000 pop.)

Ukraine: (-0,8 per 1000 pop.)

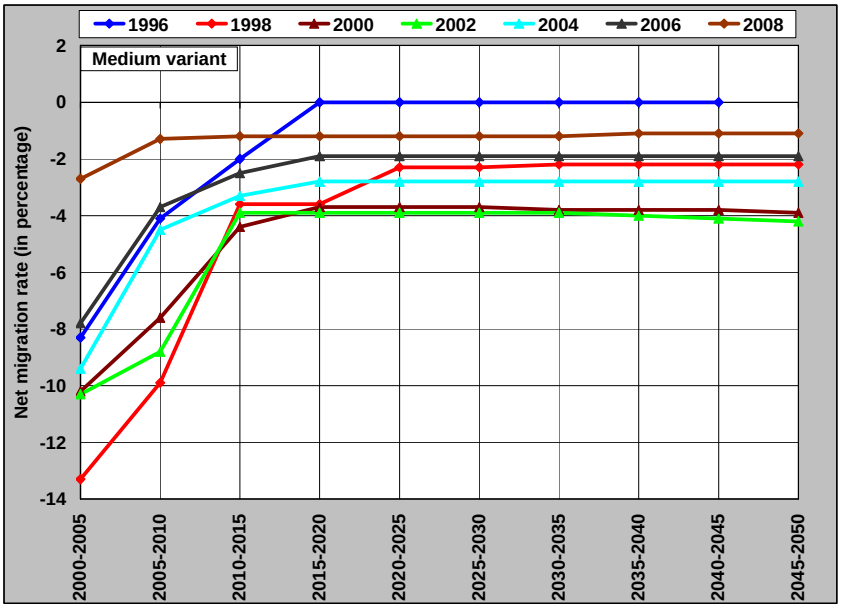
Latvia: (-6,9 per 1000 pop)

Lithuania: (-2,7 per 1000 pop)

Estonia: (-3,9 per 1000 pop)

Migration flows after 1990-1995 had a pattern to steady decrease gathering some positive improvement. Thus, various socio-economic difficulties in the transition period were among the most important push factors motivated people to emigrate from the country. There are two different assumptions underlying the international migration assumptions: normal migration and zero-migration assumption. Under the normal migration assumption, the future path of international migration is set on the basis of past international migration estimates and consideration of the policy stance of each country with regard to future international migration flows. Projected levels of net migration are generally kept constant over the most projected period. Under zero-migration assumption, for each country, international migration is set to zero starting in 2005-2010. However, to see the future trend it is a good idea to glimpse upon projected net migration rates in percentage herein in the following figure 26.

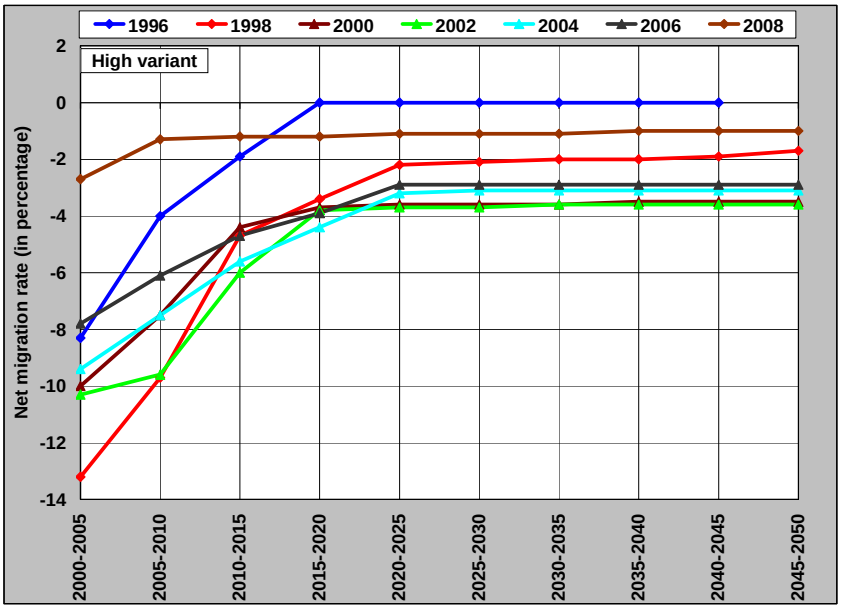
Fig. 26 – Projected net migration rate in Kazakhstan according to United Nations World Population Prospects for the period 2000-2050



Note: Each curve presents the year of revision

The clear observing trend in all figures is negative development of net migration rate within all projection scenarios.

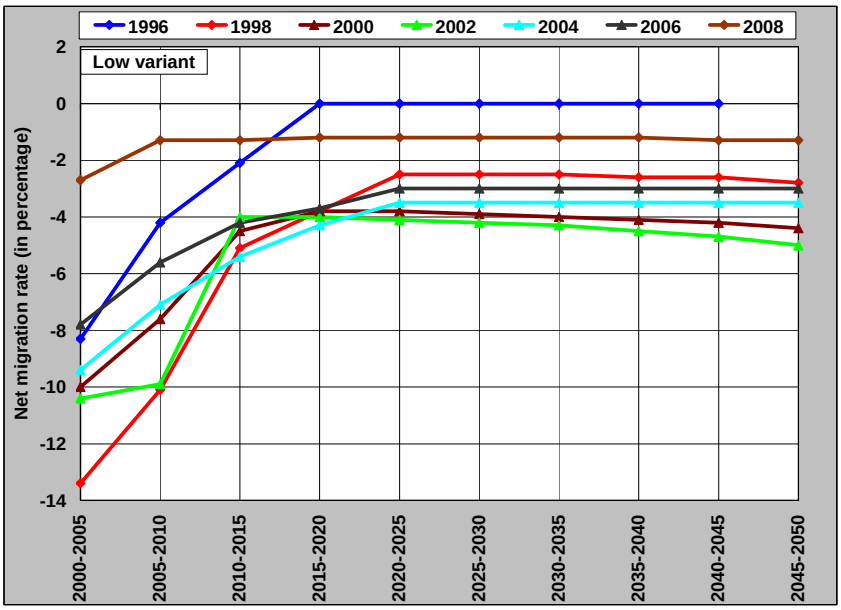
Fig. 26 – continued



Note: Each curve presents the year of revision

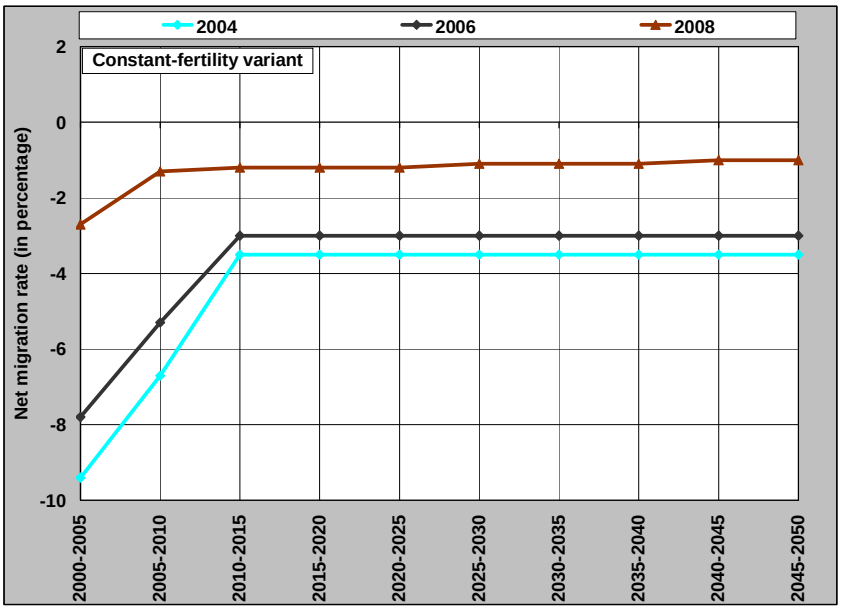
Ranging from 13.3% up to -1.1% medium variant stabilizes in 2015-2020 period from -4% up to "zero migration level" (see further underlying assumption) which does not mean that there would be no migratory flows, it means that net migration would stay constant at level around zero.

Fig. 26 – continued



Note: Each curve presents the year of revision

Fig. 26 – continued

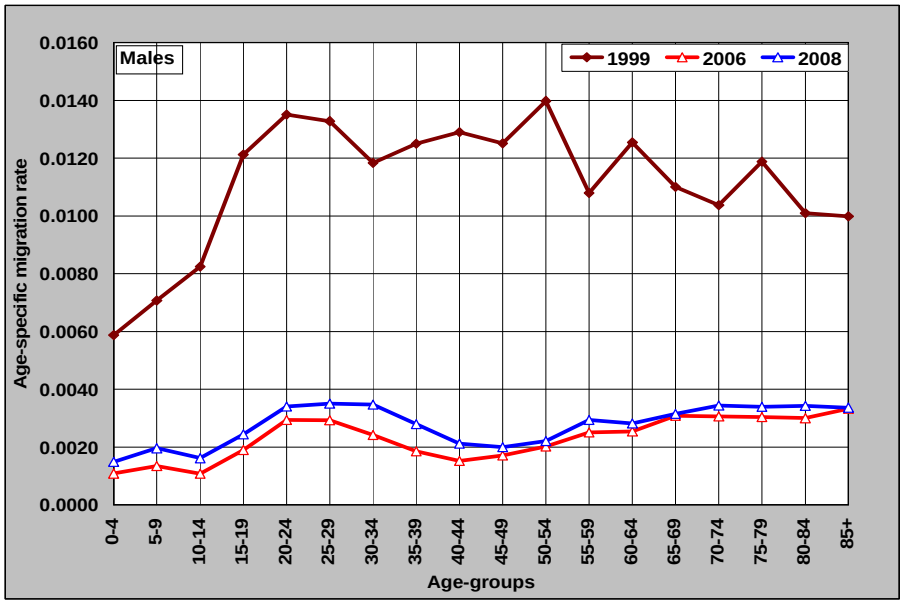


Note: Each curve presents the year of revision
Source: Author's calculations based on data from the UN WPP the 1996–2008 revisions.

High variant ranges between -13.2% up to -1%, an interesting here is that the earliest revisions the 1996 and the 1998 have closest value to the most recent the 2008 revision. The 2008 revision tends to revert to the previous trends of mid 90's. It is stabilizing in 2015-2020 as well.

Low variant has slightly downward trend in the end of the projection period. Ranging from -13.4% up to -1.2% (excluding zero migration level) suggests the fact that disparity between revisions based on either normal or on zero migration level assumption. Constant-fertility variant assumes that migratory flows would be constant over the period 2005-2010 till the end of projected period. Net migration is good indicator till the moment you would like to dig into depths of the question: To what extent and with what kind of intensity people leaving or entering the country? And especially in what age groups? To answer this questions we have to remember that migration is very sensitive indicator to age and sex composition (see Laws of migration, Ravenstein). Using the data extracted from the Demographic Yearbook of Kazakhstan, 2008 we analyze the age patterns of emigrants by sex for the "first" reference year 1999 (First independent census, earliest available Demographic Yearbook) with the most recent corresponding to the UN WPP 2006 and 2008 years. The following figure 26 presents detailed analysis of age-specific emigration rate for males and females.

Fig. 27 – Emigration rates in Kazakhstan in 1999, 2006 and 2008

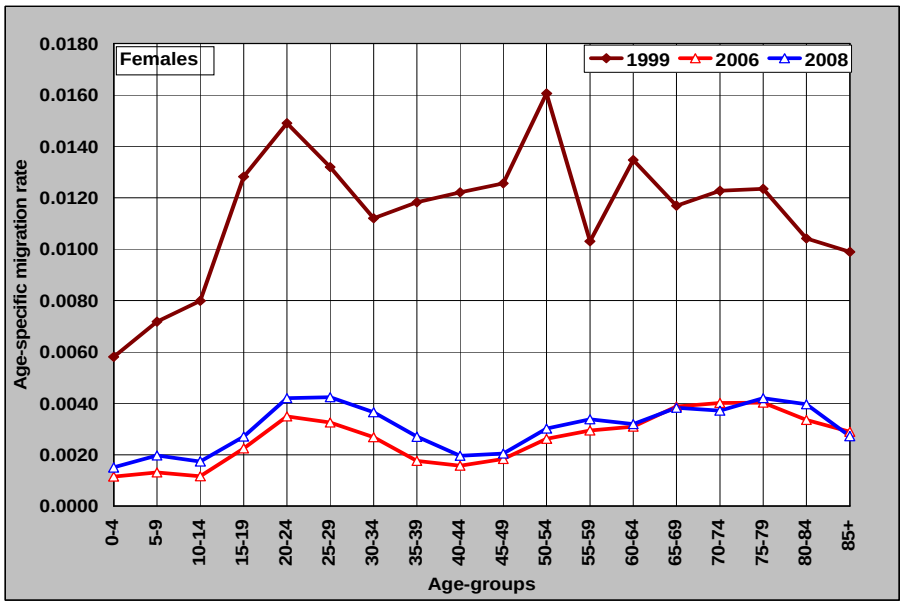


Source: Author's calculations based on Demographic Yearbook of Kazakhstan, 2008

The tendency on figure 27 for males emigration rate within age groups 0-4 up to 85+ shows that in 1999 there were fluctuations and high irregularities due to "push-pull factors" when people start leaving country (residual effect of 1990-1995 tendency see figure 22, 23 for overall development including immigrants). It is highly irregular distribution of emigrants along the age groups. It is probably related to the fact that a wide range of men's age-groups were leaving for ethnical homes e.g. Germany, Russia,

Israel etc.: families with young children (5-9, 10-14, 15-19) students (student migration abroad) and parents (20-24 up to 55-59), grandparents (65+).

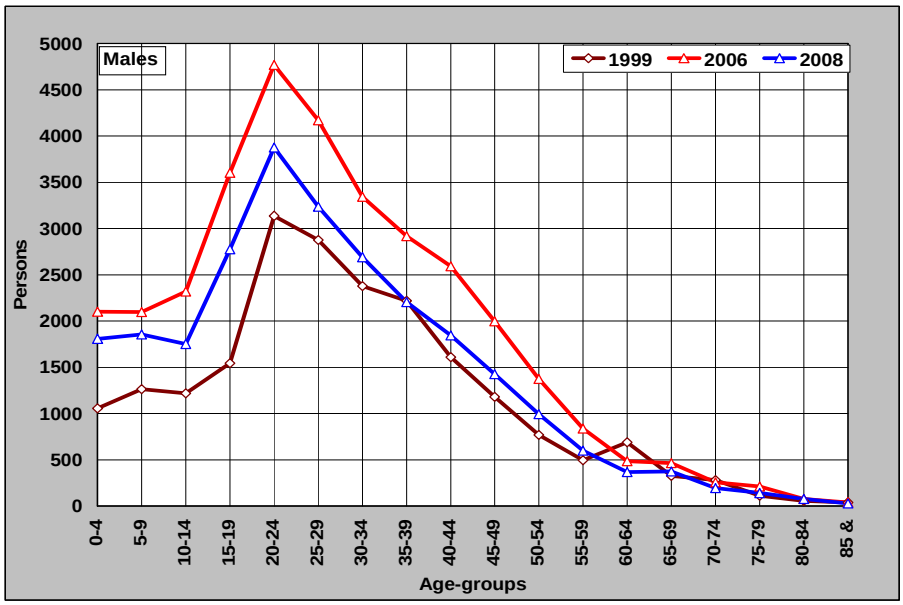
Fig. 27 – continued



Source: Author's calculations based on Demographic Yearbook of Kazakhstan, 2008

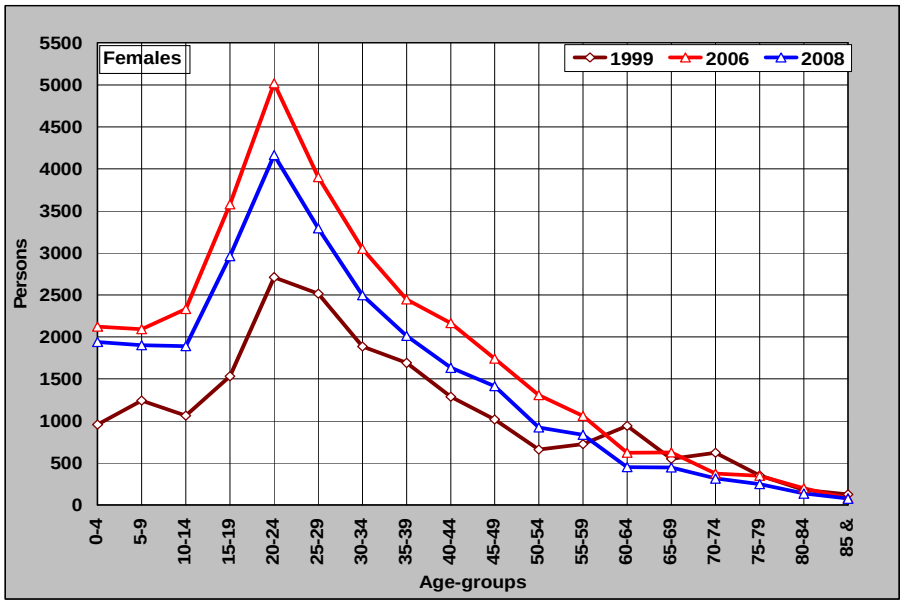
The rest two curves 2006 and 2008 presents stabilization trend when lower number of people where leaving country, due to improved socio-economical situation however same age-groups with smaller extent 15-19 up to 40-44 who are economically active were emigrating abroad, slight decrease afterwards shifts with another little increase in emigrants which furthermore continues with more or less predictable values. Another interesting picture draws the figure about females who start to emigrate within same age groups 10-14 (general trend for both sexes, kids leaving with parents), however values for the consecutive age-groups peaks at 20-24 afterwards it falls, there is a slightly stable period which ends with another sudden fluctuation between 45-49 and 55-59 which relates to "parents and grandparents" category going back to their ethnical and language Motherlands. Irregularities presented in line referring to 1999 should be taken into consideration with caution since figures on people who leave the country are based on requirements to leave identification document at police office prior to departure a duty which is not followed by many. The 2006 and 2008 data are almost identical for females which give us the chance to judge this data as residual trend of "last emigrants of second wave" (first wave 1990-1995, second 1995-2000) leaving the country seeking their ethnical homes, better living conditions and better "pull-factors".

Fig. 28 – Immigrants to Kazakhstan in 1999, 2006 and 2008



Source: Based on Demographic Yearbook of Kazakhstan, 2008

Fig. 28 – continued



Source: Based on Demographic Yearbook of Kazakhstan, 2008

Figure 28 are supplementary figure to the emigrants and aimed to show labor-force movement into country within increasing number of 10-14 peaked at 20-24 age groups. The highest values reached by the 2006 year among 20-24 age groups of males conducted 4768 thousand of young men. Afterwards it tends to steady decline and stabilize at 55-59. Almost identical picture is observing into females population within 10-14 till the 60-64 age groups. Peak comes to 20-24 age-groups with 5017 thousand of young

women is also tends to decline afterwards till the 60-64 where it is relatively stabilizes. It is estimated that recently experienced high annual GDP growth, driven by the dividends from Oil and Gas sector flourishing the remaining sectors causing returning waves and initiate "new-comers" to stay in Kazakhstan (work visas, family deals etc). This is already having been seen from the figures of projected net migration rate on figures 26. Where socio-economical progress is responded in graph positively with Ravenstein's "Laws of migration" and Lee's pull factors. Kazakhstan is being transformed since the beginning of 2000's into an increasingly attractive destination country for labor migrants. The following table 15 is the final destinations for immigrants and emigrants for corresponding 1999, 2006 and 2008 years respectively using the data of the Demographic Yearbook of Kazakhstan, 2008.

Tab. 15 – Immigrants, emigrants and net migration in absolute numbers for both sexes combined in Kazakhstan in 1999, 2006 and 2008

Countries	Immigrants			Emmigrants			Net migration		
	1999	2006	2008	1999	2006	2008	1999	2006	2008
CIS countries	39461	56635	42613	120240	30271	39767	-80779	26364	2846
Azerbaijan	284	301	121	208	52	61	76	249	60
Armenia	48	317	67	42	15	9	6	302	58
Belarus	417	148	136	4656	623	805	-4239	-475	-669
Gergia	93	203	73	78	6	7	15	197	66
Kyrgyzstan	1392	2397	1760	1110	130	126	282	2267	1634
Moldova	88	28	19	177	19	15	-89	9	4
Russian Federation	26719	15001	10966	108115	28228	37704	-81396	-13227	-26738
Tajikistan	455	684	154	57	38	25	398	646	129
Turkmenistan	1356	4565	4090	448	17	25	908	4548	4065
Uzbekistan	7215	32620	24940	2269	608	451	4946	32012	24489
Ukraine	1394	371	287	3080	535	539	-1686	-164	-252
Non-CIS countries	1859	10096	10784	44707	3419	2668	-42848	6677	8116
USA	23	37	40	609	235	155	-586	-198	-115
Germany	507	615	562	40862	2528	1848	-40355	-1913	-1286
Greece	43	15	17	277	16	6	-234	-1	11
Israiel	63	81	82	1585	123	63	-1522	-42	19
Iran	75	40	26	-	0	-	75	40	26
Canda	2	38	19	332	182	152	-330	-144	-133
China	145	5003	5829	5	90	50	140	4913	5779
Latvia	23	7	4	16	2	3	7	5	1
Luthuania	22	2	2	42	0	2	-20	2	0
Mongolia	437	3648	3706	162	43	25	275	3605	3681
Turkey	95	343	304	46	6	3	49	337	301
Estonia	4	2	6	8	0	3	-4	2	3
Other countries	420	265	187	763	194	358	-343	71	-171

Source: Based on Demographic Yearbook of Kazakhstan, 2008

Greater portion of people moves within the boundaries of CIS countries. Clear negative net migration values have got the 1999 year. It was also observed in previous figure 28. It is confirming the

Ravenstein's "Laws of migration" where he formulated that the most migrants move only a short distance. The year 2006 and 2008 has residual negative values in net migration by final destination. It is still clearly observed that Kazakhstan is suffering from highly unbalanced migratory flows which in fact affecting to the population change and population growth discussed above. Development of the national legislation system and establishment of new laws regulating the migratory flows would in great extent help dealing with such unbalances. For example, the simplification of the procedures of granting the permissions to foreigners and stateless persons getting visas and entering Kazakhstan for lawful residence and engaging them into work activities, which in its own turn will stimulate the sectors of economy with skilled or at least literated people. Adopted concept of "Migration policy of the Republic of Kazakhstan for 2007-2015 years" in 28 august, 2007 has aimed to re-arranging basic migratory flows system and turns it to Kazakhstan's benefit. This concept openly says that Kazakhstan "must do list" of activities shall be fulfilled with a new migration policy in a meantime. Otherwise, "Kazakhstan will keep facing difficulties related to negative net migration and in its turn loss of highly-skilled population, increase in illegal migration, increasing pressure within all boarders due to unbalanced distribution of population caused by low density per square kilometer" (Migration policy of the Republic of Kazakhstan for 2007-2015 years, 2007). Implementation of the principle of "one-window" is obviously affects positively on intensification of migratory processes towards to its more legalization.

It is known that population movements across national boarders are not always goes by immigrants-emigrants system. There are transiting migrants, who are transiting the country somewhere to the third countries. It is pretty difficult task to define what categories of migrants shall be defined as transiting migrants. Probably we shall say about an aliens who stay in the country for some period of time while seeking to migrate permanently to another country (Verdiyeva N. 2009) There are of course some push factors for such people to be a transiting migrants, likely they are: political and economical instability, risk to their life, worse living conditions, no access to public health or educational attainment etc. (see Table 13 to discuss furthermore). There are pull factors as well presented which let people stay within the boundaries of Kazakhstan feeling themselves comfortable. Such pull factors may be considered as: language similarities (Russian speaking environment), security in the sense of political and economical stability, ethnically friendly and welcoming host environment, etc.

Relatively detailed data do not fully let us to foresee future migration developments, its in-out flows, volume, and demographic age and sex structure. Among reasons: reliability of available information, namely concerning the emigration flows. Another factor - political or national identification policy is also playing crucial role in determining what Kazakhstan we will be living soon. Will it be ethnically "wiped" from non-title ethnic or would it be a multi-ethnical country, which is being so far.

Concluding this sub-chapter we would like to stress that migratory process is and will be one of the most important component of development in the future path of Kazakhstan within this century according to the UN WPP and at the same time remains the most uncertain population development component.

Chapter 6

Changing view on population development of Kazakhstan by principal results

Populations are dynamic entities. Over time they grow or decline, they become younger or older and their geographic distribution changes. Such changes are the cumulative effects of the events that people undergo during their lives, namely births, deaths and migrations. One of the concerns in demography is to trace out the consequence of changes in individual-level behavior for aggregate processes (Preston, Heuveline and Guillot, 2001). The combination of these individual events shapes the population and though partially predictable, the outcome is sometimes surprising. While no other century has witnessed such rapid and accelerating population growth as did the twentieth, population declines have been observed in several countries during the past decade or so. Such declines are foreseen to become the rule rather than the exception in some regions of the world, while in other regions the population will continue to grow, albeit at a more moderate pace. Thus, this chapter will mainly focus on changing view on population development by principal results of estimation and projection periods for total population, age and sex structure and some other indicators to see whether occurred recently changes become rules rather than the exceptional consequences.

6.1 Total population

Estimation and projection of total number of population of Kazakhstan according to the United Nations World Population Prospects still remains very important concern which involves in fact all other demographical characteristics to be analyzed ahead. For policy-makers and high-ranked governors overall development of population by estimation and projection methods of total population as a characteristic is much more important than detailed analysis of population growth. It is due to the intension to present favorable information for wide audience and mass-media resources to gain the authority credit further. However, playing with numbers sometimes may cause misleading in decision-making and orientation priorities. Therefore, an attempt was given to discuss the decisive role of componential development by

fertility, mortality and migration in previous chapter by estimation period 1950-2000 and by projection period 2000-2050 first, to ensure that this work at least will serve as a ground for further discussion in the context of future population development.

Number of total population is an overall indicator of population development as it was mentioned above serves many different purposes and may implement different meanings in its interpretation. Since the beginning of the 90's Kazakhstan started to lose inhabitants due to increased mortality risks, migratory out-flows and increased pace of fertility change affected to the total number population. Therefore, for better understanding to what extent mentioned factors affected to the total population and to get the idea about the shape of population we will try to present estimated number of total population according to the UN WPP. The following table 16 relates to estimated total number of population for the period 1950-2005.

Tab. 16 - Estimated total number of population for the period 1950-2005 in Kazakhstan according to the United Nations World Population Prospects the 1992-2008 revisions

Revisions/Estimation period	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
1992	6756	8014	9975	11911	13110	14136	14875	15935	16741	x	x	x	x
1994	6756	8014	9975	11911	13110	14136	14907	15780	16670	x	x	x	x
1996	6703	7992	9996	11909	13110	14136	14919	15827	16742	16817	x	x	x
1998	6703	7992	9996	11909	13110	14136	14919	15827	16742	16507	x	x	x
2000	6703	7992	9996	11909	13110	14136	14919	15827	16742	16611	16172	x	x
2002	6703	7992	9996	11909	13110	14136	14919	15894	16809	16556	15640	x	x
2004	6703	7992	9996	11909	13110	14136	14919	15640	16472	16172	15773	x	x
2006	6703	7992	9996	11909	13110	14136	14919	15750	16512	16040	15556	15171	x
2008	6703	7992	9996	11909	13110	14136	14919	15870	16530	15926	14957	15194	x
Conducted census periods in			1959		1970		1979		1989		1999		2009
Kazakh SSR and Rep.of Kazakhstan			9295		13000		14685		16536		14954		160005

Source: Based on data from the UN WPP the 1992-2008 revisions

Table 16 is the summary of total population estimated by the UN WPP and conducted census years in Kazakh SSR and independent Republic of Kazakhstan. We may observe that till the year 1985 estimation on total population between revisions itself is almost identical (the 1992 and the 1994 revisions has slightly different numbers). Moreover, we must say that conducted pre-independent censuses present estimates of a relatively good quality. Deviation between census data and revisions looks reliable and self-proof. A little deviation are observed in 1970 census compared to the 1970 estimation period (110 thousand difference) in 1979 census compared to 1980 estimation period (190-234 thousand difference) in 1989 census compared to 1990 estimation period (64-273 thousand difference) in 1999 first independent census compared to the 2000 estimation period showed (3-1218 difference) such a great deviation will be discussed in Chapter 7. Eventhough census periods were one year before the estimation period; we may use annual interpolated total population, which however available since the 1990 to see the "adjusted" total population for the second part of table 16 since 1990 till 2010

Tab. 17 - Annual interpolated total number of population in Kazakhstan for the period 1990-2010 according to the United Nations World Population Prospects the 1992-2008 revisions

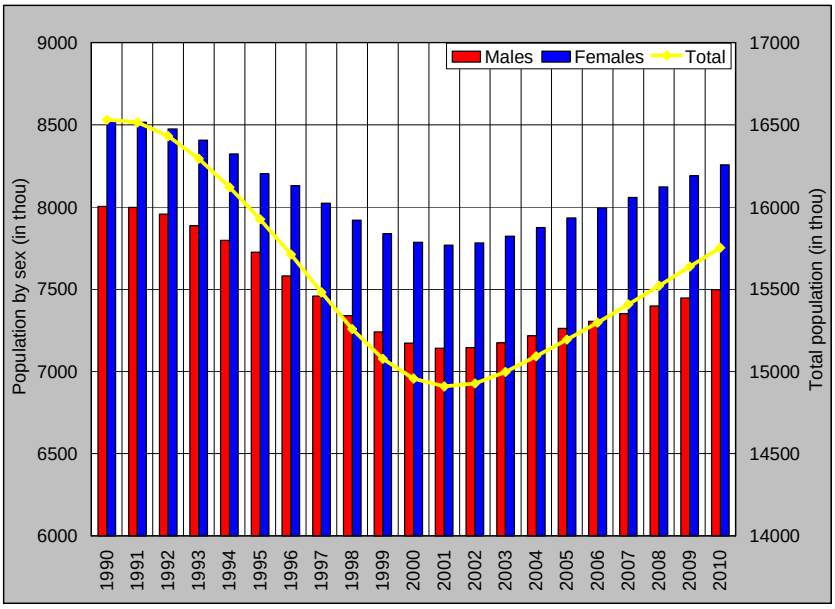
Interpolated year / Revision	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1992	**16741**	16893	17048	17176	17303	**17436**	x	x	x	x	x
1994	**16670**	16786	16877	16952	17027	**17111**	17209	17318	17437	17563	**17694**
1996	**16742**	16815	16842	16838	16824	**16817**	16820	16832	16854	16886	**16928**
1998	**16742**	16776	16748	16677	16589	**16507**	16436	16373	16319	16269	**16223**
2000	**16742**	16796	16796	16753	16687	**16611**	16529	16440	16349	16258	**16172**
2002	**16809**	16857	16849	16790	16690	**16556**	16388	16190	15983	15793	**15640**
2004	**16472**	16520	16579	16479	16305	**16172**	16370	16163	15973	15820	**15773**
2006	**16512**	16528	16445	16308	16134	**16040**	15825	15603	15381	15261	**15556**
2008	**16530**	16514	16431	16294	16120	**15926**	15711	15481	15259	15077	**14957**

Interpolated year / Revision	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1992	x	x	x	x	x	x	x	x	x	x
1994	17830	x	x	x	x	x	x	x	x	x
1996	16981	17048	17126	17215	**17311**	x	x	x	x	x
1998	16181	16147	16126	16122	**16140**	16181	16244	16321	16406	**16492**
2000	16095	16027	15968	15918	**15876**	15841	15815	15799	15794	**15800**
2002	15533	15469	15433	15403	**15364**	15311	15249	15190	15146	**15130**
2004	15709	15673	15643	15604	**15551**	15489	15430	15386	15370	**15357**
2006	15538	15468	15373	15271	**15171**	15281	15394	15510	15626	**15613**
2008	14909	14927	14997	15092	**15194**	15298	15408	15521	15637	**15753**

Source: Based on data from the UN WPP the 1992-2008 revisions

The most recent revision 2008 made available interpolated total population by sex which is presented in the following figure 29.

Fig. 29 – Annual interpolated total number of population by sex in Kazakhstan for the period 1990-2010 according to the United Nations World Population Prospects the 2008 revision



Source: Author's calculations based on data from the UN WPP the 2008 revision

Substantial decline in interpolated total population are clearly observed by yellow line starting from 1992 and accelerated during 1995-2001 where it reached its negative peak with a steady rise afterwards. Socio-economical layout accelerated this processes in the beginning of the 90's reached its peak resulted in disastrous economical crisis of 1998, when real value of the national currency felt almost half compared to its pre-crisis value within a half year which led people to feel uncertain about their future life path (Nazarbayev A, 2008). We may assume that there was a lag between peak of economical crisis in 1998 and negative peak of total population development in 2001 for three years due to "vis inertiae". Number of women in the beginning of the interpolation period 1990 overwhelmed number of men almost for 522 thousand persons. During the decade this number increased till 760 thousand in the end of interpolation period in 2010 due to excessive mortality intensity of males caused by shift in values orientation and increased intensity of mortality due to circulatory and accidental causes (Becker C. M., 2004) another reason is better survivorship of women, who were surprisingly better prepared for such extreme conditions. It is general false believe that men have higher resistance in such times, however all conducted study showed that men died more often and in great numbers than women during that period of time. Sex ratio at birth which we were discussing earlier (see figure 11) conducted nearly 91 (90.8) men per 100 women live births played also sufficient role in prevailing number of women. The following tables 18 and 19 presents estimated number of men and women as it stays at mid year where we may observe no change in estimation in both sexes till the year 1985. Since 1985 assumption underlying the revisions started to vary among each other due to gathering "older-old-new-newer" data on birth, death

registers and data on migration flows which in fact led to slightly different estimated numbers presented in tables 18 and 19.

Tab. 18 - Estimated number of males in Kazakhstan for the period 1950-2005 according to the United Nations World Population Prospects the 1992-2008 revisions

Revisions/Estimation period	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005
1996	3244	3853	4813	5736	6315	6816	7186	7634	8122	8175	x	x
1998	3244	3853	4813	5736	6315	6816	7186	7634	8122	8027	x	x
2000	3244	3853	4813	5736	6315	6816	7186	7634	8122	8073	7843	x
2002	3244	3853	4813	5736	6315	6816	7186	7687	8174	8035	7531	x
2004	3244	3853	4813	5736	6315	6816	7186	7597	8150	7931	7668	x
2006	3244	3853	4813	5736	6315	6816	7186	7740	8127	7890	7606	7481
2008	3244	3853	4813	5736	6315	6816	7186	7697	8017	7724	7172	7369

Source: Based on data from the UN WPP the 1992-2008 revisions

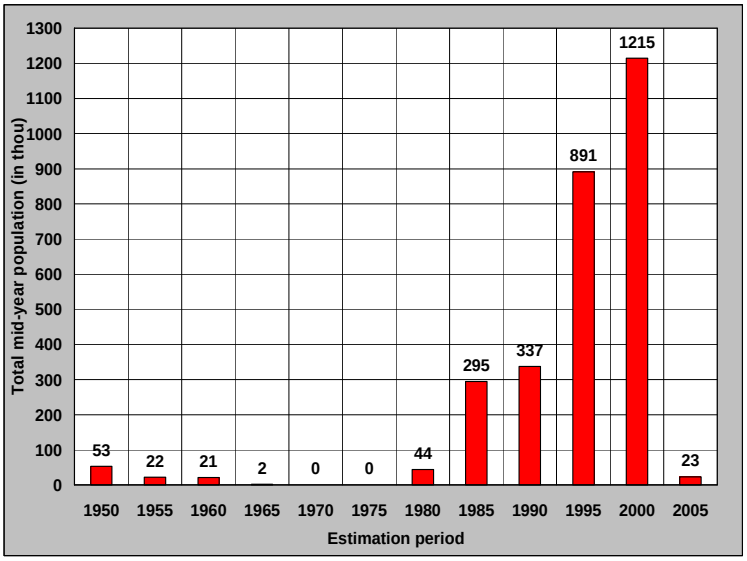
Tab. 19 - Estimated number of females in Kazakhstan for the period 1950-2005 according to the United Nations World Population Prospects the 1992-2008 revisions

Revisions/Estimation period	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005
1996	3459	4139	5183	6173	6795	7320	7733	8193	8620	8641	x	x
1998	3459	4139	5183	6173	6795	7320	7733	8193	8620	8480	x	x
2000	3459	4139	5183	6173	6795	7320	7733	8193	8620	8538	8329	x
2002	3459	4139	5183	6173	6795	7320	7733	8207	8635	8521	8108	x
2004	3459	4139	5183	6173	6795	7320	7733	8043	8322	8241	8105	x
2006	3459	4139	5183	6173	6795	7320	7733	8010	8385	8150	7950	7690
2008	3459	4139	5183	6173	6795	7320	7733	8173	8513	8202	7785	7825

Source: Based on data from the UN WPP the 1992-2008 revisions

But lets go back to the table 16 where since the 1985 estimations of total mid-year population has started to change due to gathering newer data on total mid-year population. As an evidence of that fact we may see different numbers between revisions the 1992 and the 2008. But the most important factor in this context is deviation between revisions itself over the 1985. For 1985 deviation concluded 295 thousand inhabitants, for 1990 this number already increased till 337 thousand, 1995 presented enormous 891 thousand (peak of population decline see Figure 9) however “vis inertiae” pushed estimates to further deviations. In 2000 deviation between revisions passed “magic boundary” of a million people difference and concluded nearly 1,215 million people difference which is shown in the figure below.

Fig. 30 - Estimated deviation between the revisions 1992-2008 of total population in Kazakhstan for the period 1950-2005

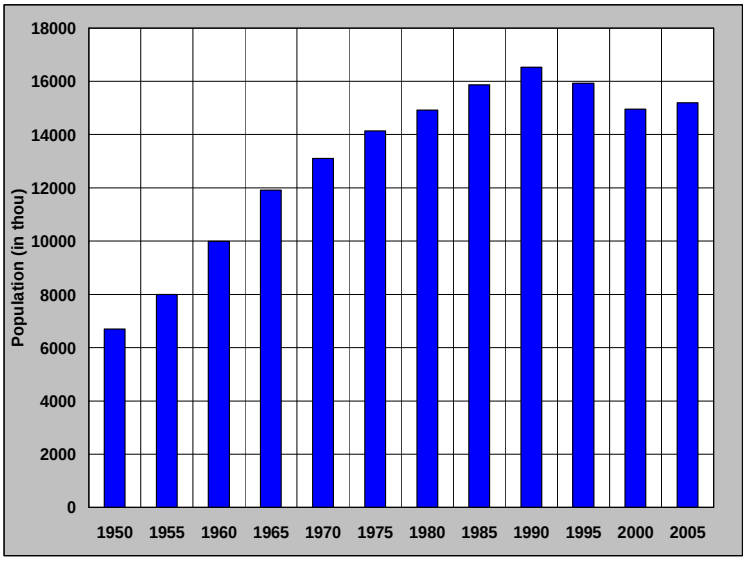


Note*: Deviation was computed as difference between maximum and minimum values of the revisions

Source: Author's calculations based from the data presented in table 15.

For the first glimpse such huge deviation looks unrealistic for the estimation period 2000 and it is partially true. However, while studying this problem, we have discovered that the revision 2000 which had the highest estimated total mid-year population 16,172 thou. people among the rest, which in fact gave such big fluctuation in estimations, is due to not up dated results on population census of revision itself. As we know the first independent population census was conducted in 25 February – 4 March 1999, however data were released into public in the second part of 2000 (Alekseenko A., 2000) while the UN WPP the revision 2000 was forthcoming in the second half of 2000, however for general use it was published in the end of 2001, which means that data on 1999 census might not be gathered by that revision due to slow data preparing by the UN WPP standards and its further transmit from Agency of Statistics of Kazakhstan to the Department of Economic and Social Affairs. This is can be considered as the primary reasons for such deviation in estimation of total population. Reliability assessment of gathered data is in our focus in the following chapter. Another hypothesis relating to this topic is that the revision 2000 interpolated total population since the 1989 All Soviet Union census using it as the reference year and updating information on birth and death registers and net migration consequently. The following figure 31 shows an interesting fact that total population for the most recent 2008 revision displays tendency to likely revert total population of 2005 to the level of 1980's. This is what we said before was mostly due to migratory out-flows process occurred during the 1990-2000 (see chapter 5, sub-chapter 5.3 Migration).

Fig. 31 - Estimated total number of population in Kazakhstan for the period 1950-2005 according to the United Nations World Population Prospects the 2008 revision

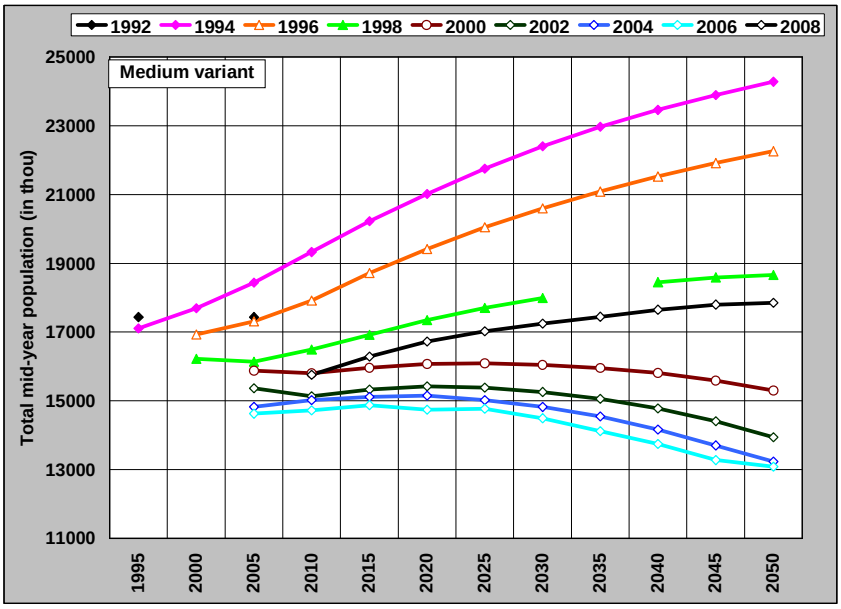


Source: Based on data from the UN WPP the 2008 revision.

This tendency to revert to the level of 1980's refers also to the compensation effect where women of 1980's cohorts started to enter their reproductive age and deliver births in smaller numbers than previous cohorts.

It was said a lot about the development of the total population during the transition period of 1990's (1990-1995 and 1995-2000) however to see the perspective trend it would be a good idea to look upon projected total population of Kazakhstan for the period 1995-2050.

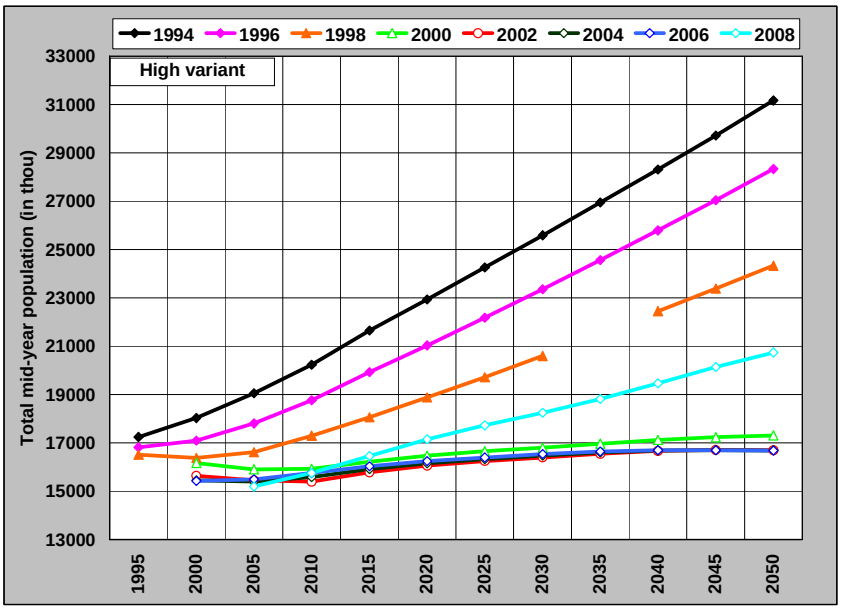
Fig. 32 - Projected total population in Kazakhstan for the period 1995-2050 according to the United Nations World Population Prospects since the 1992-2008 revision



Note: Each curve presents the year of revision

Medium variant of total population says that conducted earlier revisions like the 1992 (presented by two black colored dots), the 1994, the 1996 and the 1998 presents upward values on population projection. It is due as we already have been mentioning older data gathered from the Statistical Agency.

Fig. 32 - continued

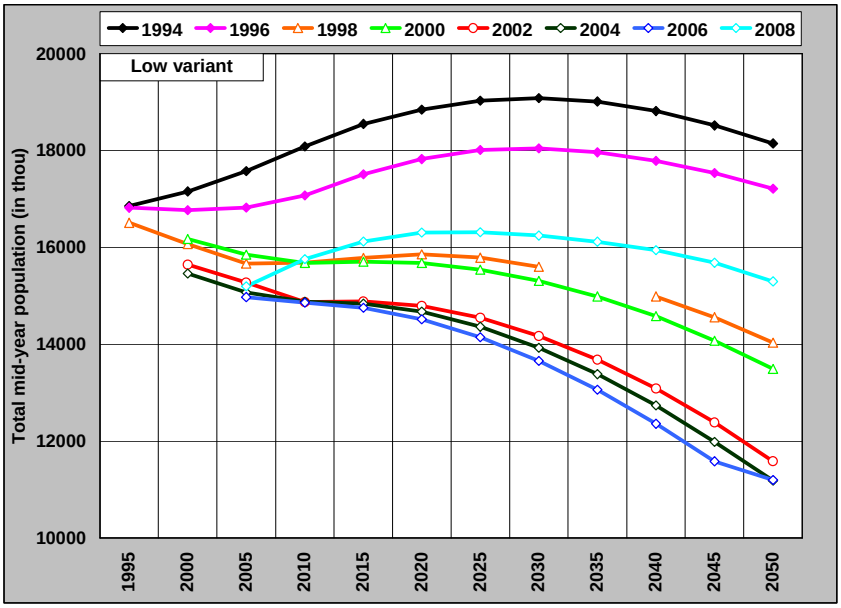


Note: Each curve presents the year of revision

The revision 1994 even projects population at a level of 24,278 thou. people at the end of projection period. Gathering newer data on population allowed UN staff to project total population of Kazakhstan with lower values and sometimes with better understanding of the situation. Since the revision 2000, future development of total population by the revisions 2002, 2004 and 2006 projects decline in population till the end of projected period by 1,423 mln people for 2002 revision, by 2004 revision for 1,587 mln people, and by the revision 2006 decline for 1,541 mln people, fixing projections around 13 mln people. The most recent 2008 revision is black colored curve projects steady increase in total population from 15,573 thou. up to 17,848 thou. people (2,275 mln increase). Well, 2,275 mln. people increase, is that really can be considered as an increase? Can we call growth for 2,275 million people within forty years a really increase? Or it is matter of cohort's compensation? Interpretation of this numbers and this question itself remains highly important and lie in the next sub-chapter age and sex structure. However we will try to give a short idea of the future population growth. So lets assume, that generation of mine's (1985-1990) will bear children by 2005-2010 (bigger cohort of 1980-1985's initiated baby boom) and children of mine will enter their own reproductive age approximately in 2020-2025 (generation of 2005-2010 assuming lowering level of TFR and decreasing level of birth order leads to smaller cohorts then we are today), further their kids (my grandchildren being even smaller due to mentioned factors) will start to childbearing by 2045-2050 bringing this number of 17848 thou. people to life. So hypothetically we may conclude that is due to cohorts' replacement where lower number of generation logically childbear lower number of children, assuming that pace of fertility change will be small meaning lower level of TFR itself. Anyway such a big problem needs to be discussed in details in next sub-chapter. Interpreting this numbers we may conclude that followed by last decade fall in TFR and slowing natural increase growth may initiate such predictions to be realistic.

High variant traces same "effect of old data" where older revisions predict higher values for the total population. In this context more important for us is to look upon the 2008 revision which in fact may be considered as "reasonable" for the first and mid-period of projections varying between 15,194 thou. people up to 20,744 thou. people.

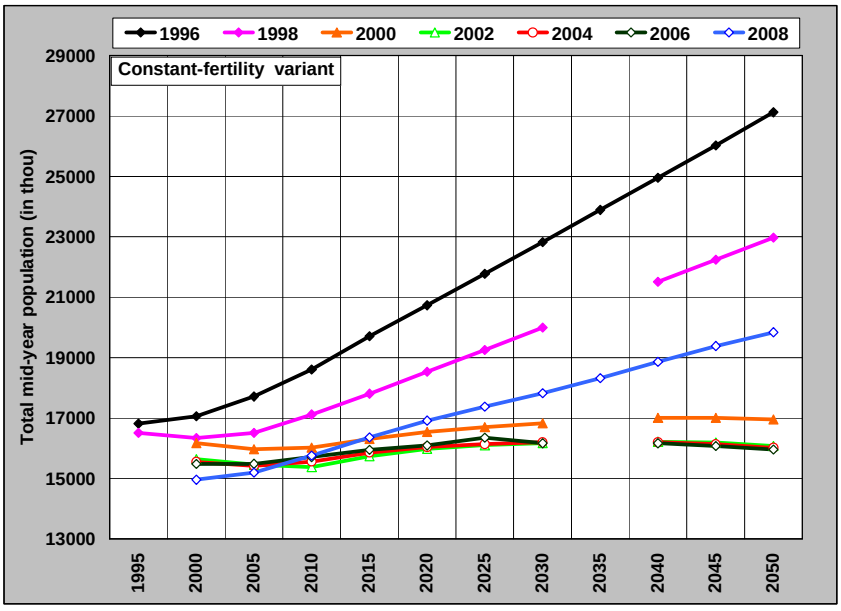
Fig. 32 - continued



Note: Each curve presents the year of revision

Low variant of projection on total population draws dramatic change in the future development of this indicator. Older revisions the 1994, 1996, 1998, and 2000 displays higher values for mid-year population. Dramatic change occurs in the revisions 2002, 2004 and 2006 they have got the lowest values for the projection period falling from 15,640 thou. up to 11,183 thou. people.

Fig. 32 - continued



Note: Each curve presents the year of revision

Source: Based on data from the UN WPP the 1992-2008 revisions

This is the most undesirable development scenario where TFR approaching lowest-low level (see figure 10, low variant), migratory flows are still remains at the level sufficient to change population (see figure 25) and stagnating level of mortality (see figure 16). Constant-fertility scenario of total population development suggests the fact that TFR in Kazakhstan assumed to remain near or at replacement level (2.0-2.1 children per woman) within all projected period. It is a hypothetical development scenario which still presents interesting standings of the revisions in the above figure.

Concluding the sub-chapter we must say that development of total population over the fifty years of estimation period (1950-2000) was affected by many different factors causing its positive or negative growth over the time (out-flow migration, excessive men's mortality, decreasing level of natural increase) however, all this factors peaked during the transition period in (1990-1995) and more or less stabilized in the second part of transition period (1995-2000) during the independence years. However, projections for 2000-2050 are remained even more important from the perspective point of view, because there is part of uncertainty in each of presented variants as the time horizon increases which can be accepted or rejected sometimes with equal probabilities. Therefore, it is crucial today to know for Kazakhstan, what kind of population structure by sex and age will be tomorrow.

6.2 Age and sex structure

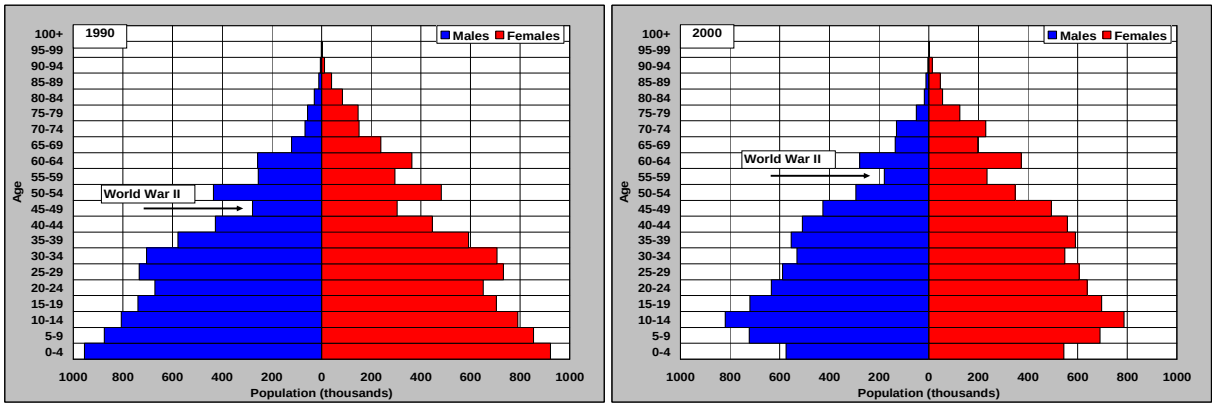
Age and sex composition or sometimes called age pyramids are powerful tools to display the "history" or better say background of studied period its inner-flows and affected to the generations changes. It might be seen from the age pyramids what age and sex structure population had, has or will have in the future. Therefore this sub-chapter aims to present estimated and projected sex and age composition of Kazakhstan its age distribution in percentage within studied period according to the UN WPP.

Recent history included civil wars, famines, mass repressions and the unprecedented human losses of the World War II, all during the lifetime of one generation. These extraordinary events and circumstances are imprinted on the age and sex composition of those countries. Kazakhstan being a part of huge country as the USSR was no exception for these extraordinary events. Of course such tragic events influence differently and can not be compared identically with Russian or any other former Soviet Union successor states. Pecularity is the highly dissorted sex ratio which we discussed previously came along with large 'irregularities' in the 1990 population pyramid. For example generations born during the years of the World War II were between 45-47 years old in 1990 and are much fewer in number than those born before or after that period (UN WPP the 1994 revision, 1995). This is seen from the most recent 2008 revision which shows "War effect" on the generations of people aged 45-49 in the following age pyramid of both sexes on figure 33.

Such shattered generations mirrors in many families in Kazakhstan nowadays. And even in the past when these people where of economically active age such deformated age and sex composition affected to the social and economical development putting the pressure on the economical system due to lack of

working people of that age. The following figures are comparison between the age and sex composition for the 1990 and 2000 by the UN WPP the 2008 revision.

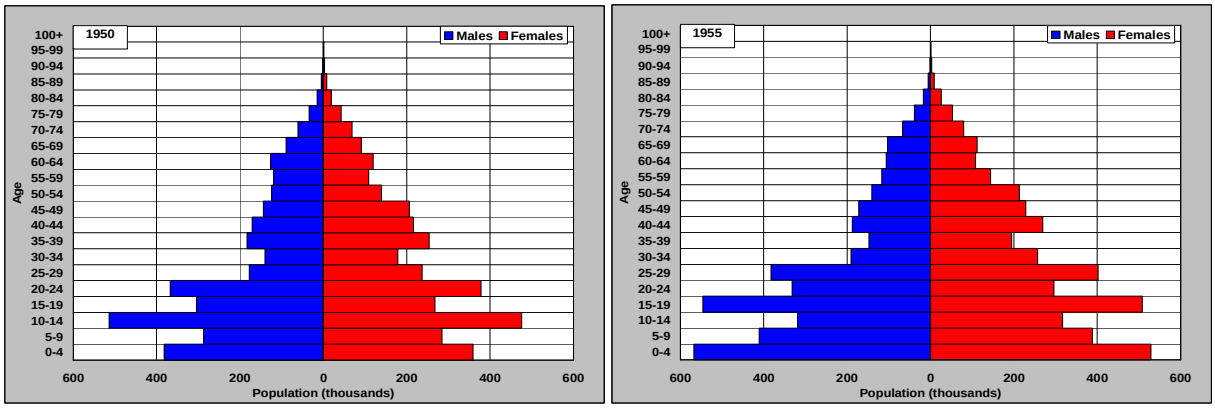
Fig. 33 - Comparison of estimated population composition by age and sex in Kazakhstan, in 1990 and 2000 according to the United Nations World Population Prospects the 2008 revision



Source: Age and sex pyramid was constructed based on data from the UN WPP the 2008 revision

As it seen shattered generation of men almost twice cut in the right-hand side graph aged 55-59 due to mortality among men in higher ages while women structure changing slowly without irregularities. Add to this dramatic out-flow of people during transition period moving other countries to search “better life and new home”. Another interesting fact is initial population (0-4 age groups) of 1990’s men and women who relates to age pyramids of 1970-1975’s cohorts aged at least 20-24 or one of the “golden ages” in Kazakhstan compared to the 2000’s initial structure of men and women which relates to the age pyramids of 1980-1985’s cohorts aged at least 20-24 who started to leave the country by educational purposes and with parents (see figure 27) in the mid 90’s. Well, to see all irregularities we have to go through all retrospective development of age and sex composition within estimated period in a row below.

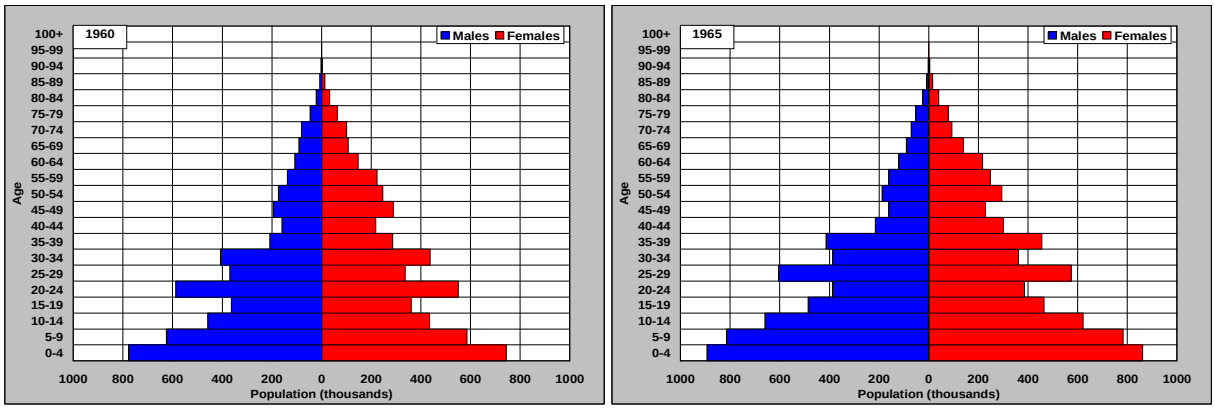
Fig. 34 - Estimated population composition by age and sex in Kazakhstan, 1950-1995 according to the United Nations World Population Prospects the 2008 revision



Source: Age and sex pyramid was constructed based on data from the UN WPP the 2008 revision

Second World War affected the population age and sex structure as we can see from the left-hand side graph related to 1950 year. Where we may observe shrinking and highly irregular age structure than in any other age pyramids. Less number of age groups 25-29 relates to the cohort born during 1925-1930's which corresponds to the industrialization period in Kazakhstan. Even more dramatic next 30-34 age groups due to "famous" collectivization of "Goloshekin's reform" when many Kazakh families ran away from punitive expeditions who collected all food and livestock resources, they migrated to China, Central and South-Central Asia (Uzbekistan, Afghanistan, Turkmenistan, Iran, Turkey etc) they did not want to give everything they had and putting it to the ideological sanctuary of Bolsheviks (History of Kazakhstan, 2000). According to historical data at least a million people (250 thousand households) were gone out of Kazakhstan during that period this caused famines of 1921, 1928-1933 when at least 2 mln. people died. As we know Kazakhs are naturally nomads and sheep and horses were the main food resources (even nowadays less things changed in this respect), so by the year 1933 total livestock number decreased by 11 times! and consisted 4.5 mln. compared to the pre-collectivization period with 40.5 mln. livestocks. So no food no resources to survive this directly mirrors in the graph of 1950 for the mentioned age groups. Generally speaking all cohorts born from 1905 to 1935's were suffering from all kinds of political insane reforms: collectivization, industrialization which caused in its turn femines and massive emigration abroad. The biggest cohort is the age-groups of 10-14 they were born in 1936-1940 right before the WWII (History of Kazakhstan, 2000). However, it looks no paradoxical in the sense of childbirth in greater volume during pre-war period having in mind all this mass repression. A hypothesis may be suggested that people likely "feel in the air" upcoming changes and somehow start to prepare themselves to replace and raise the number of population. Nevertheless the fact that people usually starts to replace lost generation afterwards which we will observe in 1960-1970's age pyramids. Summarizing all this we may also suggest the fact that Kazakhstan's territory was not under direct strikes of the battlefield before or during the WWII, being just a warehouse helped population of Kazakhstan to save and raise population afterwards.

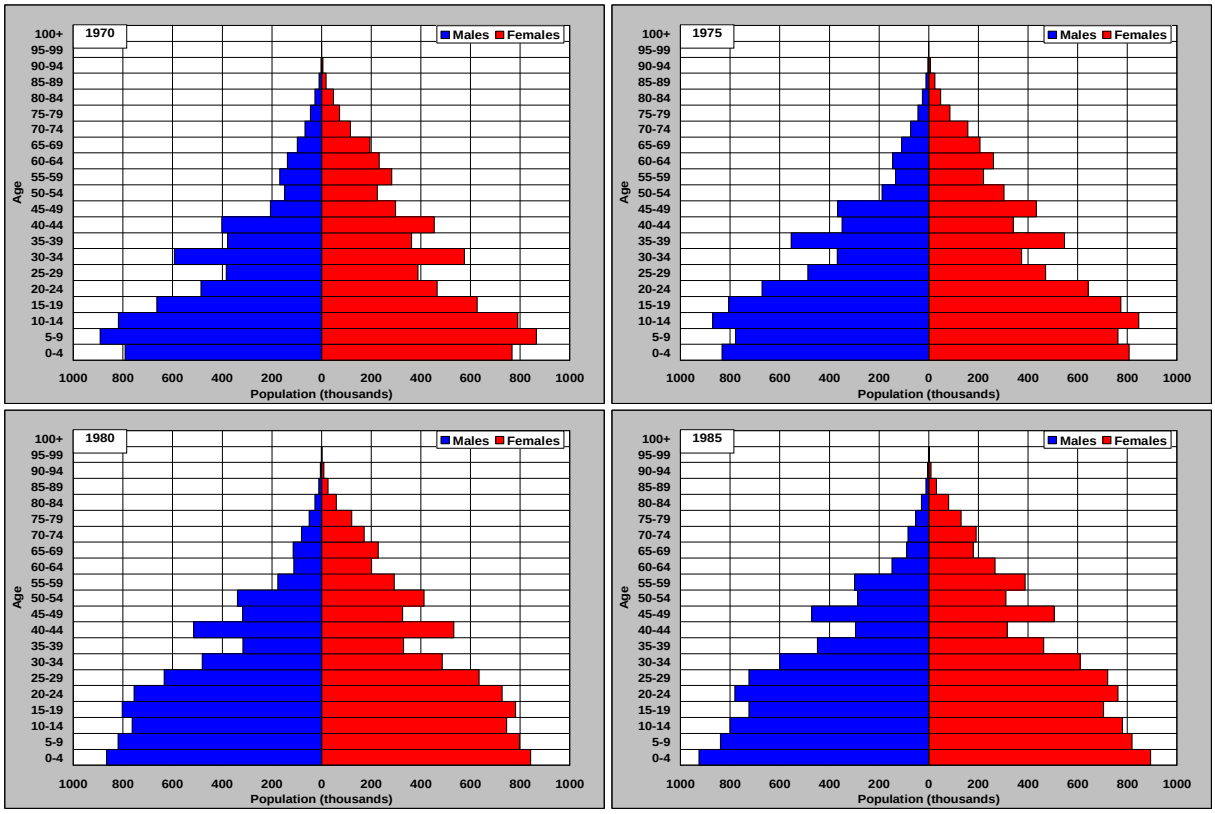
Fig. 34 - continued



Source: Age and sex pyramid was constructed based on data from the UN WPP the 2008 revision

The figure related to 1955 is the direct imprint of the events we have mentioned above. The most suffered generation 30-34 went through five-year interval and entered 35-39 age groups being the shortest age group in the age composition. An interesting fact that even women were affected in this age group in smaller proportion of course, but never since their size were at such low level. Same big cohorts of 1940-1945's are observed in ages 15-19. Figure related to 1960, age and sex composition displays same shortened 40-44 age groups (most suffered generation from collectivization and caused famine) especially among males, age groups of 20-24 (born during the pre-war times) tends to stay large generation, however age group of 0-4 born during the 1955-1960's are greater in numbers. This is what we said before, logical end of the war when people naturally start to replace their lost generations (this also relates to highest TFR and CBR in all recorded history of Kazakhstan see table 4 and 5). Attention shall be given also to the generations born during the 1941-1945 (15-19 age groups in 1960 age pyramid) whom we have already mentioned above, their less number will affect through all their life-time. In 1965 age and sex composition of "pre-war generation" moves towards to 25-29 age groups, "most suffered" generation upwards to 45-49 age groups. The base for age pyramid is effect of "compensation" which will be observed furthermore for several more generations up to 1990's.

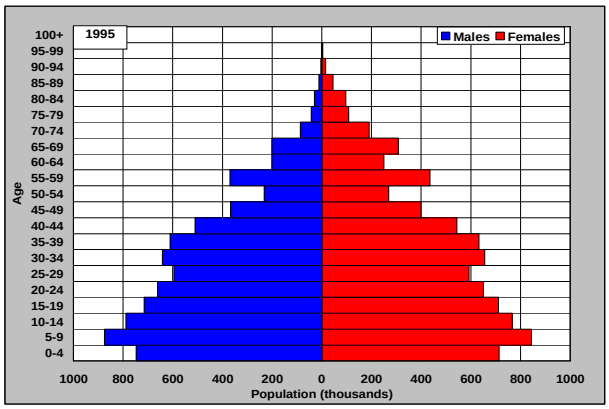
Fig. 34 - continued



Source: Age and sex pyramid was constructed based on data from the UN WPP the 2008 revision

Highly irregular age and sex composition of Kazakhstan led to extended mortality risk among males and partially among women poor living conditions after the war and during the "Country rebuild" affected to

higher age groups where very few generations remained. The most recent 2008 revision adjusted the age groups up to the 100+ by international world-wide standard due to longer life span and longevity process, however previous revisions kept in mind the average life expectancy for both sexes combined from approximately 55.0 up to 65.8 years (see table 10) and closing age group was 80+.



Source: Age and sex pyramid was constructed based on data from the UN WPP the 2008 revision

However, it is not clearly visible using as the closing group 80+ to what extent life expectancy improved over the estimation period. Therefore it was decided to take only the most recent 2008 revision's age and sex composition with 100+ closing age group. The following table 20 and 21 is the comparison between the age distribution of population in Kazakhstan and its changes between the earliest 1996 and the most recent 2008 revisions.

Tab. 20 - Estimated age distribution of population in Kazakhstan according to the United Nations World Population Prospects the 1996 revision

Age distribution	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995
Percentage aged 0-4	11.1	13.7	15.2	14.7	11.9	11.6	11.5	11.5	11.4	9.3
Percentage aged 5-14	23.3	17.9	21.0	24.2	25.7	23	20.9	20.5	20.2	20.5
Percentage aged 15-24	19.7	21.1	18.6	14.5	17.1	20.5	20.5	18.8	16.6	17.3
Percentage aged 60 or over	10.2	9.2	8.3	8.1	8.2	8.5	8.2	8.3	9.6	9.8
Percentage aged 65 or over	6.5	6.5	5.7	5.2	5.4	5.7	6.1	5.7	5.9	6.9
Percentage of women aged 15-49	50.2	52.1	47.8	44.9	46.7	49	49.4	50	48.4	50.8

Source: Based on data from the UN WPP the 1996 revision

Tab. 21 - Estimated age distribution of population in Kazakhstan according to the United Nations World Population Prospects the 2008 revision

Age distribution	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
Percentage aged 0-4	11.1	13.7	15.2	14.7	11.9	11.6	11.5	11.5	11.4	9.2	7.5
Percentage aged 5-14	23.3	17.9	21.0	24.2	25.7	23	20.9	20.4	20.5	20.9	20.5
Percentage aged 15-24	19.7	21.1	18.6	14.5	17.1	20.5	20.5	18.6	18.8	19	19.6
Percentage aged 60 or over	10.2	9.2	8.3	8.1	8.2	8.5	8.2	7.8	8.6	9	9.5
Percentage aged 65 or over	6.5	6.5	5.7	5.2	5.4	5.7	6.1	5.0	5.8	6.5	6.8
Percentage aged 80 or over	0.8	0.8	0.8	0.8	0.9	0.9	1.0	0.6	0.9	1.0	1.1
Percentage of women aged 15-49	50.2	52.1	47.8	44.9	46.7	49	49.4	50.4	51.1	51.3	52.2

Source: Based on data from the UN WPP the 2008 revision

Age distribution of population in percentage is the relative form of age and sex composition which allows seeing what age groups is or will be prevailing over the time. The most interesting for us is the period starting from 1985 when the revisions starts to deviate due to data updates. The 2008 revision also took

into account percentage of people aged 80+, however the 1996 did not. Adding new age group into consideration was due to once again increasing number of "oldest-old" age group and relative improvement of life expectancy at birth. Percentage of newly born children (0-4) is slightly decreased by the 2008 comparing to the 1996 revision. While number of adolescence people has slightly increased in the 2008 by 0.3% in 1990 and by 0.4% in 1995 compared to the 1996 revision. Age group (15-24) also tends to be higher in the end of estimation period for the 2008 revision than for the 1996 one. An interesting fact in this respect is that, controversial to the tendency in the 1996 revision, the revision 2008 has fewer percentage of people aged 60 (0.5% lower in 1985, 1% lower in 1990, 0.6% lower in 1995) and aged 65 (0.7% lower in 1985, 0.1% lower in 1990, 0.4% lower in 1995) than in the 1996 revision. However, all people who aged 80+ in the revision 1996 was concluded in the age group aged 60+ which means this relative improvement may not be really matter of improving situation or gathering new data on age structure. Detailed age distribution of the 2008 revision allows us to see 1.1% of "oldest-old" people in 2000 which is relatively small number comparing the European countries: like aging Germany with 3.5% of people aged 80+, France 3.8%, Czech Republic 2.4% (The 2008 revision population database). Of course we can not compare Kazakhstan's age structure with any of the mentioned above developed European countries, however displayed numbers allows us to say that overall tendency in aging process does not occurred yet within the relatively young Kazakhstan's population. Another important age group is the women aged reproductive age 15-49 which is directly affects to the fertility indicators. Greater number of women in these ages means higher probability that more of them will have children. Nevertheless the fact that tendency till the year 2000 showed relative improvement in numbers compared to the older revisions it is necessary to look upon the projections of age distribution in percentage and age and sex composition for the period 2000-2050 by medium, high and low variants available in the most recent 2008 revision.

Tab. 22 - Projected age distribution of population in Kazakhstan by medium variant for the period 2000-2050 according to the United Nations World Population Prospects the 2008 revision

Age distribution	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Percentage aged 0-4	7.5	7.9	9.4	8.9	8.0	7.1	6.5	6.5	6.6	6.5	6.1
Percentage aged 5-14	20.2	16.4	14.4	16.2	17.3	16.2	14.6	13.2	12.7	12.8	12.9
Percentage aged 15-24	18.0	19.5	18.6	14.9	13.3	15.2	16.5	15.6	14.0	12.7	12.3
Percentage aged 60 or over	11.2	10.3	10.2	11.3	12.9	14.5	15.5	16.8	18.1	19.9	22.4
Percentage aged 65 or over	6.8	7.9	6.9	7.0	8.2	9.6	11.0	11.9	12.9	14.0	15.6
Percentage aged 80 or over	1.0	1.0	1.3	1.1	1.5	1.3	1.5	2.1	2.7	3.1	3.4
Percentage of women aged 15-49	53.1	54.6	53.2	50.3	48.9	49.1	49.1	48.2	45.7	44.0	44.2

Source: Based on data from the UN WPP the 2008 revision

Tab. 23 - Projected age distribution of population in Kazakhstan by high variant for the period 2000-2050 according to the United Nations World Population Prospects the 2008 revision

Age distribution	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Percentage aged 0-4	7.5	7.9	9.4	9.9	9.3	8.4	7.8	8.0	8.4	8.4	8.0
Percentage aged 5-14	20.2	16.4	14.4	16.1	17.9	18.0	16.7	15.3	14.9	15.4	15.8
Percentage aged 15-24	18.0	19.5	18.6	14.8	12.9	14.6	16.5	16.6	15.4	14.1	13.8
Percentage aged 60 or over	11.2	10.3	10.2	11.2	12.5	13.9	14.7	15.6	16.5	17.6	19.3
Percentage aged 65 or over	6.8	7.9	6.9	7.0	8.0	9.2	10.4	11.0	11.7	12.4	13.4
Percentage aged 80 or over	1.0	1.0	1.3	1.1	1.5	1.2	1.4	1.9	2.4	2.8	2.9
Percentage of women aged 15-49	53.1	54.6	53.2	49.8	47.8	47.3	47.5	47.0	45.0	43.9	44.6

Source: Based on data from the UN WPP the 2008 revision

Tab. 24 - Projected age distribution of population in Kazakhstan by low variant for the period 2000-2050 according to the United Nations World Population Prospects the 2008 revision

Age distribution	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Percentage aged 0-4	7.5	7.9	9.4	8.0	6.7	5.6	5.2	5.0	5.0	4.7	4.3
Percentage aged 5-14	20.2	16.4	14.4	16.4	16.8	14.4	12.2	10.7	10.2	10.0	9.9
Percentage aged 15-24	18.0	19.5	18.6	15.1	13.6	15.9	16.5	14.2	12.1	10.7	10.3
Percentage aged 60 or over	11.2	10.3	10.2	11.5	13.2	15.1	16.5	18.2	20.1	22.6	26.1
Percentage aged 65 or over	6.8	7.9	6.9	7.1	8.4	10.0	11.7	12.9	14.3	15.9	18.2
Percentage aged 80 or over	1.0	1.0	1.3	1.1	1.5	1.3	1.6	2.2	2.9	3.6	3.9
Percentage of women aged 15-49	53.1	54.6	53.2	50.7	50.1	51.1	51.0	49.4	46.1	43.6	43.0

Source: Based on data from the UN WPP the 2008 revision

Fig. 35 - Projected population composition by age and sex in Kazakhstan for the period 2005-2050 according to the United Nations World Population Prospects the 2008 revision by medium variant

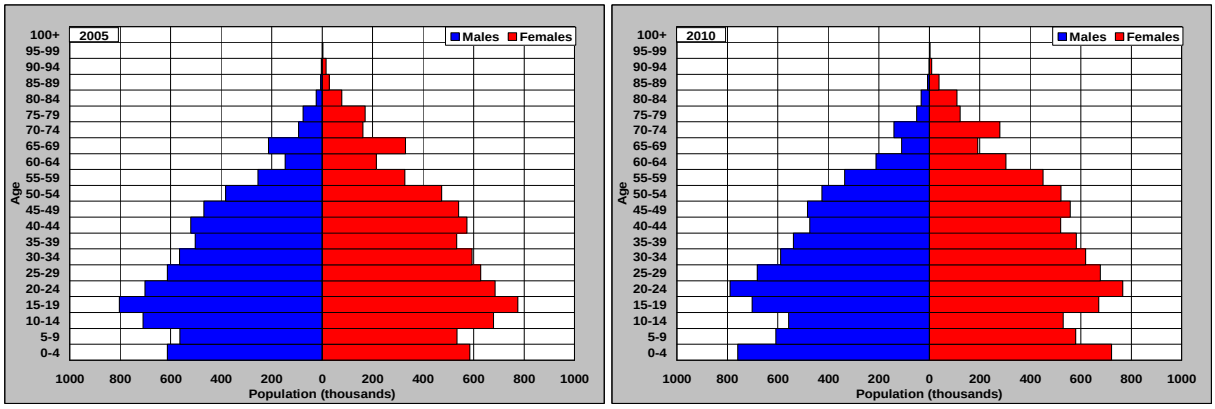
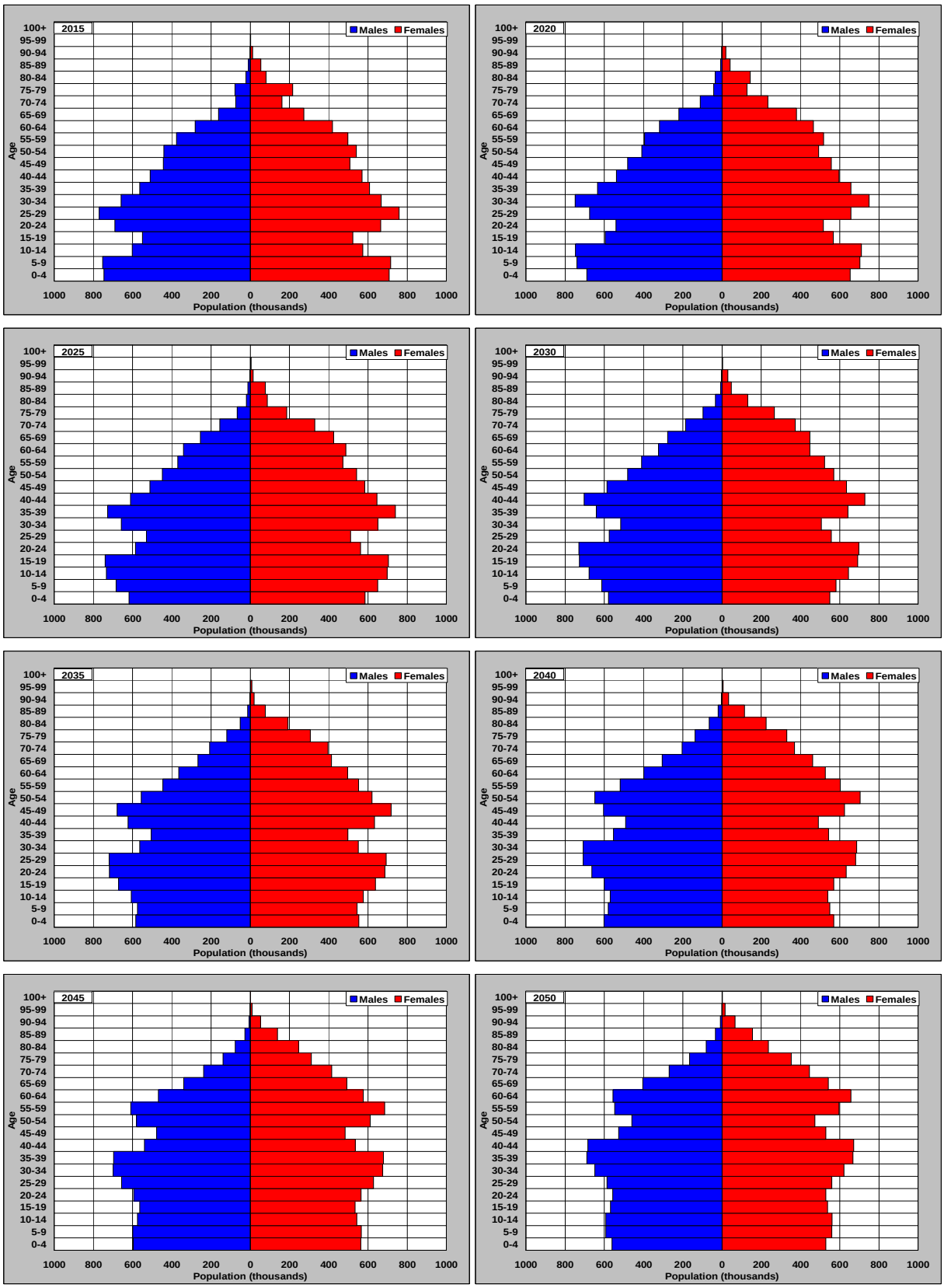


Fig. 35 - continued

Anuar Kerembayev: Changing view on future population development of the Republic of Kazakhstan according to the 118 United Nations World Population Prospects since the 1992 till the 2008 revision



Source: Age and sex pyramid was constructed based on data from the UN WPP the 2008 revision

Once we already displayed the 2000 age pyramid it was decided to present projections starting from 2005 to illuminate duplicity in the work As we may see from the 2005 age pyramid the shattered 5-9 age groups brought fewer age pyramid baseline in its turn, this is related to the transition period in Kazakhstan we discussed above. This age group will be observed as the smallest age group over all projection period. Shrinking higher aged groups getting smaller due to natural decline (most suffered age group entered 60-64). There are very few males remaining in ages higher 85+ comparing to females aged 85+ and this tendency will be kept through all projection period. Basically end of the projection period draws typical country of 2050, where median age grown till the level it started to affect on population structure leading to aging process. Shorter baseline with almost equal young age groups, broader 35-39, 40-44 age groups, affected by transition period people of 60-64 transmits to larger group of elderly people aged 65+. Highly dissorted sex ratio will still be remained a decisive factor by that days. Very few men will survive till the higher ages 85+ (which are common for almost half of the world's age pyramids by those days). As we mentioned above median age increases population gets older as well however, population aging likely will not be a deterministic factor yet, as for instance, in many developed countries (this is will be discussed in next sub-chapter). Upper boundary of projection is on the next figure 36 relating to the high variant projection of population composition by age and sex for the period 2000-2050.

Fig. 36 - Projected population composition by age and sex in Kazakhstan for the period 2000-2050 according to the United Nations World Population Prospects the 2008 revision by high variant

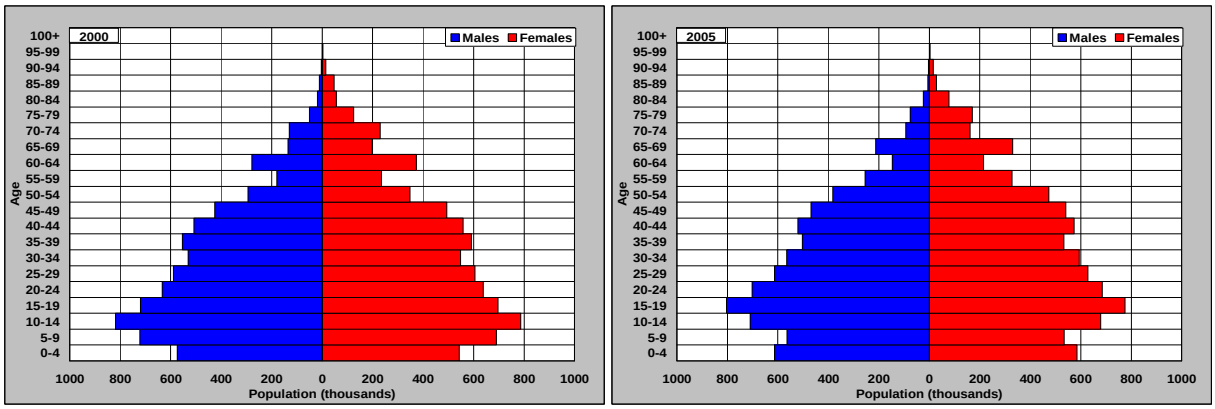
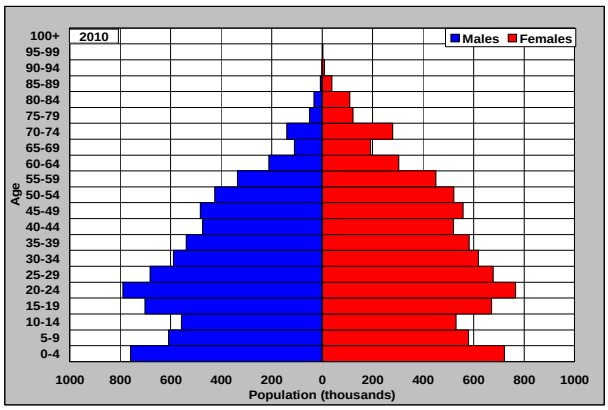
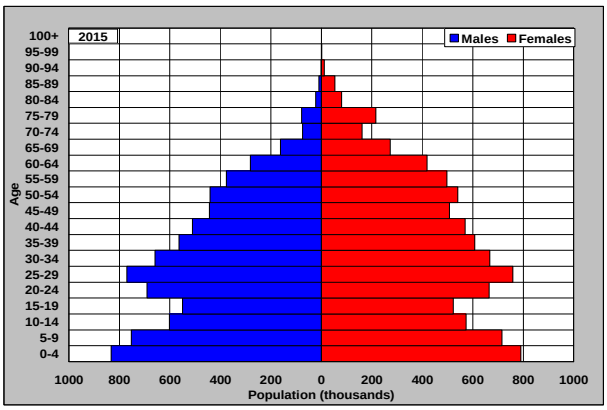
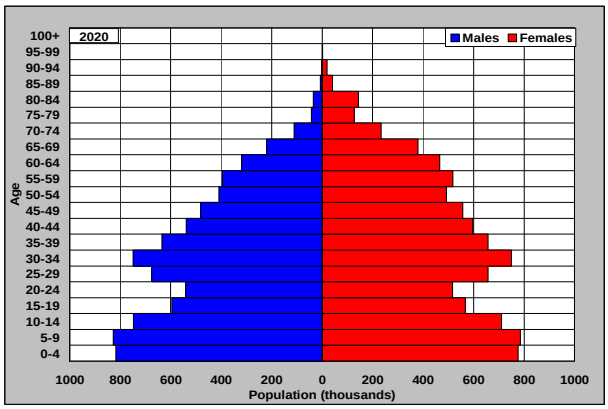


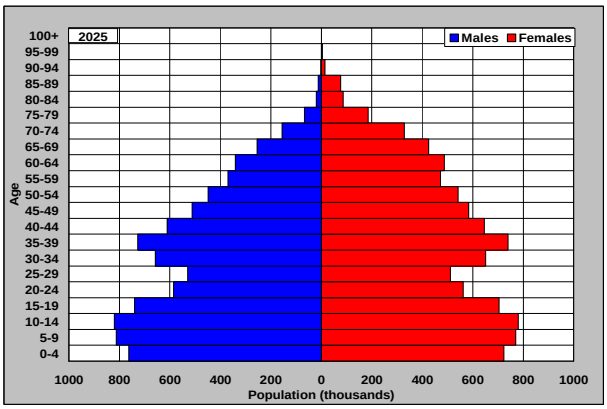
Fig. 36 - continued

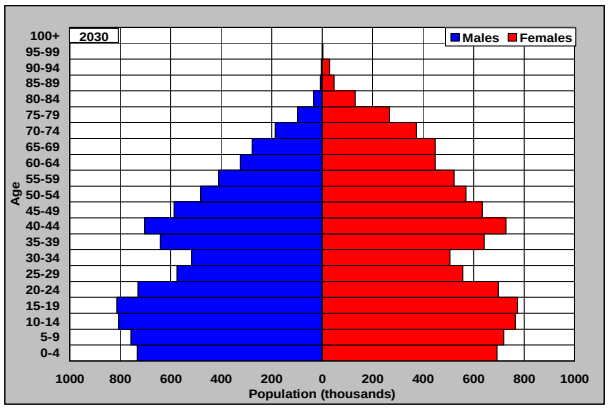
Anuar Kerembayev: Changing view on future population development of the Republic of Kazakhstan according to the 120 United Nations World Population Prospects since the 1992 till the 2008 revision

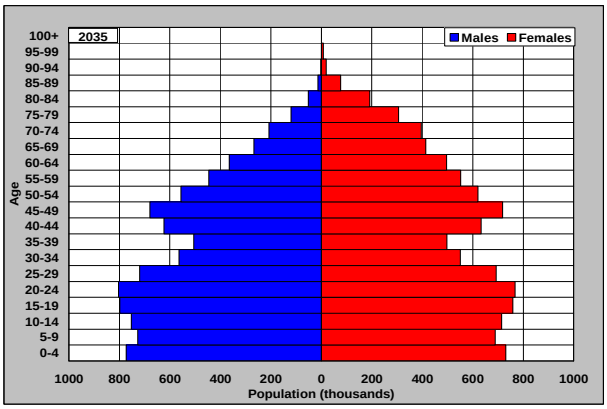


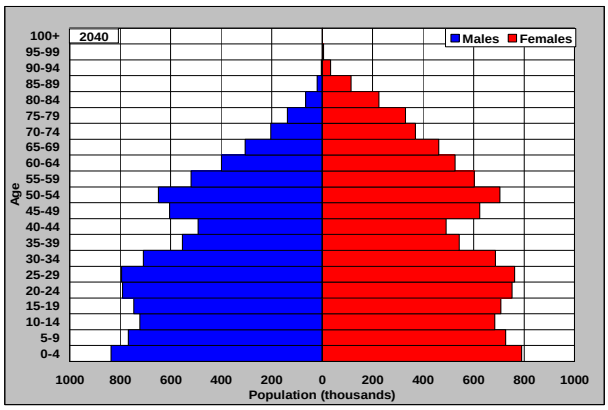












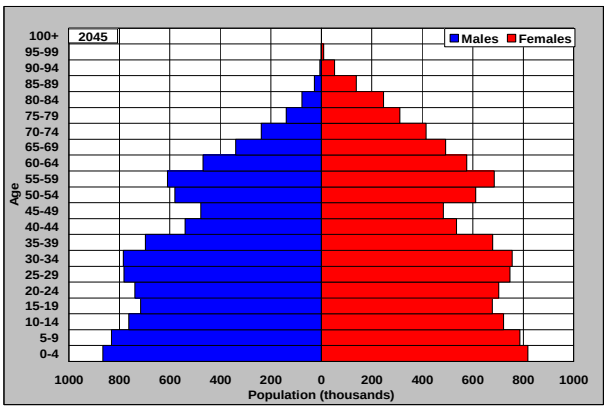
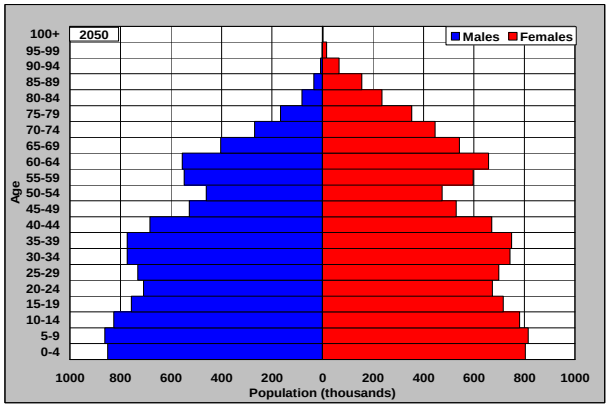


Figure 35 or high variant of projection uses same reference year as medium or low variants (2000) and assumes that age groups will be bigger due to relatively high crude birth rates. Similar age pyramids are for the 2000, 2005 and 2010 projection years. After 2015 main changes occurs in the baseline (initial) age structure. Thus all high variant projections assume greater number of people in initial age structure (0-4 age groups). Consequently, bigger number in this age group will structure bigger number for the whole age pyramids going from baseline to the upward within projection period. In this respect, we also have to look upon lower boundary of projection variation – low variant scenario of age and sex composition presented below.



Source: Age and sex pyramid was constructed based on data from the UN WPP the 2008 revision

Fig. 37 - Projected population composition by age and sex in Kazakhstan for the period 2000-2050 according to the United Nations World Population Prospects the 2008 revision by low variant

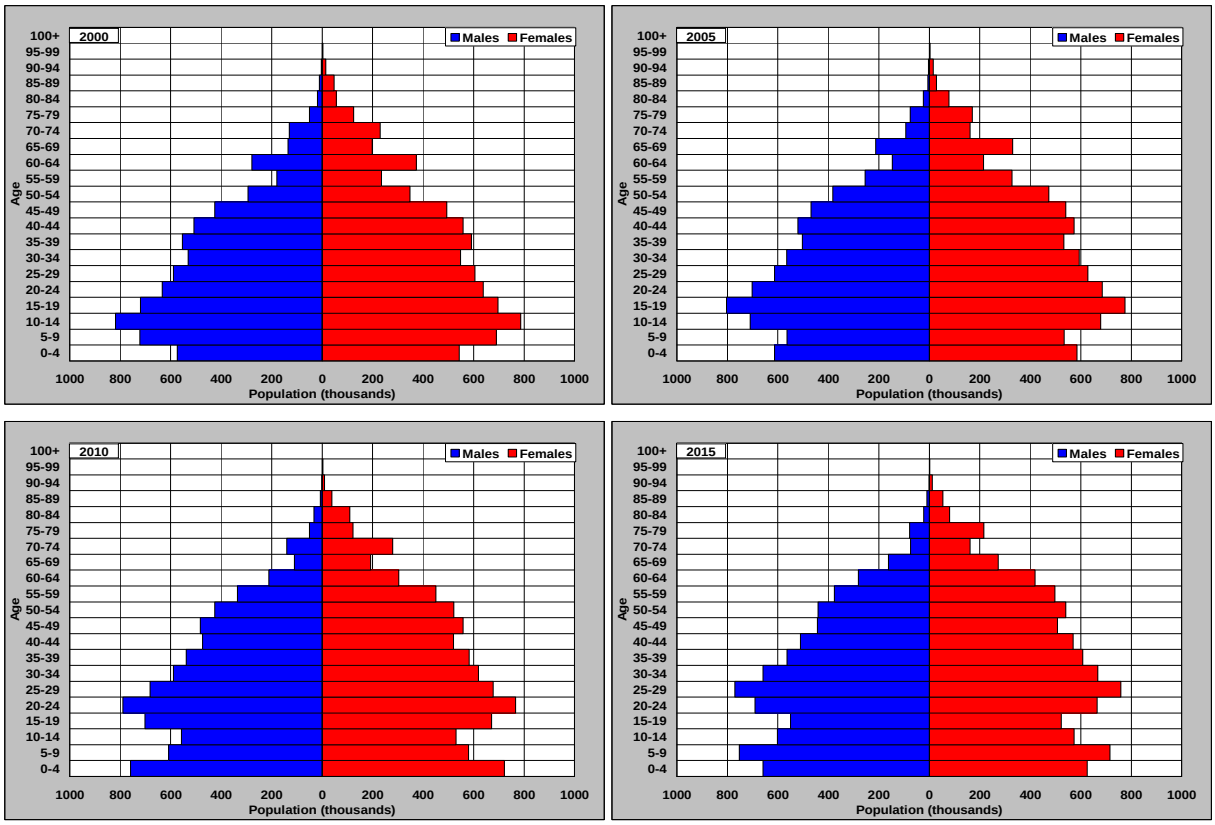
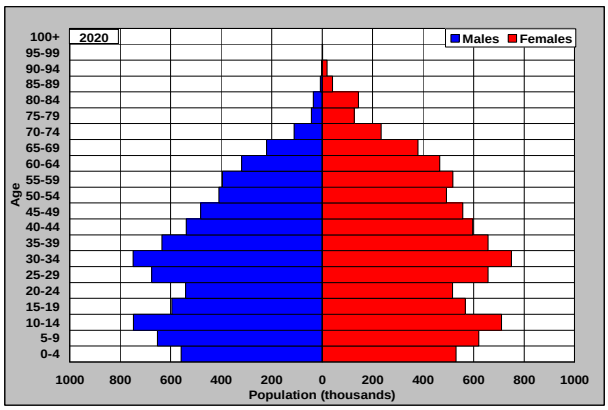
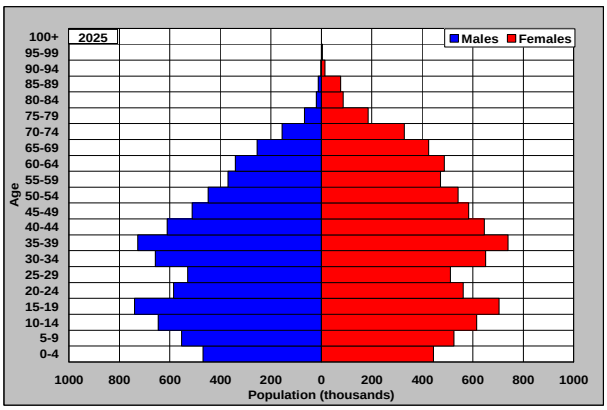
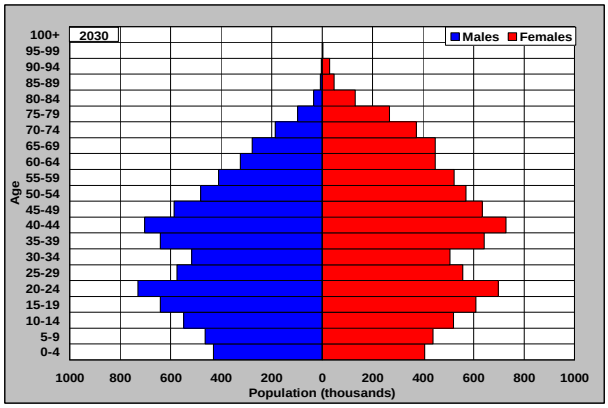
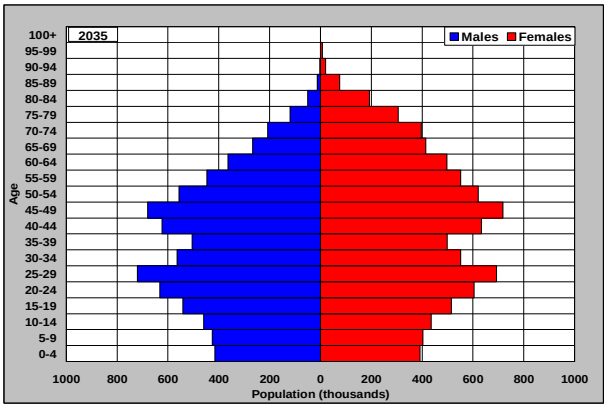


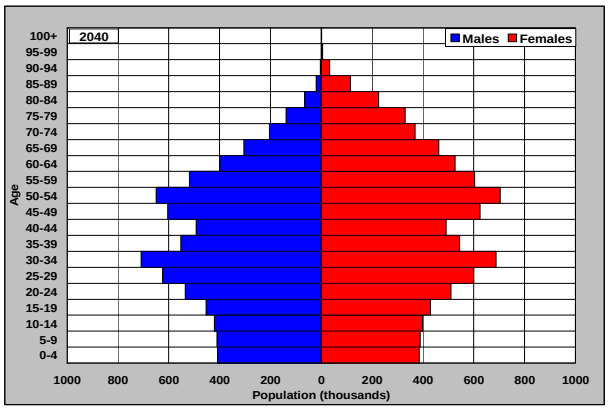
Fig. 37 - continued

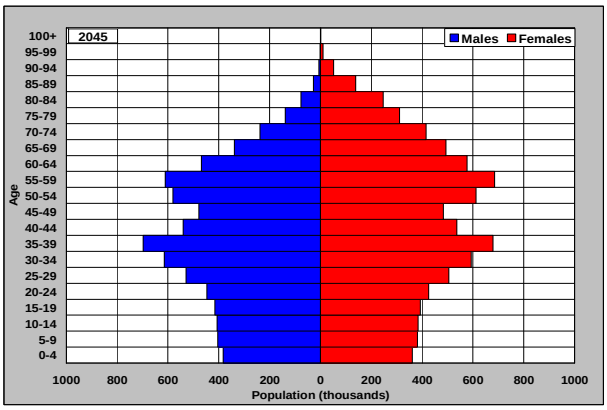




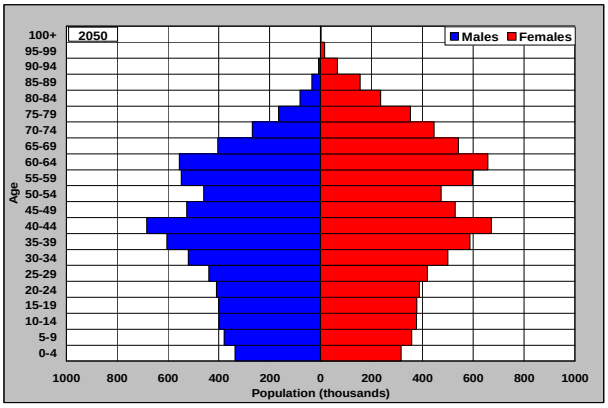








Situation with development of age and sex composition in Kazakhstan by low variant draws dramatic view over the fifty projected years. Underlying low variant assumptions based on smaller initial age structure (0-4 age groups) suggests the fact that projected fertility decline will be apparent in the pyramid which is drawn in at the base and this in its turn may lead to shrinking age and sex structure afterwards.



Source: Age and sex pyramid was constructed based on data from the UN WPP the 2008 revision

Smaller born cohorts surpassing the next age groups with fewer people in generation which by the 2050 will have right-hand side graph's situation. In this respect it is noteworthy to mention that aging process in observing graph of 2050 may be clearly defined by shrinking initial age structure with greater number of elderly people afterwards. However, development of such scenario is still doubted due to uncertainty level of the produced forecast and reliability of gathered data from the Agency of Statistics of the Republic of Kazakhstan (reliability assessment will be discussed in the following chapter 7).

6.3 Other demographic indicators

If the world would not be so full of people and most of them did not have to work so hard, there would be more time for them to lie on the grass, and there would be more grass for them to lie on (Don Marquis)

There are some basic demographic indicators which importance can not be omitted while analyzing the future population development. Among those we may include, dependency ratios, median age and population density. Each of them presents important supplementary information about population development in the past, nowadays and in the future. In this respect, the proportion of children and older persons in Kazakhstan has much to do with the balance of national expenditures on schools, childcare, immunization and reproductive health as against expenditures on old-age social security systems and health care for chronic and degenerative disease. The ratio of the population aged 65 and over to the working-age population is a fundamental consideration in the design of public pension arrangements (official retirement age since the 1st January, 1998 concludes 57 for women and 62 for men) and the ratio has its micro-level expression in the age structure of the family, affecting to the possibilities for private care of children and older persons. Political clout may also be linked to relative population proportions (Preston, 1984). The following table 24 is the total-dependency ratio variation over the revisions signifies decreasing total dependency ratio in Kazakhstan within 1990-2050 by medium variant.

Tab. 25 - Projected total-dependency ratio in Kazakhstan for the period 1990-2050 according to the United Nations World Population Prospects the 1994-2008 revisions

Revisions/Year	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1994	60	58	53	51	48	48	49	51	53	53	54	56	58
1996		58	53	49	46	46	49	51	52	52	53	55	58
1998		58	53	50	47	47	49	51	52	52	53	56	58
2000			51	47	43	43	45	47	48	48	50	53	56
2002			53	47	43	42	45	47	49	48	50	53	57
2004			53	47	43	44	46	47	48	47	51	53	58
2006			53	47	43	45	48	48	49	46	50	52	56
2008			53	47	44	47	50	49	47	46	48	50	53

Note*: Total-dependency ratio was calculated by one (medium) variant only

Source: Based on data from the UN WPP the 1994-2008 revisions

The next table 25 is the child-dependency ratio displays also general tendency for decreasing proportion.

Tab. 26 - Projected child-dependency ratio in Kazakhstan for the period 1990-2050 according to the United Nations World Population Prospects the 1994-2008 revisions

Revisions/Year	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1994	50	47	42	38	36	35	34	33	32	31	31	31	31
1996		47	42	37	35	34	34	33	32	31	31	31	31
1998		47	42	37	35	34	34	33	32	31	31	31	31
2000			41	35	32	32	31	30	29	28	28	28	28
2002			42	35	31	31	30	29	27	26	25	26	26
2004			42	35	31	33	33	31	28	27	26	27	27
2006			42	35	31	35	35	32	30	28	27	28	28
2008			42	36	34	37	38	35	31	29	29	29	29

Note*: Child-dependency ratio was calculated by one (medium) variant only

Source: Based on data from the UN WPP the 1994-2008 revisions

Tab. 27 - Projected elderly-dependency ratio in Kazakhstan for the period 1990-2050 according to the United Nations World Population Prospects the 1994-2008 revisions

Revisions/Year	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1994	9	11	11	13	12	13	15	18	21	22	23	25	27
1996		11	11	13	12	12	14	17	20	21	22	24	27
1998		11	11	13	12	12	14	17	20	22	22	25	27
2000			10	12	11	12	14	17	19	21	22	25	28
2002			11	13	12	12	15	18	21	22	25	28	31
2004			11	13	12	13	14	17	20	20	24	27	30
2006			11	13	12	12	13	16	18	21	23	26	29
2008			10	12	10	10	12	14	16	17	19	21	24

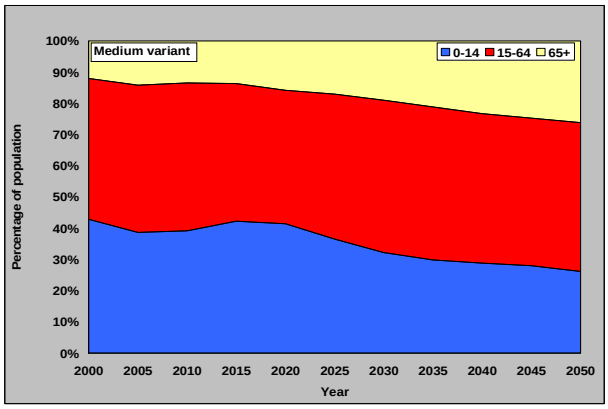
Note*: Elderly-dependency ratio was calculated by one (medium) variant only

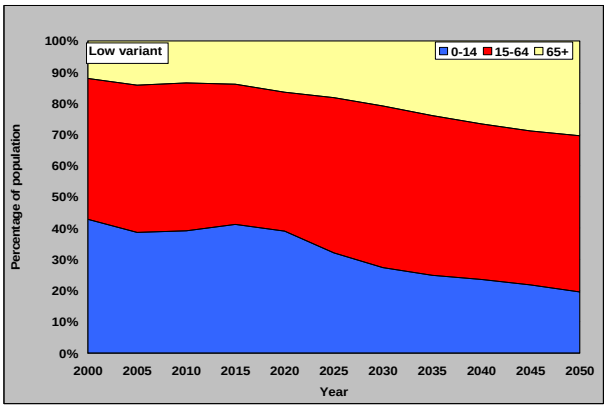
Source: Based on data from the UN WPP the 1994-2008 revisions

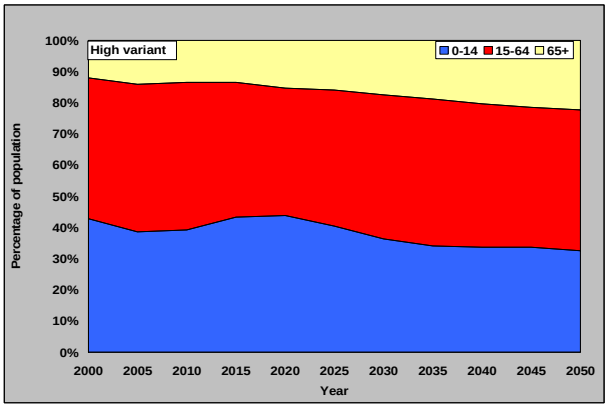
The following figure 38 is the dependency ratio displayed as the share of population in percentage by development groups united in three major groups 0-14 infants and adolescence, 15-64 economically active and aged 65+ older populations by the most recent 2008 revision. Whereas we may observe decreasing share of 0-14 age groups for medium variant with slightly increase of the development group somewhere between 2015 and 2020.

The development group15-64 is also tends to steady decrease and transmits into raising older group over the projection period. High variant displays smaller share of older people, however their increase is still projected while 0-14 and 15-64 age groups have got bigger share. Low variant presents substantial increase in older development group with lowering share of working age and infant-adolescence age groups which in fact correlates to the previous age distribution in percentage discussed above (see table 22).

Fig. 38 - Projected share of population in percentage of Kazakhstan for the period 2000-2050 according to the United Nations World Population Prospects the 2008 revision







Source: Author's calculations based on data from the UN WPP the 2008 revision

Concluding mentioned above features we may trace major change anticipated for Kazakhstan, is thus that a transfer of population from the working ages to ages 65 and over by 2050 will have such a tendency when at about two persons of working age will need to support one retiree and one infant-adolescence person. Kazakhstan pay-as-you-go pension system may not be sustainable for such increasing pressure. Because young and elderly people must be fed, clothed, housed and educated, while making little or no contribution to production. However, dependency ratio being a pure demographic measure of age structure should be used with caution, evidence suggests, for example that an older person provides support to their adult children (Morgan, Schuster and Butler, 1991; Saad, 2001).

Another important indicator is the median age (is the age at which 50 per cent of the population is older and 50 per cent is younger), increases in median age capture, in a single number, the aging process of a population (World Population Prospects: The 2004 revision: Volume III, Analytical report, 2006). Kazakhstan among developing countries is classified by the UN WPP as "eldering" country. By 2050, Kazakhstan will be among 89 countries which may face the benchmark of median age at nearly or above 40 years. Population aging which is pervasive reality in developed countries is expected to become common in the developing countries such as Kazakhstan as well. And it will occur over a shorter time span than in developed countries. Therefore it is a good idea to look on development of the median age within a century dividing it into estimation and projection periods. The following table is an illustration of the situation in Kazakhstan.

Tab. 28 - Median age in Kazakhstan for the period 1950-2050 according to the United Nations World Population Prospects the 1996-2008 revisions

Revisions/Year	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000
1996	23.2	23.3	22.9	22.4	21.8	22.3	23.5	24.6	26.1	27.0	27.0
1998	23.2	23.3	22.9	22.4	21.8	22.3	23.5	24.6	26.1	27.0	27.0
2000	23.2	23.3	22.9	22.4	21.8	22.3	23.5	24.6	26.1	26.9	28.0
2002	23.2	23.3	22.9	22.4	21.8	22.3	23.5	24.5	26.0	27.1	27.9
2004	23.2	23.3	22.9	22.4	21.8	22.3	23.5	24.5	24.8	26.7	27.6
2006	23.2	23.3	22.9	22.4	21.8	22.3	23.5	23.7	24.5	25.5	26.7
2008	23.2	23.3	22.9	22.4	21.8	22.3	23.5	24.5	25.8	26.7	27.7
Difference	0	0	0	0	0	0	0	0.9	1.6	1.6	1.3
Revisions/Year	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	
1996	29.2	30.4	31.8	33.2	34.9	35.9	37.0	38.2	…	…	
1998	29.2	30.4	31.8	33.2	34.9	35.9	37.0	…	38.2	...	
2000	29.3	30.7	32.2	33.9	35.9	37.4	38.4	39.1	39.7		40.5
2002	29.4	30.9	32.4	34.3	36.7	38.9	40.5	41.4	42.1		42.9
2004	29.4	30.3	32.1	33.9	36.5	37.9	40.2	40.9	41.8		42.5
2006	29.4	29.8	31.7	32.8	35.5	37.4	40.0	40.5	41.2		41.9
2008	28.8	29.4	30.3	31.9	33.5	34.9	35.2	35.7	37.0		38.4
Difference	0.6	1.3	2.1	2.4	3.2	4	5.3	5.7	5.1		4.5

Note*: The revisions 1992 and 1994 are not available.

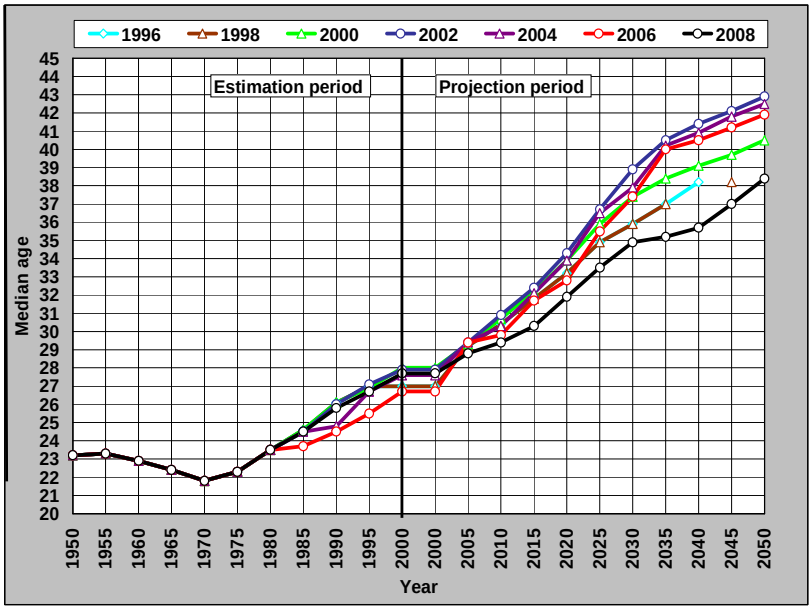
Note**: Difference was calculated as the difference between maximum and minimum values of the revisions

Note***: Three dots represent missing values.

Source: Based on data from the UN WPP the 1996-2008 revisions

As the uncertainty in the projections raises more forecast errors may occur, which is evident from the table above. Since 2035 year, median age deviation between revisions crosses 5 years and stabilizes till the end of projection between 4.5-5.7 years. The following figure is the graphical illustration of the development of median age in Kazakhstan by the 1996-2008 revision.

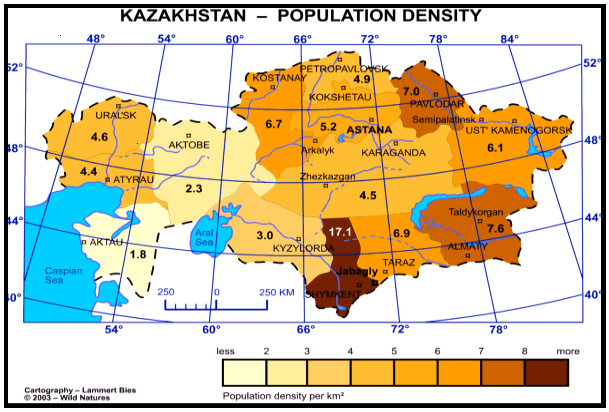
Fig. 39 – Median age in Kazakhstan, 1950-2050 according to the United Nations World Population Prospects the 2008 revision

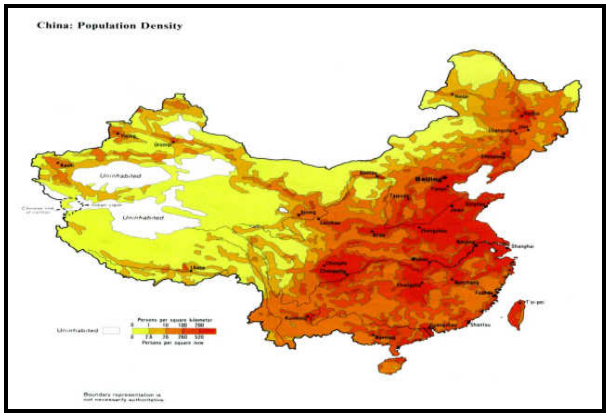


Source: Based on data from the UN WPP the 1996-2008 revisions

An increase in median age occurred over last fifty years first of all relates to the declining fertility level which we observed in previous graphs related to fertility decline. Since the 1985 median age has deviated among revisions due to different assumption underlying each revision. In 1950, median age in Kazakhstan was 23.2 years within fifty years it increased till 27.7 years (2008 revision) and projected at level of 38.4 years (2008 revision). With increasing median age in the future comes understanding of how in fact small population of Kazakhstan is to struggle with many contemporary and upcoming demographic and related to the problem socio-economical and the most important geo-political problems. Population density in this respect serves the best for the foreseeable future purposes. Population of Kazakhstan within the boundaries is presented in the following figure with the meaning to display possible density pressuring neighbors.

Fig. 40 - Population density map of Kazakhstan, China and Uzbekistan in 2003.





Source:
http://www.wild-natures.com/photo050.html
http://www.bestcountryreports.com/Population_Map_Uzbekistan.html
http://www.lib.utexas.edu/maps/thematic.html

Population density is in fact superficial indicator of the number of individuals per unit space, or quantity of square kilometers of space per head. It seems that density does not play a big role in the population development or human behavior, existing researches say it is not so. And especially for Kazakhstan with little density 5.9 person per sq. km (as of 1st January 2010 by the Agency of Statistics of the RK) compared by surrounding population "Giants" as China (1.354 mln. people with 141 person per sq. km), Russian Federation (140.4 mln. people with 8 person per sq. km) appearing from the Indian peninsula India (1.214 mln. people with 369 person per sq. km), Uzbekistan (27.8 mln. people with 62 person per sq. km) (The world Population Prospects: The 2008 Revision Population Database). The maps are displaying China and Uzbekistan as the most probable future problematic neighbors. There is a question rises from time to time in the political establishment: Which of those two more dangerous? Which of them more predictable? From the bigger scale of geo-politics: it is China, due to new policy called "China Western Development" established in 1999, which clarifies the main component of the strategy to intensify development of 6 provinces (Gansu, Guizhou, Qinghai, Shaanxi, Sichuan, and Yunnan), 5 autonomous regions (Guangxi, Inner Mongolia, Ningxia, Tibet, and Xinjiang – which is bordering with East-Kazakhstan region) in transportation, economic and social sphere and unification of all regions under the aegis of the central government. There is nothing bad in such purposes except the fact that there are almost a million of ethical Kazakhs living in Xinjiang Uyghur Autonomous District whom we have to take into consideration. As we see from the figure 39, East Kazakhstan in average has 6 persons per sq. km while Xinxiang Uyghur Autonomous District has 12 person per sq. km. (while total population of XUAD is 19.2 mln. people) by official data of Xinxiang authorities. However, strong strategical ties with Russia buffering Kazakhstan from direct expansion (not

including economic, trade, foreign investments expansion) from China. In this respect, another boiler today is Uzbekistan, uncertain and unstable with 62 persons per sq. km with seasonal demands on water resources and ethnical pressure along the border especially Ferghana valley with enormous 250 person per sq. km, it is geographically narrow valley among mountains, bordered itself with Kyrgyzstan and Tajikistan is characterized with instability and wide-spread fundamental Islamic flows, low living standards and low educational attainment of local people brings this region to be one of the most probable future "hot spots" in Central Asian region as population density in this region increases. Therefore we conclude, that Uzbekistan's population density may be more dangerous for Kazakhstan even under the protection of Russia (because Islamic groups don't really care about the political balance, all they do care is ideology – author's note) than China. Eventhough South Kazakhstan may be more resistant for density pressure than East Kazakhstan due to high population density itself in that region, it is still more dangerous from the point of similar religion believes, close history and ethnical composition (Uzbeks consists officially recorded half of million people today, excluding illegal migrants see table 14) makes it more dangerous than East Kazakhstan where Russian speaking people prevailed. Of course this is may be discussed in heat disputes which is not our aim, but to aware decision-makers to provide wise and long-term stable policy with neighbors (which has been held by President Nazarbayev for almost two decades now). As we said above, issue of low population density remains in Kazakhstan over all projection period which is seen from the following table 28. And this shall be considered as one of the key-problems in spatial distribution of population along borders.

Tab. 29 – Population density in Kazakhstan for the period 1950-2050 according to the United Nations World Population Prospects the 1996-2008 revisions

Revisions/Year	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040
1996	2	3	4	4	5	5	5	6	6	6	6	6	6	7	7	7	7	8	8
1998	2	3	4	4	5	5	5	6	6	6	6	6	6	6	6	7	7	7	8
2000	2	3	4	4	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6
2002	2	3	4	4	5	5	5	6	6	6	6	6	6	6	6	6	6	6	5
2004	2	3	4	4	5	5	5	6	6	6	6	5	5	5	6	6	6	6	7
2006	2	2	2	3	3	3	3	4	4	4	5	5	5	5	6	6	6	6	7
2008	2	3	4	4	5	5	5	6	6	6	5	6	6	6	6	6	6	6	6

Source: Based on data from the UN WPP the 1996-2008 revisions

The work of Overbeek J. "The population challenge" suggests the fact that population density is highly causative factor. In other words, when population density is high or rapidly increasing there are psychological effect afflicting on human behavior and can be correlated with crime rates, juvenile delinquency, admissions to mental hospitals and hunger to war (the last point above). Controversially when density is low so called "density vacuum" may occur, which will be "refilled" by other populations (Overbeek J, 1976).

Concluding all mentioned above threats and suggestions we have to say that as soon as Kazakhstan will be driven by friendship and cooperation with these countries more with stable and predictable China and less with unstable and hard to predict "boiling" Uzbekistan such questions of low population density would remain in the hypothetical field.

Chapter 7

Reliability assessment of the UN forecasts for Kazakhstan produced between 1992 and 2008

The qualified decision-making in the field of economics, social affairs, employment, education, health and construction of dwellings cannot stand without skilled, appropriately structured, variant and flexible demographic information. (Vano, 2002). But when such appropriately structured information are doubted due to different factors, how to judge its reliability? There is no clear answer given so far. Ascher in his work "An Appraisal for Policy-Makers" pointed that: "Energy needs...oil supplies...inflation rates...the demand for new homes...in concerns like these, forecasting plays a crucial role. Forecasts not only determine how billions of dollars will be spent by also commit national policies far into the future; yet, no one really knows how to judge the reliability of forecasts" (Ascher, 1978:23). However, in case of Kazakhstan it is not question of forecasting errors (excluding deviation between revisions which is normal) but the question of conducted national censuses and their results. So before starting the discussion about reliability assessment of the UN produced forecast results let's investigate the reliability of censuses conducted in 1999 and 2009 itself.

As we already mentioned in the beginning, census conducted in 1999 had two different meanings. First one is demographical meaning which was attempting truly to estimate number of citizens, its age and sex structure, its distribution by place of residence and settlement and many other indicators. 1999 census was the first independent census probably in whole history of Kazakhstan. It is paradox that Kazakhstan never ever before has conducted censuses on its own. More or less conscious censuses and attempts on counting how many people have Kazakhstan had during the Soviet Union period has been done many times: in 1926, 1939, 1959, 1970, 1979, 1989. And we must pay tribute to those censuses and to the people who conducted them, because censuses were relatively well-organized, reliable and self-proof to some extent. Since the gaining the independence in December 16, 1991 Kazakhstan had to conduct its own independent census which of course served the second meaning as well. It was a political meaning which used census as a tool to achieve "certain results". "The Demoscop weekly" periodical electronic bulletin publishes the article of Alexander Alekseenko about the conducted in 1999 first census in Kazakhstan. Article "About some results of the census in Kazakhstan" (Alekseenko A, 2002) approves

the political sense of the census rather than demographical one. He suggests the fact that current (1999) corrections and discrepancy correlates to the "politization" process and condensed course to "Kazakhisize" the country. Current estimates showed 48.7% of Kazakhs while 1999 census retrieved 53.4% of Kazakhs. This is 288,000 more than current (1999) statistics estimated. In 1989 there were 6496.9 mln. Kazakhs recorded; natural increase between intercensus periods concluded 1050.0 mln.; net migration of Kazakhs 150 thousand person, thus brings us to the:

6496.9 + 1050.0 + 150 = 7696.9 or 48.7% of total population;

While 1999 census registers 7985.0 mln. (53.4%) simple arithmetic difference gives us:

7985.0 – 7696.9 = 288.1 thousand "extra Kazakhs" which proves the second meaning of the 1999 census about putting extra number of Kazakhs to the total share of population. And even total population itself discussed in the article: "…So, if we trust gathered data published in the results of the 1999 census, then in 1989 total population of Kazakhstan was equal to 16199.2 thousand people. Natural increase during the intercensus years (1989-1998) was 1548.0 thousand people (see the following table 30).

Tab. 30 - Components of population change in thousands in Kazakhstan for the period 1989-1998

Years	Total increase	Including	
		Natural increase	Migratory increase
1989	154.0	255.9	-101.9
1990	101.8	233.5	-131.7
1991	161.2	218.9	-57.7
1992	43.8	200.1	-156.3
1993	-59.6	159.4	-219
1994	-261.4	145.3	-406.7
1995	-13.1	107.5	-238.5
1996	-88.4	87.1	-175.5
1997	-189.2	72.2	-261.4
1998	-134.9	68.1	-203
1989-1998	-403.7	1548	-1951.7

Musabek E. "Demographical and migratory processes" Demographic forecast//Narodonaselenye Kazaxstana, 2000

Source: Estimated by the Demographic Yearbook of Kazakhstan: Statistical Summary, 1998.

While sum of the migratory increase during the 1989-1998 was equal to negative 1951.7 thousand people. Thus, total population by the 1999 "had to decrease" for 403.7 thousand person and finally conclude 15795.5 thousand people while census counted only 14953.1 thousand people. 842.1 thousand of underestimated people (5.3% error which is significant). So 1999 census retrieved two basic problems: First, overestimation of Kazakhs for as much as 288.1 thousand people. Second, general underestimation

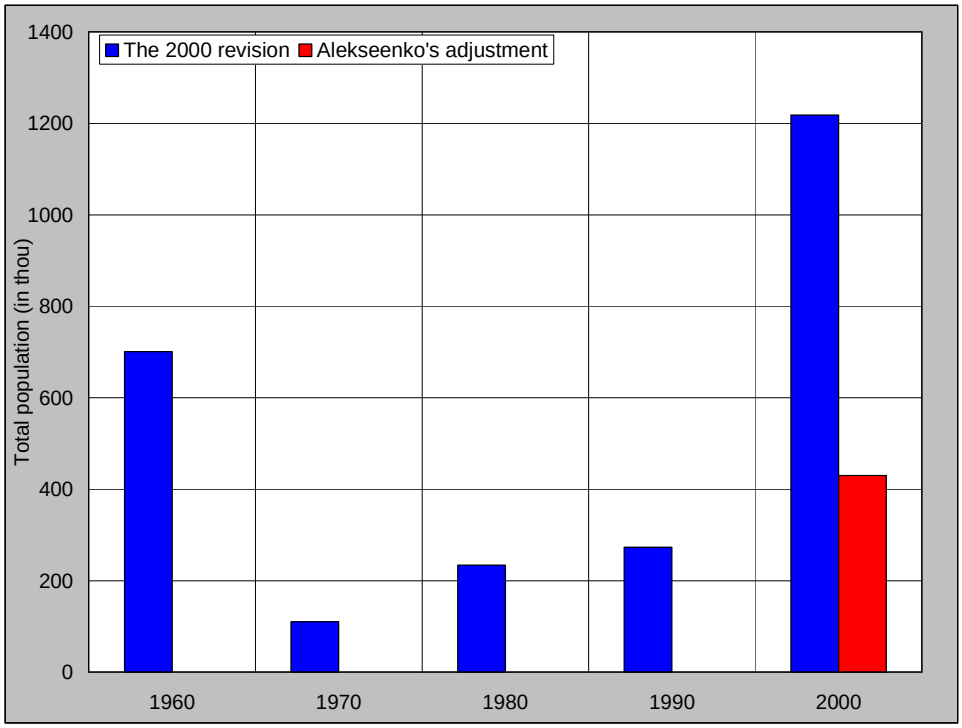
of the total population for 842.1 thousand people. Going back to the big deviation mentioned in the table 16; presented by the UN WPP estimation (corresponding to the 2000) of total population we can re-construct the figure 29 in such way that the difference between the revision 2000 and the estimated total population in 1999 census (16172 - 14954 = 1218 mln. people) can be adjusted in a form:

1)16172 thou. people (the 2000 revision estimation) minus 15795 thou. people (the true total population) gives 377 thousand people, but we have to adjust the 1999 census total population to the 2000 year using the following table 30 below (red colored numbers)

2) 15795 (true total population 1999) + 70162 (natural increase 1999) -123627 (net migration 1999) = 15742 (total population 2000)

3) 16172 (the 2000 revision) – 15742 (total population 2000) = 430 thou. (instead of 1218 mln people).

Fig. 41 - Estimated deviation between UN WPP the revision 2000 and total population in Kazakhstan (2000) by Alekseenko proposal



Source: Difference based on adjusted total population as of in Alekseenko's article: http//www.demoscope.ru/weekly/2002/057/analit04.php

As it seen from the red bar true deviation between the UN WPP the 2000 revision and total population by the adjusted 2000 year total population is not 1218 mln. but 430 thousand people, thus this 430 thousand can be further considered on the subject of reliability of the forecast itself. Taking into account the assumption that the revision 2000 didn't take 1999 census into consideration, we may assume that this 430 thousand people looks reliable and self-confident. Because estimation of total population would be much lower then 16172 mln people, thus error would be even smaller then 430 thousand people.

Therefore we have to conclude there is still problem exists with the national census data in the sense of reliability assessment neither then with the UN WPP forecasting methodology.

Tab. 31 - Estimated demographical indicators according to the Agency of Statistics of the Republic of Kazakhstan, 1990-2009

Demographical indicators	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total mid-year population	16297981	16358222	16451711	16426478	16334865	15956667	15675819	15480635	15188174	14955106
Urban population	9300779	9366910	9403993	9343196	9162543	8884367	8730331	8635249	8499409	8414472
Rural population	6997202	6991312	7047718	7083282	7172322	7072300	6945488	6845386	6688765	6540634
Births in thousands	362081	353174	337612	315482	305624	276125	253175	232356	222380	217578
CBR per 1000 person	22.2	21.5	20.5	19.3	18.9	17.5	16.3	15.2	14.8	14.57
Deaths in thousands	128576	134324	137518	156070	160339	168656	166028	160138	154314	147416
CDR per 1000 person	7.9	8.2	8.4	9.5	9.9	10.7	10.7	10.4	10.2	9.87
Natural increase	233505	218850	200094	159412	145285	107469	87147	72218	68066	70162
Natural increase per 1000	14.3	13.3	12.1	9.8	9	6.8	5.6	4.8	4.6	4.7
Number of marriages	164051	165498	147045	145686	122768	115881	102558	101874	96048	85872
Crude marriage rate	10	10.1	8.9	8.8	7.5	7.3	6.6	6.6	6.4	5.75
Number of divorces	43327	48494	49692	45180	41567	38651	40497	35736	35460	25583
Crude divorce rate	2.7	3	3	2.7	2.6	2.4	2.6	2.3	2.4	1.71
In-flow migration (internal)	637007	602049	522855	458734	397712	376096	290831	242636	269234	273747
Out-flow migration (interna	729579	659735	679116	677759	804391	614591	466369	504024	472273	397374
Net migration in thousands	-92572	-57686	-156261	-219025	-406679	-238495	-175538	-261388	-203039	-123627
Immigrants (international)	179870	170787	161499	111082	70389	71137	53874	38067	40624	41320
Emigrants (international)	272442	228473	317760	330107	477068	309632	229412	299455	243663	164947
International net migration	-92572	-57686	-156261	-219025	-406679	-238495	-175538	-261388	-203039	-123627
Demographical indicators	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Total mid-year population	14901641	14865610	14851059	14866837	14951200	15074767	15219291	15396878	15571506	15776492
Urban population	8397566	8413399	8429331	8457152	8518242	8614651	8696520	8833249	8265935	8395108
Rural population	6504075	6452211	6421728	6409685	6432958	6460116	6522771	6563629	7305571	7381384
Births in thousands	222054	221487	227171	247946	273028	278977	301756	321963	356575	357552
CBR per 1000 person	14.9	14.9	15.3	16.63	18.19	18.42	19.71	20.79	22.75	22.45
Deaths in thousands	149778	147876	149381	155277	152250	157121	157210	158297	152706	142780
CDR per 1000 person	10.1	10	10.1	10.41	10.14	10.37	10.27	10.22	9.74	8.97
Natural increase	72276	73611	77790	92669	120778	121856	144546	163666	203869	214772
Natural increase per 1000	4.9	5	5.2	6.22	8.05	8.05	9.44	10.57	13.01	13.48
Number of marriages	90873	92852	98986	110414	114685	123045	137204	146379	135280	140785
Crude marriage rate	6.1	6.3	6.7	7.41	7.64	8.12	8.96	9.45	8.63	9
Number of divorces	27391	29599	31236	31717	31492	32377	35834	36107	35852	39466
Crude divorce rate	1.8	2	2.1	2.13	2.1	2.14	2.34	2.33	2.29	2.48
In-flow migration (internal)	324141	325276	327303	357342	386247	373434	361788	365137	390777	406251
Out-flow migration (interna	432448	413438	389315	365648	383458	350766	328747	354175	389660	398749
Net migration in thousands	-108307	-88162	-62012	-8306	2789	22668	33041	10962	1117	7502
Immigrants (international)	47442	53548	58211	65584	68319	74807	66731	53397	46404	41485
Emigrants (international)	155749	141710	120223	73890	65530	52139	33690	42435	45287	33983
International net migration	-108307	-88162	-62012	-8306	2789	22668	33041	10962	1117	7502

Source: Agency of Statistics of the Republic of Kazakhstan/http://www.stat.kz/digital/naselsenie/Pages/default.aspx

The 2009 census also was problematic while the 1999 census had two main problems: 1) underestimation of total population and 2) overestimation of Kazakhs; The 2009 census faced much more problems related to the organizational arrangements, lack of personnel carrying the census (planned 65000 respondents), “furtum” of national budget which led to big corruption scandal and unplanned migration of Head of Agency of Statistics office abroad, existed duplicities and missing values or so called “dead souls” were not eliminated and sometimes were counted on purpose (Tatimov, Central Asia Monitor, 2010). But the main and probably the most unsolved problem is the situation with the non-Kazakh ethnicities. Their rapid decrease is usually explained by migration out-flow or excessive mortality levels. But based on data

we presented in previous chapters we must say that the migration potential already decreased to the insufficient level to impact in such volume. So, such "irregularity" has to be explained with some other reasons. Last 2009 census retrieved another explanation of rapid decrease in non-Kazakh ethnicities. And it is more "prosaic" than the mentioned possible reasons; it is changes in national identification: Germans, Ukrainians, Belarusians, etc. were recorded as Russians and Russians were recorded as other European looking ethnicities. Because relative correction of Russians by -2 per cent proves such statement (relative correction here means the correction of nationality due to misprint, errors occurred during the census - author's note). Sharp fall in other ethnicities and relatively stable number of Russians (decrease due to natural decline mostly, the lowest life expectancy among the ethnicities, the highest men mortality due to the circulatory and external-alcohol-related causes of death 6.2% decrease) give us the chance to assume that number of so called "Russians" was "refilled" from the other European ethnicities.

The basic results of the 2009 census are published; however, the detailed demographic indicators are forthcoming. Herein some basic indicators are presented.

Tab. 32 – Basic results of 2009 census in Kazakhstan

	Men	Women	Males per 1000 females	Absolute increase	Relative increase	Men	Women
Total population	7722.8	8282	932	1022.9	6.8%	48.3	51.7
Urban population	4050.9	4588.2	883	195.1	2.3%	46.9	53.1
Rural population	3671.9	3693.8	994	827.8	12.7%	49.9	50.1

Source: Agency of Statistics of the Republic of Kazakhstan, 2009 preliminary census results

However, even detailed demographic indicators will be released there are many abuses of regulation occurred during the 2009 census. Therefore, as Tatimov said, this census may be not the true situation in Kazakhstan but the wrecked mirror. So concluding these two censuses we must say that reliability assessment of the UN forecast results already doubted in the context of initial data.

Reliability of the forecast of the UN WPP itself can be judged from the point of variation. More variants are carried more chances that one of them would turn into the reality. For instance, mentioned in table 2 variants of projections by the most recent 2008 revision uses eight variants of projections by fertility, mortality and migration. Each of the components has another eight assumptions underlying each of them. So higher frequency of the projections higher probability they occur. Presented above results by components and principal results are evidence of such variation.

Chapter 8

Conclusion

To see clearly and yet not to despair, that my friend, is what is fitting to our years (Stephan Sweig)

An attempt to snap shot the changing picture of the population development within a century interval was carried during this thesis. Determined research goal and its objectives, related questions were used as the red-line crossing throughout the work aiming to provide better understanding of the complex view on the population development and its estimation and forecasting results produced by the United Nations World Population Prospects.

A complexity of the task in this thesis was that transformation period disrupted the normal mechanisms of population development and thus, did not let for forecasters to see the tendencies which might occur or have changed due that very turbulence period. An interesting thing is that the United Nations forecasting is lonely "reasonable source" for forecasting the population development in Kazakhstan today.

In this regards, we have to conclude, that Kazakhstan's statistics has many things to do within these upcoming decades, due to improvement of the registration system: re-arranging the database, paying much more attention to details of monitoring, execution and publishing "user-friendly" materials. Getting rid of the "infant diseases" like "budget furtum", "playing with numbers" and finally establishing the truly first School of Forecasting under aegis of the auditing and monitoring the future population development organ which would unite high-skilled staff with multi-disciplinary background. However, all mentioned here a general suggestion has to be taken into account with the respect to the United Nations World Population Prospects and their standard input-output parameters to establish really comprehensive and well-organized statistics. Thus, we have reached the point when retrieving the summary of the characteristics would be necessary for further discussion.

An identification of the retrospective factors influenced on the population development in the process of declining overall fertility from levels of 4.4 children per woman (1950-1955) within next fifty years brought level of TFR to 2.0 children per woman (1995-2000) and clearly signaled that Kazakhstan is approaching the benchmark of the replacement level of fertility (2.1 children per woman) and further

development may face TFR close to 1.85 children per woman as assumed by medium variant of the 2008 revision for the terminal period 2045-2050. Despite the fact, that undoubtedly temporary increase of fertility has occurred (in 2000 TFR was equal to 1.85, in 2005 TFR was equal 2.22, in 2007 reached to 2.46 live births per woman as officially reported by the Agency of Statistics of the Republic of Kazakhstan). This is due to the combined effect of realized postponed earlier parenthood 1990's namely by those who were born during 1970's and intensive fertility among cohorts of women born predominantly during 1980's.

Reproductive role of fertility has changed in a similar way when crude births rate value has fallen from 33.2 births per 1000 population in 1950-1955 up to the 16.2 births per 1000 population in 1995-2000, and is projected to decrease to 12.5 births per 1000 population at the horizon period 2045-2050 according to the same medium variant. The resulting consequence of occurred changes is illustrated by decreasing the total number of live births from 335,000 in 1990-1995 up to 222,000 in 2045-2050. Population growth rate reaches such a few level of increase when it almost has no effect on population development (expected annual growth rate is at the level of 0.05% in 2045-2050).

Regarding the mortality development, we could say that crude deaths rate controversially to crude births rate is expected to remain on same or at about same levels in 2045-2050 (10.8 deaths per 1000 population) as it was in 1950-1955 (14.4 deaths per 1000 population), regardless expected decrease of overall mortality development. It is simply the result of population ageing when proportion of those exposed to higher risk of death is growing. From the same reason the total numbers of deaths are expected to increase from 105,000 for both sexes combined in 1950-1955 up to 193,000 thousand in 2045-2050. While infant mortality rates vise versa were and likely will be significantly downwarded (110 deaths per 1000 live births in 1950-1955 compared to assumed 10.5 deaths per 1000 live births in 2045-2050) mostly due to improvements in medical and social care, obstetrical services and neonatal and post-neonatal care. Life expectancy should rise for males up to 71.0 and for females up to 79.2 years correspondingly in the projection horizon. While gap between sexes would narrow till the 8.2 years (UN WPP the 2008 revision). And this is response to the assumed improvements of socio-economical situation in general and living standards in particular.

The decisive role of migration component which was affecting equally to the population development as the remaining two components: mortality and fertility during the transition period would start to decrease in forming the vector of population development in mid-term and long-term perspectives. The negative net migration at the level of 20 thousand people annually assumed for the bigger part of the projection period would hardly allow maintaining a little population growth until the end of the projection period. It is likely that outflow potential would be gone by that time and will have only limited impact on the situation with population change. Improved socio-economical factors would not "push-out" people away from the country but attract some labour force immigrants to the country initiating the integration of a higher number of foreigners (possibly from China, Uzbekistan, Iran, Afghanistan, India, Pakistan, South-Asian countries with different cultures). Thus, 20 thousand of negative net migrants could be less or even do away with the reality.

All expected components of development described above will accelerate ageing process and influence substantially to the changing age and sex composition of population through the socio-economic situation within the country. This process, which is generally irrevocable, cannot be ceased only alleviated. The expected demographic development will bring several remarkable changes into question.

- Will Kazakhstan by the 2050 be ready to the situation when at about two persons of working age will need to support one retiree and one infant-adolescence person?
- Will Kazakhstan society be prepared for the increase of the share of older and "oldest-old" people with the respect to the pay-as-you-go pension system which might not be sustainable for such increasing pressure?

Answers or better say solutions to the mentioned above remarkable questions will be directly dependant on which population development route Kazakhstan would choose. It can be assumed that starting from middle period of projection (2015-2030) population growth dynamics will start to cease. The evidence of that quinquennial population growth which would not exceed 200 thousand people after 2015-2020 was discussed in the part devoted to the projections results of total population.

Today it is very hard to say at which level and to want extent the cease of growth will occur, the "uncertainty cloud" increases as the projected horizon increase. Moreover, retrieved facts of statistical errors due to the different mentioned above reasons do not let to carry a reasonable forecasting based on the input parameters of national data gained by two decennial censuses which once again retrieved unpleasant facts imprinted on the level of trust to the gathered data as the variables for a prospective modeling. Confrontation between the produced results the United Nations World Population Prospects and presented national data retrieved the fact that basically, none of the produced forecasting results between the 1992 and 2008 revisions could be judged positively on the basis of conducted census results. "Errored" inputs can not bring better outputs. Adding to natural uncertainty underlined by past two decades of sweeping changes of all components of population development we cannot reach anything other than the forecast uncertainty well illustrated by the results corresponding to the high and medium scenarios of total population growth. They are characterized by high disparity, so high that it is easier to speak about an unconfidence rather than on confidence. While medium variant of the forecast expects at about **17,848** thou. people, high variant displays **20,744** thou. people, and low variant only **15,295** thou. inhabitants in the year 2045-2050. This is the sign of the unconfidence where "conditional" numbers are varied among each other for a dozens of per cent.

Interdisciplinary relations with economy and geopolitics also helped in great extent to consider possible changes in socio-economic and political spheres. Geopolitics and economy goes along with the demographic knowledge implied.

The main feature that really makes Kazakhstan different from the other countries is that we have been tracing evolution of first demographic transition with fast pace of change in all components of population development and that was accompanied by painful transformation period, which none of the Post-Soviet Union countries experienced in such volume. Kazakhstan's relatively small population with

shattered age and sex composition will be very sensitive within the projected forty or fifty years to internal and external influences such as in-flow of “potential settlers” in the context of population density danger from neighborhood (China, Uzbekistan, Pakistan etc.), rapid change in fertile and marital behavior accompanied by stagnating mortality could possibly shake the mechanisms of positive population development.

Not only the changing view on population development itself but also the changing view on this phenomenon is a very important matter which is formed not by one day; it is long-time activity where internal deviations within the UN WPP were clearly evident. Deviations among the UN WPP revisions raised another very important question – evaluation of the inputs for the projection model. As we mentioned above initially input parameters are doubted so what to do further? What kind of future prospects could be possibly formulated here after enlightening such issues? Raising such questions would be logical response to the suggested facts during the thesis. However, to cope with the situation and form reasonable perspectives on mid and long-term time period a staff with multidisciplinary background is requested, the new approaches to evaluation of the population, family, social, economic and migration policies impact will be required as well. Moreover, we could possibly speak about new population counting necessity as soon as possible due to the critical remarks done on the addresses of 1999 and 2009 censuses. Thus, we have little time for seeking optimal solutions for our country; however their application should start as soon as possible.

In parallel, till now the manner in which journalists and laymen reacts to the current situation in Kazakhstan shows that even now population matters are ill understood by general public and press, especially when such issues reach a certain level of complexity. The need for more efforts to educate the public in this area shall be clearly recognized. Referring also to this need this work attempts to explain in comprehensive terms some basic facts about future development of Kazakhstan by presenting published trends in population based on retrospective and perspective analysis of most involved elements. At the risk of seeming pedantic, we have made some incursions into interdisciplinary fields of knowledge on population development.

We feel that an attempt by alarming interested public in this problem was done right, a considerable effort to give truly objective account on the processes which shaped the country in the past, currently is undergoing principal changes and will be principally decisive in the future.

References

Alekseenko, A. (2002). About some census results: Demoscop Weekly [Electronic resource]. http://www.demoscope.ru/weekly/2002/057/analit04.php

Andeson, D., Silver J., Ksenafontova E. (1986). Methods of estimating infant mortality rate: specificities and consequences. Epidemiological journal review, chapter 6, pp 32-40.

Ascher, W. (1978). Forecasting: an Appraisal for Policymakers and Planners. Johns Hopkins University Press, London.

Becker, C. M., Urzhumova, D. S: (2004, 2005). Mortality recovery and stabilization in Kazakhstan 1991-2001. Economics and Human Biology 3. pp. 97–122.

Bloom, D.E., Canning, D. (2003). Health, Wealth, Welfare. Finance and Development. London.

Bonhomme, J. (2009). The gender longevity gap. Journal of medical health Vol. 6, No. 3, pp. 151–154.

Bourgeois-Pichat J. (1979). Future outlook for mortality decline in the world. Prospects of Population: Methodology and assumptions: Papers of the Ad Hoc Group of experts on demographic projections, United Nations, 1977. pages 227-267

Brass, W. (1979). Note on how to improve the United Nations Population projections. Prospects of Population: Methodology and assumptions: Papers of the Ad Hoc Group of experts on demographic projections, United Nations, 1977. pages 100-107

Brass, W. (1981). Perspectives in population prediction: illustrated by statistics of England and Wales. Journal of Royal Statistical Society, Series A (General), vol. 137, part 4, page 547.

Burcin, B. (2002). Population development in the Czech Republic 1990-2002. Czech Republic Population Information. Working papers. Prague. [Electronic resource]. http://popin.natur.cuni.cz/html2/publications/papers/popdev02cz_en/mortality.pdf

Burcin, B., Kucera, M. (eds.2002): Czech Republic Population Development Forecast until 2050. Population Development in the Czech Republic 2002

Coleman, D. (2008). Migration-the new engine of demographic and social change in Population. “Hommage à Gérard Calot, Profession: Démographe” edited by Patrick Festy and Jean-Paul Sardon. Paris, INED pp 331 - 365.

Database of the Agency of Statistics of the Republic of Kazakhstan (1999). [Electronic resource]. http://www.stat.kz/Pages/default.aspx

Demeny, P. (1984). A perspective on long-term population growth. Population and Development Review, Vol. 10, 103-126

George, K. Zipf (1949). Human Behavior and the Principle of Least-Effort: Addison-Wesley press.

Howell, N. (1976). The demographic evolution of human populations. London.

Huntoon, L. (1998). Immigration to Spain: Implications for a Unified European Union Immigration Policy. International Migration Review, Vol. 32, No. 2, pp. 423-450 doi:10.2307/2547190;

Ivanets, N, Lukomskaya, I. (1990). The USSR's new alcohol policy. Paper presented at World Health Forum, Vol. 11.

Keilman, N. (1990). Uncertainty in National Population Forecasting: Issues, Backgrounds, Analyses, Recommendations. Swets & Zeitlinger. Amsterdam

Keilman, N. (2002). Why population forecasts should be probabilistic illustrated by the case of Norway up to 2050. Demographic research, volume 6, article 15.

Keilman, N., Kucera, T. (1990). The impact of forecasting methodology on the accuracy of national population forecasts: Evidence from the Netherlands and Czechoslovakia Journal of Forecasting, Volume 10 Issue 4, Pages 371–398 Published Online: 2 Nov 2006

Keyfitz, N. (1972). On future population. Journal of the American Statistical Association, Vol. 67, No. 338, 347-363

Keyfitz, N. (1979). Long-range projections: models, pitfalls, possible break-throughs. Prospects of Population: Methodology and assumptions. Papers of the Ad Hoc Group of experts on demographic projections, United Nations, 1977. pages 107-122

Keyfitz, N. (1981). The Limits of Population Forecasting: Population and Development Review 7, 579-593.

Keyfitz, N. (1983). Can knowledge improve forecasts: International Institute for Applied Systems Analysis, Research Report, RR-83-05. Laxenburg, Austria.

Lee, E.S (1966). A Theory of Migration. University of Pennsylvania.

Lee, R.D. (1979). New methods for forecasting fertility: an overview. Prospects of Population: Methodology and assumptions: Papers of the Ad Hoc Group of experts on demographic projections, United Nations, 1977. pages 215-227

Leloup, X. (1996). Migration, a complex phenomenon. International Journal Anthropology, Vol. II, N. 2-4, pages 101-115.

Morgan, D, Schuster, T, Butler, E. (1991). Role reversals in the exchange of social support. Journal of Gerontology, Vol. 46, № 5, pp. 278-287, Washington, 1991. Saad, P. (2001). Support transfers between elderly parents and adult children in two Brazilian settings Conference Papers presented at General Population Conference, Brazil, 2001.

Musabek, E. (2000). Demographical and migratory processes: Demographical forecast. Narodonaselenye Kazaxstana. pp.54-55.

Musabek, E, Skokbayeva, M. (1999). Preliminary results of first national census of the Republic of Kazakhstan: Detailed demographic parameters of Kazakhstan, Tajikistan and Turkmenistan.

Nazarbayev, N. (2008). The way of Kazakhstan. Stacey International Publishers.

Neil, C., Brickman, M. (2001). A Guide to Global Population Projections. Max-Planck-Gesellschaft.

Notestein, F.W. (1945). Population-The Long View in Food for the World. (ed.). T.W. Schultz Chicago: University of Chicago Press: 39-40.

Omran, A. (1971). Epidemiological transition: Theory and facts with focus on south India". Page 10.

Overbeek, J. (1976). The population challenge. pp.51-52, London, Greenwood press.

Philipov, D. (1999). Tempo effects in the fertility decline in Eastern Europe: Evidence from Bulgaria, the Czech Republic, Hungary, Poland and Russia. Max Planck Institute for Demographic Research; Working paper, MPIDR WP 1999-008.

Philips P.M. (1998). Dispatches from the Revolution - Russia 1916-1918, Duke University Press, Durham 1998, pages 63-64

Preston, S.H. (1984). Children and elderly: divergent paths for America's dependants. Demography, Vol. 21, № 4, pp. 435-457, Washington.

Rodrigue, J.-P., Comtois, C., Slack, B. (2009). The Geography of Transport Systems. London, New York: Routledge. ISBN 0-415-88324-7

Rychtarikova, J. (2009). Population development in the Czech Republic 2007. Prague. Page 42.

Shkolnikov, V. M., David, A Leon, D. A. (2006). The health crisis in the USSR a sustainable mortality reversal in the post-Soviet space during communism and after. International Journal of Epidemiology. 35:1406–1409, Oxford University Press.

Shryock, H., Siegel J. (1976). Methods and Materials of Demography", Academic Press, Orlando.

Stouffer. (1940). Theory of intervening opportunities. American Sociological Review, p.846.

Tatimov, M. We don't want to get a wrecked mirror: comments on the 2009 census results. Central Asia Monitor. [Electronic resource]. http://www.camonitor.com/index.php?module=news&nid=358

The Agency of Statistics of the Republic of Kazakhstan (1999). The 1999 National census results [Electronic resource]. http://www.stat.kz/Pages/default.aspx

The Agency of Statistics of the Republic of Kazakhstan (2009). The 2009 National census results [Electronic resource]. http://www.stat.kz/Pages/default.aspx

The Ministry of Labor and Social Protection of the Republic of Kazakhstan (2007). Concept of migration policy of the Republic of Kazakhstan for the 2007-2015 years. [Electronic resource].http://www.enbek.gov.kz/law/lawdetail.php?recordID=364

The United Nations publication. (1969). Methodology and evaluation of population registers and similar systems, chapter 5, pp. 42-44

The United Nations publication. (1970). Manual III: Methods for Population Projections by Sex and Age United Nations Publication, N. 56, XIII.3, pp. 70-81.

The United Nations World Population Prospects the 2004 revision: Volume III, Analytical report. Page 83. New York. United Nations. 2006.

The United Nations World Population Prospects, the 1992 revision: Volume I, Comprehensive tables. New York. United Nations. 1993.

The United Nations World Population Prospects, the 1994 revision: Volume I, Comprehensive tables. Page 177. New York. United Nations. 1995.

The United Nations World Population Prospects, the 1994 revision: Volume I, Comprehensive tables. Page 21. New York. United Nations. 1995.

The United Nations World Population Prospects, the 1994 revision: Volume I, Comprehensive tables. Page 25. New York. United Nations. 1995.

The United Nations World Population Prospects, the 1994 revision: Volume I, Comprehensive tables. Page 30. New York. United Nations. 1995.

The United Nations World Population Prospects, the 1996 revision: Volume I, Comprehensive tables. Page 192. New York. United Nations. 1997.

The United Nations World Population Prospects, the 2004 revision: Volume III, Analytical report. Page 31. New York. United Nations. 2006.

The United Nations World Population Prospects, the 2004 revision: Volume III, Analytical report. Page 5. New York. United Nations. 2006

The United Nations World Population Prospects, the 2008 revision Population Database. [Electronic version]. http://esa.un.org/unpp/index.asp?panel=2

The USSR State Committee on Statistics (1990). The 1989 All Soviet Union census results. [Electronic resource]. http://ru.wikipedia.org/wiki/Перепись_населения_СССР_(1989)

Tobler, W. (1966). Migration, Ravenstein, Thorntwaite and Beyond. London.

Vano, B., Jurcova, D. (2002). Population projection of Slovakia until 2050.Infostat.Demographic research centre. Bratislava.

Verdiyeva, N. (2009). Population forecast for the Republic of Azerbaijan for the period 2009-2050. [MA thesis]. P. 60, Charles University in Prague.

Wander, H. (1979). Future prospects of magnitude and trends of international migration. Prospects of Population: Methodology and assumptions: Papers of the Ad Hoc Group of experts on demographic projections, United Nations, 1977. pages 278-288

Ward, R.H., Weiss, K. M. (1976). The demographic evolution of human populations. London, Page 7.

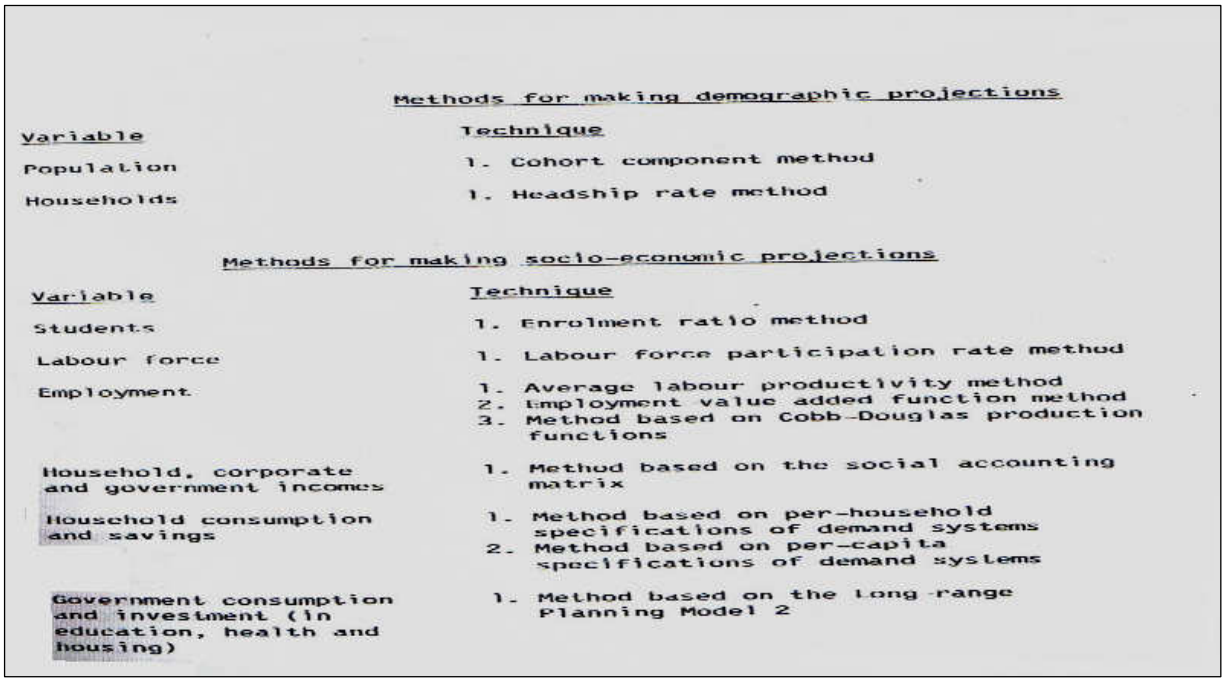
Zelinsky. (1971). Mobility transition (test of Zelinsky's theory) and economic and demographic factors: Japan and Turkey 1955-2000, conference papers.

Appendices

List of appendices

Annex 1

Projection techniques for integrating population variables in comprehensive planning



Methods for making demographic projections

Variable	Technique
Population	1. Cohort component method
Households	1. Headship rate method

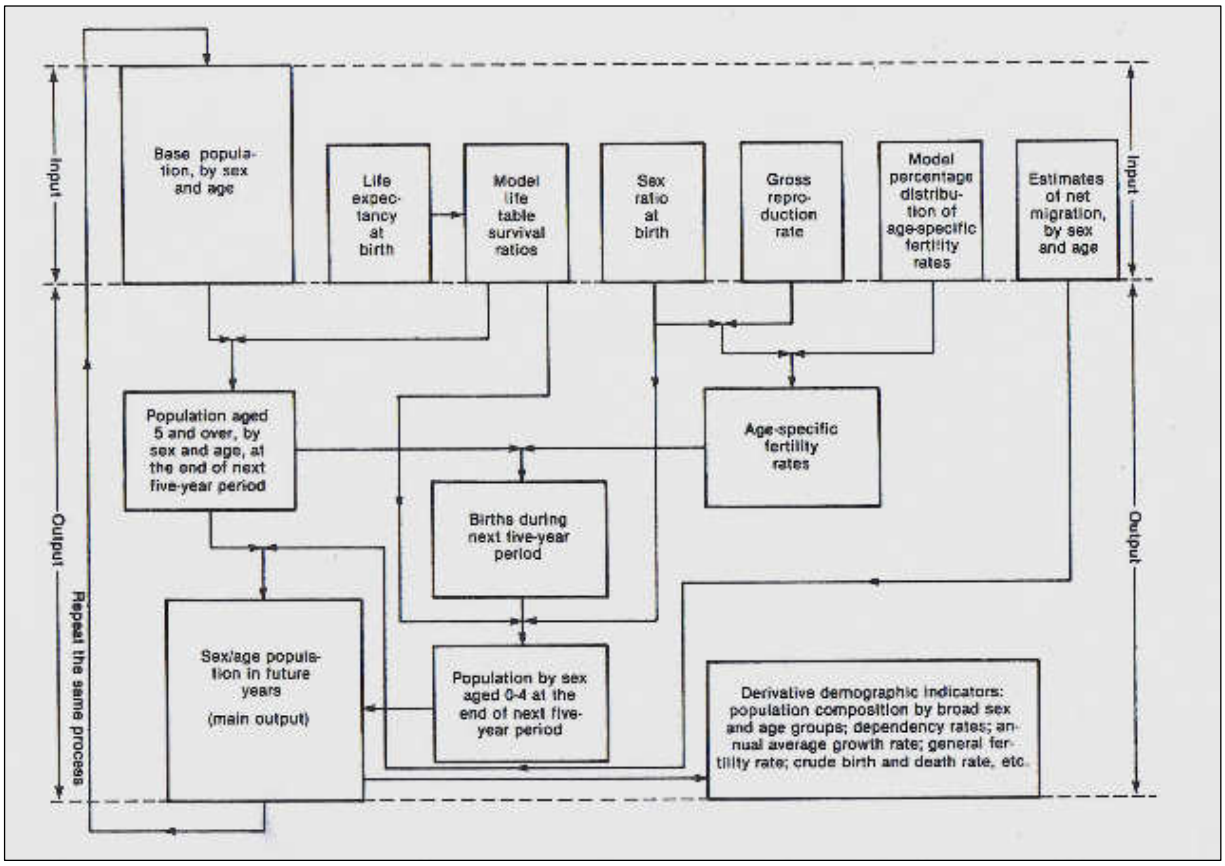
Methods for making socio-economic projections

Variable	Technique
Students	1. Enrolment ratio method
Labour force	1. Labour force participation rate method
Employment	1. Average labour productivity method 2. Employment value added function method 3. Method based on Cobb-Douglas production functions
Household, corporate and government incomes	1. Method based on the social accounting matrix
Household consumption and savings	1. Method based on per-household specifications of demand systems 2. Method based on per-capita specifications of demand systems
Government consumption and investment (in education, health and housing)	1. Method based on the long-range Planning Model 2

Source: Manuals on Method of estimating population

Annex 2

Basic steps involved in preparing the United Nations Population Projections



Source: Manuals on Method of estimating population

Annex 3

Inputs for applying the cohort component method

Box 16

Inputs for applying the cohort component method

1. Initial age and sex structure of the population (national or urban and rural)

2. Assumptions on mortality (national or urban and rural):

   Survival ratios by age and sex; or

   Expectations of life at birth by sex; or

   Infant mortality rates by sex and
   Expectations of life at age 5 by sex

3. Assumptions on fertility (national or urban and rural):

   Fertility rates by age; or

   Total fertility rates and
   Proportionate fertility rates by age

4. Assumptions on international migration (national or urban and rural; if population is open to international migration):

   Net international migration rates by age and sex; or

   Total net international migration rates by sex and
   Proportionate net international migration rates by age, by sex;
   or

   Net change to the population due to international migration by
   age and sex

5. Assumptions on internal migration (for urban or rural population; if urban and rural populations are being projected):

   Net internal (urban-rural) migration rates by age and sex; or

   Total net internal (urban-rural) migration rates by sex and
   Proportionate net internal (urban-rural) migration rates by age,
   by sex; or

   Net change to the population due to internal (urban-rural)
   migration by age and sex

Source: Manuals on Method of estimating population

Annex 4

Outputs of the cohort component method

Box 17

Outputs of the cohort component method

1. Age and sex structure of the population (national or urban, rural and national)

2. Population aggregates (national or urban, rural and national):

   Population size
   Population in selected broad age groups
   Mid-interval population size
   Number of person-years-lived
   Population growth
   Births
   Deaths
   Net change due to migration (international, internal and/or combined international and internal)

3. Indicators of the population structure (national or urban, rural and national):

   Proportions by broad age groups
   Dependency ratios
   Median age of the population
   Proportion of women in childbearing ages
   Sex ratio of the population

4. Indicators of the population distribution (national; if urban and rural populations are being projected):

   Proportion urban
   Proportion rural

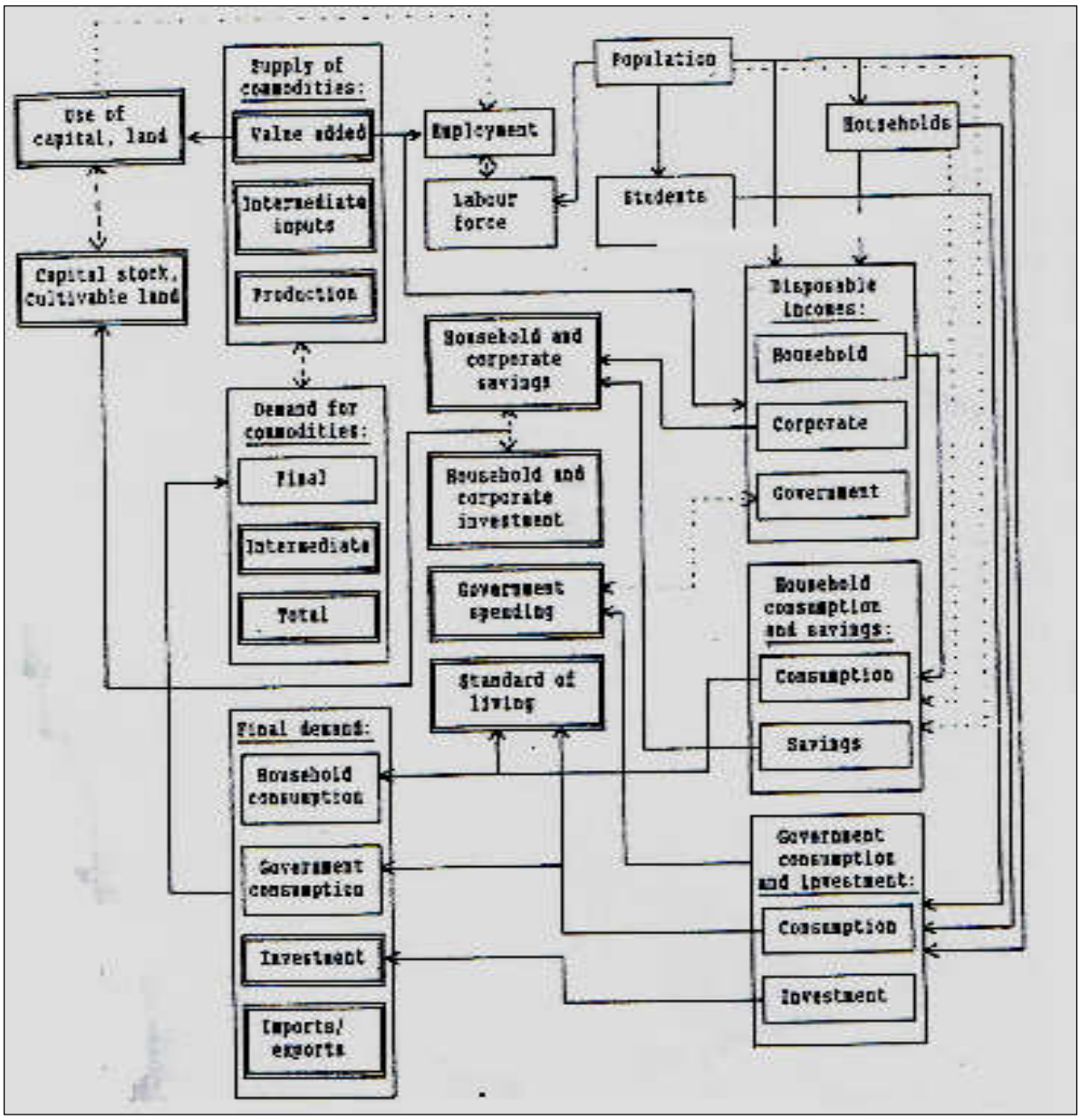
5. Rates of population change (national or urban, rural and national):

   Crude birth rate
   Crude death rate
   Rate of natural increase
   Crude net migration rates (international, internal and/or combined international and internal)
   Rate of population growth

Source: Manuals on Method of estimating population

Annex 5

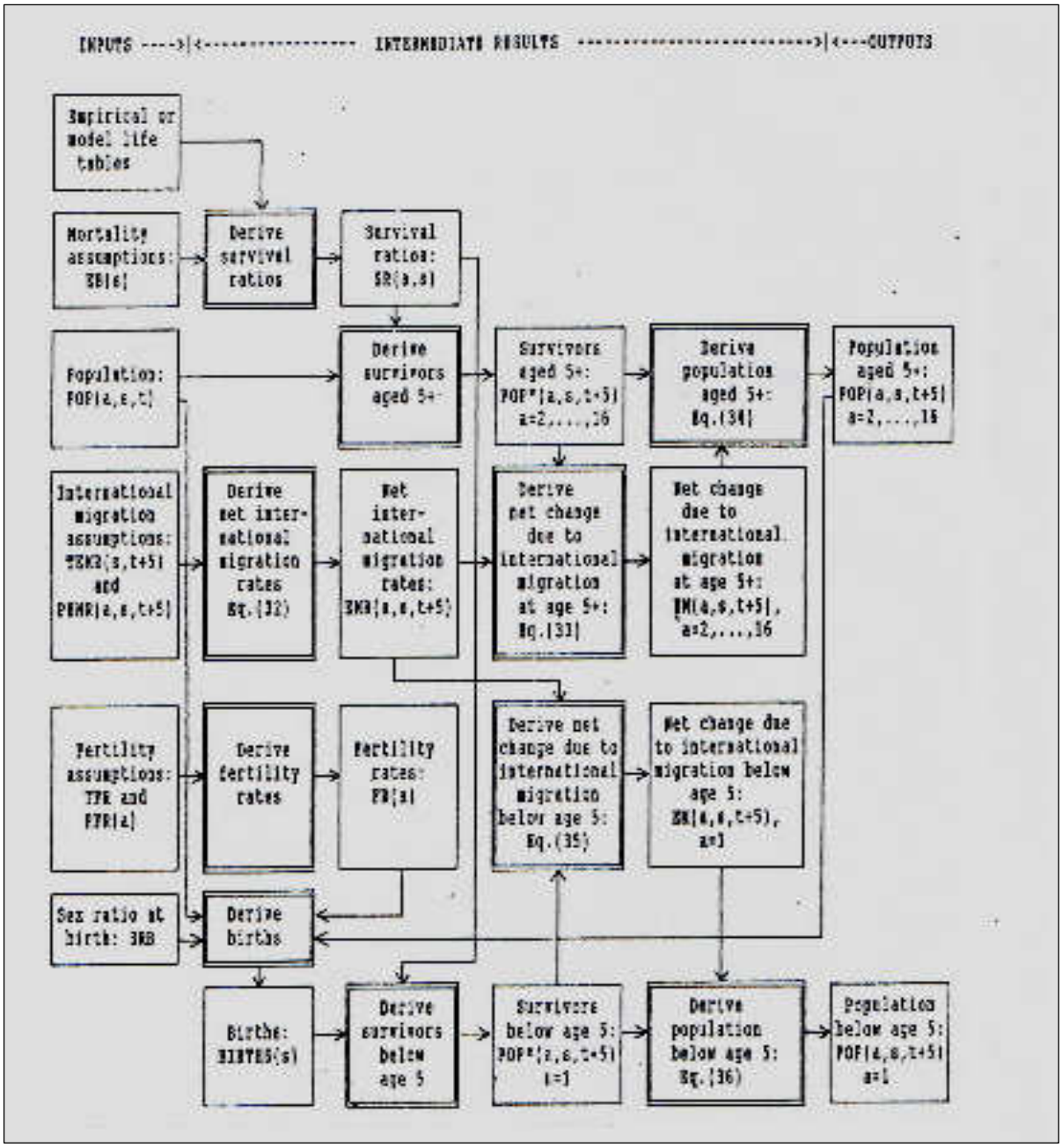
Projections of socio-economic and demographic variables in comprehensive development planning



Source: Manuals on Method of estimating population

Annex 6

Steps to derive age and sex structure of the national population open to international migration at the end of projection interval t to t + 5



Source: Manual IV: Methods of measuring Internal and International migration, UN, 1970.

Annex 7

Oil and gas transportation map of Kazakhstan, 2008 in the context of geopolitical balance with neighboring countries and possible movement of people along the energetic routes

Source: http://www.wild-natures.com/photo056.html

Annex 8

Brief summary of demographic indicators according to the United Nations World Population Prospects the 2008 revision

Components of development	Beginning of study	Transformation period		End of study	Index		
	1950-1955	1990-1995	1995-2000	2045-2050	1990-1995/ 1950-1955	1995-2000/ 1950-1955	2045-2050/ 1950-1955
Fertility							
Total number of live births (in thou)	244	335	251	222	137	103	91
Crude Birth Rate (per 1000 population)	33.2	20.6	16.2	12.5	62	49	38
Total Fertility Rate (children per woman)	4.4	2.5	2.0	1.85	57	45	42
Population change (in thou)	258	-121	-194	9	-47	-75	3
Population growth rate in percentage	3.5	-0.75	-1.26	0.05	-21	-36	1
Net Reproduction Rate (daughters per woman)	1.90	1.15	0.91	0.88	61	48	46
Percentage of women aged 15-49 (in percentage)	50.2	49.7	52	44.1	99	104	88
Population sex ratio (males per 100 females)	93.4	93.7	92.8	91.4	100	99	98
Mortality							
Deaths both sexes combined (in thou)	105	154	180	193	147	171	184
Males (in thou)	63	82	100	94	130	159	149
Females (in thou)	42	72	80	98	171	190	233
Crude Death Rate (per 1000 population)	14.4	9.5	11.7	10.8	66	81	75
Life expectancy at birth both sexes (years)	55.0	65.5	63.0	75.3	119	115	137
Males (years)	50.2	60.5	57.5	71.0	121	115	141
Females (years)	60.6	70.3	68.9	79.2	116	114	131
Infant mortality rate (per 1000 live births)	110	51	43.4	10.5	46	39	10
Migration							
Net migration both sexes (in thou)	119	-302	-264	-20	-254	-222	-17
Net migration rate (per 1000 population)	16.2	-18.6	-17.1	-1.1	-115	-106	-7
Age and sex composition							
Total number of population (in thou)	7348	16228	15442	17825	221	210	243
Males (in thou)	3549	7850	7434	8509	221	209	240
Females (in thou)	3799	8379	8008	9316	221	211	245
Aged 0-4 (in percentage)	12.4	10.3	8.4	6.3	83	67	51
Aged 5-14 (in percentage)	20.6	20.4	20.4	12.9	99	99	62
Aged 15-24 (in percentage)	20.35	17.0	17.6	12.5	83	86	61
Aged over 65 (in percentage)	6.5	6.6	7.0	14.8	101	108	228
Aged over 80 (in percentage)	0.8	1.2	1.2	3.3	150	144	406
Median age (years)	23.3	26.5	27.4	37.7	114	118	162
Population density (population per sq. km)	3	6	6	7	200	200	233

Source: Based on data of the UN WPP the 2008 revision.