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Tempo and quantum of population ageing in the world: development opportunities and challenges

Dynamika a rozsah populačního stárnutí ve světě: rozvojové příležitosti a problémy

Master Thesis

Supervisor: RNDr. Tomáš Kučera, CSc.

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I declare that this thesis is my own work under the supervision of RNDr. Tomáš Kučera, CSc. Where other sources of information have been used, they have been acknowledged.

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Tempo and quantum of population ageing in the world: development opportunities and challenges

Abstract

This diploma thesis aims to identify and describe the differentiation of the scale and dynamics of the ageing process in the world at sub-regional level and to develop a typology of those sub-regions and selected countries in terms of mentioned characteristics of population ageing. Furthermore, relatively homogenous groups of countries have been distinguished based on the cluster analysis of social conditions in the context of ageing in order to access their readiness to face further development of the phenomenon. Major development opportunities and imminent challenges associated with population ageing have been evaluated in the end. The results show that the timing and extent of age structure changes are very closely related. Countries that have undergone longer demographic transitions experienced longer demographic windows of opportunity that allowed them to reap the benefits of demographic dividends and to develop better social conditions as a result. Rapidly ageing societies from developing regions, on the contrary, have less time and resources to counteract the challenges resulting from the demographic changes where timely measures and policies have to be prioritized by policymakers.

Keywords: population ageing, world, tempo, quantum, demographic transition, development, opportunities, challenges

Dynamika a rozsah populačního stárnutí ve světě: rozvojové příležitosti a problémy

Abstrakt

Tato diplomová práce si klade za cíl identifikovat a popsat rozdílnost rozsahu a dynamiky procesu stárnutí ve světě na sub-regionální úrovni a rozvinout typologii těchto oblastí z hlediska vybraných charakteristik stárnutí populace. Dále byly v souvislosti s fenoménem procesem stárnutím rozlišeny relativně homogenní skupiny zemí na základě shlukové analýzy sociálních podmínek, tak aby mohly být zhodnoceny. Na závěr byly vyhodnoceny hlavní rozvojové příležitosti a bezprostřední úkoly spojené se stárnutím populace. Výsledky ukazují, že načasování a rozsah změn věkové struktury spolu velmi těsně souvisí. Zemím, které již prošly demografickým přechodem, se otevřely příležitosti, které jim umožnily těžit z výhod demografických dividend a vytvářet lepší sociální podmínky. Rychle stárnoucí společnosti v rozvíjejících se regionech, mají naopak méně času a zdrojů, aby čelily výzvám vyplývajícím z demografických změn. Proto jen správné politiky a včasná opatření mohou přinést dobré výsledky.

Klíčová slova: populační stárnutí, svět, dynamika, rozsah, demografický přechod, rozvoj, příležitosti, problémy

CONTENTS

LIST OF ABBREVIATIONS

CBR	Crude birth rate
CDR	Crude death rate
DTM	Demographic transition model
GDP	Gross Domestic Product
ILO	International Labor Organization
ISSA	International Social Security Association
LFPR	Labor force participation rate
NCD	Noncommunicable disease
NIR	Natural increase rate
OECD	Organization for Economic Co-operation and Development
PAYG	Pay-as-you-go system
TFR	Total fertility rate
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
USD	United States Dollar
WHO	World Health Organization

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Chapter 1

Introduction

"*Old age hath yet his honour and his toil*"
Alfred Lord Tennyson, Ulysses

1.1 Problem definition and relevance of the research

Population ageing is in the first place a demographic phenomenon but it has become a significant social, health and economic subject as a result of its consequences and ubiquity.

"We are ageing – not just as individuals or communities but as a world." (National Institute of Aging and U.S. Department of State 2007:4). The process of population ageing being the direct outcome of the demographic transition is also expected to eventually affect all of the countries worldwide. The extent of demographic changes during the demographic transition differs among the countries but they follow more or less similar pattern of declining mortality rates followed by the declines in fertility (Reher 2004; Dyson 2010).

Developed countries which have already completed the process of demographic transition have a substantially higher proportion of older population aged 65 and over compared to developing countries. Developing countries, however, have started to experience rapid demographic changes only over the last few decades resulting in rising proportion of older population where it is expected to undergo a more rapid rate of increase (Kinsella and Phillips 2005).

Population ageing – one of the greatest achievements of the human kind – poses major social and economic consequences which can turn either into challenges or opportunities depending on the readiness of a country to face the ageing process. Shifting age structures resulting in contraction of working-age population present negative consequences to social security sustainability. In a number of less developed countries poverty levels among older population are even higher than the poverty levels of the whole population and coverage of older population above legal retirement age with old-age pensions is extremely limited (United Nations 2013). Shrinking proportion of working-age population also threaten economic development which is dependent on the size and quality of labor supply. At the same time, labor force participation rates (LFPR) are quite low among older workers

especially in developed countries and the average age at which economically active individuals exit employment is considerably lower than legal pensionable age (Bloom and McKinnon 2010). The major health threats posed by infectious diseases in the beginning of the 20th century are being replaced by increasing burden of noncommunicable diseases today causing substantial challenges for healthcare as well as long-term care around the world in the light of population ageing (National Institute on Ageing and World Health Organization 2011).

Some of the governments have already started addressing the issues of population ageing through necessary measures and policies while others have not. Less developed countries are ageing with a higher speed and intensity which does not leave them much time to prepare unlike more developed countries which have experienced sufficiently longer demographic transition. Furthermore, more developed countries have enough resources at disposal in contradistinction to less developed ones. As a result, the demographic changes resulting in the ageing of our societies are starting to make headlines in the agendas of the policymakers around the world more frequently.

1.2 Research aim and objectives

The aim of this thesis is to identify and describe the differentiation of the scale and dynamics of the ageing process in the world at sub-region and country level and to develop a typology of countries in terms of mentioned characteristics of ageing. Based on the analysis of social conditions of sub-regions and selected countries then evaluate major development opportunities and challenges associated with population ageing. The following research objectives have been set in order to meet the aim of this study:

- To determine the significance of population ageing and to identify its main drivers;
- To analyze and compare quantum and tempo of changes during the demographic transition among sub-regions and selected countries;
- To analyze and compare quantum and tempo of population ageing process among sub-regions and selected countries;
- To classify sub-regions based on risks related to ageing and assess their readiness to face the process;
- To examine social conditions of sub-regions around the world in the context of population ageing;
- To explore opportunities for economic growth and impending challenges related to the ageing process.

1.3 Research questions and hypotheses

The following research questions have been asked in order to guide this study:

- What are the main determinants of population ageing occurring during the demographic transition process?
- How and to what extent do quantum and tempo of demographic changes during the transition process differ among sub-regions and countries worldwide?
- How are sub-regions and countries in the world differentiated in terms of the speed and intensity of population ageing?
- Which sub-regions are ageing with comparatively analogous intensity and under similar social conditions, such as quality of education, employment opportunities, social security and public health?
- Why and what measures do governments and policymakers have to take in the context of their ageing societies?
- What are the challenges and potential development opportunities directly related to ageing populations?

As a result the following hypotheses were formulated and tested during the research:

1. The timing and extent of age structure changes in the context of population ageing are closely related.
2. Compared to other parts of the world, the proportion of older individuals is increasing with the highest speed and intensity in African countries.
3. There is a relationship between longer demographic transitions with intermediary rates of natural increase and better social conditions including higher educational attainment and extent of pension coverage among older population.
4. Countries undergoing the process of population ageing with higher speed and intensity experience shorter demographic windows of opportunity.

1.4 Structure of the research

This study consists of eight parts including introduction and conclusion. Introductory chapter presents the main idea behind this research as well as topicality of the problem that determined the choice of this topic. The chapter identifies the aim and objectives of this study and includes the research questions that have been asked and hypotheses that have been proposed.

Literature overview, presented in Chapter 2, revises the studies dedicated to the theory of demographic transition as well as the works analyzing the demographic changes occurring during transition and ageing processes along with the consequences of those phenomena worldwide. The overview compares different views of authors and evaluates the availability of relevant studies analyzing population ageing by country with worldwide coverage.

Chapter 3 deals with data and methods adopted in this study. It starts with basic terminology adopted in the study. Indicators and methods are described in detail for a better comprehension of the study. Availability and quality of data sources used throughout this study are identified and evaluated as well.

Chapter 4 is comprised of the two sub-chapters. The first one interprets the concepts of age and identifies the significance of the ageing process. The second sub-chapter identifies the main determinants of the ageing process including fertility, mortality, changes in the population age structure and migration.

The following Chapter 5 includes the core analysis of this study and includes two sub-chapters with two sections each. Section 5.1.1 of the first sub-chapter investigates world transition profiles by quantum and tempo of changes. Section 5.1.2 presents classification of sub-regions and selected countries by quantum and tempo effects of the demographic transition. The period of data coverage differs by country with probably the longest historical vital rates series available for Sweden and France going back to as far as 1740 and 1745, respectively. The second sub-chapter analyzes the speed and intensity of population ageing by sub-regions and selected countries worldwide with the data covering the period 1950-2100. Last but not least, it presents the typology of sub-regions and selected countries in terms of mentioned characteristics of ageing.

Chapter 6 evaluates the social conditions of sub-regions around the world in the context of population ageing. The differences in quality of education, labor market, social security system and healthcare are identified. Possible solutions for offsetting the potential challenges posed by the ageing process which are proposed by policymakers and researchers are explained afterwards. The chapter is finalized with the differentiation of sub-regions according to their social conditions and speed of ageing assessed through cluster analysis delineating the readiness to face the process.

Chapter 7 explores the challenges of ageing populations along with opportunities for economic growth resulting from the changes in the population age structure which are presented during the demographic window of opportunity in the form of demographic dividends that can be reaped while the “windows” are open.

In the end, the conclusions of the study are summarized in the final Chapter 8 of the thesis.

Chapter 2

Literature overview

Population ageing has been raising more widespread concern among researchers and policymakers over the past few decades. The reason being that the process has shown to be ubiquitous in nature as all of the countries worldwide will at some point undergo population ageing. The ageing process is known to be the direct outcome of the demographic revolution when the age structure of a population becomes older by virtue of fertility and mortality declines. "Demographic revolution" is referred to as "demographic transition" by most of the authors. In classic literature, Frank Notestein is considered to be the one who first coined the term "demographic transition" (Rowland 2003). Rowland, referring to Notestein as the originator of the demographic transition theory identifies the classical pattern of the transition process through four main stages including: pre-transitional stage characterized by high birth and death rates; second stage of early transition when the death rates start to fall while birth rates remain high resulting in a rapid population growth; third stage of late transition when birth rates start to fall as well; and the post-transitional stage characterized by already low birth and death rates.

A number of researchers have made useful contributions on theoretical framework of the demographic transition. Pavlik (1980:135), in his article "The Theory of Demographic Revolution", describes the demographic transition as "revolutionary and in the entire history of mankind unique quantitative-qualitative transformation of the nature of the demographic pattern, which in its outcome is most marked in changes in the levels of fertility, mortality and the age structure of individual populations". The first real explosion of population growth occurred with the onset of Industrial Revolution and cultural advancement of the human society. That was the force that encouraged a remarkable population growth which initiated in Europe.

Every country in the world at some point is affected by the demographic transition. The main elements characterizing the transition including declining fertility and mortality changes are common across all regions around the globe, albeit the scope and dynamics are not. The process of demographic transition has distinctive outsets and developments in different countries. The book "Population and Development: The Demographic Transition" by Dyson (2010) provides comprehensive characterization of demographic transition supported by empirical precision

indicating the fact that the main processes of transition are influenced by the historical, institutional, geographical, socio-economic, cultural and other circumstances resulting in varied timing and speed of their (processes) development in one country or another.

The first features of demographic transition emerged with mortality declines in Northern and Western Europe. Mortality started to decline towards the end of the 18th century but with a slower pace compared to more prominent decrease that followed during the 19th as well as 20th century (Caldwell 2006; Dyson 2010). The opinions regarding the causes of mortality declines at early stages differ to some extent. Davis (1945), for instance, put varied food supply at the forefront of the causes for mortality declines in Northern and Western Europe. He argued that improved agricultural techniques together with transportation and invention of machinery were part of the improving technological system which resulted in reduction of famine, undernourishment and susceptibility to deceases. Kirk (1996) gives credit to improved infrastructure along with rising incomes and development of the modern state which, on his opinion, were the most important grounds for alleviation of famine and also epidemics that led to mortality declines at early periods of transition. However, later stages of decreasing mortality were induced by medical revolution according to Kirk. Dyson (2010), on his turn, also emphasizes on the improvement in mortality as a result of "gradual emergence of the modern nation-state" and progress in reducing deaths from infectious diseases while arguing that the role of nutritional improvement in mortality alleviation at early stages of transition has been overestimated. Caldwell (2006) states that Industrial Revolution was not only driven by changes in production ways but the great advances in technical and scientific spheres including the levels of education. All of the above mentioned causes contributed to the reduction of mortality to their own extent as the Period of Enlightenment was characterized by the changes in all spheres of life including social, economic, political, and health aspects. Kingsley Davis made a noteworthy remark, in this regard, stating that: "The decline in mortality was itself a cause as well as a result of the social transformation, because it made possible a longer and more efficient use of human energies" (Davis 1945:5).

Declining death rates that preceded the fall in birth rates resulted in the protracted period during which the population of Western European countries was growing rapidly. Davis noted that European population expanded by seven times in mere three centuries from approximately 100 million in 1650 up to around 720 million in 1933 while populations in other parts of the world increased by three times only.

Causes of fertility decline vary around reduction in marriage through its postponement or rise in the proportion of single women while in the long run the main context lies in birth control (Dyson 2010). Landry (1987) presented evidence of birth control use in France at the early stage of demographic transition when the birth rates started to fall. He argues that it was the result of people's strivings to retain the already achieved living standards. Prior declines of child and, later on, infant mortality meant that more children started to survive which resulted in conscious control of fertility. The important characteristic mentioned by Reher (2004) and Dyson (2010), however, is that mortality decline is the fundamental cause of fertility decline observed in every society, be it

developed countries that have already undergone the demographic transition or part of the developing world which is now in the process.

In 1986, Ron Lesthaege and Dirk van de Kaa have suggested the new concept of the second demographic transition (van de Kaa 2008). The conclusion was made based on the identified changes in behavior and trends of fertility along with family formation and dissolution. The shifts in population trends were distinguished with an emergence of a new "individualistic family model" in exchange for existing "bourgeois family model". Lesthaege (2010) noted that the first signs of the second demographic transition emerged in the 1950s. The family that was considered to strengthen its positions as a social institution during the first transition started dissolving with manifestation of rising rates of divorce, abortion and cohabitation (van de Kaa 2008). Some authors, however, criticized the notion of the second demographic transtion. Massimo Livi Bacci stated that there is only one "demographic transition in world history" whose opinion was shared by Robert Cliquet and David Coleman according to whom it is merely a continuation or a "secondary feature" while Zdenek Pavlik and Alexander Vishnevsky favor a single "demographic revolution" (van de Kaa 2008; Lesthaege 2010).

Not many works, though, deal with in-depth empirical analysis of demographic transition variations by regions or countries worldwide. In this regard, Chesnais (1992) with his book "The Demographic Transition – Stages, Patterns, and Economic Implications", which contains a longitudinal study of 67 countries covering the period 1720-1984, has made a remarkable contribution. The author has conducted a comprehensive analysis of long time series in international perspective backed up by exhaustive theoretical framework.

Any process is normally driven by particular factors and population ageing is not an exception. The researchers studying and analyzing population ageing agree on the fact that fertility and mortality are the main drivers of the phenomenon. But when it comes to replacement migration as a potential driver, opinions start to differ. The estimations presented in the United Nations (2001) report "Replacement Migration: Is It a Solution to Declining and Ageing Populations?" indicate that international migration cannot counteract the process of population ageing as the estimated volume of required immigrants is not realistic. Burcin, Drbohlav and Kucera (2005) based their research findings on the example of Czechia and came to a similar conclusion adding that migrants themselves get older over time and their potential contribution must be balanced by new net-migration inflows. Kinsella and Phillips (2005) argue that international migration does not play a major role but can be useful in smaller populations, namely, some parts of the Caribbean. Gavrilov and Heuveline (2003), though, do believe that migration can actually slow down population ageing since immigrants tend to be young and have more children.

The ageing process is taking place and will take place with different speed and intensity in various parts of the world. To our knowledge, none of the existing studies are dedicated to thorough analysis of tempo and quantum of ageing by regions or countries with worldwide coverage. Most of the researches are based on one particular country or a small group of countries. United Nations (UN) "World Population Ageing 2013" report provides the overall analysis of demographic

determinants and speed of population ageing based on more and less developed groups of countries (referred to as "major development regions" in UN terminology) without more detailed approach on a country or sub-regional level. Kinsella and Phillips (2005), for instance, present the comparative analysis of the speed of population ageing in 20 selected countries from more and less developed regions. And a number of studies cite those authors when describing or analyzing the speed of the ageing process which limits the diversity of available self-conducted analyses.

Changes in the age structure leading to increasing proportion of older population happen in various social conditions. Quality of education along with employment opportunities, social security and healthcare determine the readiness of countries to face the ageing process.

Positive correlation between educational attainment and financial well-being as well as health, especially at older ages, has been confirmed by a wide range of studies. Barro and Lee (2013) provide a comprehensive analysis on educational attainment panel data set covering the period 1950-2010. The study is among a few, if not the only one, that covers practically entire world (146 countries analyzed by sub-regions) allowing to observe the trend and compare the improvements in educational attainment across the countries.

When it comes to labor market in the face of ageing, there are both demand and supply factors that have to be taken into account. Shrinking proportion of working-age individuals that occurs as a result of changes in the population age structure has negative effects on the supply side of the labor market. Additionally, the studies of Kinsella and He (2009) as well as National Institute of Aging and U.S. Department of State (2007) point out that LFPR decline as people approach retirement age and the share of workers aged 65 and over is very small too which has been predominantly true for developed countries and not so much for less developed ones. However, it is added that the trend has somewhat reversed since the beginning of the 1990s which is confirmed by the study results of D'Addio, Keese and Whitehouse (2010) for Organization for Economic Co-operation and Development (OECD) member countries. The authors suggest that recent pension reforms have influenced LFPR among older workers in a positive way but further measures are still required on the demand side in terms of age discrimination and human capital of older workers.

Social security conditions differ from one country to another to a great extent. Population ageing will eventually affect all of the countries throughout the world raising the questions of social security sustainability. By the year 2050, in developed countries the potential support ratio of working-age individuals aged 15-64 to pensioners is estimated to drop from current four or five economically active persons per pensioner to only two (Sigg 2005). ISSA (2013, 2014, 2014a, 2015) reports include exhaustive analyses of social security programs by country worldwide providing a clear picture of differences in social and economic conditions created for older population. The challenges for social security systems resulting from population ageing can be prevented through timely adapted measures and policies. Bloom and McKinnon (2010), ISSA (2010), Sigg (2005), National Institute of Aging and U.S. Department of State (2007) along with Reznik, Shoffner, and Weaver (2007) believe that the following reforms can be beneficial in that regard: to raise the retirement age as a result of increasing life expectancy; to increase LFPR and

effectiveness through integration of non-workers, women and encouragement of older people to stay in the labor force for a longer period by implementing life-long education and skills updating along with better working environments for older workers; to increase productivity and tackle unemployment; and even to increase the contribution/tax rate for economically active population or reduce pension benefits.

Fried and Paccaud (2010) allege that healthy ageing is the critical point for ageing societies to utilize the benefits of longer lifespan as well as the main element of public health agendas around the world adding that most of the developed countries compared to developing countries have undergone considerably long demographic transitions which allowed their healthcare systems to adapt relatively easily having enough of resources at disposal. It can be assumed that the ageing process is associated with rising per capita public health expenditures, but some studies including De La Maisonneuve and Martins (2013) assert that it is not ageing but death proximity ("death-related costs" hypothesis) what affects health spending.

Finally, demographic changes that result in shifting age structures carry implications for the economic growth but at the same time create windows of opportunity for potential development. Necessary policies and measures taken much in advance can counteract negative consequences of the ageing process through utilization of the two demographic dividends arising as a result of demographic transition. Ronald Lee and Andrew Mason appear to be among the researchers who have made substantial contributions to the topics of "demographic dividend" and "demographic window of opportunity". Many works analyzing demographic dividend refer to their studies as primary sources. Mason (2005, 2007) and Lee and Mason (2006a) offer detailed estimation procedures of the two dividends. The first demographic dividend is measured by the rate of growth of the economic support ratio (the difference between the rate of growth in output per effective consumer and the rate of growth of output per worker) while the second dividend is determined through the accumulation of wealth and its relation to population ageing since the phenomenon leads to increasing demand for resources resulting from extended life course. Most of the studies analyzing the demographic dividend do not distinguish the possibility of the second dividend which according to Mason (2005, 2007) is permanent in nature since population ageing resulting in the increasing proportion of older population is inevitable.

Chapter 3

Data and methods

3.1 Basic concepts and terminology

For better understanding of the given research, this sub-chapter specifies relevant terminology applied in the study. Unless otherwise cited, basic terminology and concepts are based on UN definitions.

Countries have been grouped in sub-regions according to United Nations (2014a) classification with exception to the sections dealing with demographic transitions analysis. Quantum and tempo of changes during the demographic transition by sub-regions and countries worldwide were analyzed mainly based on data provided by Chesnais (1992). The lists of included countries by sub-regions are noted in corresponding Figures and Tables.

UN system does not have an established convention regarding the designation of *developed countries* and *developing countries.* Still, the terms used in this study refer to common delineation proposed by the UN. Thus, developed countries refer to Japan, Australia, New Zealand and countries of Northern America as well as Europe. Developing countries include those of Africa, Americas (excluding Northern America), Caribbean, Central America, South America, Asia (excluding Japan) and Oceania (excluding Australia and New Zealand).

Age in demographical terms is calculated in a number of ways: age in completed years or age at last birthday which constitutes the number of complete years at a given moment; age reached during the year which is the difference between the current year and the year of birth; exact age that is used in life table calculations and expressed in years, months and days or sometimes in tenths or hundredths of a year (INED Glossary 2015).

Age structure (distribution) refers to the classification of the population by age groups or individual years of age.

Retrospective age is a measure of chronological age, i.e., how many years a person has already lived. *Prospective age* concerns future when everyone has the same amount of expected remaining years of life (Sanderson and Scherbov 2007).

Older population does not have a universally accepted definition but the UN uses the threshold of 60 years (or 65 years) to refer to older people. So do most of the demographers worldwide. Population aged 80 years and over, in its turn, is referred to as *oldest old.*

Ageing population, as a result, is referred to a population with increasing proportion of older people aged 65 and over. Whereas, a society where the proportion of population aged 65 and over passes the threshold of 7%, 14% or 20% is considered to be "ageing" society, "aged" society and "super-aged" society, respectively.

Demographic transition refers to the shift from high mortality and fertility to low mortality and fertility in a population.

Life expectancy is the average number of years a person could expect to live if current levels of mortality observed for ages above that age were to continue for the rest of that person's life.

Fertility refers to human reproductive performance. *Fertility rate* or *birth rate* is defined as the rate or incidence of births in a female population or its part.

Mortality is referred to the incidence of deaths in a human population. *Mortality rate* or *death rate* comprises the rates measuring the frequency of deaths.

Migration is defined as the movement across boundaries of political or administrative unit for a certain period of time.

Replacement migration is the international migration required to counteract population decline or population ageing.

Working-age population is the proportion of population aged 15 to 64.

Illiteracy rate indicates the proportion of persons in a population or particular age group who can neither read with understanding nor write a short simple statement about their everyday life.

Educational attainment refers to the highest grade (stage of instruction covered in the course of a school year) of education a person has completed.

Economically active individual is the person engaged in labor for production of economic goods and services.

Labor force participation rate (LFPR) measures economically active population in a particular age group as a proportion of the total population of the same age group.

Social security is the income security provided to population in case of old age, invalidity, sickness, unemployment, work injury and maternity (ILO 2015b).

Pay-as-you-go (PAYG) system is usually run by a government and is based on pensions paid from current contributions/taxes.

Noncommunicable diseases (NCDs) also referred to as chronic diseases which are not passed from one person to another. There are four main types of NCDs including cardiovascular diseases, cancers, chronic respiratory diseases and diabetes (World Health Organization 2015b).

3.2 Analytical methods

3.2.1 Adopted approaches and indicators

The following are the main approaches and indicators used in this study. Generally accepted UN formulations have been used, unless otherwise stated below.

Crude birth rate (CBR) is the number of live births *N* per 1,000 mid-year population *P* in a given year:

$$CBR = \frac{N}{P} * 1000.$$

Crude death rate (CDR) is the number of deaths *D* per 1,000 mid-year population *P* in the given year:

$$CDR = \frac{D}{P} * 1000.$$

Natural increase rate (NIR) is the difference between crude birth rate (CBR) and crude death rate (CDR):

$$NIR = CBR - CDR.$$

Total fertility rate (TFR) refers to the average number of children that would be born alive to a woman during her lifetime if she were to pass through the childbearing years bearing children according to a current schedule of age-specific fertility rates:

$$TFR = \sum (\frac{Bx}{P^F x}),$$

where: Bx = number of live births to women aged *x* during a calendar year; $P^F x$ = mid-year number of women at age *x*.

Median age divides a population into two groups of the same size where half of the total population is younger and the other half is older than this age. Censuses and surveys collect the information on the numbers in age groups. The median age from grouped data is a useful measure of age structure as, compared to the mean, it is unaffected by extreme values and can be calculated for age groups with open intervals:

$$Median\ age = l + \frac{\frac{N}{2} - F}{f} * i,$$

where: l = lower limit of the class containing the middle case; N = total population; F = cumulative frequency up to the age group containing the middle case; f = frequency of the class containing the middle case; i = size of the class interval containing the middle case.

Child dependency ratio is measured as the number of individuals aged 0-14 per 100 individuals aged 15-64:

$$Child\ dependency\ ratio = \frac{P_{0-14}}{P_{15-64}} * 100.$$

Old-age dependency ratio is measured as the number of individuals aged 65 and over per 100 individuals aged 15-64:

$$Old-age\ dependency\ ratio = \frac{P_{65+}}{P_{15-64}} * 100.$$

Total dependency ratio is measured as the number of individuals aged 0-14 plus individuals aged 65 and over per 100 individuals aged 15-64. It is the sum of child dependency ratio and old-age dependency ratio:

$$Total\ dependency\ ratio = \frac{P_{0-14}+P_{65+}}{P_{15-64}} * 100.$$

Potential support ratio is the number of individuals aged 15-64 per every individual aged 65 and over:

$$Potential\ support\ ratio = \frac{P_{15-64}}{P_{65+}}.$$

Formulations of demographic dividends have been adopted from Lee and Mason (2006a). *First demographic dividend* is measured by the rate of growth of the economic support ratio, i.e., the difference between the rate of growth in output per effective consumer and the rate of growth of output per worker. *Second demographic dividend* is measured by the rate of growth of productivity reflecting increases in the ratio of capital-labor. According to Lee and Mason, if the effective number of consumers is expressed by *N* and the effective number of producers by *L*, then:

$$N(t) = \sum_{\alpha} \alpha(a)P(a,t),$$
$$L(t) = \sum_{\alpha} \gamma(a)P(a,t),$$

where: $P(a,t)$ is the population aged *a* at time *t* and $\alpha(a)$ and $\gamma(a)$ are age-specific coefficients denoting relative levels of consumption and production, respectively. Then, output per effective consumer (*Y/N*) is expressed as follows:

$$\frac{Y(t)}{N(t)} = \frac{L(t)}{N(t)} * \frac{Y(t)}{L(t)}.$$

By taking the natural logarithm of both sides of the above equation and deriving it in respect to time, rates of growth can be obtained as follows:

$$y^n(t) = L\dot{(t)} - N\dot{(t)} + y\dot{(t)}.$$

The sum of the two components equals to the rate of growth in output per effective consumer. The first dividend in this case is the first component ($L\dot{(t)} - N\dot{(t)}$). The second dividend is the second component ($y\dot{(t)}$).

Demographic windows of opportunity were calculated based on UN definition. Windows of opportunity are considered to be open when the share of young population (aged 0-14 years) falls below 30% while the proportion of older population (aged 65 and over) is still below 15%.

Criteria for delimiting the length of demographic transitions have been adopted from the methods provided by Chesnais (1992). *The beginning of the demographic transition* (Tα) is marked by the starting-point of a continuous decline in mortality rates (a decline which is not followed by a

return to higher rates). *The end of the demographic transition* (Tω) is indicated by the point where natural increase returns (a period of at least five years) to the rate equal to or less than that of the period preceding the onset of the transition. Two cases regarding mortality are also considered: firstly, "mortality is not yet very low, which enables us to discount subsequent improvements and to recognize that the equilibrium at a given level is only provisional (as in certain European countries at the time of the 1930s depression)" and secondly, "mortality is very low, less than the level just cited; only then do we have the point at which the previous trend has been overcome" (Chesnais 1992:14).

Typology of sub-regions and selected countries by the scale and dynamics of their demographic transitions was also developed based on methods offered by Chesnais (1992). The countries were classified according to the maximal NIR by identifying three groups: less than 2% per year, 2-3% per year and over 3% per year. While the length of the transition exceeding 70 years was considered to be "long" and the duration of less than 70 years as "short".

Analysis of population ageing by sub-regions and selected countries was carried out based on the data for the period 1950-2100 provided by the 2012 Revision of the World Population Prospects of the UN. In the methodological part of the report it was noted that lack of detailed information on fertility and mortality trends over time in developing countries compared to developed countries required a more complex procedure on producing reliable estimates of past population dynamics. Past demographic trends back to 1950 were reconstructed for each component of demographic change using the available data from censuses, surveys and population registers. In many cases data was only available through retrospective sources. Furthermore, different data sources and various analytical methods can produce different estimates. "To address these various challenges, trends by age and sex (or overall summary indices like ${}_5q_0$ and ${}_{45}q_{15}$ when time series of age-specific mortality rate were unavailable) were generated either through expert-based opinion reviewing and weighting each observation analytically, or, in more recent years, using automated statistical methods (for example, pooled analysis using Loess (local regression) or cubic splines with analytical weights." (United Nations 2014b:5).

Population projections for individual countries presented in the 2012 Revision of the World Population Prospects employ the cohort-component projection method. As noted in the methodological section of the report, it is not really a projection method as it requires births, deaths and migration to be projected in advance. Thus, it is more an application of matrix algebra enabling calculation of the effect of assumed future patterns of change at given point in the future.

The methods of measuring the speed of population ageing represent the techniques adopted from Kinsella and Phillips (2005) and Golini, Marini and Iacoucci (2007). As a result, the *speed of population ageing* in this study was measured as a ratio of percentage point increase, in the proportion of population aged 65 and over from 7% to 14%, to the number of years required. As mentioned in the previous section, according to the UN definition, a society is considered to be "ageing" when the proportion of older population aged 65 and over passes the threshold of 7%, whereas the threshold of 14% signifies already "aged" society.

Sub-regions and selected countries were classified by quantum and tempo of ageing based on two factors: the expected time when the proportion of population aged 65 and over would reach 14% (before the year 2050 or during the period 2050-2100) and the speed of the ageing process based on aforementioned proportion margins (comparatively low speed of less than 0.18 percentage points per year, high speed of 0.18-0.30 percentage points and very high speed of more than 0.30 percentage points).

3.2.2 Cluster analysis

Cluster analysis was carried out based on five indicators including speed of population ageing, average years of schooling, labor participation rates among older individuals aged 65 and over, proportion of population above legal retirement age in receipt of old-age pension, percentage of deaths (of all ages) caused by noncommunicable diseases (NCDs). The analysis was applied to the same sub-regions worldwide which were examined throughout the study. The indicators were selected based on the idea to evaluate the differentiation of countries by the social conditions in the context of the ageing process.

Hierarchical cluster analysis based on Ward's minimum variance method was used in order to group the countries with similar social conditions and the speed of ageing. The choice of method was based on SAS software user's guide referral to the results of various studies comparing the performance of different clustering methods where Ward's method has shown the best overall performance. It is recommended to use Ward's method for quantitative and not binary variables where data does not contain outliers and clusters of similar sizes are expected. All variables were transformed into *Z* scores before clustering:

$$z_i = \frac{x_i - \bar{x}}{\sigma},$$

where: x_i is the value of the variable; $\bar{x}$ is the mean value; and σ is standard deviation.

Theoretical requirement for using a distance measure in Ward's method is Euclidean distance. Euclidean distance between two points X (x_1, x_2, ... x_n) and Y (y_1, y_2, ... y_n) can be defined in the following way:

$$d = \sqrt{\sum_{i=1}^{n} (x_i - y_i)^2}.$$

The analysis was performed using the SAS software.

3.3 Data availability and quality

Data availability and quality are one of the core components of any empirical study. The research conducted in this diploma thesis was mainly based on the data provided by the 2012 Revision of the World Population Prospects of the UN. It contains population estimates and projections for the period of 1950-2100. Past estimates presented in the report were collected directly from national statistical sources. In some instances, the original data was adjusted for deficiencies in age

misreporting, under-enumeration or underreporting of vital events. As noted in the report, the availability of detailed information on fertility and mortality trends over time and of periodic censuses of population for developed countries allowed to produce the most reliable among available estimates of past population dynamics. However, in developing countries, demographic information is most of the time limited or not available at all. Furthermore, even the limited data can be unreliable. As a result, as stated in the report, consistency in the data has been achieved through the use of models along with methods of indirect estimation. In some extreme cases when data was lacking completely, the estimates were obtained from the data on other countries in the same region with a similar socio-economic profile.

Vital statistics prior the year 1950 used for the analysis of demographic transitions by sub-regions and selected countries was obtained mostly from Chesnais (1992). The author analyzed 67 countries, 38 of which are less developed. Supplementary sources of vital series included the 2012 Revision of the World Population Prospects, Human Mortality Database and Statistical Offices of Czechia, Japan and Sweden.

It would have been more appropriate to use moving averages to smooth out vital series data but since the data post 1950 was mostly obtained from the World Population Prospects of the UN (2012 Revision) which is available only in averages over the five-year periods (from mid-year (t) to mid-year (t+5) centered on 1 January year (t+3)), it was not possible, in order to avoid inconsistency in the analysis.

Chesnais (1992) also noted that the presented data for developed countries is of high quality unlike the data from developing countries. The extent of inaccuracy of crude rates, however, differs by country where countries in advanced stages of transition – "on the point of returning to an equilibrium of feeble growth" – are less problematic in this regard (Chesnais 1992: 50). In the case of Africa, more reliable and complete data is available for the countries of Northern Africa. Tunisia and Egypt are the two countries of the sub-region with the most reliable data according to Chesnais. Latin America presents comparatively accurate data that covers a larger period and is available for a substantial number of countries. In Asia the extent of availability and quality of data is somewhere between Africa and Latin America. Sri Lanka is one of the few Asian countries possessing more or less complete civil registration for a relatively long period of time. Thus, the quality of historical vital series for developing countries used in this study may not be classified as completely accurate.

Social conditions of countries were analyzed using a variety of sources. Illiteracy rates were derived from United Nations Educational, Scientific and Cultural Organization (UNESCO) database and United Nations (2011) report on "Current Status of the Social Situation, Well-Being, Participation in Development and Rights of Older Persons Worldwide". Continuous data series for countries worldwide are not available. The latest data on illiteracy covering all of the regions worldwide was available only for the years 2005-2007. UNESCO database also does not provide complete data on educational attainment expressed in the average years of schooling among the population by countries around the world. Barro and Lee (2013) in this regard offer a more complete data set covering 146 countries worldwide for the period 1950-2010.

LFPR by sex, age group and sub-regions worldwide has been obtained from the International Labor Organization (ILO) LABORISTA database. Main source of statistics for those rates in the latest edition are 169 labour force surveys. International Social Security Association (ISSA) publishes reports on Social Security Programs Throughout the World. The latest editions (ISSA 2013, 2014, 2014b, 2015) covering all major regions worldwide with detailed information on each country were used to acquire the data regarding old-age pension benefits. It is a valuable source containing exhaustive amount of quality data that has been used in this study.

Finally, structure of death causes by major regions worldwide for the year 2013 and projected data for 2030 were adopted from the World Health Organization (WHO) database. WHO data on cause-specific mortality is obtained mainly from vital registration system of countries. For some of the countries non-national death registration data and other sources are used as well. Completeness of recorded mortality data in the population aged five and over is usually assessed through application of demographic techniques such as Brass Growth-Balance method, Generalized Growth-Balance method or Bennett-Horiuchi method.

Chapter 4

Population ageing and its drivers

Population ageing has become a major topic over the last period of time as a result of its ubiquity and impact. Ageing will eventually take place in all of the countries throughout the world. Populations in developed countries have been growing older for over a century now but developing countries are starting to catch up with the process. This global demographic trend is expected to intensify during this century as the less developed countries undergo faster processes. It is projected that by 2050 only 22% of the world's older population will reside in developed countries as nearly 1.2 billion of the expected 1.5 billion people aged 65 and older will be living in the developing part of the world (Kinsella and Phillips 2005).

4.1 What is ageing and why is this process so important

When does someone become "old" and what is "ageing"? There are a number of terms describing the people who are considered old but "old" does not have a specific age. The boundaries between ages do not have exact definition universally as they differ from one society to another. One can be 50 and be old while someone else can also be 70 and be young. Nevertheless, in most parts of the world, people are considered old based on the changes in their physical manifestations and social roles. UN uses the threshold of 60 years (or 65 years, it being the age when people become eligible for old-age benefits in many countries) to refer to older people, which is also used by demographers to divide younger and older cohorts of a population (UNFPA and HelpAge International 2012).

Population ageing is often referred to as a success story of the humanity demonstrating a victory over infectious and other diseases but the phenomenon has also brought along some challenges for economic and social development of communities with regards to their sustainability in providing for the ageing population.

Lutz, Sanderson, and Scherbov (2008) made a brilliant point stating that in the past we used to look at the picture of ageing in black and white but it is much more informative, even though complex, to produce and analyze the picture in color.

4.1.1 The concepts of age

In demography age is a fundamental characteristic of population structure normally expressed in years or in years and months (Multilingual Demographic Dictionary 1982). The concept of age has become more intricate with increasing lifespan of population when it is becoming more important to distinguish between functional and chronological age. In contrast to widely used chronological age measured by the number of years a person has already lived, Ryder (1975) proposed a new concept of age. He argued that age measured in terms of the number of years elapsed since birth is a useful index of development from birth to maturity only, beyond which it would be more reasonable to measure age in terms of the number of years remaining until death. It was proposed to determine the point of entry into old age when the expectation of life remains to be 10 years.

The idea of Norman Ryder was followed by Sanderson and Scherbov (2007), who proposed a new forward-looking measure of "prospective age" in contrast to chronological age or "retrospective age" as they call it. Contrary to retrospective age when everyone of the same age has lived the same amount of years, prospective age is engaged with the future when everyone has the same amount of expected remaining years of life. The authors prove that using retrospective age we are inclined to think that people of the same age in different years behave in a like manner but as a result of increasing life expectancy that may not be the case in particular aspects of behavior. Sanderson and Scherbov also proposed new forward-looking measures – prospective median age and old age dependency redefined with a constant prospective age, opposed to conventional ones which are backward-looking measures. It was indicated that the best way to understand population ageing is to look at age in both backward and forward looking dimensions but the latter is argued to be more accurate in designing policies concerning retirement and pensions as well as medical care as it takes into account future changes in life expectancy.

With advancements in health and longevity, studies of population ageing should be carried out using appropriate measures that do not refer to, for instance, 65 years old people born in 1950 and in 2010 identically. They would have different remaining life expectancy resulting in different behavior and physical state. And the phrases like "40 is the new 30" are becoming more frequent today which actually result from the fact that people whose chronological age is 40 today cannot be compared with people who had the same age a century ago.

4.1.2 Population ageing and its significance

The term "ageing" does not have a uniform definition globally as its perception differs by country. Ageing of population implies the increase in the proportion of elderly at retirement ages. But how old is old age? UN considers age 60 to be a threshold of old age. In most of the developed countries the threshold is 65 years as it is the age when people start to be eligible for old-age social benefits. As stated in Gavrilov and Heuveline (2003), a society is regarded relatively old, nowadays, when the proportion of population aged 65 and over exceeds 8-10%. In 1950, the proportion of older population in developed countries worldwide was already 7.7% which doubled by 2000 and is projected to reach 25.8% by the year 2050 (United Nations 2014a). Developing world, in contrast,

was yet very young in 1950 when the proportion of individuals aged 65 and older equaled to 3.8% and increased only to 5.1% by the year 2000, albeit the proportion is projected to almost triple by 2050 when it is expected to reach 14%. The above figures indicate the fact that developing countries are ageing more rapidly compared to developed countries where the phenomenon occurred way ahead as a result of early and long demographic transition.

Older population itself is ageing. The proportion of individuals aged 85 and over is projected to increase globally by 151% between 2005 and 2030 in contrast to a 104% increase of population 65 and over and a mere 21% increase of population under age 65 while the most striking increase will be observed in Japan where by 2030 roughly 24% of all older people will be 85 and over (Powell 2010).

Longer lifespan is a great achievement of the humanity, a triumph over infectious diseases, and a success story of advancements in public health, economic development and education. People today live longer than ever before and in more cases remaining healthy and active until later years. Life expectancy in developed countries was approximately 77 years in 2010 in contrast to 67 years in developing countries which is higher by a whole decade but it is important to note that the rate of increase is much more rapid in the latter (United Nations 2014a). Additionally, when people expect to live longer they have a motivation to save more for the years after retirement and in economic terms savings are translated into investment which on its turn stirs the accumulation of capital and technological progress (Beard et al. 2012).

Despite the great achievements lying behind the phenomenon of population ageing, it carries a number of challenges for the societies. Ageing implies shifting of work and retirement patterns. Increasing proportion of older population and shrinking workforce create burden for the economies in terms of social security systems and public health. It is raising problems around public policies with regards to requisite increases in retirement age and contributions/tax rates for workers. Noncommunicable diseases (NCDs) present another critical issue in light of global population ageing as they account for more than 87% of the burden of disease (total loss of healthy years of life due to disease and injury) for the population aged 60 and over (National Institute of Aging and U.S. Department of State 2007). The issue is more salient in less developed regions where the countries are struggling to allocate the resources for communicable diseases as well. Another important implication concerns changing family structure. Decreasing fertility will result in less familial care and support for the elderly. The cost of long-term care is becoming a burden for societies. Those challenges are already being addressed by some of the developed countries. But they have the resources to do so and have reached comparatively high levels of economic development while the processes of demographic transition that resulted in population ageing were quite long and gradual in contrast to developing countries where those processes are way faster and intensive but the economic development is lagging behind. So the developing countries have to address those issues with appropriate measures and policies far in advance to be able to convert the challenges into future opportunities without any considerable losses.

4.2 The drivers of population ageing

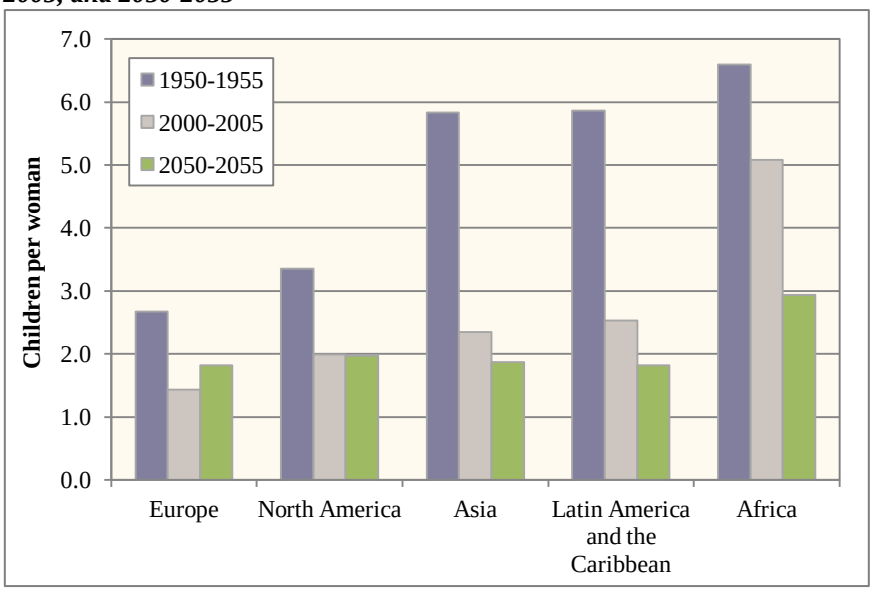
The shifts in fertility and mortality levels during the demographic transition have evolved to the changes in the age structure of the world population. As a result, population ageing is determined by trends in fertility and mortality. While the improvement in life expectancy has been very impressive during the past century, it has had a limited effect on population ageing around the world so far; increasing life expectancy was initially driven by the declines in infant and child mortality resulting in the rejuvenation of the population where according to Ronald Lee, for Western countries, the increase in life expectancy was driven by reduction in mortality among older population and thus contributing to population ageing only when life expectancy at birth passed the threshold of 72 years (Lee 1994, cited in Bengtsson and Scott 2010). In the process of time, a decline in birth rates results in fewer young people and proportionally more people at older ages. Some authors like Gavrilov and Heuveline (2003), for instance, assert that immigration may slow down the population ageing as immigrants tend to be younger and have more children, while emigration of working-age population accelerates ageing.

4.2.1 Fertility

Population ageing in the world has been predominantly fuelled by the fall in fertility. The world's total fertility rate (TFR) fell from 5 children per woman in 1950 to 2.5 in 2010 (United Nations 2014a). Based on the United Nations estimates, the developed countries reached below replacement level (replacement level equals to 2.1 children per woman) back in the late 1970s albeit more dramatic declines are inherent to developing countries where the TFR dropped from 6 children per woman in 1950 to 2.7 in 2010 that has contributed to substantial contraction of the gap between the two development regions. Sustained low fertility since the 1970s in the developed countries has reduced the size and successive births cohorts while increasing the proportion of older individuals (Kinsella and Phillips 2005).

Figure 1 illustrates the development of TFR in the regions around the world since the middle of the past century and projected UN data through the middle of this century. Europe and Northern America have overseen proportional decrease of roughly 1.3 children per woman during the period of 1950-2005 having reached below replacement levels of 1.4 and 1.9, respectively. United Nations (2014a) medium variant projections suggest revival of fertility rates in Europe towards the middle of the 21st century while in Northern America they are expected to remain at the same level. The most dramatic decrease is observed in Asia where TFR reduced more than twofold from 5.8 to 2.4 during the period 1950-2005 and expected to decrease even further below replacement level. The situation in Latin America and the Caribbean is practically the same as in Asia. Fertility rates in Africa have been reducing at a much slower pace having reached the level of 5.1 children per woman in 2000 from roughly 6.6 children in 1950. However, according to medium variant projections the pace is expected to accelerate within the next few decades where TFR of Africa in 2050 should drop to 2.9 children per woman.

Fig. 1 – Total fertility rate in the regions around the world, 1950-1955, 2000-2005, and 2050-2055



Source: Adapted from United Nations 2014a.

Families are having fewer children, which results in the increasing proportion of older population. Changes from high fertility and mortality rates to low fertility and mortality rates occurring during the demographic transition are fundamental preconditions leading to population ageing. The demographic transition phenomenon is characterized first by declines in infant and childhood mortality. Improvement in mortality takes place while fertility resumes high which results in large birth cohorts and increasing proportion of children with respect to older individuals. Later on, the proportion of older population starts to increase once fertility starts to drop as well.

4.2.2 Mortality

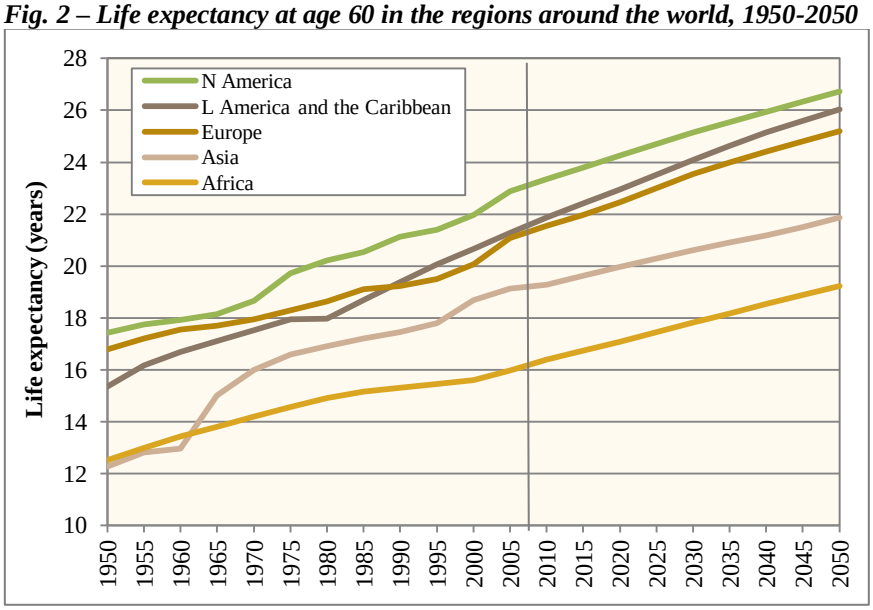
The effect of mortality decline on the process of population ageing is more secondary compared to fertility trends. Mortality decline occurs before fertility decline during the demographic transition but at the beginning it benefits infants and children in particular which actually make population younger resulting in larger proportions of children. Thereby, early improvements in life expectancy are mostly achieved through mortality declines at younger ages as well.

Only towards the end of the 1990s the assumption that mortality rate increases with age in an exponential manner was refuted by the newer research findings demonstrating the fact that the rate of increase in mortality tends to slow down at very old ages (Kinsella and Phillips 2005). As a result low fertility and mortality along with further declines in mortality at very old ages play an important role in the process of population ageing.

As noted by Kinsella and Phillips, many countries are experiencing increasing life expectancy at older ages which promotes life expectancy at birth. Life expectancy at birth has increased by more than two decades in the world during the period 1950-2010 from approximately 47 years to 69 years and is projected to add another decade by the year 2050; as for the differences between

development regions, people today live a decade longer in more developed countries compared to the less developed ones (77 years and 67 years, respectively) though the gap has decreased significantly in the second half of the 20th century and is expected to shrink further (United Nations 2014a).

Fig. 2 – Life expectancy at age 60 in the regions around the world, 1950-2050



Source: Adapted from United Nations 2014a.

Life expectancy at older ages has been rapidly increasing and individuals at age 60 nowadays have more years of remaining life compared to the past. Globally, people at the age of 60 today have remaining life expectancy of 20 years on average which is 6 years more than in the year 1950, according to United Nations. As illustrated in Figure 2, regional disparities around the world are quite prominent with the highest life expectancy at age 60 in Northern America opposed to the lowest level in Africa (in the year 2010, 23 and 16 remaining years respectively). Africa is also the "slowest" region in terms of the rate of increase in life expectancy at older ages as it added a mere of 3 years within the last six decades. Asia, on the other hand, has been showing considerable rate of increase while having same life expectancy at age 60 as Africa in the year 1950 and nearly reaching the level of Europe in 2010 with on average 19 years of remaining life at the age of 60 years. Latin America and the Caribbean have roughly the same life expectancy at age 60 along with Europe where people have 22 more years to live. UN medium variant projections suggest that the rates of increase would remain more or less the same during this century and life expectancy at older age would continue to increase further.

4.2.3 Age structure

It happened in Europe during the 2000s when people aged 65 and over outnumbered children (0-14 years) (United Nations 2014a). All of the societies worldwide once had a young population structure with a large proportion of population under age 15. The process of demographic transition with declining mortality and fertility levels, however, causes substantial changes in the age structure

of a population. Countries undergoing early stages of transition have a younger age structure compared to the ones at later stages. As a result, the societies who have completed the demographic transition have a transformed age structure with a growing proportion of older people.

A well-recognized age structure classification of a Swedish demographer Gustav Sundbärg distinguishes three principal types: progressive, stationary and regressive (Tab. 1). As seen from Table 1, in all three types, about half of the population belongs to the age group of 15-49 years. So the patterns actually differ in terms of the younger and older population proportions. Progressive age structure, with a higher proportion (around 40%) of individuals aged 0-14 and a substantially lower proportion (around 10%) of persons aged 50 and over, is typical for early stages of the demographic transition. Countries that are half way through the transition process normally have a stationary type of population age structure where the proportion of children aged 0-14 is practically the same as the proportion of people aged 50 and over. The third pattern according to Sundbärg, has a regressive type of population where proportion of children aged 0-14 decreases further while the age group of 50 and over is increasing. This type of population structure can be observed at the final post-transitional stage of the demographic transition.

Tab. 1 – Sundbärg's classification of population age structures

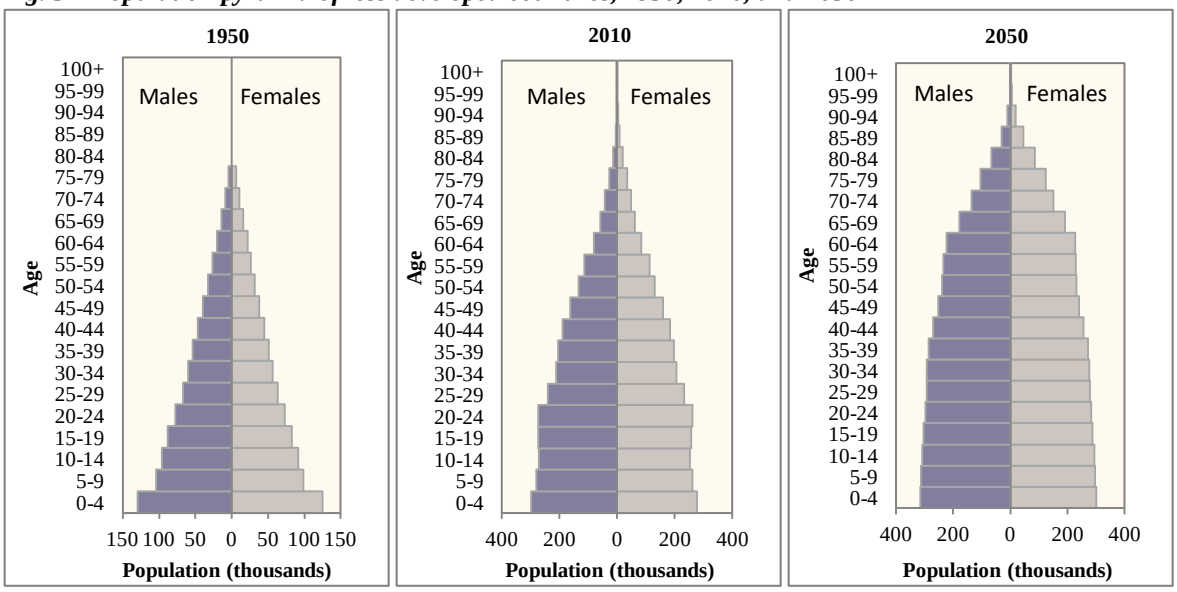
Type of population structure	Age group		
	0-14	15-49	50 and over
Progressive	40.0	50.0	10.0
Stationary	26.5	50.5	23.0
Regressive	20.0	50.0	30.0

Source: Adapted from S. R. 1907.

Most of the less developed countries still had comparatively high fertility rates in the 1950s resulting in the progressive age structure of the population (Fig. 3). As seen from Figure 3, decreasing fertility and mortality along with increasing life expectancy have brought noticeable changes to the age structure by the year 2010 where the base of the pyramid has shrunk while the proportion of working-age population has increased. By 2050, the proportion of older population is expected to increase quite considerably with a notable increase of oldest old individuals (aged 80 and over).

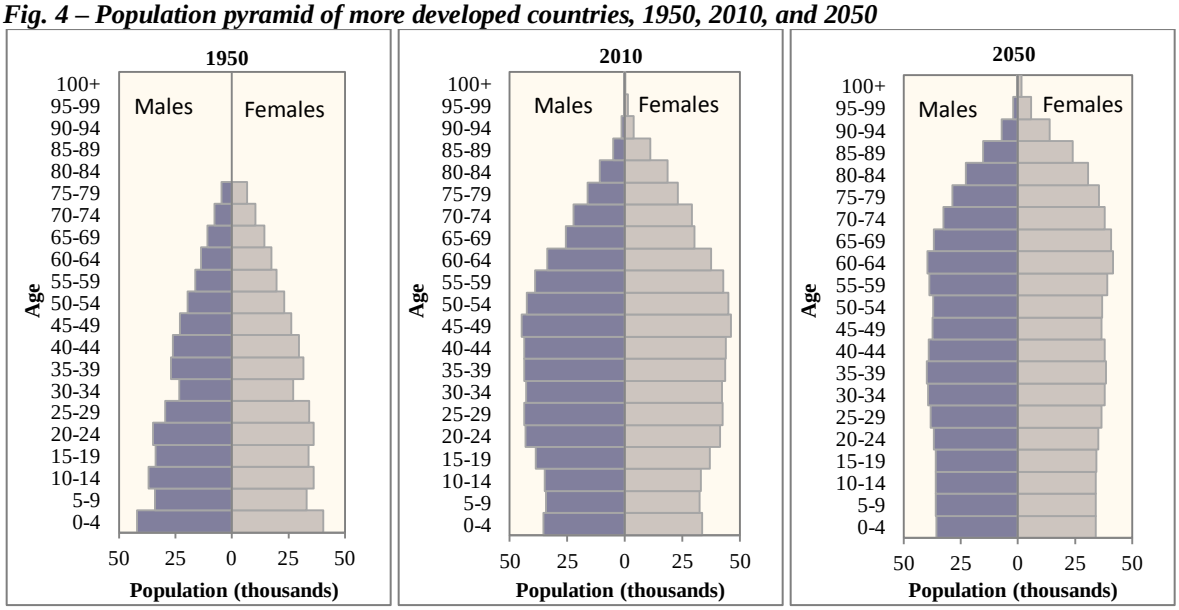
The age structure of more developed countries has been and will be quite different (Fig. 4). In 1950, most if not all of the more developed countries were at the last stage of the demographic transition with already low mortality and continuously decreasing fertility resulting in a population pyramid with high proportion of working-age population and considerably high percentage of older population. By 2010, the proportion of older people has increased to a great extent with a considerable increase of oldest old population while the percentage of young population has decreased that have resulted in a regressive type of population pyramid. As illustrated in Figure 4, older people are expected to comprise even larger portion of the population in more developed countries by 2050 resulting in more weight on top of the population pyramid.

Fig. 3 – Population pyramid of less developed countries, 1950, 2010, and 2050



Source: Adapted from United Nations 2014a.

Fig. 4 – Population pyramid of more developed countries, 1950, 2010, and 2050



Source: Adapted from United Nations 2014a.

Apart from population pyramids and proportions of population by broad age groups, the age composition can be analyzed through dependency ratios, measures of central age and index of dissimilarity.

There are three main types of dependency ratios that are based on a division of broad age groups including younger population aged 0-14, working-age population aged 15-64 and older population aged 65 and over (Rowland 2003). Those types include child dependency ratio measured by the number of children per hundred people of working age, old-age dependency ratio estimated through the number of older persons per hundred of working-age individuals, and total dependency ratio which is the sum of the two previous ones. Changing age structure of the population poses a

sufficient influence on the expenditures in education, healthcare and social insurance and assessment of this impact is usually done through old-age dependency ratio which aims to measure the number of "dependants" for each person in working-age group (Bongaarts 2009). The indicators of dependency ratio change along the process of demographic transition from high proportion of young population in the beginning to high proportion of older population towards the end of the transition.

Measures of central age including the mean age (the average age of the population), the mode (the most frequently occurring age in a population) and the median age (divides a population into two groups of the same size where half of the total population is younger and the other half is older than this age) provide a single number to represent the population age structure compared to dependency ratios which tend to focus on specific features of age composition (Rowland 2003). As noted by Rowland, the median age is a more preferential measure compared to the mean since it is not influenced by extreme values and can be calculated for age groups with open ended intervals (such as "aged 65 and over").

Finally, Rowland also specifies a "simple yet versatile statistic" that can be used when comparing population age structures including other characteristics of the population that is index of dissimilarity. The author denotes that the index estimates the extent of evenness between two percentage distributions indicating the percentage of one population required to be redistributed between age groups to coincide with the age distribution of the standard population. It is also mentioned that the greater number of age groups results in a higher potential value of the index since more detailed comparisons tend to result in more differences.

4.2.4 Migration

A number of studies focusing on replacement migration concept have attempted to answer the question whether and to what extent migration can actually offset population ageing. Kinsella and Phillips (2005) note that population ageing starts with fertility declines and improvements in adult mortality rates while international migration usually does not play a major role yet can be important in smaller populations (in some parts of the Caribbean, for instance, there have been a trend of emigration of working-age population combined with immigration of retired people from other countries and return migration of older former emigrants contributing to population ageing). Gavrilov and Heuveline (2003) argue that migration can modulate population ageing. The authors state that immigration usually slows down the process of ageing since immigrants as a norm are younger and have more children whereas emigration of working-age individuals accelerates the process. Based on research findings focusing on natural development prospects of Czechia's population through the concept of replacement migration, Burcin, Drbohlav and Kucera (2005), on their turn, have concluded that migration cannot offset the process of population ageing because the estimated volume of required net-migration inflows is "outside any reality" and that migrants are also getting older over time and their potential contribution must be counterbalanced by new net

immigrants. They point out that international migration can only influence population decline caused by low natural reproduction levels.

United Nations (2001) study on replacement migration has drawn a conclusion that the levels of migration required to prevent population ageing are totally unrealistic. Thereby, the report states, sustaining current levels of potential support ratios through replacement migration alone would be impossible as, for example, the United States would require increasing current net migration by more than ten times while the South Korea would need to receive an average of 94 million migrants per year during the period 1995-2050.

Chapter 5

Relation between quantum and tempo of changes directly related to the demographic transition and trends within the scope of ageing

Demographic transition is perhaps one of the most prominent events of population development in the modern history of mankind. It is a widely recognized fact that before the demographic transition that started in Europe during the end of the 18th century the length of human life was short with high fertility and mortality resulting in slow growth and young population (Dyson 2010). The demographic transition with its declining birth and death rates produces an increase in the elderly as a proportion of the total population. Low fertility and increasing life expectancy result in the phenomenon of population ageing. Being an inevitable outcome of the demographic transition, population ageing will also eventually affect all of the countries in the world.

5.1 Quantum and tempo of changes during the demographic transition

The demographic transition is a transformation of demographic patterns manifested by the changes in the levels of mortality, fertility and the age structure of individual populations (Pavlik 1980). The first real explosion of population growth occurred with the onset of Industrial Revolution and cultural advancement of the human society. That was the force that encouraged a remarkable population growth which started in Europe and got spread around the world as a result of migration. It was for the very first time when it became possible to refer to the world's population as a single entity reacting to one dynamic process but with a different extent (Davis 1945).

Every country in the world at some point is affected by the demographic transition. The main elements characterizing the transition including declining fertility and mortality changes are common across all regions around the globe, albeit the scope and dynamics are not. The demographic transition has distinctive outsets and developments in different countries. Dyson (2010) indicates the fact that the main processes of transition are influenced by the historical,

institutional, geographical, socio-economic, cultural and other circumstances resulting in varied timing and speed of their (processes) development in one country or another.

This sub-chapter is dealing with the analysis of the quantum and tempo of changes during the demographic transition at sub-regional level. As mentioned in the methodological section of this study, criteria for delimiting the demographic transitions was based on the methods provided by Chesnais (1992) where the beginning of the transition is marked by the starting-point of a continuous decline in mortality while the end of the transition is indicated by the point where natural increase returns (a period of at least five years) to the rate equal to or less than that of the period preceding the onset of the transition. Typology of sub-regions and selected countries by the scale and dynamics of their demographic transitions is also developed based on methods offered by Chesnais. The countries are classified according to the maximal natural increase rate (NIR) by identifying three groups: less than 2% per year, 2-3% per year and over 3% per year. While the length of the transition exceeding 70 years was considered to be "long" and the duration of less than 70 years as "short".

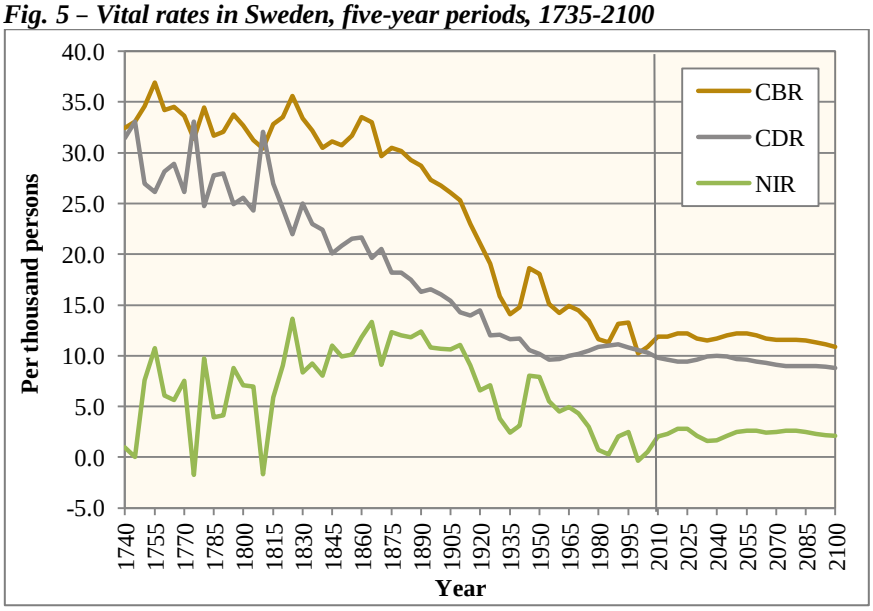
5.1.1 World transition profiles: quantum and tempo effects by selected countries

Speaking of today, the demographic transition has practically affected all of the countries in the world including the poorest ones as the transition occurs irrespectively of the economic development. The differences between historical and contemporary transitions are very important when it comes to comparisons of the phenomenon's tempo and quantum effects. The earlier transitions were quite gradual which have mostly completed by today. The more recent transitions, on the other hand, have faster processes influenced by the developments of the outside world (the effect of the integrated world we live in today), for instance, with regards to rapid reductions in death rates. This section is dealing with the analysis of the demographic transition patterns in some of the developed as well as developing countries. Lack or unreliability of historical vital series as well as the size limitation of this work do not obviously allow analyzing all of the countries and their transitions separately. The countries with vital rates illustrations were chosen based on the factor that they stand to be the pioneers of the demographic transition in the sub-regions they belong to. In the following section we will make an attempt to classify the sub-regions and selected countries by the scale and dynamics of the demographic transition for a clearer picture of the differences as well as similarities. The results will serve as the basis for further analysis of intensity and speed of population ageing in the world on the level of sub-regions and selected countries.

Countries of Western and Northern Europe being among the first to have undergone unprecedented declines of death and later on birth rates are the pioneers of the demographic transition. Sweden is one of the best examples of early transitions that occurred in Northern Europe (Fig. 5). It is one of the few countries having the continuous historical data available and the transition model of Sweden almost exactly matches the classical demographic transition model (DTM).

At pre-transitional stage, Sweden's crude birth and death rates were fluctuating in the range of 25-35 per 1000 persons. Death rates started decreasing steadily in the beginning of the 19th century (around 1805-1810) while birth rates underwent continued decline starting from around 1875. The demographic transition in Sweden ended around 1955-1960 when NIR fell to around 5 per 1000 which indicated the starting point of its lasting return to the level less than that of the period preceding the onset date of the transition. Rate of natural increase was at its lowest (-0.3 per 1000) during 1995-2000 since its continuous increase starting from the year 1810 followed by subsequent decline after reaching the peak of 17 per 1000 around 1860. United Nations (2014a) medium variant projections indicate steady development of birth rates around 11-12 per 1000 while death rates are expected to remain at about current rate followed by a slight decrease towards the end of the century.

Fig. 5 – Vital rates in Sweden, five-year periods, 1735-2100



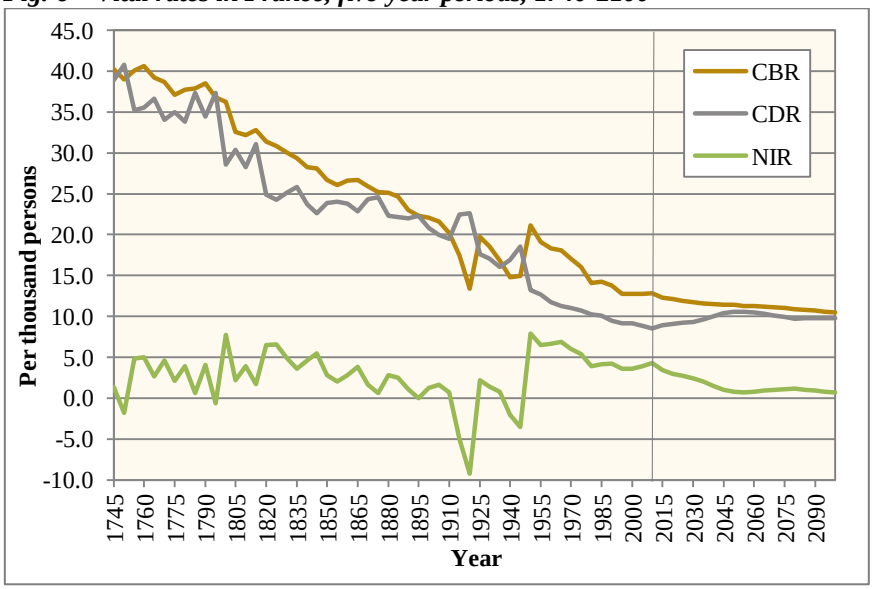
Notes: CBR – crude birth rate (number of births per 1000 persons)
CDR – crude death rate (number of deaths per 1000 persons)
NIR – rate of natural increase (NIR = CBR – CDR)
The five-year period data post 2010 represents United Nations (2014a) projections

Sources: Statistics Sweden 2015, Chesnais 1992, United Nations 2014a, and own calculations.

France was also among the first Western European countries to undergo the demographic transition, albeit, it has atypical features based on the fact that the rate of natural increase (NIR) was rather flat. Birth and death rates were declining at about the same pace inclining towards permanent equilibrium (Fig. 6). At pre-transitional stage birth and death rates fluctuated around 35-40 per 1000 persons. Fertility decline occurred very early compared to other countries of Western Europe. So the onset of demographic transition was marked around 1790-1795, which was an apparent starting point of a continuous decline in mortality. The transition in France ended around 1970-1975 when fertility and mortality rates accounted for 17 births and 11 deaths per 1000, respectively. Based on United Nations (2014a) medium variant projections, birth rates are expected to fluctuate around 10-

12 births per 1000 throughout this century while death rates will slightly rise towards mid-century leveling off at 10-11 deaths per 1000 persons.

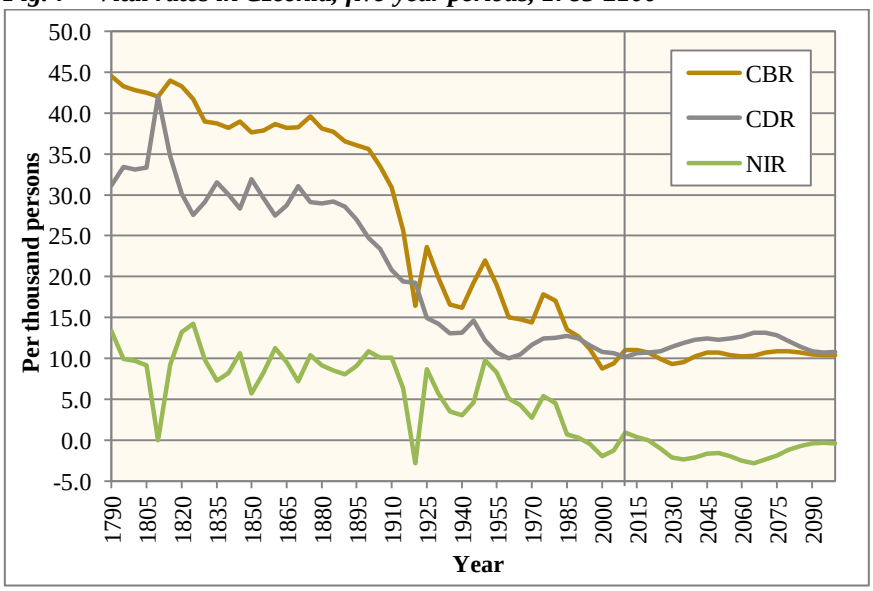
Fig. 6 – Vital rates in France, five-year periods, 1740-2100



Sources: Human Mortality Database, Chesnais 1992, United Nations 2014a, and own calculations.

When it comes to Central Europe, Czechia seems to have one of the longest historical vital rates series which gives the possibility to trace the onset of the demographic transition. The beginning of the continuous decline in mortality was marked during 1865-1870 when the rate was registered at an average of 31.3 per 1000 and never returned to that level again (Fig. 7). Continuous decline in fertility occurred around the same time, i.e. from 1870-1875 onwards when the last peak was registered at 39.6 births per 1000 persons. The transition here ended around 1955-1960.

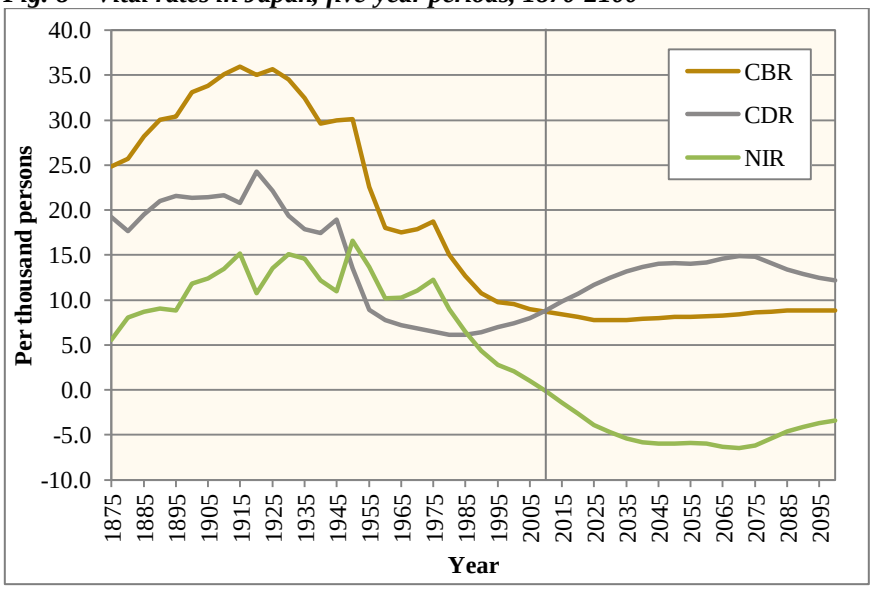
Fig. 7 – Vital rates in Czechia, five-year periods, 1785-2100



Sources: Czech Statistical Office 2015, United Nations 2014a, and own calculations.

As seen from Figure 7, the development of birth and death rates until the end of the 19th century was quite flat in Czechia which was the case with France as well (Fig. 6). United Nations (2014a) medium variant projections indicate an increase in mortality towards the year 2070 which assumedly would be the result of failure in health improvement to recompense for the effects of population ageing.

Fig. 8 – Vital rates in Japan, five-year periods, 1870-2100

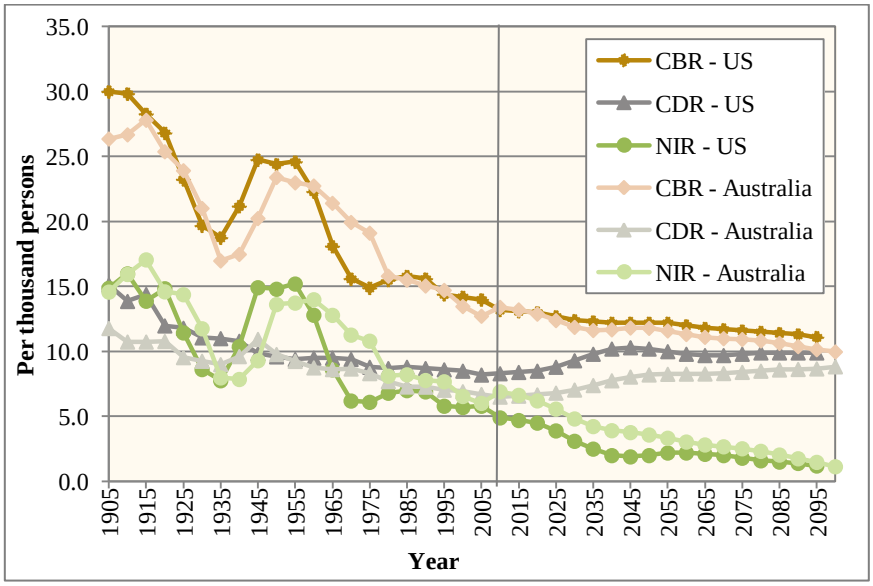


Sources: Statistics Japan 1996, United Nations 2014a, and own calculations.

In the case of Japan, continuous fertility and mortality decline occurred around 1915-1920 (Fig. 8). During the period of 1950-1960 it experienced a very rapid fertility decline from 30.1 to 18.0 births per 1000 which was the result of the eugenic population policy established in 1948 (Chesnais 1992). "Eugenic Protection Law" adopted in 1948 aimed, as stated in the first Article, "to prevent birth of inferior descendants from the eugenic point of view, and to protect life and health of mother, as well" (Tsuchiya 1997). The law permitted sterilization of the person with his/her and partner's consent. Tsuchiya also noted that along with voluntary sterilization, the law also permitted involuntary sterilization of population with intellectual or mental disabilities during the period 1948-1996. Japan is one of the oldest countries in the world today and according to the United Nations (2014a) projections NIR can decline to as low as 0.65% per year.

Australia and the United States have somewhat similar trend of vital rates since the beginning of the 20th century (Fig. 9). Earlier historical series are not available which makes the start date of the demographic transition to be unclear as mortality is already low and fertility is decreasing. United Nations medium variant projections indicate a downward trend of NIR towards the year 2100.

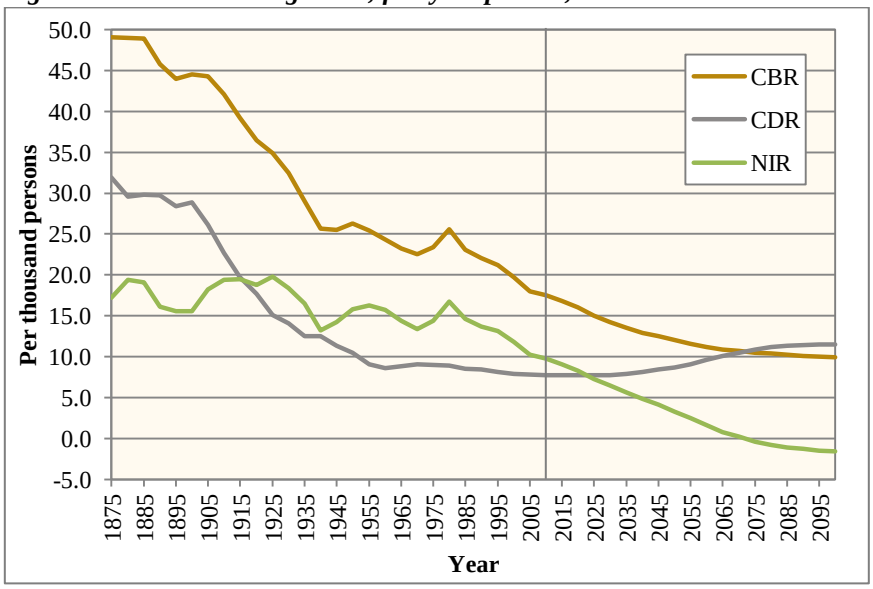
Fig. 9 – Vital rates in the United States and Australia, five-year periods, 1900-2100



Sources: Chesnais 1992, United Nations 2014a, and own calculations.

The illustrations of the vital rates of the developed countries indicate a longer duration of the demographic transition which has been completed in most cases by today. Lack of historical data for some of the countries makes it difficult to determine the approximate date of the demographic transition onset. Developing countries are distinguished by a comparatively later date of the beginning of the demographic transition. Various cultural, social and economic aspects influence the situation.

Fig. 10 – Vital rates in Argentina, five-year periods, 1870-2100

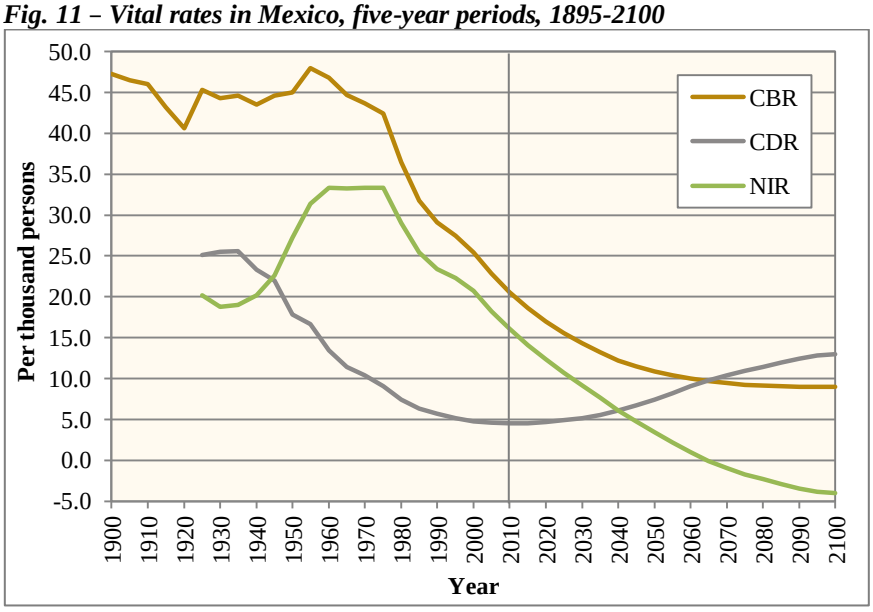


Sources: Chesnais 1992, United Nations 2014a, and own calculations.

Argentina is one of the exceptions of the developing world as the population of this country was settled by the immigrants from European countries in the beginning of the 16th century. However,

the available data starting from the end of the 19th century does not provide a reliable picture as it is not clear when exactly the downward trend of vital rates took place (Fig. 10). Medium variant projections of the United Nations (2014a) suggest a relatively steep downward trend of NIR.

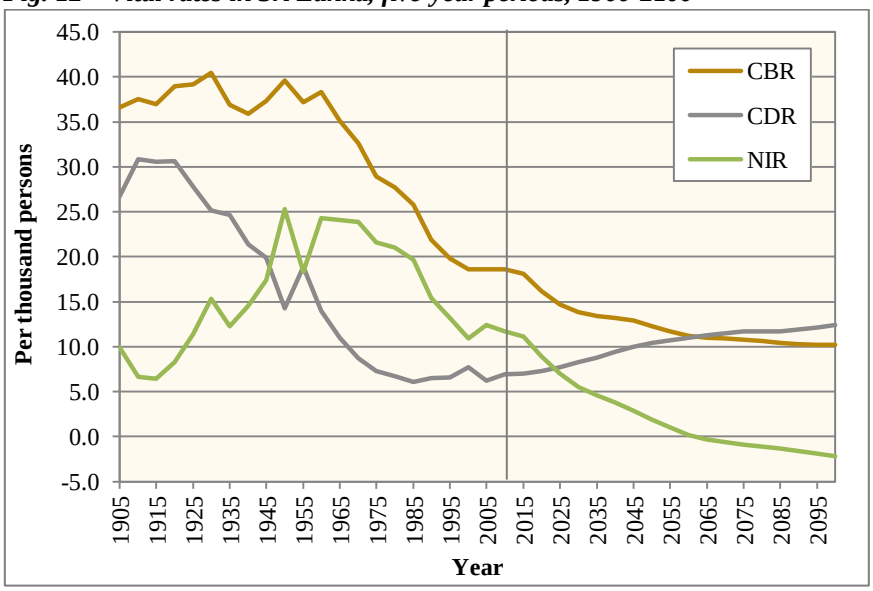
Fig. 11 – Vital rates in Mexico, five-year periods, 1895-2100



Sources: Chesnais 1992, United Nations 2014a, and own calculations.

Vital rates series for Mexico more or less follow the pattern of the classic DTM at its first stages (Fig. 11). The start of the continuous decline in mortality is observed during 1935-1940 followed by a decline in fertility around 1950-1955. Rapid decline of fertility starting from 1975-1980 resulted in a slowdown of natural increase which is projected to undergo a further dramatic decrease towards the end of the 21st century according to the United Nations (2014a).

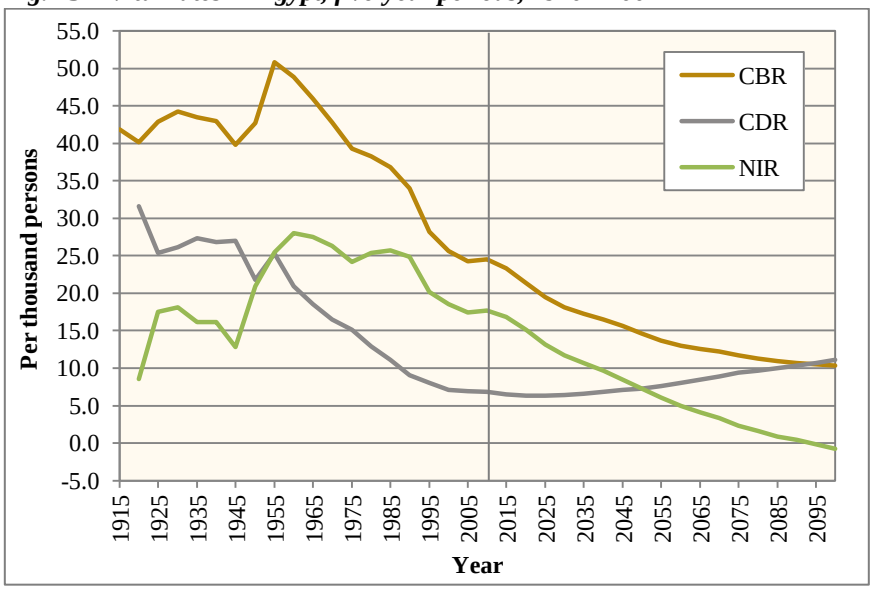
Fig. 12 – Vital rates in Sri Lanka, five-year periods, 1900-2100



Sources: Chesnais 1992, United Nations 2014a, and own calculations.

Sri Lanka was among the first countries of Southern Asia to experience the demographic transition. Death rates started to continuously decline as early as 1920-1925 when they decreased to 27.8 per 1000 without returning to that level again (Fig. 12). Uninterrupted and very steep decline in birth rates occurred during the period of 1960-1965. As seen from the Figure 12, the rate of natural increase is expected to reach its lowest pre-transitional level of 0.6% around the period of 2025-2030.

Fig. 13 – Vital rates in Egypt, five-year periods, 1910-2100



Sources: Chesnais 1992, United Nations 2014a, and own calculations.

When it comes to Northern Africa, Egypt has started its demographic transition right after the mid-20th century when mortality started to decrease from the rate of around 25.3 deaths per 1000 persons followed by a fertility decline just a decade later (Fig. 13). Rate of natural increase is expected to decline through this century reaching zero growth according to United Nations (2014a) medium variant projections.

The demographic transition profiles of the developing countries have demonstrated two distinctive features including later start of the phenomenon and a more rapid progress with higher intensity. The next section includes the analysis of the quantum and tempo effects of countries and the sub-regions they belong to.

5.1.2 Quantum and tempo effects in comparison: classification of sub-regions and selected countries

Demographic transition is an inescapable phenomenon that has affected or going to affect, eventually all of the countries in the world. It is one of the few existing processes manifesting on a universal level. There is of course no single uniform model of demographic transition as vital processes develop in the countries under different circumstances including various historical, social, cultural and economic conditions. Albeit, all of the countries follow a pattern of demographic transition stages where mortality decline stands at the forefront and is followed by fertility decline.

In this section we will attempt to create a classification of the countries and sub-regions based on the duration of the demographic transition as an indication of the quantum effect while the rate of natural increase will be analyzed as a tempo effect.

To our knowledge, none of the existing literature analyzing demographic transition as a precursor to population ageing classifies countries or regions worldwide by the scale and dynamics of those processes. Most of the literature analyzes current stages of the demographic transition in certain countries or the transition processes in some countries that have been completed. Population projections up to the year 2100 provided by the UN within the last 2012 Revision of the World Population Prospects present a unique opportunity to analyze the scale and dynamics of the demographic transition and population ageing processes far ahead. Analysis is based on medium fertility projections.

The countries that have completed their transition process until today include those of Europe, Americas, Australia/New Zealand, and some countries from Asia including China inclusive of Hong Kong, Japan, Malaysia, Singapore, South Korea, North Korea and Cyprus. The rest of the countries are still undergoing the process most of which are expected to complete it by mid-century apart from many African countries where demographic transition will not end until a few decades later. (Chesnais 1992; United Nations 2014a)

In order to classify the scale and dynamics of the demographic transitions in the world it was necessary to identify and analyze the duration of those transitions by sub-regions as well as the weighted averages of maximal rate of natural increase per year observed during those periods. Lack of historical data series however hinders the analysis of some of the transitions within sub-regions worldwide. So most of the sub-regions, apart from those of Africa, were analyzed primarily based on data provided in Chesnais (1992) which covers 67 countries worldwide. Thus, only countries with available data were grouped into sub-regions they belong to. Lists of included countries are noted under the Tables.

The following four Tables illustrate the length and dynamics of demographic transitions by sub-regions and separate countries with atypical models from those of their sub-regions.

The durations and rates for European sub-regions as well as Northern America and Australia/New Zealand are analyzed in Table 2. All of the sub-regions are characterized by intermediary rates of natural increase not exceeding 2% with long transitions lasting on average from 70 years up to one and a half centuries. European transitions along with those of Northern America and Australia/New Zealand are the oldest in the world. Being the pioneers of the process all of the sub-regions have now completed their transition. As seen from Table 2, Albania and France represent atypical cases where Albania in comparison to Southern Europe has started its transition much later having the highest rates of natural increase of about 3.3% and shortest duration of the transition, while France portrays the lowest rates of natural increase below 1% and the longest transition in the world that lasted nearly two centuries.

Tab. 2 – Length and dynamics of demographic transitions in Europe, Northern America, and Australia/New Zealand

Sub-region/Country	Beginning of transition	End of transition	Duration	Maximal rate of natural increase per year (%)
Northern Europe	1810-1815	1960-1965	150	1-2
Western Europe	1870-1875	1960-1965	90	1-2
France	1790-1795	1970-1975	180	< 1
Central Europe	1870-1875	1960-1965	90	1-2
Southern Europe	1885-1890	1965-1970	80	1-2
Albania	1940-1945	1995-2000	65	> 3
Eastern Europe	1895-1900	1965-1970	70	1-2
Northern America*	1890-1895	1960-1965	70	1-2
Australia/New Zealand*	1870-1875	1960-1965	90	1-2

Notes: Northern Europe: Denmark, Finland, Norway, Sweden, and United Kingdom.
Western Europe: Belgium, France, Netherlands, and Switzerland.
Central Europe: Austria, Czechia, Germany, Hungary, and Poland.
Southern Europe: Albania, Bosnia and Herzegovina, Croatia, TFYR Macedonia, Montenegro, Serbia, Slovenia, Greece, Italy, Portugal, and Spain.
Eastern Europe: Belarus, Bulgaria, Romania, Russia, and Ukraine.
Northern America: Canada and United States.
* It is not possible to trace the onset of demographic transition in countries historically populated by immigrants due to data unavailability. The proposed dates are approximate starting dates of transitions mentioned by Chesnais (1992) who used the estimations for life expectancy or infant mortality.

Sources: Chesnais 1992, United Nations 2014a, and own calculations.

Countries of Asian sub-regions are quite diverse in all aspects including maximal NIR, the onset as well as the duration of transitions (Tab. 3). Eastern Asia and South-Eastern Asia are the most prominent cases in that regard. As a result it was not adequate to analyze them at sub-regional level due to high heterogeneity but only at country level. Japan, for instance, has the lowest rate of natural increase at around 1.7%. Having started the transition around 1915-1920, Japan has already completed the process by 1980-1985. Hong Kong represents the shortest transition of around 40 years while having very high rates of natural increase above 3%. China followed a similar pattern in terms of the onset date and duration but with lower maximal NIR of approximately 2.7%. Singapore also completed its transition in 50 years like China but 20 years earlier and with much higher NIR. Mongolia, unlike other countries of Eastern Asia is undergoing relatively long transition process which is expected to end around 2040. Similarly to South America analyzed above, Southern Asia is also divided into two groups due to differences in maximal rates of natural increase. Central Asian sub-region is characterized by very high NIR with the onset of the transition process in the 1950s that is projected to last until around the year 2030. Western Asia was the last Asian sub-region to start the transition process around the 1960s with a projected end around the 2030s. Yemen being an extreme case with maximal NIR above 4% started undergoing the process only around the year 1980 and is expected to complete the process in 80 years. Sri Lanka has an atypical

model for its region as it started the process way ahead around 1920 with relatively high NIR and is most likely going to complete the transition around 2025.

Tab. 3 – Length and dynamics of demographic transitions in Asian sub-regions and selected countries

Sub-region/Country	Beginning of transition	End of transition	Duration	Maximal rate of natural increase per year (%)
Eastern Asia				
China	1945-1950	1995-2000	50	2-3
Japan	1915-1920	1980-1985	65	1-2
South and North Korea	1905-1910	1995-2000	90	2-3
Hong Kong	1940-1945	1980-1985	40	> 3
Mongolia	1935-1940	2035-2040	100	2-3
Central Asia	1945-1950	2025-2030	80	> 3
Southern Asia I	1950-1955	2025-2030	75	2-3
Southern Asia II	1950-1955	2025-2030	75	> 3
Sri Lanka	1920-1925	2025-2030	105	2-3
Afghanistan	1975-1980	2045-2050	70	> 3
South-Eastern Asia				
Singapore	1925-1930	1975-1980	50	> 3
Malaysia	1930-1935	2005-2010	75	> 3
Philippines	1915-1920	2015-2020	100	2-3
Cyprus	1920-1925	1995-2000	75	2-3
Western Asia	1955-1960	2025-2030	70	> 3
Yemen	1975-1980	2055-2060	80	> 3

Notes: Central Asia: Uzbekistan, Turkmenistan, Kazakhstan, and Kyrgyzstan.
Southern Asia I: India, Bhutan, Nepal, Pakistan, and Sri Lanka.
Southern Asia II: Afghanistan, Bangladesh, Iran, and Maldives.
Western Asia: Bahrain, Cyprus, Oman, Saudi Arabia, Palestine, Syria, and Yemen.

Sources: Bolormaa 2011, Chesnais 1992, Kim 1994, United Nations 2014a, and own calculations.

American sub-regions are distinguished by much higher NIR and shorter durations of transitions lasting around 60-70 years (Tab. 4). Despite the fact that American sub-regions (apart from Northern America) started to experience declining mortality and fertility rates much later than the European ones, they have already reached the end of the process. In order to distinguish relatively homogenous groups of countries, South America is divided into two groups because of quite substantial differences in maximal NIR. Argentina is one of the exceptions in the region that represents considerably longer transition based on the fact that the population of the country was initially comprised of the European immigrants and followed the trait of the European transition model as a result. Countries of the Caribbean underwent the shortest transitions lasting 60 years on average with an exception of Jamaica, for instance, which experienced longer demographic transition and higher maximal NIR.

Tab. 4 – Length and dynamics of demographic transitions in American sub-regions and selected countries

Sub-region/Country	Beginning of transition	End of transition	Duration	Maximal rate of natural increase per year (%)
Central America	1925-1930	1995-2000	70	> 3
South America I	1935-1940	1990-1995	65	2-3
South America II	1935-1940	1990-1995	65	> 3
Argentina*	1895-1900	1995-2000	100	1-2
Caribbean	1915-1920	1975-1980	60	2-3
Jamaica	1915-1920	1995-2000	80	> 3

Notes: Central America: Cost Rica, Mexico, Panama, and El Salvador.
South America I: Argentina, Brazil, Chile, Ecuador, Peru, and Uruguay.
South America II: Colombia, Venezuela, and Suriname.
Caribbean: Cuba, Jamaica, Puerto Rico, and Trinidad and Tobago.
* It is not possible to trace the onset of demographic transition in countries historically populated by immigrants due to data unavailability. The proposed date is an approximate starting date of transition mentioned by Chesnais (1992) who used the estimations for life expectancy or infant mortality.

Sources: Chesnais 1992, United Nations 2014a, and own calculations.

African sub-regions are among the last ones in the world to have started undergoing the declining mortality and fertility rates (Tab. 5). Average rates for Eastern and Middle Africa are roughly the same with the transition lasting from 1970 and until around 2060. Western Africa illustrates the latest transition in the region that started only around 1980 and is projected to be finalized by approximately 2070 while Northern Africa should be the first African sub-region to complete its transition around the year 2030.

Tab. 5 – Length and dynamics of demographic transitions in African sub-regions

Sub-region/Country	Beginning of transition	End of transition	Duration	Maximal rate of natural increase per year (%)
Northern Africa	1955-1960	2025-2030	70	2-3
Eastern Africa	1965-1970	2055-2060	90	> 3
Middle Africa	1965-1970	2055-2060	90	2-3
Southern Africa	1955-1960	2045-2050	90	2-3
Western Africa	1975-1980	2065-2070	90	2-3

Notes: African sub-regions are represented by all of the countries belonging to those areas.

Sources: United Nations 2014a and own calculations.

Having identified and analyzed the durations of the demographic transitions in sub-regions and selected countries along with the maximal rates of natural increase observed during that period we have developed the classification of those sub-regions (with same delimitation of countries as mentioned above) based on the scale and dynamics of the transition processes (Tab. 6). There are six main types of demographic transitions that have been identified according to the duration (long transitions lasting over 70 years and short transitions less than 70 years respectively) and the maximal rate of natural increase (below 2%, 2-3% and over 3%).

Tab. 6 – Classification of the scale and dynamics of the demographic transition models in the world by sub-regions and selected countries

Type I – Long low transition Duration: longer than 70 years Rate of natural increase (%): < 2	**Type II – Short low transition** Duration: shorter than 70 years Rate of natural increase (%): < 2
• Northern Europe • Western Europe • Central Europe • Southern Europe • Eastern Europe • Northern America • Argentina (South America) • Australia/New Zealand	• Japan (Eastern Asia)
Type III – Long intermediate transition Duration: longer than 70 years Rate of natural increase (%): 2-3	**Type IV – Short intermediate transition** Duration: shorter than 70 years Rate of natural increase (%): 2-3
• South and North Korea (Eastern Asia) • Mongolia (Eastern Asia) • Southern Asia I • Sri Lanka (Southern Asia) • Philippines (South-Eastern Asia) • Cyprus (Western Asia) • Northern Africa • Middle Africa • Southern Africa • Western Africa	• South America I • Caribbean • China (Eastern Asia)
Type V – Long high transition Duration: longer than 70 years Rate of natural increase (%): > 3	**Type VI – Short high transition** Duration: shorter than 70 years Rate of natural increase (%): > 3
• Central America • Jamaica and Trinidad and Tobago (Caribbean) • Central Asia • Southern Asia II • Afghanistan (Southern Asia) • Malaysia (South-Eastern Asia) • Western Asia • Eastern Africa	• Albania (Southern Europe) • South America II • Hong Kong (Eastern Asia) • Singapore (South-Eastern Asia)

Sources: Author's own study based on data from Bolormaa 2011, Chesnais 1992, Kim 1994, and United Nations 2014a.

The classification of sub-regions by the scale and dynamics of transitions clearly depicts the homogeneity as well as heterogeneity of group of countries according to their vital rates development. As seen from Table 6, European sub-regions are quite homogeneous in terms of the period it took them to develop from high birth and death rates to low birth and death rates. Japan is perhaps the most unique case being the only country falling under the second type of short low transition as the process lasted there only around 65 years with considerably low NIR not exceeding 1.7%. It is interesting to note that some countries of Central America, Central Asia, Western Asia and Eastern Africa belong to the same type of long and high transition. There are just a few countries that underwent short transition with intermediate and high maximal rates of natural increase around 2-3% and above 3% respectively.

The results of the analysis reveal the fact that majority of the sub-regions in the world tend to undergo long transitions lasting over 70 years. Even the contemporary transitions, i.e. in African sub-regions are expected to have relatively long processes of declining birth and death rates according to medium variant projections of United Nations (2014a). The fastest processes are observed in Eastern Asia and South America.

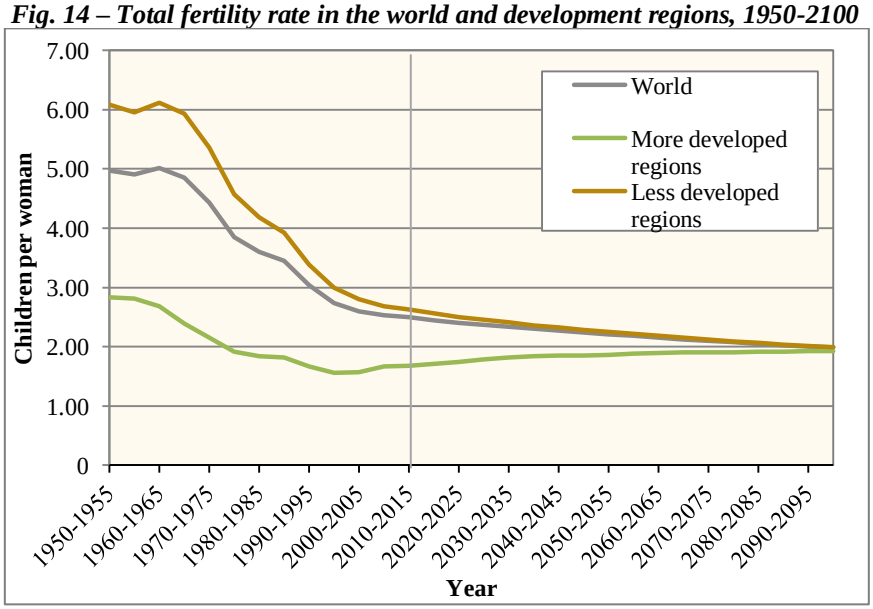
5.2 Quantum and tempo of population ageing

The demographic transition with its declining birth and death rates results in an increasing proportion of older population. Low fertility and increasing life expectancy result in the phenomenon of population ageing. Being an inevitable outcome of the demographic transition, population ageing will also eventually affect all of the countries in the world. The population of the developed countries that have already completed demographic transition is formed of a larger proportion of elderly compared to the rest of the world. And this proportion of older population is continuing to increase though not as rapidly as in the developing countries.

5.2.1 Global processes of ageing

The number of older persons aged 65 and over worldwide has reached approximately 530 million in 2010 which has increased fourfold since 1950 when it was 128 million (United Nations 2014a). The growth of the proportion of older population is usually associated with developed countries, which is true as more developed regions have relatively high proportions of older persons but this segment of population is actually growing at a faster rate in the less developed part of the world according to United Nations (2013) calculations.

Fig. 14 – Total fertility rate in the world and development regions, 1950-2100



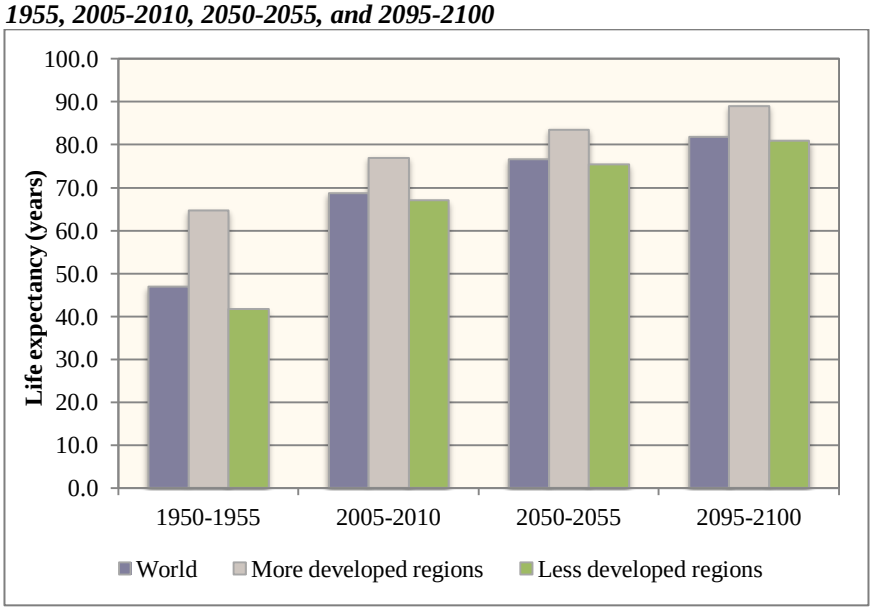
Source: Adapted from United Nations 2014a.

Fertility decline has been the main factor driving population ageing (Kinsella and Phillips 2005). Fertility rate has been steadily decreasing over the last decades and has dropped by roughly 50% over the course of the second half of the 20th century from approximately 5.0 to 2.5 children per woman globally (Fig. 14).

In more developed regions TFR has dropped below replacement level around the year 1975. World level (2.5 children in 2010) is kept above replacement fertility due to high rates among less developed regions. Nevertheless, as seen from Figure 14, fertility rate has been decreasing at a much faster pace in the less developed regions, which has narrowed the gap with regards to the levels of the more developed regions. Based on United Nations (2014a) medium projections, fertility rates should continue to decrease in the less developed regions while more developed regions are expected to undergo a slight increase which should nearly equalize TFR in both development regions towards the end of this century.

Increasing life expectancy is also one of the prerequisites of population ageing however it does not have direct immediate results in the ageing process. Early improvements in life expectancy resulting from declines in child mortality lead to increased number of infants and children as well as reductions in the proportions of older people while continued progress in lifespan later on contributes to growing proportion of older individuals as more and more people survive to older ages (United Nations 2013).

Fig. 15 – Life expectancy at birth in the world and development regions, 1950-1955, 2005-2010, 2050-2055, and 2095-2100



Source: Adapted from United Nations 2014a.

In the 1950s more developed regions had the level of life expectancy at birth (roughly 65 years) that was reached by the less developed regions only in the beginning of the 2000s (Fig. 15). However, the gap between more and less developed regions has decreased twofold over the last decades as a result of rapid increment observed in the less developed regions. It is projected by the United Nations (2014a) that life expectancy at birth in the less developed regions is going to double

from 40 to approximately 80 years during the period 1950-2100 which would signify a great leap forward for the humanity.

5.2.2 Typology of sub-regions and selected countries by quantum and tempo of population ageing

Even though population ageing is considered to be one of the greatest achievements of the humanity, it can bring along a number of threats apart from opportunities to the economical well-being of countries if appropriate measures are not taken into account in advance. This section will analyze what is already known and identify future trends of population ageing in terms of its quantum and tempo effects in sub-regions and selected countries worldwide. The grouping of countries in sub-regions is presented according to UN classification. As a result, Central Europe is not identified unlike in the previous sub-chapter dealing with demographic transitions.

Rapid increase in the proportion of older persons stands at the forefront of population ageing process. The proportion of older individuals aged 65 and over worldwide was around 7.7% in 2010 which is projected to double by the year 2050 according to United Nations (2014a) estimates. The growth of older persons started to accelerate towards the end of the 20th century as a result of rapid increase that started in the developing world.

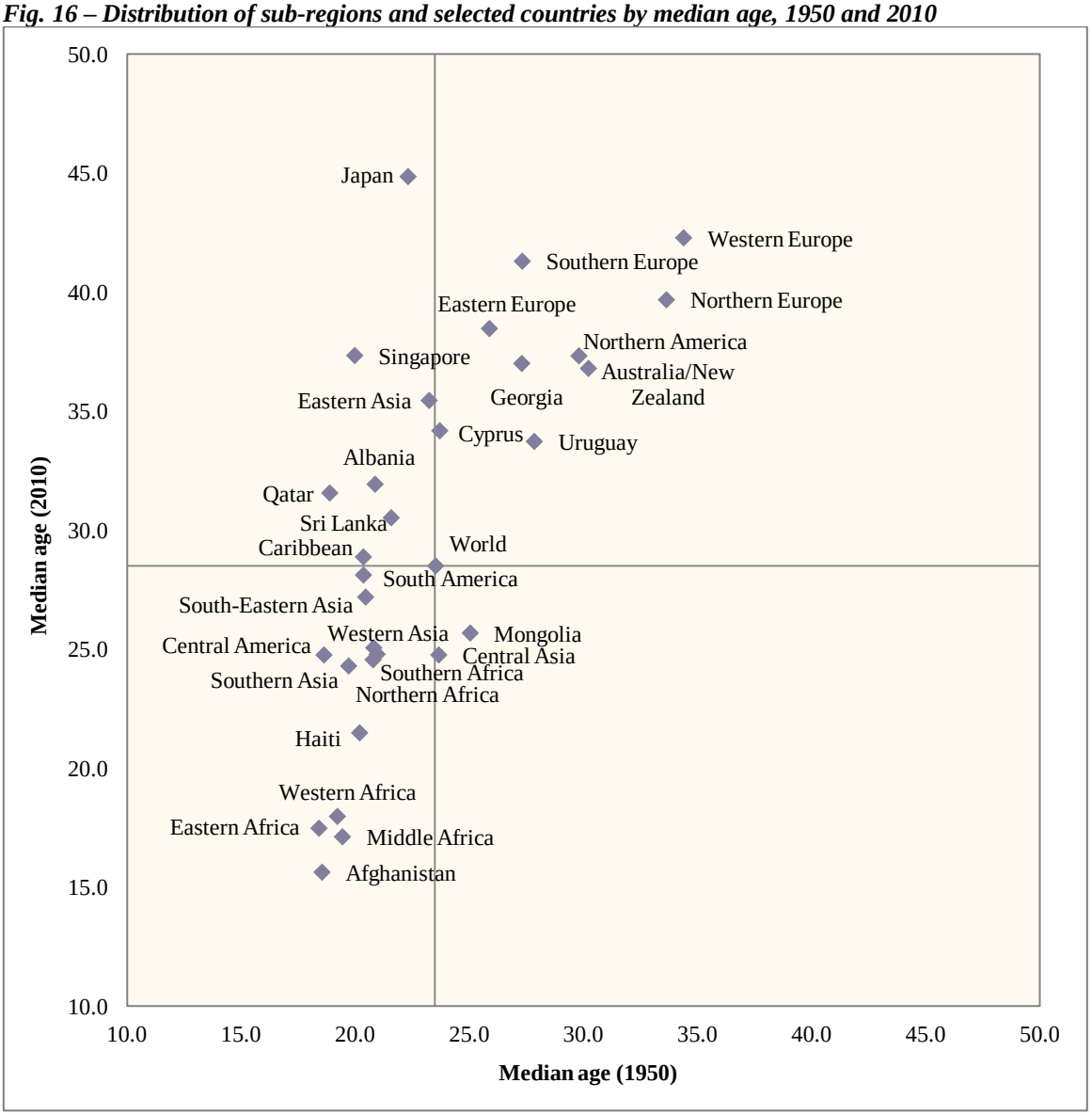
It is also important to note that the proportion of oldest old (aged 80 and older) individuals is increasing at a faster rate as well which means that the older population itself is ageing too. The share of the oldest old within the older population was 14% in 2013 and is projected to reach 19% by mid-century (United Nations 2013).

Shift in the median age of population is another evidence of population ageing. In 2010 half of the world population was younger than 29 years while the other half was older (United Nations 2014a). Median age of population in the world as a whole has increased by 5 years since 1960 and is projected to increase by another 7 years towards the mid-century from that point. Developing countries differ significantly from developed ones where the median age of the latter was 40 years in 2010 which is almost 14 years higher than that observed in developing countries. But the rate of increase in median age has accelerated in developing countries over the past two decades and is projected to reach 35 years by the year 2050 according to United Nations medium variant estimates. According to United Nations, in 2010 the oldest country in the world with median age of 44.9 years was Japan while the youngest was Niger where half of the population was 15.1 years old or younger.

Figure 16 shows the distribution of oldest and youngest sub-regions and selected countries by median age of population in 1950 and 2010. Selected countries are identified in the analysis as a result of their atypical rates compared to the average of the sub-regions they belong to. Most atypical cases are observed in Asian sub-regions as some of the countries there started undergoing the demographic transition with declining birth and death rates considerably earlier which has resulted in higher proportion of older population. The values in the scatter plot (Fig. 16) are relative to the world estimates of median age of 23.5 and 28.5 years in 1950 and 2010, respectively. We can

spot the distribution of sub-regions and selected countries from the youngest ones at the bottom and the oldest at the top. The "older" the sub-region or a country is the further up is its position on the scatter plot. All of the European sub-regions along with Northern America and Australia/New Zealand are scattered in the upper right corner which signifies the fact that countries in those sub-regions were already quite "old" in the 1950s. Japan and Afghanistan represent two extreme cases where the median age of the latter has remained practically the same while in Japan it has more than doubled.

Fig. 16 – Distribution of sub-regions and selected countries by median age, 1950 and 2010



Source: Adapted from United Nations 2014a.

Based on Figure 16, we can divide the sub-regions and selected countries into two groups with older and younger population relative to the world estimates. All of the sub-regions and countries situated above the horizontal axis fall under the group with older population while the group with relatively young and very young population is below that axis.

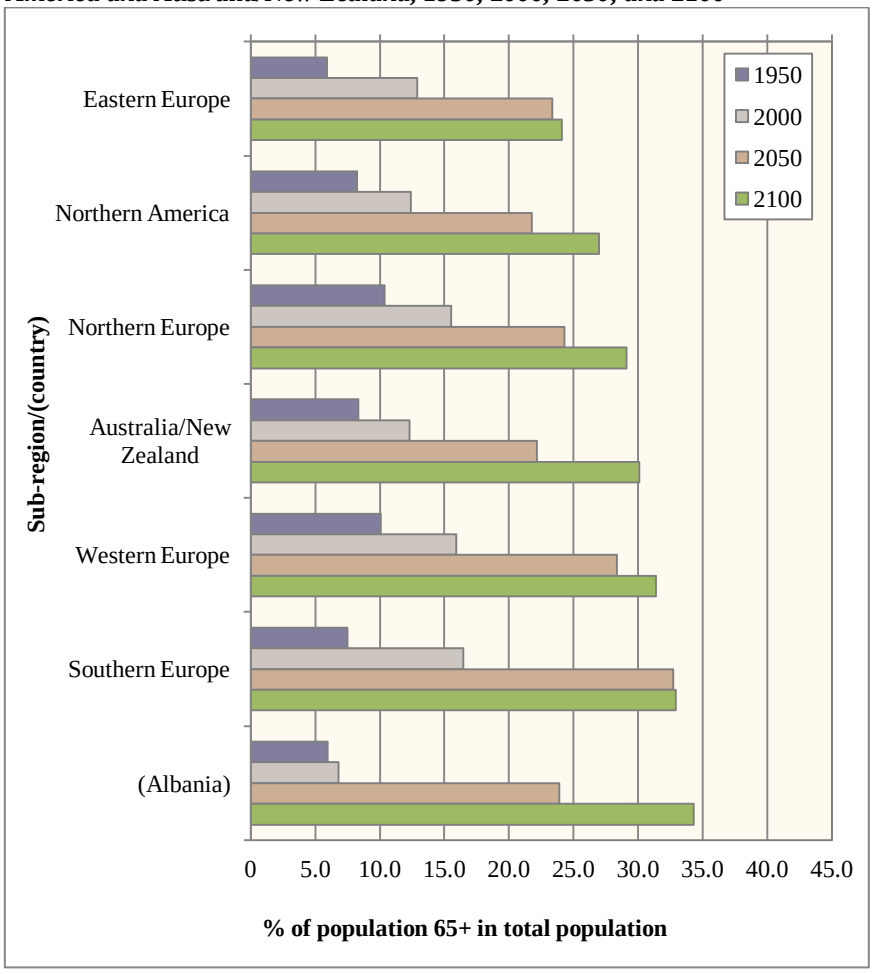
The speed and intensity of increase in the proportion of older individuals shows stark differences between developed and developing countries. Furthermore, there are some obvious differences within the less developed sub-regions where some of the countries display different levels as they started their demographic transition ahead of their sub-regions and are at a more advanced stage of population ageing as a result. More developed sub-regions on their turn show comparatively analogous pace.

Figure 17 illustrates the trend of population ageing in the European sub-regions as well as in Northern America and Australia/New Zealand. Europe is the "oldest" region in the world. The proportion of older population in European sub-regions is the highest in the world with Southern and Western Europe leading the way having had 18.1% and 18.5% of population aged 65 and over respectively in 2010 according to United Nations (2014a) estimates. Albania is an exception in the Southern Europe where the proportion was only 6.8% in 2000 which was more than two times lower than the average percentage of the sub-region (Fig. 17). But it can be seen that the rate of increase has been speeding up in Albania where the proportion of older individuals is projected to reach almost a quarter of the total population by mid-century.

The proportion of population aged 65 and older in France increased from 7% to 14% in 115 years (1865-1980); and it took Sweden around 85 years (1890-1975), Australia – 74 years (1938-2012), and United States required 68 years (1944-2012) (Kinsella and Phillips 2005). Since historical data series of population size by age groups are not available for all of the countries, the data of France, Sweden, United States and Australia will represent the sub-regions of Western Europe, Northern Europe, Northern America and Australia/New Zealand respectively as the latest trends of those countries are compatible with averages of the whole sub-regions. Based on average data for the whole sub-region, it took Eastern Europe around 42 years (period of 1963-2005) for the proportion of older population to increase from 7% to 14% while Southern Europe required around 45 years (1947-1992) (United Nations 2014a). Albania being an exception reached the proportion of 7% only in 2001 but should require only 21 years until 2022 to reach the level of 14% which is twice as fast as Southern Europe, according to United Nations estimates.

As mentioned in the methodological section, the speed of population ageing is measured as a ratio of percentage point increase, in the proportion of population aged 65 and over from 7% to 14%, to the number of years required. As a result, the speed of population ageing in Western Europe is approximately 0.06 percentage points, while in Northern Europe it is 0.08, in Eastern Europe – 0.17, and in Southern Europe – 0.16 (where Albania's speed is 0.33 percentage points). In Northern America the speed is estimated at 0.10 percentage points per year and in Australia/New Zealand it is 0.09 percentage points.

Fig. 17 – Proportion of population aged 65 and over in Europe, Northern America and Australia/New Zealand, 1950, 2000, 2050, and 2100



Source: Adapted from United Nations 2014a.

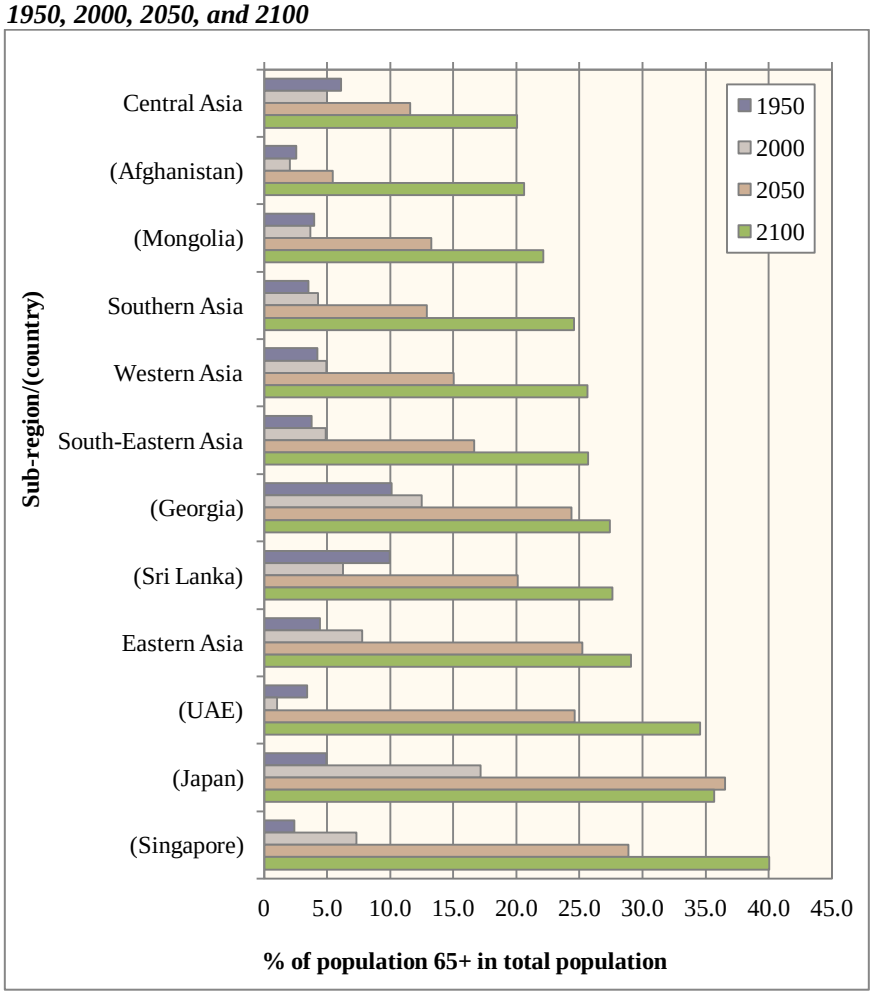
The increase in the proportion of older people in Asian sub-regions and selected countries over the course of 150 years (1950-2100) is illustrated in Figure 18. Asian countries are very heterogeneous with regards to the speed and intensity of increase in the proportion of older population. As seen from Figure 18, in the year 2000 Japan had the highest proportion at the level of 17.2% which was almost five times higher compared to Mongolia situated in Eastern Asia as well. Singapore is undergoing tremendous acceleration and is projected to have as much as 40% of older population by the end of this century.

In Eastern Asia the proportion of older individuals reached 7% only in 1996 but it is projected to increase up to 14% in just 26 years (United Nations 2014a). It took Japan around the same length of time (25 years) to undergo the same increase but a few decades earlier (1970-1995) while in Mongolia the 7% threshold should be reached in 2030 and 14% in 2052 resulting in the duration of only 22 years. The same increase in the proportion of older persons is projected to occur in Central Asia in 31 years (2026-2057), while Southern Asia is estimated to require 27 years (2025-2052) (where Afghanistan should need only 16 years (2058-2074) and Sri Lanka – 25 years (2005-2030)), South-Eastern Asia – 22 years (2020-2042) (where Singapore is expected to experience the increase

in 20 years (2000-2020)), and Western Asia in 22 years (2025-2047) (where United Arab Emirates are projected to have the proportion increased in just 5 years (2039-2044) which is quite a surprising estimate) according to United Nations medium variant projections.

The speed of population ageing in Eastern Asia is roughly 0.27 percentage points per year while in Japan it is 0.28 and 0.32 in Mongolia. Population is ageing a bit slower in Central Asia at a pace of 0.23 percentage points. Southern Asia has a similar rate to Eastern Asia as the speed of population ageing is 0.26 percentage points per year while it is 0.44 in Afghanistan and 0.28 in Sri Lanka. The speed of South-Eastern and Western Asia is estimated at 0.32 percentage points per year while in Singapore it is 0.35 and is as high as 1.4 in United Arab Emirates.

Fig. 18 – Proportion of population aged 65 and over in Asian sub-regions, 1950, 2000, 2050, and 2100



Source: Adapted from United Nations 2014a.

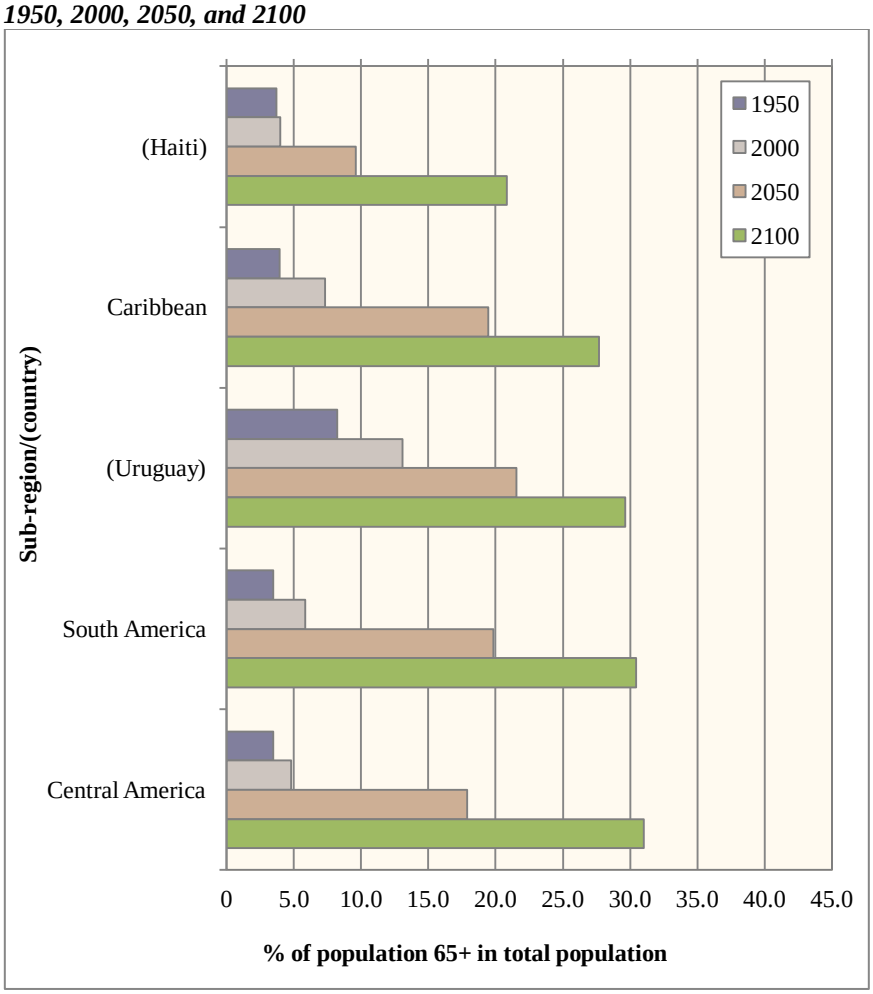
Countries in American sub-regions (apart from Northern America) are more or less homogeneous in their proportions of older people apart from just a few exceptions. This part of the world is comparatively young but the rate of increase in the proportion of older individuals has started to accelerate. The proportion of people aged 65 and over is expected to nearly triple in the Caribbean during the period of 2000-2050 from 7.3% to 19.5% (Fig. 19). Haiti is an exception to

the Caribbean sub-region where the proportion is considerably smaller and is not increasing at a fast pace at the moment but this is projected to change from the middle of this century. By 2050, older individuals in Haiti are expected to constitute only 9.6%. South America has somewhat similar rates with the Caribbean but the pace is increasing in the first. Central America is a bit "younger" though the proportion is increasing with a higher tempo. Uruguay, on its turn, is the "oldest" country in the region as a result of the historical immigrant population from Europe.

As mentioned above, the speed of increase of older population is considerably high in American sub-regions. It is projected to take the Caribbean around 36 years (1995-2031) for the population aged 65 and over to increase from 7% to 14% (where Haiti will require only about 25 years but much later (2040-2065)), while in Central America the same increase will occur in mere 23 years (2017-2040) and in South America in about 25 years (2010-2035) (United Nations 2014a).

In the Caribbean population is ageing at a speed of 0.19 percentage points per year while in Haiti it is estimated at 0.28 percentage points. In Central and South America the pace is similar to Haiti as it is 0.30 and 0.28 percentage points, respectively.

Fig. 19 – Proportion of population aged 65 and over in American sub-regions, 1950, 2000, 2050, and 2100

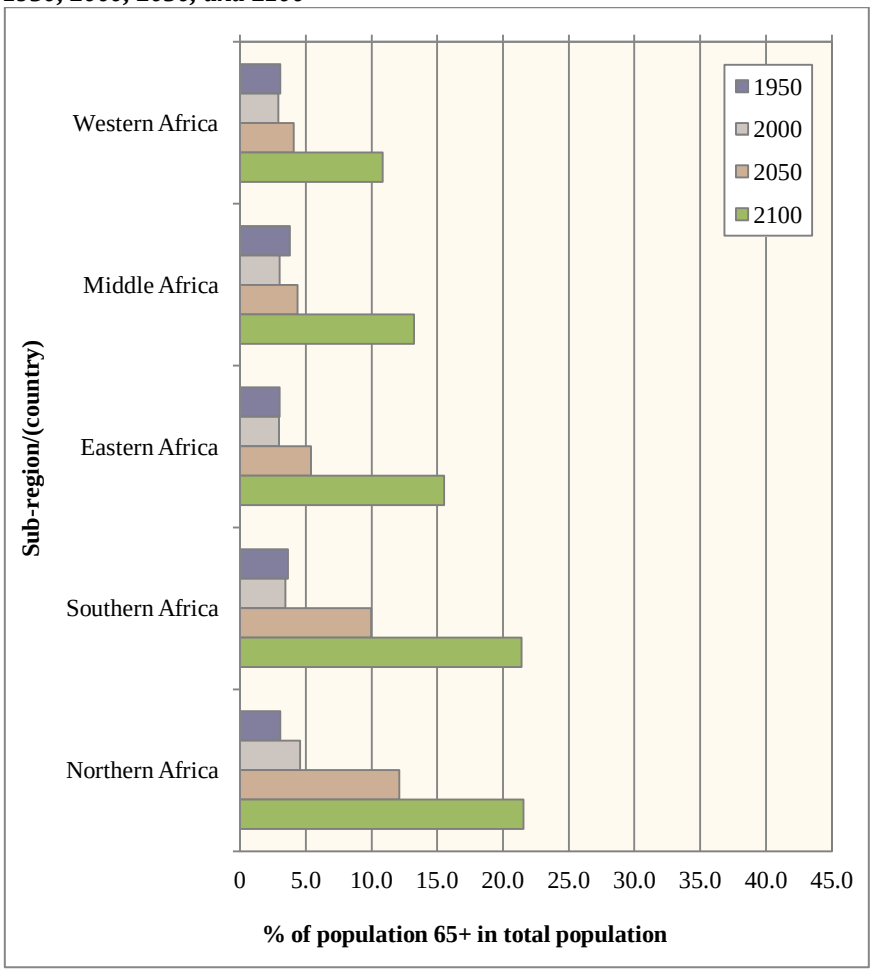


Source: Adapted from United Nations 2014a.

African sub-regions are the "youngest" in the world. Neither of African sub-regions has reached even 5% threshold of population aged 65 and older in 2000 (Fig. 20). Based on United Nations (2014a) medium variant projections, the increase of older population from 7% to 14% in Eastern Africa is projected to occur in 33 years in the second half of this century (2060-2093) while in Northern Africa it should take approximately 30 years but much earlier (2027-2057), and in Southern Africa estimated 35 years from the year 2030 until 2065. In Middle and Western Africa the older population is projected to increase up to 7% only by the year 2070 and 2080 respectively and is not expected to reach 14% threshold by the end of this century.

The speed of population ageing in African sub-regions is considerably high but not the highest as in Eastern Africa it is 0.21 percentage points per year, and 0.23 and 0.20 percentage points in Northern and Southern Africa accordingly. Very approximate speed for Middle and Western Africa is 0.20 percentage points per year.

Fig. 20 – Proportion of population aged 65 and over in African sub-regions, 1950, 2000, 2050, and 2100



Source: Adapted from United Nations 2014a.

Based on the analysis of population ageing in the world we have developed the typology of sub-regions and selected countries by quantum and tempo of population ageing (Tab. 7). We distinguish

six different types of the ageing process based on the speed and period of increase in the proportion of population aged 65 and older from crucial 7% to 14%.

Tab. 7 – Typology of sub-regions and selected countries worldwide by quantum and tempo of population ageing

Type I – Low speed early ageing Period: before 2050 Speed: < 0.18	**Type II – High speed early ageing** Period: before 2050 Speed: 0.18-0.30
• Western Europe • Northern Europe • Eastern Europe • Southern Europe • Northern America • Australia/New Zealand	• Eastern Asia • Japan (Eastern Asia) • Sri Lanka (Southern Asia) • South America • Caribbean
Type III – Very high speed early ageing Period: before 2050 Speed: > 0.30	**Type IV – Low speed late ageing** Period: between 2050-2100 Speed: < 0.18
• Albania (Southern Europe) • South-Eastern Asia • Western Asia • Central America	N/A
Type V – High speed late ageing Period: between 2050-2100 Speed: 0.18-0.30	**Type VI – Very high speed late ageing** Period: between 2050-2100 Speed: > 0.30
• Central Asia • Southern Asia • Haiti (Caribbean) • Eastern Africa • Northern Africa • Southern Africa • Middle Africa • Western Africa	• Mongolia (Eastern Asia) • Afghanistan (Southern Asia)

Notes: "Period" implies the timing when the proportion of older population is estimated to reach 14%.
"Speed" is measured in percentage points per year (as mentioned in the methodological section).

Sources: Author's own study based on data from Kinsella and Phillips 2005 and United Nations 2014a.

As seen from Table 7, the lowest speed of population ageing was inherent to European sub-regions while most of Africa should be ageing with a higher speed but not as high as Asia and part of America. Type V including the sub-regions with high speed late ageing is the most widespread one with seven sub-regions from Africa and Asia. None of the countries in the world are expected to age with a low speed at a later period of time. It implies that the processes of population ageing are only accelerating further.

Chapter 6

Social conditions of sub-regions around the world in the context of ageing

"Populations around the world are growing older, but the trends are not cause for despair." (Anderson and Hussey 2000:191). Population ageing is not a catastrophe as it may be perceived by some. On the contrary, it is one of the greatest achievements of the human kind as the medical advancements are leading towards decreasing mortality rates and increasing life expectancy worldwide. Life expectancy in Japan is approximately 83 years today which is the highest in the world and it is projected to increase even further reaching 90 years by mid-century (United Nations 2014a).

It is obvious, that the demographic changes taking place during the ageing process bring along significant socioeconomic consequences. But it is the policymakers and governments who have the chance to turn those consequences into opportunities or let them become threats for their societies.

Countries around the globe are not ageing at the same time and the intensity along with the speed of the process differs as well. Social conditions are very diverse too, so that some countries and regions are generally better prepared to cope with the negative consequences of the ageing phenomenon compared to the other.

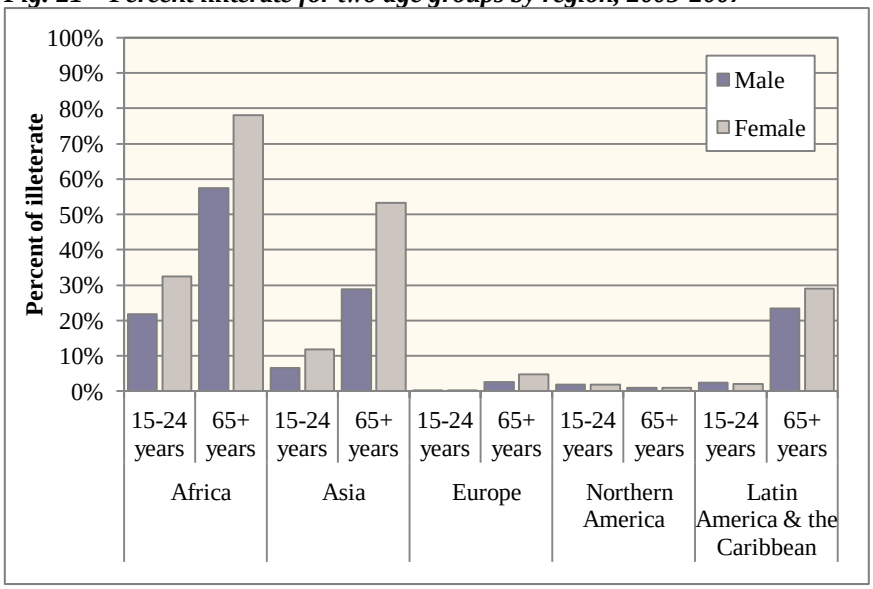
6.1 Quality of education

Equal access to quality education is an essential element influencing economic growth and healthier and longer lives of individuals (UNECE 2013). Considering education in the context of population ageing is crucial. Over the past decades increased attention given to education around the world has contributed to increasing levels of education quality and literacy among younger population albeit they still tend to be low among older individuals. There are substantial differences between more and less developed countries with regards to the levels of literacy and education while they tend to be even lower in rural areas compared to urban areas of the developing world.

During the period 2005-2007, global literacy rate was 71% among the population aged 65 and older, with averages of 97% and only 54% in developed and developing countries, respectively

(United Nations 2011). Female literacy rate was the same as the overall average in more developed countries compared to only 42% in less developed part of the world. Furthermore, during the same period, Cuba, Estonia, Latvia and Lithuania reported to have the highest levels of literacy among older population aged 65 and over (100% for both males and females) while Burkina Faso with 9% (12% for males and 5% for females), Guinea-Bissau with 9% (14% and 5% for males and females accordingly) and Ethiopia with 10% (16% and 4% for males and females, respectively) had the lowest levels observed in this age group. Literacy levels among the ageing population are expected to improve in the decades to come as the current younger generations with better education are growing older.

Fig. 21 – Percent illiterate for two age groups by region, 2005-2007



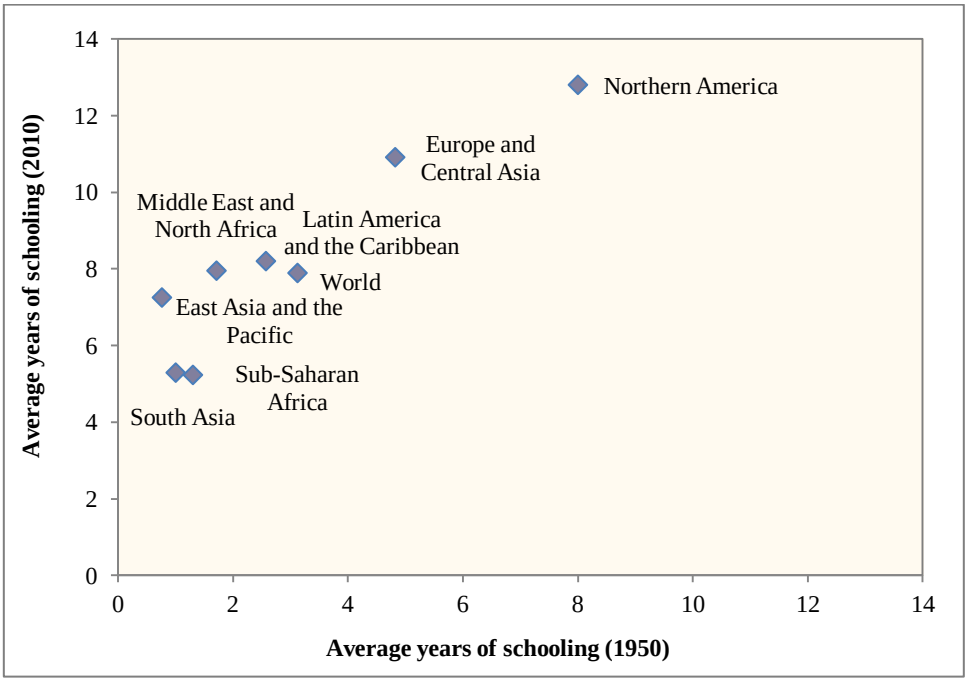
Sources: Adapted from United Nations 2011 and UNESCO 2015.

In developing countries, high proportions of older population are still illiterate today as they lived most of their lives prior rapid development of education that took place post the middle of the 20th century. As seen from Figure 21, illiteracy rates are extremely high among older population in Africa with 58% and 78% for males and females respectively and very high among young population as well. In Asia and Europe the gap between male and female illiteracy among older population aged 65 and over is nearly 50% though the rates are considerably higher in Asia. The comparative rates between the two age groups show that literacy levels were already quite high in Europe and Northern America a few decades ago but the highest achievements in eradicating the illiteracy among the population today are observed in Asia as well as Latin America and the Caribbean.

Much research has been dedicated to analyzing and confirming the causal relationship of better education and better health as well as higher income. Recent studies have proposed to use educational attainment in demographic analysis when projecting the future size of older population as educational composition in the study of ageing can improve the results by revealing dramatic changes in population composition along with avoiding underestimations (Joung et al. 2000;

Batljan, Lagergren, and Thorslund 2009; Lutz 2009). These studies conclude that the improvements in educational composition of the population are likely to counteract negative consequences of ageing in terms of disability and ill-health of older population.

Fig. 22 – Educational attainment by sub-regions, population aged 15 and over, 1950 and 2010



Source: Adapted from Barro and Lee 2013.

Educational attainment differs considerably around the world. The differentiation is illustrated in Figure 22 with average years of schooling in sub-regions for the population aged 15 and over today compared to the situation six decades ago. All of the sub-regions display a great leap forward in terms of educational level among the population. The highest level of educational attainment is observed in Northern America where the average years of schooling today is nearly 13 years which has increased by five years since 1950. Average years of schooling more than doubled in all of the mentioned sub-regions where Middle East and Northern Africa have shown a tremendous achievement with ninefold increase during the period 1950-2010. Educational attainment has increased in Southern Asia and Sub-Saharan Africa to a great extent as well, compared to the year 1950 when the average years of schooling among the population was only around one year, yet is still very low today with five years on average. World average has increased from three to eight years of schooling among the population aged 15 and over during the 1950-2010 period.

Differences in educational attainment by sex still prevail worldwide (Tab. 8). It might not be the case for developed countries but the level of education does vary at least by one year of schooling in the developing world with an exception of Latin America and the Caribbean where both males and females have had approximately equal educational attainment since 1950. The largest gap is observed in Southern Asia where female population aged 15 and over has roughly two years less of schooling.

Tab. 8 – Educational attainment by sex and sub-regions, population aged 15 and over, 1950 and 2010

Region	1950		2010	
	Males	Females	Males	Females
World	3.5	2.7	8.4	7.4
Middle East and Northern Africa	1.1	0.4	8.0	6.5
Sub-Saharan Africa	1.7	1.0	5.8	4.7
Latin America and the Caribbean	2.8	2.4	8.3	8.1
Eastern Asia and the Pacific	2.3	1.1	8.4	7.5
Southern Asia	1.5	0.4	6.3	4.3
Northern America	7.8	8.2	12.7	12.8
Europe and Central Asia	5.7	4.2	11.0	10.8

Source: Adapted from Barro and Lee 2013.

Educational attainment is one of the key factors of population's well-being and health, especially at older ages. The last few decades have commemorated the great progress of education worldwide. The proportion of population aged 15 and over with completed tertiary education has increased from 2.8% to 17.9% and from 0.5% to 5.7% in developed and developing countries, respectively over the period 1950-2010; the percentage of population with no schooling has, on its turn, decreased from 9.2% to 2.4% in developed countries and more significantly from 61.1% to 17.4% in developing countries. (Barro and Lee 2013). Further efforts and resources applied towards improving the educational attainment among the population are ought to be on the agenda of the developing countries which are ageing with a higher speed and intensity as better education leads to higher income, lower mortality rates, better overall health and cognitive functioning at older age.

6.2 Employment opportunities

"For many older individuals, employment provides the income needed to escape extreme poverty. Work-related accomplishments can also be a source of personal satisfaction and social esteem." (United Nations 2011:17). Most of the countries with ageing population today are concerned with labor market conditions. It is perhaps one of the most challenging issues for economic security of population on individual as well as national level. Population ageing results in a decreasing size of working-age population and potential labor supply as well as changing age structure of labor force. The ratio of the workforce to the number of pensioners declines as people live longer and their participation in the workforce declines (National Institute of Aging and U.S. Department of State 2007). According to the United Nations (2014a) estimates, potential support ratio has been decreasing in both developing and developed countries around the globe, having dropped from 15.2 and 8.4 to 11.2 and 4.2, respectively during the period 1950-2010, and is expected to decline even further.

While older people share some common characteristics worldwide including declining LFPR as people get closer to retirement age and commonly a very small share of workers aged 65 and over of the total labor force, there are also clear regional differences expressed in generally lower LFPR of older workers in developed compared to developing countries (Kinsella and He 2009). However,

the declining trend in developed countries has reversed since the beginning of the 1990s, especially among women (National Institute of Aging and U.S. Department of State 2007).

Tab. 9 – Labor force participation rates (LFPR), by sex, age group and region, 2010

Sub-region	Age group					
	25-54 years		55-64 years		65+ years	
	Male	Female	Male	Female	Male	Female
Eastern Europe	89.8	81.8	52.2	33.2	11.5	7.5
Northern Europe	91.4	80.6	69.3	54.6	11.3	5.8
Southern Europe	90.4	71.6	55.0	31.4	6.9	2.9
Western Europe	93.5	82.2	59.2	45.7	5.2	2.4
Northern America	89.5	75.9	69.1	59.2	21.4	13.1
Australia/New Zealand	90.8	75.5	72.8	56.2	16.5	7.7
Eastern Asia	96.5	84.5	74.4	40.4	31.2	11.3
South-Central Asia	96.8	39.2	79.9	30.3	45.1	13.0
South-Eastern Asia	96.2	69.9	79.6	54.7	46.9	24.9
Western Asia	90.6	34.9	56.7	20.8	22.9	7.5
Caribbean	91.2	67.6	66.6	34.6	24.3	9.1
Central America	94.9	55.3	79.7	36.3	45.7	15.7
South America	94.3	70.5	76.9	44.6	37.5	16.1
Eastern Africa	96.1	87.5	92.5	79.8	72.6	53.4
Middle Africa	94.4	81.8	87.5	76.2	68.9	51.4
Northern Africa	94.7	28.9	65.8	16.4	28.2	7.2
Southern Africa	83.4	63.5	52.7	31.9	15.1	7.2
Western Africa	85.3	63.4	81.4	62.9	63.8	41.6

Source: Adapted from ILO 2011.

Table 9 illustrates LFPR by sex among three age groups worldwide. The lowest LFPR among older individuals are observed in Europe, where Western Europe is characterized by the lowest levels of 5.2% and 2.4% for males and females, respectively. European countries also have considerably low percentage of LFPR among people aged 55-64 years where just over half of males in this age category are economically active. Northern America shows the highest rates among older population among developed regions where 21.4% of males and 13.1% of females aged 65 and over are still economically active. Highest LFPR among older individuals are prevalent in Africa, i.e. in Eastern, Middle and Western Africa with 72.6%, 68.9% and 63.8% for males and 53.4%, 51.4% and 41.6% for females accordingly. The situation in Asian and American sub-regions is quite diverse among older population. In South-Eastern Asia and South-Central Asia, for instance, the rate among males aged 65 and over is 46.9% and 45.1%, respectively, which is roughly twice as high as in Western Asia where only 22.9% of males at that age category are economically active. The LFPR among females in those sub-regions is considerably lower compared to males ranging from around 7% to 25%. Central America differs by the highest rates among males of all age categories. Caribbean has the lowest participation rates among population aged 65 and over with

24.3% and 9.1% for males and females accordingly. Overall, there is a clear trend regarding LFPR among older population connected with the economic conditions and social security policies of sub-regions. In developed countries, the percent of individuals staying economically active at older ages is dramatically lower in comparison to developing countries where staying employed at older ages is crucial, it being the only source of income.

Employment patterns vary among older workers and prime-aged and younger workers in a number of significant ways including instances when older workers are less apt to become unemployed but take longer to find another job or even forced to leave the labor market if unemployed, are less geographically mobile and less active in formal education and workplace training participation (Dixon 2003). United Nations (2011) asserts that in both developed and developing countries, older workers also tend to have higher participation levels in the agricultural along with informal sectors and to work part time. The report also states that in developed countries highly skilled workers tend to retire later than low-skilled while a 2002 survey of 15 European countries showed that 37% of working females and 7% of working males aged 50-64 years together with 63% of economically active females and 45% of economically active males aged 65 and over were employed part-time. Another mentioned feature of labor market in developing countries is the only possible engagement of older persons in the informal sector which does not provide retirement benefits, job tenure and is low paid backed with an example of Thailand where 90% of economically active individuals aged 60 and over were employed in informal sector.

The average age at which economically active individuals step out of employment in most of the countries is considerably lower in comparison to legal pensionable age which has become widespread since the 1970s when it was actually promoted in response to high levels of unemployment (Bloom and McKinnon 2010). In developing countries the data on retirement trends is very scarce and most of the time unavailable. Developed countries, on their turn, have started initiating encouraging policies to prolong employment among older people as a result of changing age structure of labor force and decreasing size of working-age population. A recent study results of D'Addio, Keese and Whitehouse (2010) on population ageing and OECD labor markets have confirmed that recent reforms in those countries encourage later retirement with just a few exceptions where incentives to stop working early are still in place. The authors come to a conclusion, that apart from financial incentives to increase employment of older workers in order to counteract negative consequences of population ageing, other measures, tackling discouraging demand side factors like seniority rules in wage setting, low training participation, age discrimination and employment protection rules are absolutely necessary.

6.3 Social security

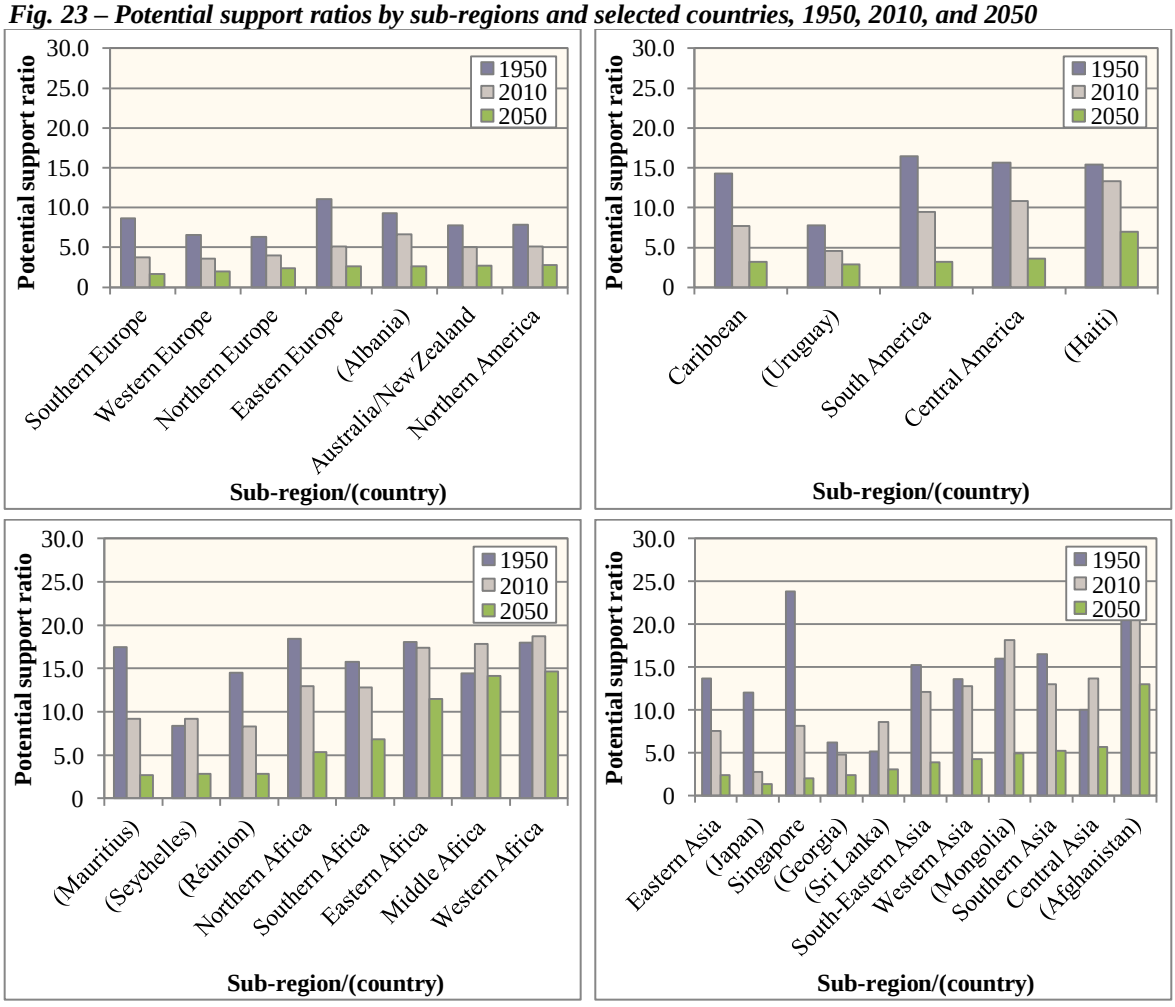
Rapid demographic changes bring along significant challenges for social security. Whilst social security conditions differ between countries to a great extent, population ageing will touch upon all

of the countries worldwide raising the questions of sustainable financing of social security in those ageing societies. Globally, old-age benefits can be financed through three possible sources:

- Proportion of covered wages or salaries paid by the worker;
- Proportion of covered payroll paid by the employer;
- Government contribution as a percentage of Gross Domestic Product (GDP) (ISSA 2014).

The process of population ageing resulting in the decline of labor force size and parallel growth of pensioners is likely to negatively influence the financing of social security systems and especially PAYG (Pay-as-you-go) basis since social security around the world is mainly financed through social insurance of workers and their employers who regularly pay contributions. It is expected that in developed countries, the ratio of working-age people to pensioners would drop from current level of four to five potential economically active individuals aged 15-64 for every pensioner to merely two workers for every pensioner by the year 2050 (Sigg 2005).

Fig. 23 – Potential support ratios by sub-regions and selected countries, 1950, 2010, and 2050



Source: Adapted from United Nations 2014a.

Figure 23 illustrates the decline in potential support ratios by sub-regions and selected countries worldwide with a few exceptions of increase by the year 2010. The lowest ratios of working-age population to older individuals aged 65 and over are observed among Europe, Northern America

and Australia/New Zealand with Western and Southern Europe leading the group where the ratios were estimated at 3.6 and 3.7 in the year 2010. Albania is an exception to Southern Europe where the ratio has been declining with the slowest pace since 1950 but is expected to accelerate by 2050 whilst average rates for Southern and Eastern Europe have shown the most dramatic decline over the last six decades. Latin America and the Caribbean have higher rates at present but those are declining with a comparatively higher speed and are expected to decrease twofold and even more by 2050 with an exception of Uruguay where the ratio is already low with approximately five working-age individuals per one older person aged 65 and over. The situation among African and Asian sub-regions is quite diverse. Middle and Western Africa have 18 and 19 working-age people per pensioner respectively which has actually increased from 14 and 18 since the year 1950 but is projected to decrease over the next decades. Japan and Singapore represent the most extreme exceptions of Eastern and South-Eastern Asia where the potential support ratio has dropped from 12.1 and 23.8 to 2.8 and 8.2 accordingly over the period 1950-2010 and is expected to decrease even further reaching as low as 1.4 and 2.1 by 2050. Overall, the highest rates of decline over the last decades and most probably for decades to come are observed among Asian sub-regions.

Social security pension levels also depend on government contributions from GDP where, for instance, high-income countries allocate around 6.9% of GDP on social security old-age pension system while middle-income and low-income countries only 2.1% and 0.6%, respectively (ILO 2010). The size of old-age pension spending is also conditional on the number of beneficiaries as well as the level of pensions.

In ISSA (2013, 2014, 2014b, 2015) reports, the types of mandatory, old-age income security programs around the world are specified as follows:

- Flat-rate pension of uniform amount or one based on years of service or residence but independent of earnings which is financed by payroll tax contributions from employees, employers, or both;
- Earnings-related pension based on earnings and financed by payroll tax contributions from employees, employers, or both;
- Means-tested pension paid to eligible persons whose own or family income, assets, or both fall below defined levels. It is financed through government contributions, with no contributions from employers or employees;
- Flat-rate universal pension of uniform amount based on residence but independent of earnings which is normally financed through government contributions, with no contributions from employers or employees;
- Provident funds – special publicly managed funds where employee and employer contributions are set aside for each employee. Pensions are usually paid as a lump sum with accrued interest. There are no provident funds in European and American countries.
- Occupational retirement schemes provided by employers and financed by employer and, in some instances, employee contributions. Benefits are distributed as a lump sum, annuity, or pension;

- Individual retirement schemes when employees and, in some instances, employers contribute a certain percentage of earnings to an individual account managed by a public or private fund manager chosen by the employee. The accumulated capital in the individual account may be paid as a lump sum or used to purchase an annuity, make programmed withdrawals, or a combination of the two.

The proportion of older individuals receiving old-age pensions differs remarkably around the world (see Appendix 1). Countries of Europe, Northern America and Australia/New Zealand have the highest share of old-age pension beneficiaries as a proportion of population above legal retirement age (Fig. 24). In Northern and Western Europe along with Northern America, above 95% of older population receives pension benefits. The share is high in Eastern Europe and Australia/New Zealand as well where roughly 81% and 91% of older population receive pension. Southern Europe has the lowest percentage among European sub-regions where only about 66% of individuals above retirement age receive pension benefits. The indicator is above 60% in all of the European countries apart from Serbia and TFYR Macedonia (ILO 2015a).

Fig. 24 – Old-age pensioners as a proportion of older population in Europe, Northern America, and Australia/New Zealand, latest available year

Notes: Beneficiaries from supplementary benefits received in complement to another basic old-age benefit (i.e. "second-pillar" schemes) are excluded to avoid double counting.
Benefits covered are periodic cash retirement benefits. They can be means-tested or non-means-tested and provided through contributory, universal or targeted schemes.
As far as possible, it includes survivor and disability benefits once the beneficiary of such benefit reaches the legal retirement age.
The national statutory retirement age (so far as there is one) is used for the calculation of the indicator.

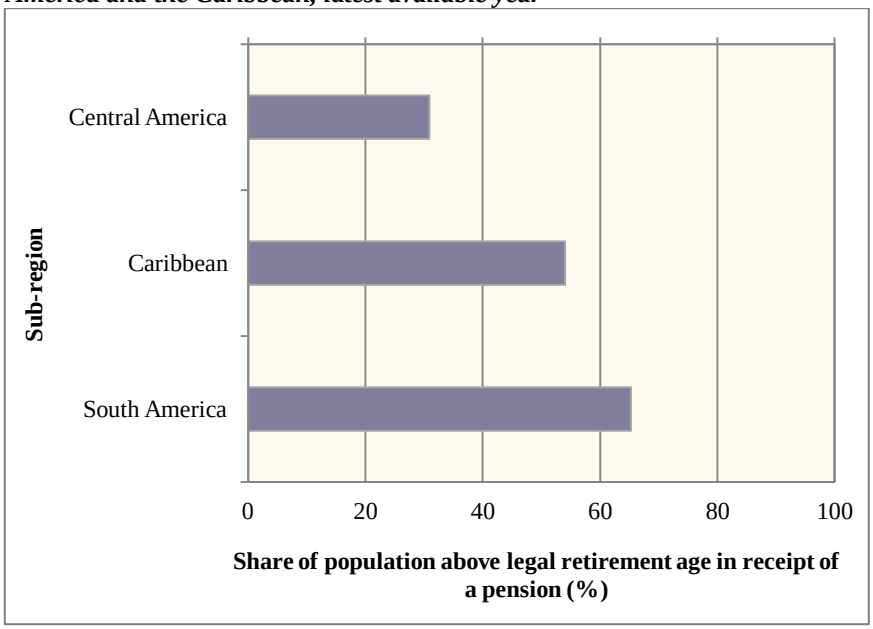
Source: Adapted from ILO 2015a.

Extensive coverage of pensioners with old-age benefits, however, is not always a sign of well-being among older population. Moldova, Estonia and Slovenia have approximately the same share

of population above legal retirement age receiving old-age pensions, however, the minimum monthly benefits differ significantly with 58USD (exchange rate: 1USD=12.90 New Lei), 193USD (exchange rate: 1USD=0.73 Euros) and 270USD (exchange rate: 1USD=0.73 Euros) respectively (ISSA 2014). Mentioned exchange rates are taken from cited ISSA report.

Old-age social security coverage in Latin America and the Caribbean is relatively lower when compared to that of Europe, Northern America and Australia/New Zealand (Fig. 25). In majority of countries just less than half of population above legal retirement age enjoys old-age benefits. Central America has the lowest share of pensioners among older population estimated at around 31% followed by the Caribbean where just over half of older people (54%) receive pension and South America with the highest share of 65%. Nicaragua, for example, with the indicator at approximately 4.7% represents the smallest share of old people receiving pensions while in Aruba the coverage is the highest in the region at around 89.5% (ILO 2010). As mentioned in International Labor Organization (ILO) report, countries of Latin America and the Caribbean have a long history of social security system where the majority of older population receiving the benefits represents the proportion of individuals working in the formal economy. It also mentions that in Brazil, for example, the old-age pension coverage of a considerably high percentage of older population is made possible through contributory benefits combined with tax-financed rural and social pensions. While in Argentina and in Chile the levels of coverage are expected to rise to those in Brazil and Uruguay, as a result of newly introduced reforms.

Fig. 25 – Old-age pensioners as a proportion of older population in Latin America and the Caribbean, latest available year



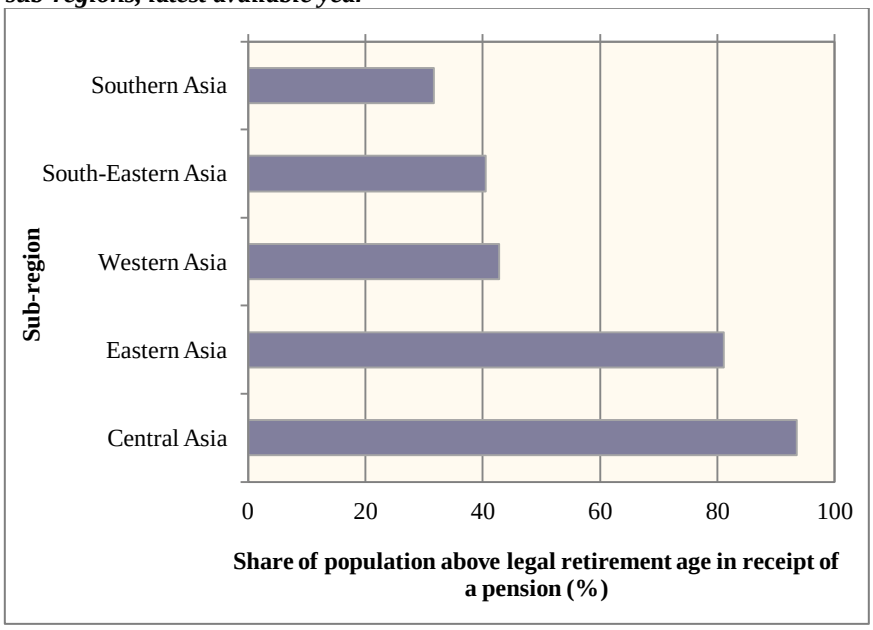
Notes: See Notes to Figure 24.

Source: Adapted from ILO 2015a.

Situation in Asian sub-regions is quite diverse as more than half of the countries have less than 45% coverage (Fig. 26). The countries of Central Asia have relatively high share of older

individuals receiving pensions with more than 90% beneficiaries. But the actual benefits paid to pensioners in some of those countries are very low and insufficient to cover even basic needs of the elderly. In Tajikistan, for instance, the minimum monthly old-age pension is as low as roughly 27USD (exchange rate: 1USD=4.80 somoni) (ISSA 2015). ILO (2010) report states that improvements in coverage are expected in the near future in some of the Asian countries due to the policy reforms, yet most of the countries are still incapable of preventing the people from poverty among rapidly ageing population where most of the workers are engaged in the informal sector having no access to any social security benefits whatsoever.

Fig. 26 – Old-age pensioners as a proportion of older population in Asian sub-regions, latest available year

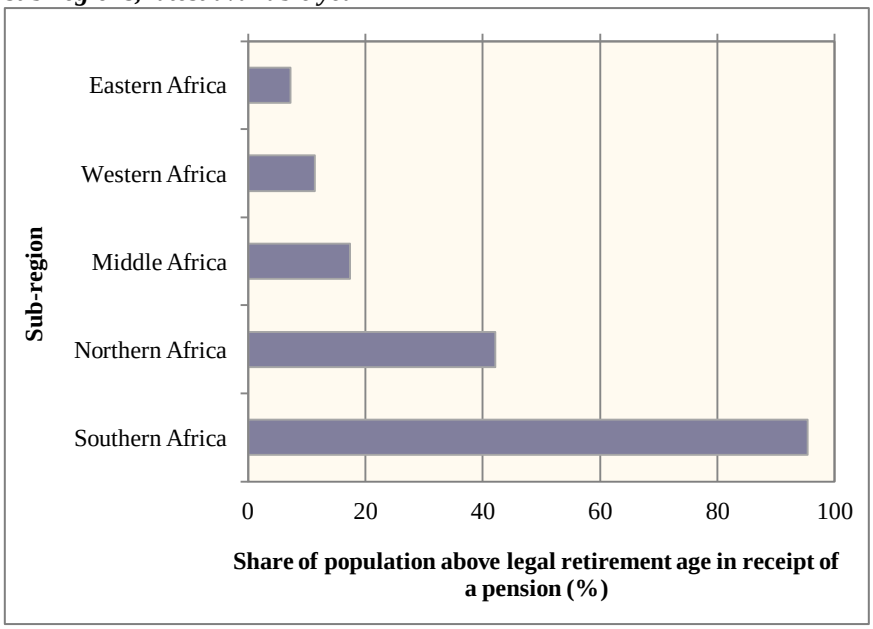


Notes: See Notes to Figure 24.

Source: Adapted from ILO 2015a.

The worst situation is observed in Africa where the majority of countries have less than 20% pension coverage among older population (Fig. 27). In Uganda and Sierra Leone not even one percent of older population receives some kind of old-age benefits (ILO 2010). In Southern Africa, older population is at a more privileged situation as approximately 95% receive old-age pensions. But that is achieved through large amount of resources allocated by the governments with more than 5% of GDP spending on pension and other social security schemes while most of the countries in Sub-Saharan Africa spend no more than 1% of GDP. The situation in African region is not expected to improve dramatically, as mentioned in ILO report, since most of the contributory pension programs are young and not many workers have contributed long enough, and only less than 10% of economically active population contributes to a pension system on average.

Fig. 27 – Old-age pensioners as a proportion of older population in African sub-regions, latest available year



Notes: See Notes to Figure 24.

Source: Adapted from ILO 2015a.

The challenges for social security to rise in the light of population ageing are well understood. A number of solutions are being proposed by policymakers and researchers to counteract the negative consequences and adapt the social security system into stemming demographic changes including the following reforms: to raise the retirement age as a result of increasing life expectancy; to increase LFPR and effectiveness through integration of non-workers, women and encouragement of older people to stay in the labor force for a longer period by implementing life-long education and skills updating along with better working environments for older workers; to increase productivity and tackle unemployment; and even to increase the contribution/tax rate for economically active population or reduce pension benefits (ISSA 2010; Sigg 2005; National Institute of Aging and U.S. Department of State 2007; Reznik, Shoffner, and Weaver 2007; Bloom and McKinnon 2010). Policymakers have to make competent decisions and implement the reforms most suitable for their societies considering demographic, economic, and social conditions as the solutions suitable for some countries may not be relevant to the other. Reducing pension benefits is not a solution for most of the developing countries as it would put the older population at risk of severe poverty since pensions in those countries are already very low. In a number of African countries, for instance, raising the retirement age would be inadequate as life expectancy is lower than the statuary pensionable age (National Institute of Aging and U.S. Department of State 2007).

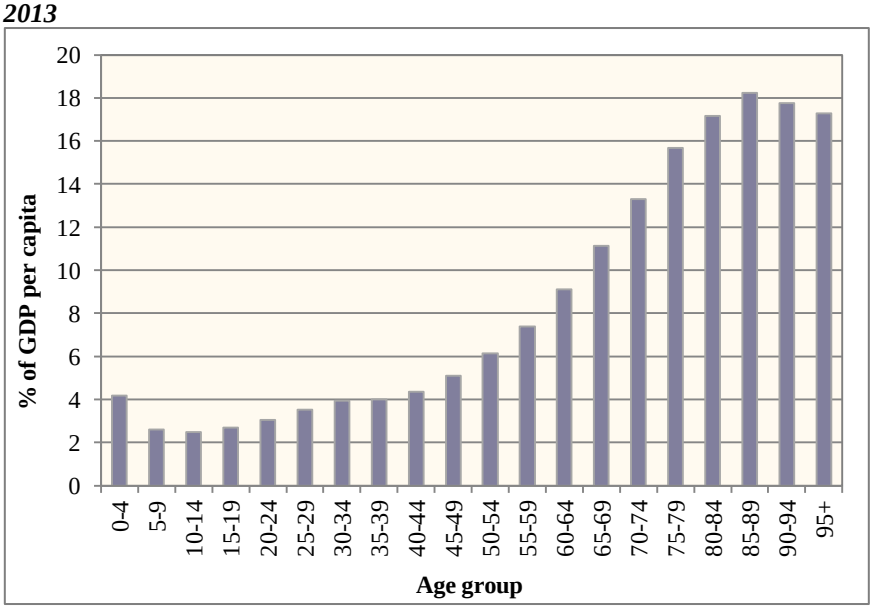
"Societies have proven their remarkable ability to adjust to change, and there is no reason why they should not do likewise in respect of population ageing. Adjustment could be made easier by focusing on policies to bolster employment and productivity, with due regard for the needs of all population groups. Only in this way can we guarantee citizens of all ages a just and fair society." (Sigg 2005: 175).

6.4 Public health

The number and proportion of older population aged 65 and over is increasing worldwide, so is the concern over challenges for public health. People are living longer today and life expectancy is increasing even further at a steady pace, so helping populations remain healthy across entire lifetime is becoming an issue. As noted by Fried and Paccaud (2010), under the current demographic changes, healthy ageing is the critical point for ageing societies to utilize the benefits of longer lifespan as well as the main element of public health agendas around the world. The authors also made an important point regarding the fact that most of the developed countries undergone considerably long demographic transition which allowed their healthcare systems to adapt relatively easily having enough of resources at disposal. The situation in developing countries is completely the opposite, however, as populations there are ageing substantially faster along with persisting public health problems of communicable diseases and maternal and child health, as well as limited financial resources and time to address the issues.

GDP expenditures on healthcare differ substantially from one country to another (see Appendix 2). World Health Organization (2015a) data for the year 2013 shows that the United States GDP spending on healthcare are the highest in the world amounting to 17%, while in Asia and Africa it ranges from as low as 1-2% to 11-12%. But the percentage of GDP spent on public health is not always comparable among the countries as the size of GDP itself differs and the indicator of 8% in Afghanistan cannot imply better or even relatively same quality and conditions of public health in comparison to Czechia, for example, where healthcare expenditures constitute 7% of GDP.

Fig. 28 – Public healthcare expenditures in OECD countries, by age groups, 2013



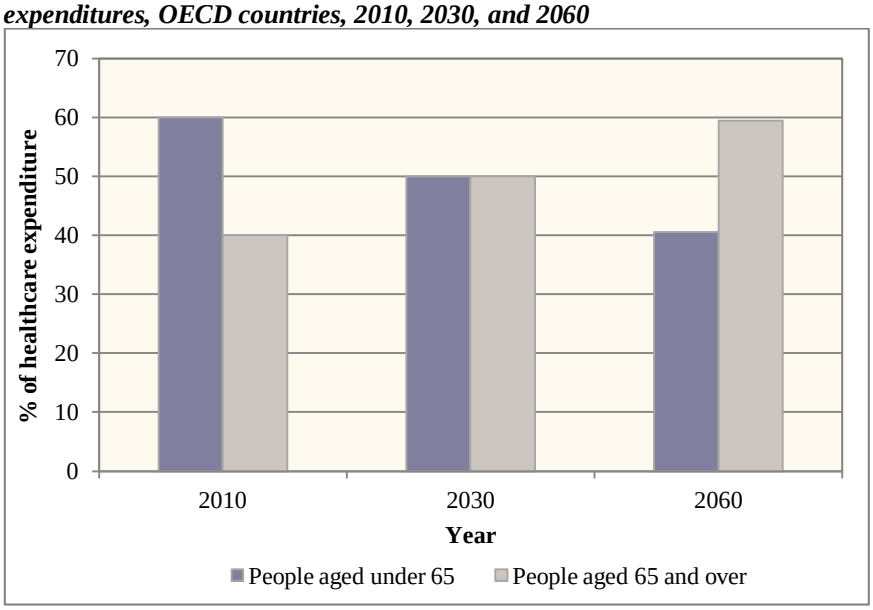
Source: Adapted from De La Maisonneuve and Martins 2013.

Figure 28 demonstrates the increasing per capita public healthcare spending in OECD countries for older age groups peaking at age 85-89. Hence, as mentioned in De La Maisonneuve and Martins

(2013), it can be assumed from this trend that population ageing is associated with rising per capita public health expenditures, however, as argued by quite a few other studies too, it is not ageing but death proximity ("death-related costs" hypothesis) what affects health spending. Thereby, as stated in the report, increasing healthcare spending is associated with rising mortality rates with age.

In 2010, a higher portion (around 60%) of total healthcare expenditures was spent on population under 65 years of age among OECD countries (Fig. 29). The situation is changing as public health spending on older population aged 65 and over is increasing which is expected to reach roughly 50% and 60% by 2030 and 2060 accordingly. Although demographic changes are not the main causes of public healthcare expenditures growth they will urge considerable shifts in the structure of those expenditures (De La Maisonneuve and Martins 2013).

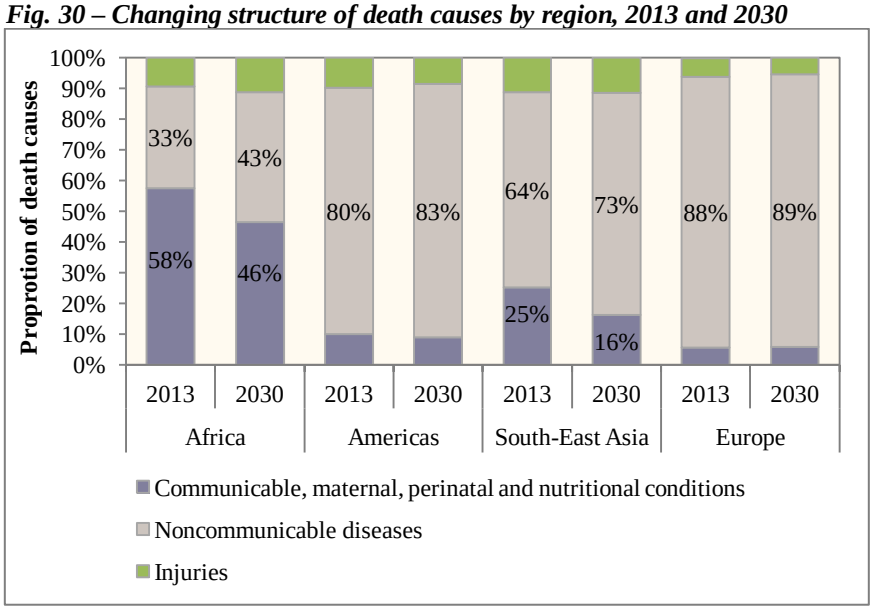
Fig. 29 – Shares of healthcare expenditures by age in total health care expenditures, OECD countries, 2010, 2030, and 2060



Source: De La Maisonneuve and Martins 2013.

The prevalence of NCDs is increasing in all parts of the world while the number of deaths caused by infectious diseases is decreasing in the regions where they are still common (Fig. 30). Deaths caused by NCDs account for more than 80% in the Americas and Europe. In Africa the situation with infectious and parasitic diseases is improving where deaths caused by those diseases are expected to decline from approximately 58% to 46% during the period 2013-2030. The same progress is observed in South-Eastern Asia where the decline is projected to reach around ten percentage points. Overall, it can be observed that the increasing number of NCDs on a global scale stands to be the major epidemiologic trend of the upcoming decades.

Fig. 30 – Changing structure of death causes by region, 2013 and 2030



Source: Adapted from World Health Organization 2013.

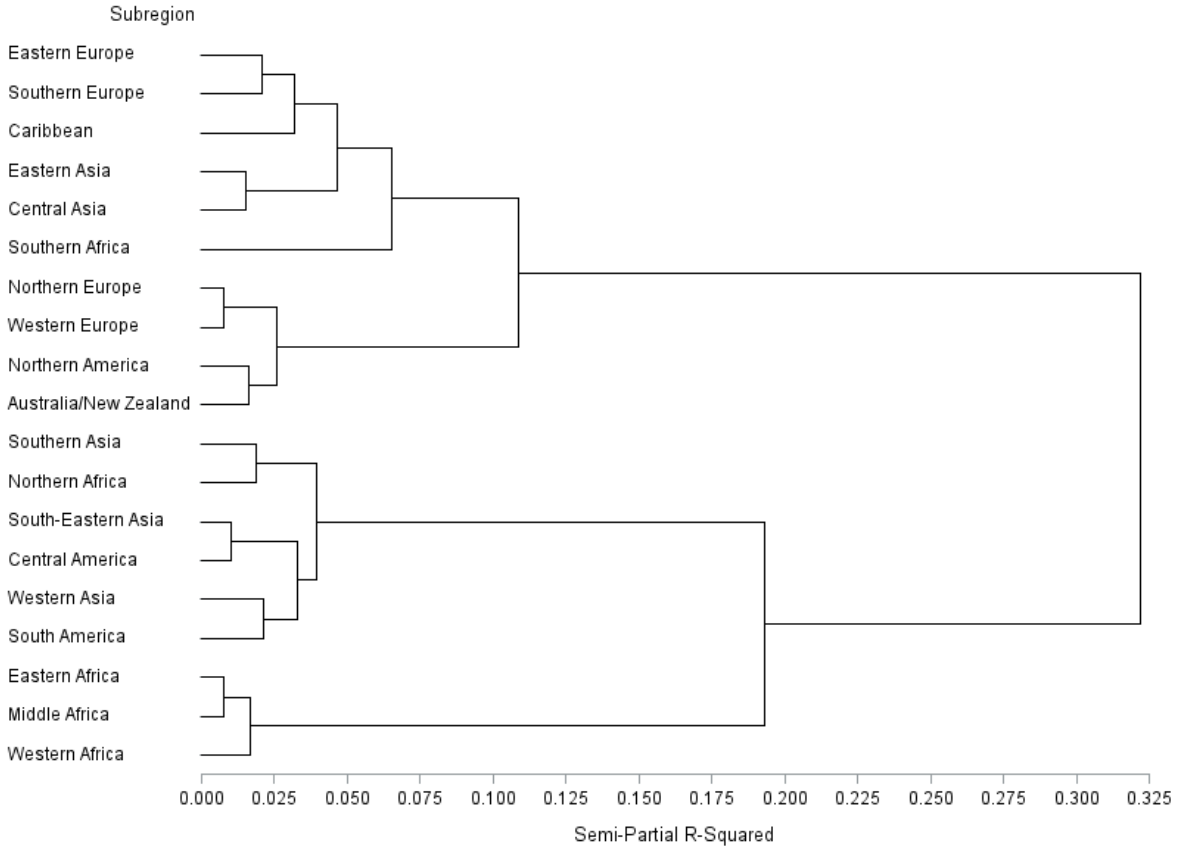
There is an ongoing debate whether people are actually living healthier lives while living longer or the added years to our lifespan are spent in poor health, where some researchers argue that the prevalence of disability will decrease with increasing life expectancy calling it a "compression of morbidity" while others, on the contrary, anticipate "expansion of morbidity", i.e. rising prevalence of disability while life expectancy increases, and there are also those who claim that milder chronic diseases will tend to prevail while severe disability will decline as a result of slowing down progress from chronic diseases to disability caused by medical breakthroughs (National Institute on Ageing and World Health Organization 2011).

Whether a majority or not, many of the older and especially oldest-old people experience decline in physical and cognitive functioning as a result of which they require long-term care. Changing family structures are affecting familial support at older ages. There are fewer children born to support and care for their elderly parents which is more prominent in less developed countries where institutional long-term care is unaffordable to majority and most of the time is of poor quality. During the period 2000-2050, the number of individuals aged 65 and over is projected to increase by around 350% worldwide and the number of oldest old population aged 80 and over is estimated to rise by unprecedented 530% while the amount of children under five years is expected to grow only by approximately 110% (United Nations 2014a). Those numbers are especially pertinent for the developing world where populations are ageing at a predominantly higher rate which is determining the growing need for professional long-term care with established infrastructure and better overall quality and affordability of healthcare. Developed countries, nevertheless, are far from perfection in this regard as well and the phenomenon of ageing is not less important there.

6.5 Differentiation of sub-regions and selected countries based on risks related to ageing: readiness to face the process

Cluster analysis was used to identify and visualize the differentiation of sub-regions according to their speed of ageing and social conditions. The analysis was carried out for 19 sub-regions (Eastern Europe, Northern Europe, Southern Europe, Western Europe, Northern America, Australia/New Zealand, Eastern Asia, Central Asia, Southern Asia, South-Eastern Asia, Western Asia, Caribbean, Central America, South America, Eastern Africa, Middle Africa, Northern Africa, Southern Africa, and Western Africa) worldwide. The examined variables included the speed of ageing, average years of schooling among population aged 15 and over, LFPR among population aged 65 and over, proportion of population above legal retirement age in receipt of old-age pension and percentage of deaths caused by NCDs. The input data is displayed in Appendix 3.

Fig. 31 – Dendrogram using Ward's Method illustrating grouping of sub-regions based on speed of ageing and social conditions, latest available year



Source: Author's calculations in SAS.

As mentioned in the methodological section, sub-regions were grouped into clusters based on hierarchical clustering using Ward's method. The results are shown in the dendrogram (Fig. 31) suggesting that four groups of sub-regions can be distinguished. Mean values of initial variables were computed for the four clusters that are demonstrated in Table 10.

Tab. 10 – Selected statistical measures used for clustered sub-regions, latest available year

Cluster	Statistical Measures	Speed of ageing	Average years of schooling among 15+	LFPR among 65+	Population above legal retirement age receiving pension (%)	Percentage of deaths caused by NCDs
# 1 Eastern Africa Middle Africa Western Africa	Mean Std. Dev	0.20 0.01	4.3 0.8	57.0 5.1	12.0 5.1	29.6 1.8
# 2 Australia/New Zealand Northern America Northern Europe Western Europe	Mean Std. Dev	0.08 0.02	12.1 0.7	10.6 5.9	95.2 3.5	84.8 8.6
# 3 Central America Northern Africa South America South-Eastern Asia Southern Asia Western Asia	Mean Std. Dev	0.29 0.04	7.1 1.4	24.8 7.9	42.2 12.5	68.7 4.9
#4 Caribbean Central Asia Eastern Asia Eastern Europe Southern Africa Southern Europe	Mean Std. Dev	0.20 0.04	9.6 1.2	14.7 8.4	80.8 17.2	74.8 20.4
Total	Mean Std. Dev	0.20 0.08	8.5 2.8	23.7 17.2	60.8 32.2	67.8 21.4

Source: Author's calculations in SAS.

The first group of sub-regions includes Eastern Africa, Middle Africa, and Western Africa. Those African sub-regions are characterized by the lowest educational attainment (mean value of the average years of schooling is only four years) and lowest coverage (only 12% on average) of older population receiving pension benefits. Percentage of deaths caused by NCDs is relatively low (approximately 30%) compared to other groups because majority of deaths in those regions of Africa are still caused by communicable (infectious) diseases. More than half of the population aged 65 and over are still employed as a result of low pension coverage where work remains to be the only source of income in those countries. Eastern Africa, Middle Africa and Western Africa are

ageing with an intermediary high speed under very poor social conditions. Policymakers have to start planning ahead in order to avoid destructive challenges that might occur in the nearest future as a result of intensifying rate of demographic changes.

The next cluster is comprised of Australia/New Zealand, Northern America, Northern Europe and Western Europe. It is not surprising that those sub-regions ended up in one group as they are characterized by relatively homogenous social conditions as well as similar speed of ageing. This group of countries has the highest educational attainment (around 12 years), highest old-age pension coverage (approximately 95%) but lowest LFPR among older population aged 65 and over (roughly 11%) and very high percentage of deaths caused by NCDs (about 85%). These sub-regions have the lowest speed of ageing but they already have the oldest populations in the world as a result of long demographic transitions that started far in advance of the other parts of the world. In the context of ageing, as mentioned before, LFPR among older individuals have to be promoted to higher levels in order to ensure the effectiveness of labor market and sustainability of economic growth as a result.

Central America, Northern Africa, South America, South-Eastern Asia, Southern Asia and Western Asia belong to the third cluster. This group of sub-regions is characterized by the fastest speed of ageing. Countries in those parts of the world are ageing under relatively poor social conditions. Population aged 15 and over has on average seven years of schooling and less than half of the older population above legal retirement age receives old-age pension benefits. About 25% of older individuals aged 65 and over continue working. NCDs here are more common causes of deaths compared to infectious diseases. Northern Africa is included in this group as it has comparatively better social conditions than the neighboring African sub-regions.

Finally, the fourth group of countries includes Caribbean, Central Asia, Eastern Asia, Eastern Europe, Southern Africa and Southern Europe. It is surprising that Eastern and Southern Europe ended up in this cluster as countries in those regions have quite similar social conditions to the rest of Europe. It can be explained by their speed of ageing. Eastern Europe is ageing with the speed of roughly 0.17 percentage points per year and in Southern Europe it is 0.16 which is roughly twice as high compared to the rest of Europe. And countries of Southern Europe have a slightly lower educational attainment (around ten years of schooling) and lower coverage of older people with pensions (approximately 66%) in comparison with the rest of Europe. Eastern Asia is ageing with approximately same speed as the third group of countries but it has much better mentioned social conditions and has been placed in this cluster as a result. This group of sub-regions is similar to the second group in terms of the level of social conditions but has the same speed of the ageing process as the first group.

To sum up the results of the performed cluster analysis, it can be concluded that the first and third groups of sub-regions have the highest risks of facing the adverse consequences of population ageing process as countries in these parts of the world are undergoing high tempo and quantum of changes in the context of ageing and that is taking place under poor social conditions.

Chapter 7

Development opportunities and imminent challenges related to ageing

The phenomenon of population ageing has to be perceived as an inevitable outcome of progress our societies are going through. It is not a hazard as viewed by some and possible challenges associated with the process can certainly be turned into opportunities for growth and further advancement of populations worldwide. Growing number of older people cannot be viewed as a burden to societies and economies but a depository of experience and wisdom. The number of older individuals aged 65 and over is estimated to triple worldwide in just four decades from current levels reaching nearly 1.5 million by the year 2050 out of which 1.2 million will be residing in developing countries (United Nations 2014a).

Changing age structures carry implications for the economic growth but at the same time create windows of opportunity for potential development. Necessary policies and measures taken much in advance can counteract negative consequences of the ageing process through utilization of the two demographic dividends arising as a result of the demographic transition. The level of profits from the first demographic dividend depends on the productivity of population which is mainly determined by quality of education, employment practices, health, and retirement policies among others, while the potential benefits from the second dividend depend on how well a society takes care of its older population (Lee and Mason 2006).

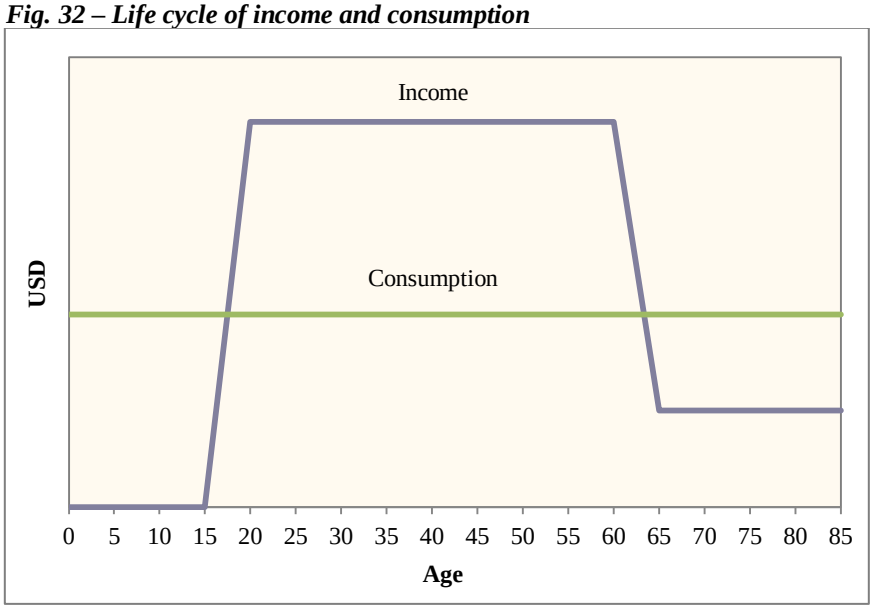
7.1 Demographic dividends

World population reached its first billion around the year 1804 while the second milestone of two billion was reached approximately 123 years later followed by accelerated growth where population globally has been adding another billion in less than two decades having approached the seven billion mark in 2011 (United Nations 1999, 2014a). Until just a few decades back the role of demography in economic growth had been studied only through population size and growth. Since the late eighties of the last century the demographers have started to recognize the importance of age structure when it comes to economic performance, the findings of which were stated by Bloom

and Freeman (1987), one of the forerunners in this regard, arguing that it is not the average rates of population growth that are associated with income growth but the level of birth and death rates.

Age structure of the population influencing the economic growth does that in distinctive ways. Each age group has different characteristics and requirements. Namely, young and older age groups tend to be on a demand side of the economy as they require investments in health, education and social security while middle-aged population constitute the supply side forming the major force of the economy – labor supply and savings. Changing age structures eventuating in changing economic behaviour, as a result, significantly influences country's income generation (Bloom, Canning and Sevilla 2003). Figure 32 illustrates the aforementioned life cycle of income and consumption.

Fig. 32 – Life cycle of income and consumption



Source: Bloom, Canning and Sevilla 2003.

Demographic dividends occur as a result of changing age structure of the population during the demographic transition. The first dividend arises at an early stage of the demographic transition when decreasing fertility rates result in shrinking proportion of younger population as well as dependency ratios while the labour force grows more rapidly for a certain period of time, all of which ensuing in per capita income growth at a faster pace due to the release of resources for investment in economic development (Lee and Mason 2006).

The first demographic dividend is channeled through a number of ways, among which the most significant ones are:

- Labor supply, which is subjected to variations in age structure of the population during the demographic transition. Effect of ageing baby-boom generation is quite prominent especially during their prime working ages of 20 to 54 when they notably contribute to the labor supply, if labor market capacities allow, by increasing per capita production. Contribution of women is increasing as well. Declining fertility results in smaller families

where more women nowadays tend to be better educated which altogether increases their participation and productivity in the labor market.

- Savings, encouraged during the demographic transition, also contribute towards economic growth. Young and old generations tend to consume more than they produce influencing the economy in a consumptive rather than contributory way. Working-age population, though, tend to save more (especially at the age of 40 to 65) and have a higher level of economic output. As a result, when the baby-boom generation reaches those ages, their contributions influence the increasing national savings. Those effects however do not work automatically and can produce results only under appropriate policy environment.
- Investment in human capital is another vital feature observed during the transition through decreasing mortality and increasing life expectancy. People live longer and healthier lives today which has shifted their behaviors during the life course. Education today is the driver of economic development and people spend more years towards education entering the labor market considerably later but tend to be more productive and have higher earnings. Namely, in Latin America, economically active individuals with six years of schooling earn approximately 50% more compared to those with no formal education while the premium is as high as 200% for people with completed tertiary education (an average of 17 years of schooling) (Bloom, Canning and Sevilla 2003; Lee and Mason 2006a).

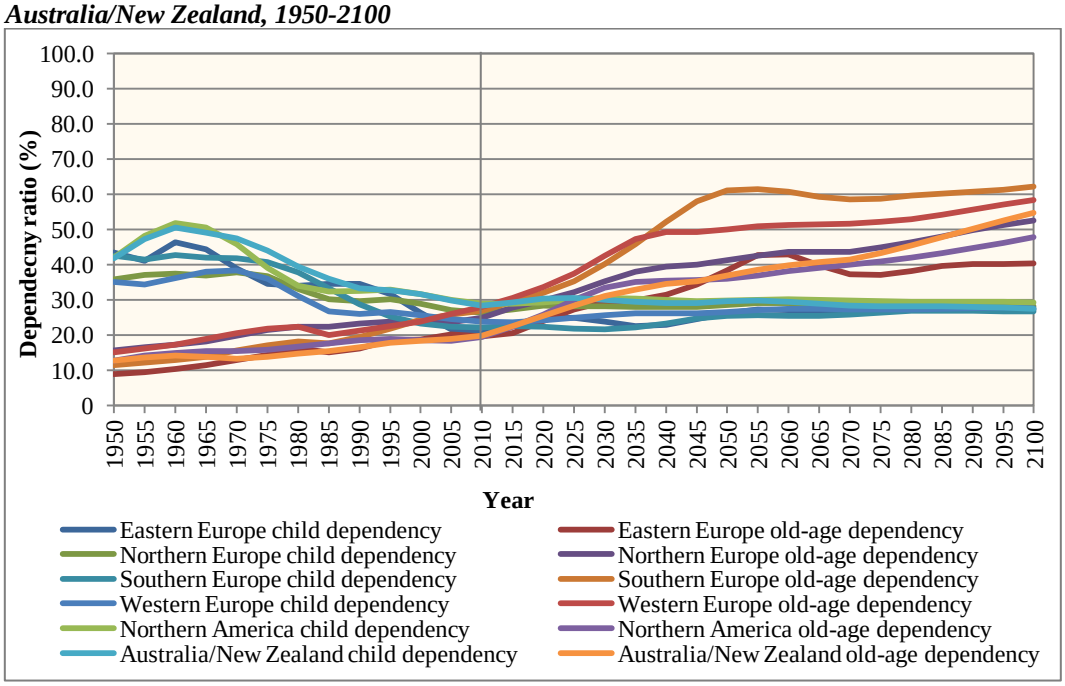
Tab. 11 – Proportion of working-age population by sub-regions, %, 1950, 1980, 2010, 2040, 2070, and 2100

Sub-region	1950	1980	2010	2040	2070	2100
Eastern Europe	65.5	66.5	71.2	64.7	61.1	59.7
Northern Europe	65.9	64.2	66.0	59.7	58.1	55.3
Southern Europe	64.8	64.0	67.0	57.0	54.2	52.9
Western Europe	66.5	65.1	65.8	57.0	55.8	53.7
Northern America	64.6	66.3	67.3	60.4	58.8	56.4
Australia/New Zealand	64.6	64.8	67.4	61.0	58.8	54.8
Eastern Asia	60.7	60.5	72.6	62.4	57.5	55.9
Central Asia	61.2	56.7	65.9	68.4	64.1	59.8
Southern Asia	58.4	56.1	64.1	68.5	64.0	59.7
South-Eastern Asia	57.5	55.2	66.3	66.3	61.8	58.8
Western Asia	57.8	54.3	64.1	67.5	62.0	58.5
Caribbean	56.6	57.6	64.9	63.0	59.6	57.1
Central America	54.0	51.6	62.7	65.2	58.7	54.4
South America	57.0	57.5	66.1	65.4	58.4	55.0
Eastern Africa	54.0	50.8	52.4	60.5	64.1	63.2
Middle Africa	55.0	52.0	51.7	59.3	65.0	65.4
Northern Africa	56.8	53.1	63.6	66.3	64.3	61.1
Southern Africa	57.5	54.8	64.4	68.2	66.3	61.8
Western Africa	55.4	52.6	53.4	57.9	63.8	65.8

Source: Adapted from United Nations 2014a.

Advanced economies of Europe, Northern America and Oceania were among the first to experience the decreasing child dependency ratios (Fig. 33) as they started undergoing the demographic transition way ahead from the rest of the world. Most of those countries have completed the transition by the second half of the last century (Tab. 2) when fertility was already low and child dependency ratio started to decline quite intensively having dropped almost twofold from 48% to 29% during the period 1970-2010 in Australia and New Zealand, for instance, while old-age dependency ratios started to increase with an accelerating pace as well where Southern Europe being at the forefront of those regions has undergone old-age dependency ratio growth from 16% to 27%. The proportion of working-age population in those regions is starting to contract as indicated in Table 11.

Fig. 33 – Child and old-age dependency ratios in Europe, Northern America, and Australia/New Zealand, 1950-2100

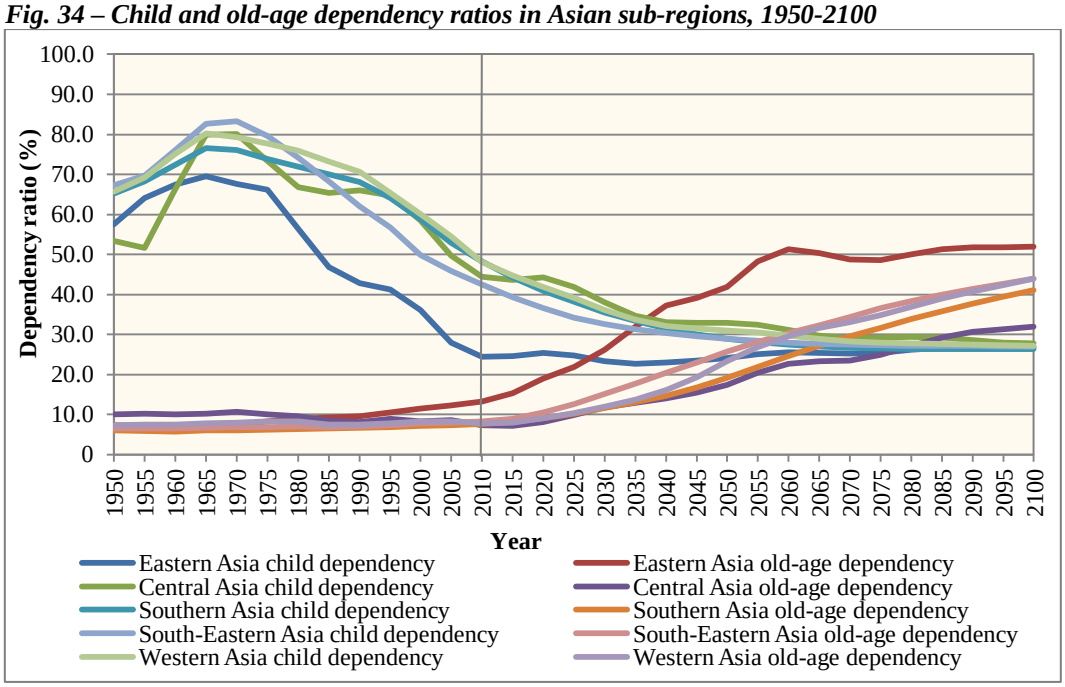


Source: Adapted from United Nations 2014a.

In Asian sub-regions child dependency ratios started to decrease around the same period as well but the rate of decrease was dramatically higher as the fertility rates were falling with a very high intensity in those countries during the second half of the 20th century (Fig. 34). It was the result of the demographic transition that took place much later than in Europe but with a considerably higher speed and intensity. In Eastern Asia child dependency ratio decreased from 68% to 24% in just four decades from the year 1970 to 2010. The slowest but still comparatively high decrease in the child dependency ratio among the Asian sub-regions was observed in Southern Asia where it fell from 76% to 48% over the same period. The trend of old-age dependency ratio in Asia has been relatively flat apart from a slight increase being observed in Eastern Asia since the 1970s. However, estimates proposed by the United Nations (2014a) project a sharp increase post the year 2015 in all of the Asian

sub-regions. The proportion of working-age population which has been increasing until now is projected to start its downward trend in the near decades as a result of the ageing process (Tab. 11).

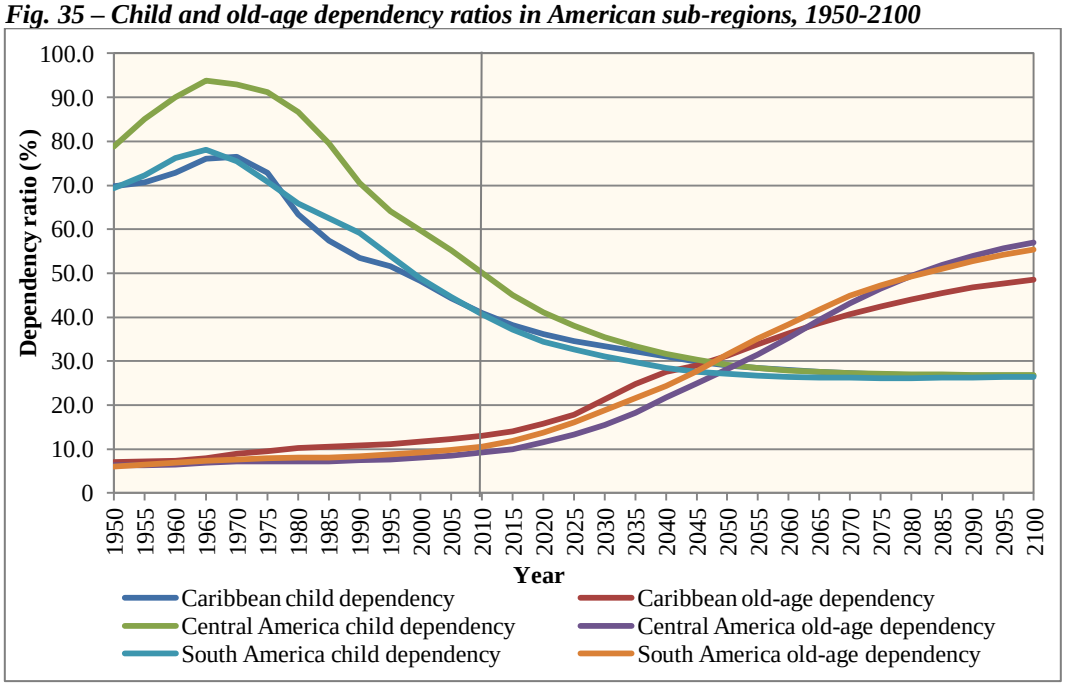
Fig. 34 – Child and old-age dependency ratios in Asian sub-regions, 1950-2100



Source: Adapted from United Nations 2014a.

Child and old-age dependency ratio trends in American sub-regions illustrated in Figure 35 are similar to those observed in Asia.

Fig. 35 – Child and old-age dependency ratios in American sub-regions, 1950-2100

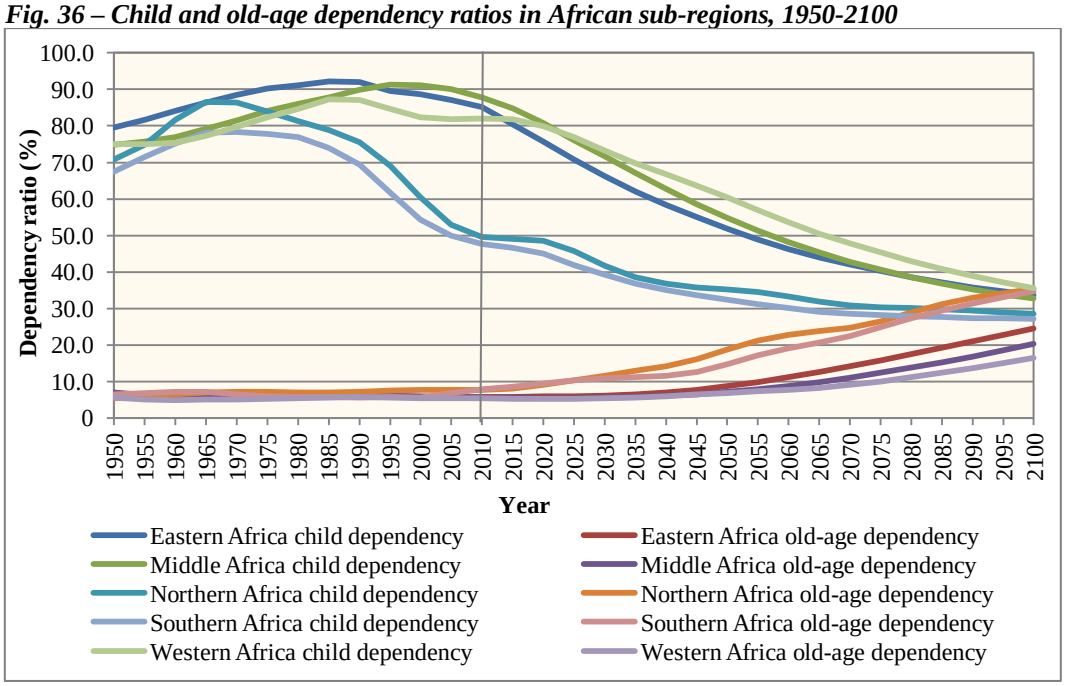


Source: Adapted from United Nations 2014a.

The trends of South America and the Caribbean are practically identical apart from a few alterations (Fig. 35). Here, child-dependency ratio fell from around 76% to 41% during the period 1970-2010 while in South America it decreased from approximately 93% to 50%. Old-age dependency ratio has started its slow upward trend which is projected to accelerate post 2015.

Being the last ones, African sub-regions stepped in the demographic transition process mostly towards the end of the second half of the previous century (Tab. 5). As a result, child dependency ratio started to decline only during the 1990s in most of the regions apart from Northern and Southern Africa where it happened a few decades earlier. In 2010, the highest rate was observed in Middle Africa where it was estimated at 88% while the lowest 48% belonged to Southern Africa. The rate of old-age dependency unlike child dependency has been practically flat in all of the sub-regions which is projected to gradually increase in the next decades accelerating towards the end of this century. The share of working-age population is projected to continue growing until the end of this century in Western and Middle Africa which are expected to be among the last ones in the world to complete the demographic transition. The rest of the African sub-regions are expected to undergo a slight decrease in the working-age population only during the last decades of the century.

Fig. 36 – Child and old-age dependency ratios in African sub-regions, 1950-2100



Source: Adapted from United Nations 2014a.

The first demographic dividend, measured by the rate of growth of the economic support ratio (the difference between the rate of growth in output per effective consumer and the rate of growth of output per worker), can last for a few decades but once the population ageing takes over with decreasing proportion of working-age population, the dividend turns negative (Lee and Mason 2006a). As per Mason (2005) estimates, developed regions including Northern America, Australia/New Zealand and most of Europe were among the first ones where the first dividend turned positive though its duration was relatively short lasting around 30 years only (the 1970-2000

period) followed by Latin America shortly after where the first dividend is estimated to stay positive until around 2020 completing a 48-year period. The timing of the first dividend in Asia, according to the author, is expected to vary from roughly 47 years, having started during the late 1970s, in Eastern and South-Eastern Asia to about 60 years in Southern Asia having commenced from the mid 1980s. Part of Western Asia along with Northern Africa would have the privilege to experience a considerably long period of the first demographic dividend too which is projected to last for around 52 years up to the year 2030. Sub-Saharan Africa was the last to start the transition process as a result of which the demographic dividend is estimated to last until after 2050 having started almost at the beginning of the new millennium. Mason also notes that the period of the first dividend begins before the year 1950 in some of the developed countries but the data availability prior that year is scarce which can result in biased durations for some of the regions.

Mason tries to draw a parallel between the dividend period and its magnitude. The author concludes that they are usually closely linked only when the dividend period lasts on average less than 40 years. For instance, in case of a 15-year period the support ratio increases overall by a mere 5% and if the dividend period lasts for 35 years, then the support ratio rises by 25% already. As a result, Northern America along with Australia/New Zealand and all of European regions have received comparatively low total gains from their short first demographic dividend period. No apparent relationship was found between the duration and magnitude of the first dividend that lasted more than 40 years where in all cases the support ratio during the whole period of the dividend was estimated at 35-40%. This means that countries undergoing comparatively slow demographic transitions including those in Sub-Saharan Africa and Southern Asia can expect to benefit from the first dividend with the same amount of total gains as the countries with rapid transitions including Eastern and South-Eastern Asia along with Latin America and the Caribbean. The difference would be reflected in annual gains, however, where they would be obviously lower in countries with slow demographic transitions.

The second demographic dividend is determined through the accumulation of wealth and its relation to population ageing since the phenomenon leads to increasing demand for resources resulting from extended life course (Mason 2005; Lee and Mason 2006a). Wealth can be accumulated either through transfers from pension programs or family support at old age, or saved capital during economically active years which would be used as a source of income during retirement (Lee and Mason 2006a). The second dividend, estimated through macroeconomic model using the impact of population on savings and capital along with the effect of capital on productivity, is more complicated to measure compared to the first dividend as wealth accumulation is accumulated in preparation of future needs and is forward looking as a result (Mason 2005).

Unlike the first demographic dividend, the second one is permanent in nature since population ageing resulting in the increasing proportion of older population is inevitable. Albeit it does not mean that life cycle wealth would automatically continue to increase with the growing share of older population, though long-term simulations for countries like Japan, United States and India

have shown that wealth does continue to grow relative to income and the second demographic dividend is estimated to be positive without turning negative later on. (Mason 2005, 2007)

Tab. 12 – Estimates of the first and second dividends and the actual growth in GDP per effective consumer (GDP/N), 1970-2000

Region	Demographic Dividends			Actual growth in GDP/N	Actual Dividend
	First	Second	Total		
Industrial[1]	0.34	0.69	1.03	2.25	1.22
Eastern Asia and South-Eastern Asia	0.59	1.31	1.90	4.32	2.42
Southern Asia	0.10	0.69	0.80	1.88	1.08
Latin America	0.62	1.08	1.70	0.94	-0.76
Sub-Saharan Africa	-0.09	0.17	0.08	0.06	-0.02
Western Asia[2] and Northern Africa	0.51	0.70	1.21	1.10	-0.11
Transitional[3]	0.24	0.57	0.81	0.61	-0.20

Notes: [1]Includes Andorra, Australia, Austria, Belgium, Bermuda, Canada, Channel Islands, Denmark, Faeroe Islands, Finland, France, Germany, Gibraltar, Greece, Greenland, Holy See, Iceland, Ireland, Isle of Man, Italy, Japan, Liechtenstein, Luxembourg, Malta, Monaco, Netherlands, New Zealand, Norway, Portugal, San Marino, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States of America.
[2]Includes Middle Eastern countries.
[3]Includes Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czechia, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Mongolia, Poland, Republic of Moldova, Romania, Russian Federation, Serbia and Montenegro, Slovakia, Slovenia, Tajikistan, TFYR Macedonia, Turkmenistan, Ukraine, and Uzbekistan.

Source: Adapted from Mason 2005.

Table 12 demonstrates the estimates of the first and second demographic dividends and their actual contribution to the GDP per effective consumer for the period 1970-2000. The highest estimates of the first dividend are observed in Latin America (0.62% per year), Eastern and South-Eastern Asia (0.59% per year) and Western Asia and Northern Africa (0.51% per year) during the specified period. The first dividend is negative in Sub-Saharan Africa since it started only in the beginning of the 2000s in those countries. The first dividend is not very high in industrialized and transitional economies of Northern America, Australia/New Zealand, Europe and part of Asia ranging from 0.24% to 0.34% because of relatively short dividend period which has been already mentioned above. The second demographic dividend is notably higher than the first one in all of the regions during the observed period of three decades. At last, only Eastern, South-Eastern and Southern Asia along with industrialized countries were able to achieve economic growth that actually surpassed the actual dividend (by 2.42% in Eastern and South-Eastern Asia, by 1.08% in Southern Asia and 1.22% in industrial countries) during the analyzed period of 1970-2000. It cannot be asserted that the economic growth in those countries was induced by the size of the dividend. Nevertheless, "Asian Tigers" of Eastern Asia where the actual dividend was the highest, are perhaps the best example of successfully ripped benefits from the demographic dividend.

7.2 Demographic window of opportunity

The first demographic dividend, being transitory in nature creates temporary opportunities for economic growth as changes is age structure correlate with the life cycle of production and consumption. In case of effective policy implementation, the second demographic dividend, in its turn, converts those temporary opportunities into sustainable economic development.

The first demographic dividend turns positive and remains so only when the demographic window of opportunity is open. According to the UN definition, demographic window of opportunity opens when the share of young population (aged 0-14 years) falls below 30% while the proportion of older population (aged 65 and over) is still below 15% (Hakkert 2007). Since the window of opportunity appears as a result of changing age structure of population during the transition, which varies by the timing of its occurrence and tempo effects, countries worldwide experience it at different periods of time varying in durations.

Tab. 13 – Demographic windows of opportunity by country, Europe, Northern America, and Australia/New Zealand

	Eastern Europe	pre-1950-2015		Albania	2005-2020
	Belarus	pre-1950-2020		Bosnia and Herzegovina	1980-2005
	Bulgaria	pre-1950-1990		Croatia	pre-1950-1995
	Czechia	pre-1950-2005		Greece	pre-1950-1990
	Hungary	pre-1950-1995		Italy	pre-1950-1990
	Poland	pre-1950-2010		Malta	1970-2010
	Moldova	pre-1950-2020		Portugal	pre-1950-1990
	Romania	pre-1950-2010		Serbia	pre-1950-2015
	Russia	pre-1950-2020		Slovenia	pre-1950-2000
	Slovakia	pre-1950-2015		Spain	pre-1950-1990
	Ukraine	pre-1950-2000		TFYR Macedonia	1980-2020
	Northern Europe	pre-1950-1985		**Western Europe**	pre-1950-1990
	Denmark	pre-1950-1980		Austria	pre-1950-1985
	Estonia	pre-1950-1995		Belgium	pre-1950-1985
	Finland	pre-1950-2000		France	pre-1950-1990
	Iceland	1980-2015		Germany	pre-1950-1975
	Ireland	pre-1950-2020		Luxembourg	pre-1950-2015
	Latvia	pre-1950-1995		Netherlands	pre-1950-2005
	Lithuania	pre-1950-2000		Switzerland	pre-1950-1995
	Norway	pre-1950-1980		**Northern America**	pre-1950-2015
	Sweden	pre-1950-1970		Canada	pre-1950-2010
	United Kingdom	pre-1950-1980		United States of America	pre-1950-2015
	Southern Europe	pre-1950-1995		**Australia/New Zealand**	pre-1950-2015

Notes: Brown shading to the left of the country denotes that the demographic window of opportunity has closed, and grey shading means that the window is currently open.

Source: Author's calculations based on data from United Nations 2014a.

The windows have already closed in most of the countries of Europe, Northern America and Australia/New Zealand by now (Tab. 13) since they have mostly completed the process of demographic transition. Albania stands out among the rest as the window of opportunity there has opened only in the year 2005 and is expected to close already in 15 years by 2020. It ensues from the fact that Albania entered the process of the demographic transition much later than the rest of

Europe but over the last few years the demographic changes has been taking place with a very high intensity resulting in a rapidly increasing proportion of older population. Exact durations of demographic windows in most of the European countries are difficult to determine due to data scarcity prior 1950.

Tab. 14 – Demographic windows of opportunity by country, Asian sub-regions

	Eastern Asia	1985-2025		Indonesia	2005-2045
	China	1990-2025		Laos	2030-2055
	Hong Kong	1980-2015		Malaysia	2010-2045
	Macao	1975-2020		Myanmar	2005-2045
	North Korea	1990-2030		Philippines	2030-2070
	Japan	1965-1995		Singapore	1980-2020
	Mongolia	2005-2050		Thailand	1995-2020
	South Korea	1990-2015		Timor-Leste	2060-2085
	Central Asia	2010-2060		Vietnam	2005-2030
	Kazakhstan	1995-2070		**Western Asia**	2015-2045
	Kyrgyzstan	2030-2075		Armenia	1995-2025
	Tajikistan	2040-2090		Azerbaijan	2005-2040
	Turkmenistan	2010-2055		Bahrain	2005-2045
	Uzbekistan	2010-2050		Cyprus	1975-2020
	Southern Asia	2015-2055		Georgia	pre-1950-2015
	Afghanistan	2040-2075		Iraq	2045-2085
	Bangladesh	2015-2045		Israel	1995-2030
	Bhutan	2010-2045		Jordan	2030-2055
	India	2015-2055		Kuwait	1995-2060
	Iran	2005-2045		Lebanon	2000-2030
	Maldives	2010-2045		Oman	2010-2045
	Nepal	2020-2055		Qatar	1985-2040
	Pakistan	2025-2065		Saudi Arabia	2015-2040
	Sri Lanka	1995-2030		Syria	2025-2050
	South-Eastern Asia	2005-2040		Turkey	2005-2035
	Brunei	2005-2030		United Arab Emirates	1995-2040
	Cambodia	2025-2045		Yemen	2035-2080

Notes: Brown shading to the left of the country denotes that the demographic window of opportunity has closed, grey shading means that the window is currently open, and green shading that the window of opportunity is projected to open during the specified period of time.

Source: Author's calculations based on data from United Nations 2014a.

As seen from Table 14, most of Asian countries have the windows of opportunity open at the moment providing a chance of substantial economic growth in case of appropriate policies implementation. Japan is the only country where the window has closed back in the year 1995. Some of the countries like Afghanistan, Pakistan, Yemen and others having late demographic transition processes are expected to experience the window of opportunities in the near future. The windows in Asia last on average 30-40 years which is shorter than in most of Europe.

The situation in Latin America and the Caribbean is somewhat similar to Asia (Tab. 15). Most of the countries of the Caribbean and South America are currently experiencing demographic window of opportunity lasting approximately 30 to 40 years. Uruguay is the only country where demographic window of opportunity opened prior the year 1950 and is still open which is the result of slow pace of demographic changes. In the Caribbean most of the countries are expected to have

the windows closed by mid-century except for Haiti where it has not even opened yet. Majority of Central American countries, however, are expected to have the windows open only in the future.

Tab. 15 – Demographic windows of opportunity by country, American sub-regions

	Caribbean	2005-2030		Honduras	2030-2055
	Antigua and Barbuda	1985-2030		Mexico	2010-2035
	Aruba	1980-2020		Nicaragua	2020-2045
	Bahamas	2000-2030		Panama	2010-2040
	Barbados	1980-2020		**South America**	2005-2035
	Cuba	1985-2015		Argentina	1970-2035
	Dominican Republic	2015-2040		Bolivia	2030-2070
	Grenada	2005-2040		Brazil	2000-2030
	Haiti	2030-2065		Chile	1995-2025
	Jamaica	2010-2030		Colombia	2010-2040
	Puerto Rico	1985-2015		Ecuador	2015-2040
	Trinidad and Tobago	2000-2025		Guyana	2020-2060
	Central America	2015-2040		Paraguay	2025-2060
	Belize	2025-2050		Peru	2010-2040
	Costa Rica	2005-2030		Suriname	2005-2040
	El Salvador	2015-2045		Uruguay	pre-1950-2020
	Guatemala	2045-2070		Venezuela	2010-2045

Notes: Grey shading to the left of the country denotes that the window is currently open, and green shading that the window of opportunity is projected to open during the specified period of time.

Source: Author's calculations based on data from United Nations 2014a.

African countries will be the last ones to experience demographic window of opportunity because they have entered the transition process only towards the end of the 20th century (Tab. 16). Countries of Northern Africa along with Mauritius, Réunion, Seychelles and Southern Africa are the exceptions where the demographic window of opportunity has already opened. Predominant majority of countries in Africa are expected to experience the demographic window of opportunity only during the second half of this century with varying durations from as short as 25 years to as long as 50 and possibly more years.

The governments have to prioritize the implementation of the right policies in order to make use of the demographic window of opportunity and profit from the demographic dividend. Bloom, Canning and Sevilla (2003) stress on the following critical policy areas: public health, family planning, education, as well as economic policies promoting flexibility of the labor market, trade openness and savings. Authors emphasize on the recent findings concluding that health is one of the key determinants of economic development in contrast to previous assumptions of the opposite causation. Population policies including family planning are mentioned to have a direct impact on the speed and intensity of demographic transition process with accordant effects on economic growth. Open economies along with better educated and flexible workforce as well as effective institutions can serve as the key drivers of sustainable economic development helping to fully reap the demographic dividend resulting from the transition process. Private savings promotion through securing price stability is also mentioned by Bloom, Canning and Sevilla as an essential area of fruitful policy environment.

Tab. 16 – Demographic windows of opportunity by country, African sub-regions

	Eastern Africa	2060-2095		**Northern Africa**	2025-2060
	Burundi	2075-post 2100		Algeria	2005-2050
	Comoros	2060-post 2100		Egypt	2020-2055
	Djibouti	2030-2065		Libya	2010-2040
	Eritrea	2050-2085		Morocco	2010-2045
	Ethiopia	2040-2070		Sudan	2050-post 2100
	Kenya	2055-2090		Tunisia	2000-2030
	Madagascar	2060-2100		Western Sahara	2010-2045
	Malawi	2070-post 2100		**Southern Africa**	2015-2070
	Mauritius	1990-2025		Botswana	2030-2065
	Mayotte	2040-2070		Lesotho	2040-2080
	Mozambique	2065-post 2100		Namibia	2030-2070
	Réunion	1995-2025		Southern Africa	2010-2065
	Rwanda	2050-2080		Swaziland	2040-2085
	Seychelles	2000-2030		**Western Africa**	2075-post 2100
	Somalia	2075-post 2100		Benin	2055-post 2100
	South Sudan	2055-2095		Burkina Faso	2065-post 2100
	Uganda	2070-2100		Cape Verde	2015-2045
	Tanzania	2070-post 2100		Côte d'Ivoire	2065-post 2100
	Zambia	2095-post 2100		Gambia	2070-post 2100
	Zimbabwe	2040-2070		Ghana	2040-2100
	Middle Africa	2065-post 2100		Guinea	2055-post 2100
	Angola	2065-post 2100		Guinea-Bissau	2060-post 2100
	Cameron	2060-2100		Liberia	2060-2100
	Central African Republic	2045-2085		Mali	2080-post 2100
	Chad	2070-post 2100		Mauritania	2055-post 2100
	Congo	2070-post 2100		Niger	2095-post 2100
	Democratic Republic of the Congo	2065-post 2100		Nigeria	2075-post 2100
	Equatorial Guinea	2045-2085		Senegal	2065-post 2100
	Gabon	2045-2085		Sierra Leone	2055-post 2100
	Sao Tome and Principe	2050-2095		Togo	2060-post 2100

Notes: Grey shading to the left of the country denotes that the window is currently open, and green shading that the window of opportunity is projected to open during the specified period of time.

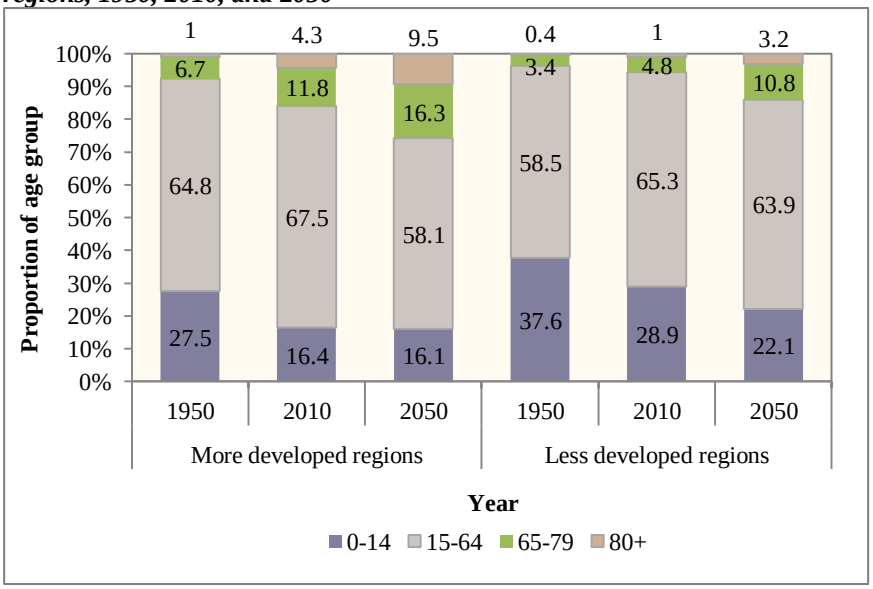
Source: Author's calculations based on data from United Nations 2014a.

The success story of "Asian Tigers" can probably testify the dependence of the demographic dividend on the right policy implementation. Export-oriented strategies in Eastern Asia have led to created capacities of labor market to suit the growing labor supply while stable macroeconomic environment promoted private savings and investments (Mason 2001). Latin America, on the contrary, represents the example of failed opportunity to reap the benefits of the demographic dividend. The demographic changes observed in Latin America were similar to those of Eastern Asia, however, lack of openness along with poor policy environment did not let Latin American countries to profit from the demographic dividend which was reflected in GDP per capita differences, for instance, where during the period 1975-1995 Eastern Asia experienced annual growth of roughly 6.8% while the growth rate in Latin America was only 0.7% over the same period (Bloom, Canning and Sevilla 2003).

7.3 Challenges of ageing populations

Notwithstanding that population ageing is and has to be perceived as one of the greatest achievements of humanity, as mentioned previously, the phenomenon poses significant social and economic challenges both at individual and societal levels. It can cause substantial implications for economic development but timely measures are capable to turn the negative consequences into potential opportunities. Older age structures are predominant in developed countries at the moment but the speed and intensity of the ageing process is much higher in developing countries. The transformation from young to old population age structures in developing countries is expected to occur over a considerably shorter period. The share of older population aged 65 and over in developed countries is estimated at approximately 16.1% and is projected to add 9.7% by the year 2050 (Fig. 37). In developing countries the proportion is still comparatively low today amounting to 5.8% but by 2050 it is expected to increase more than twofold reaching 14%. The proportion of oldest old individuals aged 80 and over is growing even faster. Back in 1950 the oldest old constituted 1% of total population in more developed countries which has increased to 4.3% by 2010 and is projected to reach as much as 9.5% in 2050. The rate of growth of oldest old population in less developed countries was slower during the previous decades compared to more developed countries as it has increased from 0.4% to 1% during the period 1950-2010. But it is projected to accelerate reaching 3.2% by the year 2050. Less developed countries, as a result of high pace of demographic changes along with lower levels of economic advancement, would stumble upon even bigger challenges in this case.

Fig. 37 – Proportion of population by broad age groups in major development regions, 1950, 2010, and 2050



Source: Adapted from United Nations 2014a.

Changing age structure of the population will result in shrinking proportion of working-age individuals (Fig. 37) threatening the economic development which very much depends on the size

and quality of labor force. Possible policy responses to the problem include promotion of employment among older workers, increases in labor force participation among women, and (re)integration of people with disabilities into the labor market (Bloom et al. 2011; Whiteford 2005; Zaidi 2008).

As analyzed in Chapter 6, LFPR among older workers are quite low throughout the world, especially in developed countries. The rates among the older female workers are at least twice as low. A number of potential solutions are available to improve employment prospects for older individuals. Those include reduction of work disincentives by raising the pension age, eradication of mandatory retirement, restriction of possibilities to early retirement and increase of benefits for late retirement. The access to disability benefits has to be strengthened because they remain to be a major pathway to early retirement in many developed countries. Apart from financial disincentives, employer practices have to be changed too. Age discrimination is one of the main factors demotivating older workers and strengthening of measures and legislation should be applied to combat it. Overall, measures taken towards increasing the human capital of older workers would be a big step forward in improving their employability (D'Addio, Keese and Whitehouse 2010; Whiteford 2005; Zaidi 2008).

Increases in female labor force participation can help to counteract shrinking labor force through gender equity as well as family friendly policies with provisions for child care and parental benefits. Utilization of employment potential among individuals with disabilities should be considered to a higher extent as well.

Promotion of employment, however, has to be preceded by advancements in labor market itself. The capacity and conditions of labor market are crucial in accommodating the potential increase on the supply side. This applies to less developed countries in particular.

Strain on pension systems is another challenge that will be felt to a great extent especially in rapidly ageing developing countries in the nearest future. Efficient pension schemes have to be implemented in every country to provide adequate standard of living for older individuals. World Bank (1994) report defines three main pension pillars:

- Anti-poverty pillar with basic pension based on non-contributory scheme intended to protect older individuals from poverty;
- Forced savings pillar providing pension benefits only to contributors. The amount of benefits is directly correlated with the level of contributions;
- Voluntary savings pillar as a supplement to retirement income provided by the first and second pillars.

Policymakers are responsible for decisions made towards the schemes suitable for their country's conditions and capacities keeping in mind its sustainability under future demographic changes. The findings indicate that contributory pension schemes have not proved themselves to be efficient since they cover only individuals employed in the formal sector leaving majority of people in developing countries out of coverage (Sigg 2005; World Bank 1994).

Successful pension schemes in selected countries can serve as examples for policymakers when opting for a particular program or combination of them. The problem for developing economies is more prominent as most of them fail to provide basic level of financial security for the elderly. Universal pension scheme adapted in Namibia, for example, provides flat-rate pension for older population being non-taxable and non-contributory and the research results show that it has positive effects on poverty reduction and food security (Sigg 2005). Government mandated and regulated but privately managed pension system in Chile substituted the insolvent PAYG program and have overall been producing very high real returns despite of some drawbacks (Attah-Botchwey 2014).

Health and long-term care is another major challenge for ageing societies. Countries worldwide undergo demographic transition along with epidemiological transition when the prevalence of infectious diseases is replaced by growing abundance of NCDs which requires facilitation of increasing demand for affordable quality health and long-term care. Some developing countries experience yet higher cost burden since the number of infectious diseases is still high and rising number of NCDs in light of population ageing tends to bring extra pressure (UNFPA and HelpAge International 2012). The increasing proportion of older population followed by rising number of NCDs is happening ubiquitously without any exceptions. Affordable and quality healthcare should not be the prerogative of a few predominantly in the developed countries but the vital right of all including the less developed world. Developing countries where population is still comparatively young, in this case, have opportunities to make use of the window of opportunity and capitalize on demographic dividend.

Chapter 8

Conclusions

This thesis investigated the differentiation of tempo and quantum of demographic changes taking place during the population ageing process in the world, and development opportunities and imminent challenges resulting from the phenomenon.

First, the demographic transitions by selected countries which were the pioneers of the process in the regions they belong to were analyzed in detail. Further, the sub-regions and selected countries with atypical cases were classified according to the scale and dynamics of their demographic transitions. The results showed that the countries that have already completed their transition process until today include those of Europe, Americas, Australia/New Zealand, and some countries from Asia including China inclusive of Hong Kong, Japan, Malaysia, Singapore, South Korea, North Korea and Cyprus. The rest of the countries are still undergoing the process most of which are expected to complete it by mid-century or even later. It has also been revealed that majority of the sub-regions in the world tend to undergo long transitions lasting over 70 years, but contemporary ones proceed with a higher intensity having higher maximal rates of natural increase. Countries of Northern Europe along with France experienced the longest historical transitions stretched over the period of approximately 150 years that started as early as the very beginning of the 19th century. Even the contemporary transitions in African sub-regions are expected to have relatively long processes of declining birth and death rates according to UN medium variant projections where transitions are estimated to last for an average of 90 years. The fastest processes are observed in Eastern Asia and South America. Suchwise, China and Singapore completed their transition processes in just 50 years.

Demographic transition brings along inescapable changes in the age structures that lead to the ageing of population. The proportion of older individuals aged 65 and over worldwide was around 7.7% in 2010 which is projected to double by the year 2050 according to United Nations (2014a) estimates. The growth of older persons started to accelerate towards the end of the 20th century as a result of a rapid increase that started in the developing world. An important trend of the ageing process that is being observed today is the increasing proportion of the oldest old persons aged 80 and over. The proportion of the oldest old within the older population was 14% in 2013 and is projected to reach 19% by mid-century (United Nations 2013).

The analysis of the speed and intensity of population ageing by sub-regions and selected countries worldwide has resulted in the following conclusions: the lowest speed of population ageing was inherent to European sub-regions while most of Africa will be ageing with a higher speed but not as high as Asia and part of America. High speed late ageing (speed between 0.18-0.30 percentage points and the proportion of older population aged 65 and over to reach 14% of the total population only during the period 2050-2100) is the most widespread one inherent to all of Africa along with countries of Central and Southern Asia. The hypothesis formulated in the beginning of the study stating that the proportion of older individuals is increasing with the highest speed and intensity in African countries compared to other parts of the world is rejected as some countries of South-Eastern Asia, Eastern Asia, Western Asia and Central America are ageing with even higher speed. None of the countries in the world will be ageing with a low speed at a later period of time. It indicates the fact that the processes of population ageing are only accelerating further. The above findings confirm the initial hypothesis regarding close relation of the timing and extent of age structure changes in the context of population ageing. The more recent the demographic transition, the shorter the duration and the higher the speed of ageing process tend to be.

To identify the homogeneity of countries grouped in sub-regions according to their social conditions and to evaluate their readiness to face population ageing, cluster analysis was carried out based on five indicators including speed of population ageing, average years of schooling, LFPR among older individuals aged 65 and over, proportion of population above legal retirement age in receipt of old-age pension, percentage of deaths (of all ages) caused by NCDs. The results suggest that two groups of sub-regions including Eastern, Middle and Western Africa comprising one cluster and Central and South America, Northern Africa, South-Eastern, Southern and Western Asia comprising the other cluster have the highest risks of facing the adverse consequences of population ageing process as countries in these parts of the world are undergoing high tempo and quantum of changes in the context of ageing and that is taking place under poor social conditions. The findings of this Chapter can also partly confirm the hypothesis which stated that there is a relationship between longer demographic transitions with intermediary rates of natural increase and better social conditions, including higher educational attainment and extent of pension coverage among older population. Countries of Europe, Northern America and Australia/New Zealand experienced long transition processes with intermediate rates of maximal natural increase below 2% and have the best indicators of social conditions examined during this study. However, countries of Eastern Asia also have good social conditions including relatively high average years of schooling (10 years on average) and high share of older population receiving old-age pension benefits (roughly 81%) but tend to go through relatively short or very short demographic transitions. It can be concluded that there is a relationship stated in the hypothesis but it is not always the case.

The results, obtained from the final Chapter where development opportunities and challenges related to population ageing were analyzed, allow concluding that the length and timing of the

demographic window of opportunity are directly correlated with the tempo and quantum effects of the demographic transition. Consequently, the last hypothesis is confirmed as countries that had experienced long demographic transitions tended to have longer windows of opportunity, whereas countries with faster processes leading towards higher speed and intensity of population ageing are assumed to have short demographic windows.

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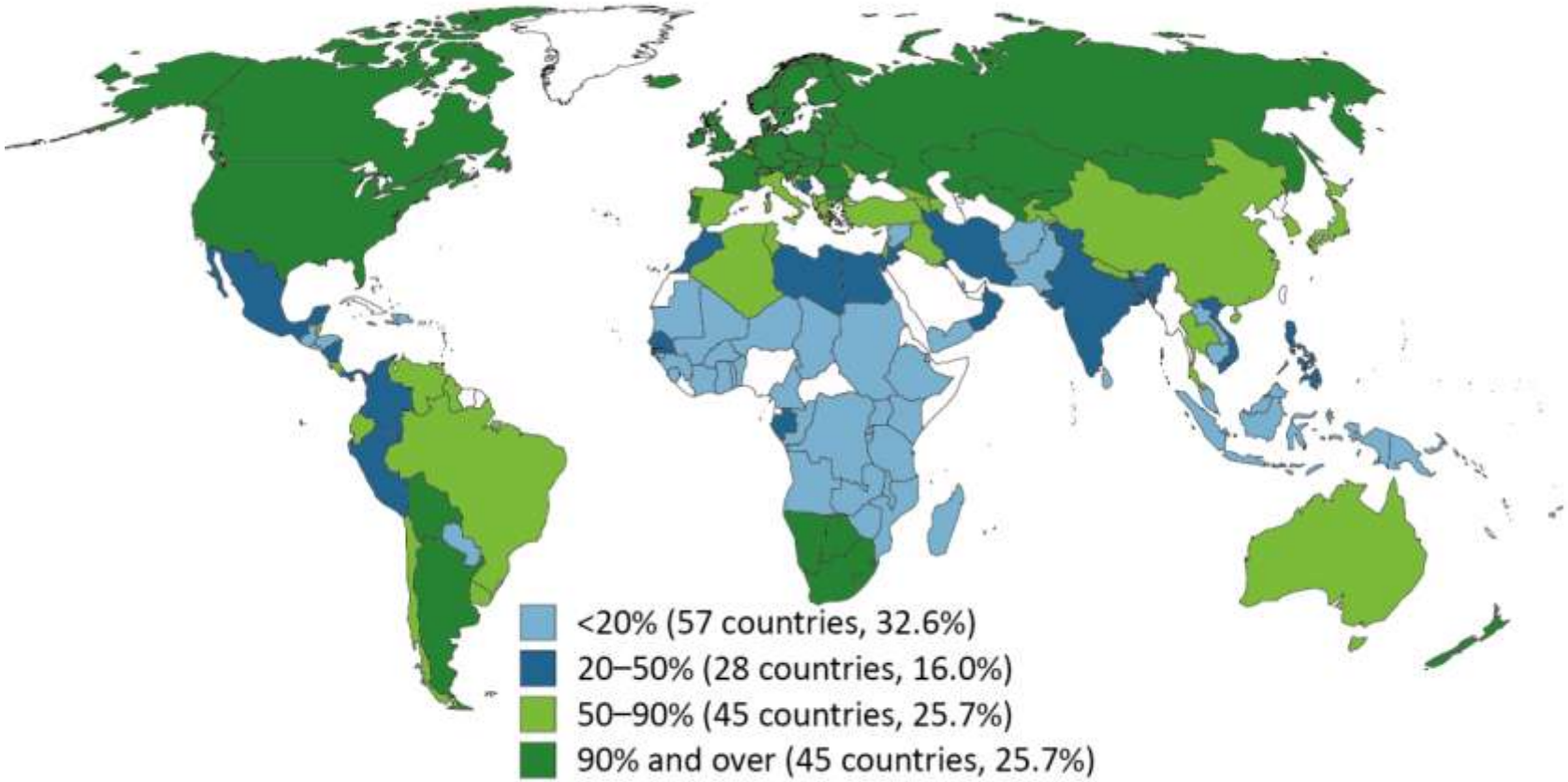
APPENDICES

Appendix 1 – Old age pension beneficiaries by country, 2010-2012



Source: ILO 2015a.

Appendix 2 – Total health expenditures by country, % of GDP, 2013

Country	Total health spending in % of GDP	Country	Total health spending in % of GDP	Country	Total health spending in % of GDP	Country	Total health spending in % of GDP	Country	Total health spending in % of GDP
Africa		America		Asia		Europe		Oceania	
Algeria	7	Antigua and Barbuda	5	Afghanistan	8	Albania	6	Australia	9
Angola	4	Argentina	7	Armenia	5	Andorra	8	Cook Islands	3
Benin	5	Bahamas	7	Azerbaijan	6	Austria	11	Fiji	4
Botswana	5	Barbados	7	Bahrain	5	Belarus	6	Kiribati	10
Burkina Faso	6	Belize	5	Bangladesh	4	Belgium	11	Marshall Islands	17
Burundi	8	Bolivia	6	Bhutan	4	Bosnia and Herzegovina	10	Micronesia	13
Cabo Verde	4	Canada	11	Cambodia	8	Croatia	7	New Zealand	10
Central African Republic	4	Chile	8	China	6	Czech Republic	7	Niue	7
Chad	4	Colombia	7	Cyprus	7	Denmark	11	Palau	10
Comoros	6	Costa Rica	10	Djibouti	9	Estonia	6	Papua New Guinea	4
Congo	4	Cuba	9	Egypt	5	Finland	9	Samoa	8
Côte d'Ivoire	6	Dominica	6	Georgia	9	France	12	Solomon Islands	5
Democratic Republic of the Congo	4	Dominican Republic	5	India	4	Germany	11	Tonga	5
Equatorial Guinea	3	Ecuador	8	Indonesia	3	Greece	10	Tuvalu	20
Eritrea	3	El Salvador	7	Iran	7	Hungary	8		
Ethiopia	5	Grenada	6	Iraq	5	Iceland	9		
Gabon	4	Guatemala	6	Israel	7	Ireland	9		
Gambia	6	Guyana	7	Japan	10	Italy	9		
Ghana	5	Haiti	9	Jordan	7	Latvia	6		
Guinea	5	Honduras	9	Jordan	7	Lithuania	6		
Guinea-Bissau	5	Jamaica	6	Kazakhstan	4	Luxembourg	7		
Kenya	4	Mexico	6	Kuwait	3	Malta	9		
Lesotho	11	Nicaragua	8	Kyrgyzstan	7	Monaco	4		

Liberia	10	Panama	7	Lebanon	7	Montenegro	6		
Madagascar	4	Paraguay	9	Libya	4	Netherlands	13		
Malawi	8	Peru	5	Malaysia	4	Norway	10		
Mali	7	Saint Kitts and Nevis	6	Maldives	11	Poland	7		
Mauritania	4	Saint Lucia	9	Mongolia	6	Portugal	10		
Mauritius	5	Saint Vincent and the Grenadines	5	Morocco	6	Moldova	12		
Mozambique	7	Suriname	5	Myanmar	2	Romania	5		
Namibia	8	Trinidad and Tobago	5	Nepal	6	Russian Federation	7		
Niger	7	United States of America	17	Oman	3	San Marino	6		
Nigeria	4	Uruguay	9	Pakistan	3	Serbia	11		
Rwanda	11	Venezuela	4	Philippines	4	Slovakia	8		
Sao Tome and Principe	7			Qatar	2	Slovenia	9		
Senegal	4			Republic of Korea	7	Spain	9		
Seychelles	4			Saudi Arabia	3	Sweden	10		
Sierra Leone	12			Singapore	5	Switzerland	11		
South Africa	9			Sri Lanka	3	TFYR Macedonia	6		
South Sudan	2			Sudan	7	Ukraine	8		
Swaziland	8			Syria	3	United Kingdom	9		
Togo	9			Tajikistan	7				
Tanzania	7			Thailand	5				
				Tunisia	7				
				Turkey	6				
				Turkmenistan	2				
				United Arab Emirates	3				
				Uzbekistan	6				
				Vietnam	6				
				Yemen	5				

Source: World Health Organization 2015a.

Appendix 3 – Input data for cluster analysis

Sub-region	Speed of ageing	Average years of schooling among 15+	LFPR among 65+	Population above legal retirement age receiving old-age pension (%)	Percentage of deaths caused by NCDs
Eastern Europe	0.17	11.3	9.1	94.4	90.3
Northern Europe	0.08	11.7	8.5	98.8	90.1
Southern Europe	0.16	9.8	4.8	66.4	91.4
Western Europe	0.06	11.4	3.8	96.4	89.2
Northern America	0.10	12.6	17.8	95.1	88.0
Australia/New Zealand	0.09	12.7	12.4	90.5	71.9
Eastern Asia	0.27	9.8	20.6	81.0	80.7
Central Asia	0.23	9.9	27.6	93.5	76.3
Southern Asia	0.26	5.3	27.6	31.7	61.6
South-Eastern Asia	0.32	6.9	34.6	40.5	64.9
Western Asia	0.32	8.8	14.3	42.8	74.7
Caribbean	0.19	8.9	16.1	54.0	74.2
Central America	0.30	7.4	30.0	30.9	67.5
South America	0.28	8.4	25.8	65.3	71.7
Eastern Africa	0.21	4.9	61.2	7.3	29.9
Middle Africa	0.20	4.7	58.6	17.4	27.7
Northern Africa	0.23	5.9	16.4	42.1	71.9
Southern Africa	0.20	7.6	10.1	95.4	35.6
Western Africa	0.20	3.4	51.3	11.3	31.2

Source: Barro and Lee 2013, ILO 2011, 2015a, World Health Organization 2013, and own calculations.