ANALYSIS OF DEPENDENCY RATIOS IN EUROPEAN COUNTRIES

Martina Miskolczi – Jitka Langhamrová – Jana Langhamrová

Abstract

Population ageing can be observed in all developed countries over the world. In absolute meaning people live longer, in relative view it means growing proportion of old people. Ageing is accompanied by growing burden put on productive population. Productive part of the population has to support still larger non-productive part that consists mostly from seniors. This burden can be measured by total dependency ratio, junior and senior dependency ratio, ratio of seniority and other indicators. Currently, senior dependency ratio (SDR, old-age dependency ratio) in the Czech Republic is on the level of 0.216. In other European countries we can find values from 0.168 (Ireland, Slovak Republic 0.169) to 0.313 (Germany). Using existing population projection, SDR is forecasted to touch the threshold of 0.68 in the year 2060. This means that one person in productive age has to support additional 0.68 individual in post-productive age.

Comparison of European countries of both historical and future trends is provided in the paper using population distribution and population projections. In all cases increase of SDR and other indicators is projected. Consequently, European countries have to solve problems arising from population ageing and growing proportion of post-productive generation.

Key words: population ageing, dependency ratios, senior dependency ratio, comparison of EU countries

JEL Code: J11, J14

Introduction

Absolute ageing means that mortality characteristics improve and life expectancy grows, there are more senior in population. It is also called ageing on the top of population pyramid. Simultaneously, absolute ageing is combined with relative ageing, which is caused by natality

decline and growing proportion of older people in population. Older people are defined by age 65 years and more.

Process of population ageing became one of widely discussed issues with significant consequences on economic, social, technical and political life affecting people's lives, families, communities etc. Currently, the Czech Republic discusses impacts of ageing upon social, health and pension systems. Pension system seems to be overloaded by growing number of pensioners, which requires larger financial volumes.

1   Definition of Ratios

Ageing and its impact on economic activity could be analyzed from many views. Besides population pyramid, mainly ratios of dependency are used based on population distribution into economic generations:

- pre-productive generation, I^{st} economic generation: age 0–14 or 0–19,

- productive generation, IInd economic generation: age 15–64 or 20–64,

- post-productive generation, IIIrd economic generation: age 65 and more.

Different definitions of limits depends on each country, in corresponds for example with length of education and preparation for work, age of retirement and length of economic activity (participation).

1.1   Ratios of Dependency

Increasing proportion of people aged 65+ brings substantial economic burden. Assuming that individuals in age 65 years and more and children are economically inactive and people aged 20–64 are economically active, there are introduced several ratios between economically inactive age and economically active age:

- junior dependency ratio: $JDR = I_{eg} / II_{eg}$

- senior dependency ratio, old-age dependency ratio: $SDR = III_{eg} / II_{eg}$,

- total dependency ratio: $TDR = (I_{eg} + II_{eg} + III_{eg}) / II_{eg}$. If total dependency ratio overcomes threshold of 2, then one productive person is responsible for himself/herselft and one other individual. This is called "overpopulation"

- weighted total dependency ratio: $TDR_w = (\alpha*I_{eg} + 1*II_{eg} + \beta*III_{eg}) / II_{eg}$, $\alpha=\beta=0.7$. Weighted version of total dependency ratio expresses fact that pre-productive and post-productive parts of population do not require same volume of costs for living, smaller amount is usually sufficient for them.

1.2 Data

In this article, data form EUROSTAT (1990-2009, projection 2010-2060) will be used to compare European Union countries. Projection prepared by EUROSTAT and used here is based on The Europop2010 (Eurostat Population Projections 2010-based) convergence scenario with horizon 1.1.2061. It assumes that net migration converges to 0 and socio-economic and cultural differences among 27 EU countries will diminish in the year of convergence (2150).

It has to be mentioned that assumptions of full economic activity of people aged 15–64 is not valid. First, young people start their job later, education and preparation for work prolongs significantly. Second, smaller part of people do not participate, are economically inactive – from various reasons, for example health conditions. Third, age of retirement is set differently in EU countries, somewhere even separately for males and females. For example, real retirement ages in the Czech Republic were defined as 60 years for males and 54–57 for females according to number of raised children. Since 1997 are these limits gradually extended with different dynamics for males and females and with no upper boundary. Thus, decision about changer of pension system should be based on calculations that reflect real participation rates and retirement ages.

2 Proportion of Seniors in Population

2.1 Proportion of Seniors 65+

Proportion of people aged 65+ ranged from 10.0 % (Poland) to 17.8 % (Sweden) in 1990. In 2009 this proportion moved to range 11.0 % (Ireland) to 20.4 % (Germany). EU average increased by 3.5 p.b. from 13.7 % to 17.2 %. The fastest jump reported Slovenia, Estonia, Latvia, Italy, Lithuania and Germany.

2.2   Proportion of Seniors 80+

Ageing populations publish statistics regarding proportion of people aged 80+ or even 90+, 100+. In European Union it is projected to have 12.1 % people aged 80+ in 2060, whereas in 2009 this proportion was 4.5 %. Increment of 7.6 p.b. is compensated by decrease in pre-productive and productive groups of population. This means 61 millions of people out of total 506 millions in EU.

In the Czech Republic proportion of people aged 80+ was 3.5 % in 2009 and is projected to be 13.4 % in the year 2060. The highest proportion is planned in case of Italy (14.9 %) that has currently 5.6 %, and Spain (4.7 % to 14.5 %).

3   Old-age Dependency Ratio in Europe

Senior dependency ratio or old-age dependency ratio shows how many seniors depend on productive part of population. According to EUROSTAT methodology, it is defined as the number of persons aged 65 and over expressed as a percentage of the number of persons aged between 15 and 64. Projected old-age dependency ratio is presented based on EUROSTAT population projections and population distribution 0–14, 15–64 and 65+.

Tab. 1: Projected old-age dependency ratio (EU and selected countries, 2010–2060) in %

Country	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
EU (27 countries)	25,92	28,48	31,37	34,57	38,33	42,31	45,52	48,00	50,16	51,82	52,55
Belgium	26,03	27,99	30,25	33,23	36,68	39,30	40,95	41,69	42,48	43,07	43,83
Bulgaria	25,44	28,86	32,46	35,80	38,69	41,63	45,96	51,55	56,06	60,11	60,32
Czech Republic	21,57	26,02	30,37	32,78	34,32	35,91	40,07	46,40	50,14	53,29	55,00
Denmark	24,87	28,83	31,42	33,85	37,00	40,13	41,91	42,45	41,79	42,04	43,52
Germany	31,26	32,52	35,78	40,22	47,21	54,20	56,44	56,92	58,11	59,57	59,89
Estonia	25,18	27,21	30,07	33,12	35,83	37,61	40,48	43,59	48,33	54,28	55,54
Ireland	16,82	19,98	22,79	25,09	27,59	30,04	33,07	36,30	39,66	38,62	36,65
Greece	28,41	30,60	32,57	34,91	37,74	42,45	47,83	53,35	57,45	57,65	56,65
Spain	24,69	27,04	28,94	31,57	35,52	40,60	46,70	53,26	56,91	57,25	56,37
France	25,66	29,22	32,71	35,81	39,06	41,95	44,37	44,77	45,48	46,34	46,58
Italy	30,78	33,13	34,76	37,02	41,14	46,50	51,73	55,13	56,34	56,58	56,65
Cyprus	18,64	21,59	24,88	28,22	30,79	31,99	33,32	35,52	39,82	43,76	47,57
Latvia	25,19	26,63	28,84	32,24	36,17	39,17	43,27	47,56	54,25	63,34	67,99
Lithuania	23,28	24,41	26,58	30,42	35,20	38,76	41,79	43,74	47,25	52,73	56,65
Luxembourg	20,43	21,31	23,12	26,04	29,98	34,07	37,08	39,57	41,94	43,58	45,05
Hungary	24,20	26,15	29,98	32,79	33,57	35,69	39,52	46,00	50,18	54,16	57,81
Malta	21,26	27,03	31,75	36,28	39,22	39,35	40,20	42,93	46,47	51,05	55,56
Netherlands	22,82	27,11	30,79	35,15	40,25	44,84	47,29	46,91	46,50	46,69	47,47
Austria	26,10	27,82	29,78	33,34	38,83	44,22	46,83	47,39	48,56	49,27	50,73
Poland	18,96	21,75	26,94	32,42	35,24	36,86	39,89	45,25	53,00	60,01	64,59
Portugal	26,70	28,98	31,32	34,04	37,85	41,79	46,72	52,04	55,62	56,66	57,20
Romania	21,37	22,59	25,68	29,04	30,23	35,28	40,65	47,61	53,81	62,31	64,77
Slovenia	23,80	25,83	30,41	34,82	38,84	42,73	46,14	50,81	55,05	57,81	57,61
Slovakia	16,93	19,14	23,59	27,98	31,36	33,88	37,99	44,63	51,38	57,58	61,80
Finland	25,63	31,41	36,18	39,82	42,74	44,25	43,46	43,79	44,86	45,74	47,43
Sweden	27,72	31,28	33,47	35,30	37,21	39,27	40,45	40,85	41,70	43,71	46,21
United Kingdom	24,86	27,76	29,63	31,74	34,83	37,70	38,86	38,58	39,41	40,90	42,07
Iceland	17,87	21,29	25,07	28,84	32,15	33,93	34,45	34,03	33,54	32,57	33,49
Liechtenstein	19,29	24,19	29,68	36,19	43,61	50,61	54,36	54,57	54,08	53,53	52,87
Norway	22,46	24,96	27,39	30,27	33,02	36,13	38,49	39,36	40,29	41,54	42,97
Switzerland	24,71	26,97	29,48	33,11	38,04	42,77	45,71	47,95	50,53	52,76	54,36

Source: EUROSTAT

European Union average starts at the level 26 %, which means that one productive person is responsible for 0.259 senior. This ratio is projected to grow quite fast with slowdown after 2045. It reaches level of 0.33 before 2025, level of 0.50 in 2050 and finally stops at the level 0.526 in 2060. In 1990 this ratio was only 0.205.

Fig. 1: Trend of old-age dependency ratio (selected countries, 2010–2060) in %
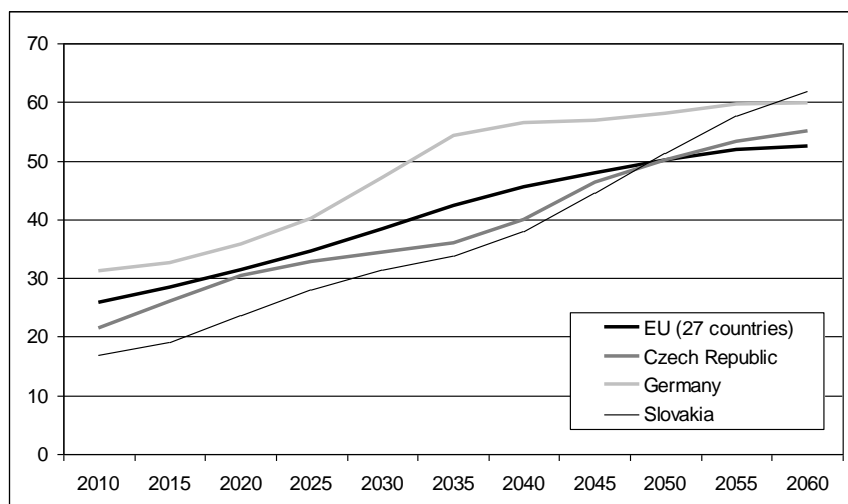
Source: EUROSTAT

The Czech Republic has growing trend as well but with different progress. Level of ratio was 0.190 back in 1990 and grew to 0.216 in 2010. Currently it is projected to reach 0.550 in 2060, which means that productive person is responsible for more than one half of other non-productive individual. Increment is 33.4 p.b. Growth after 2035 is caused by large generation of people born in 1970th who will reach age of 65 in this period and will be moved from productive part (15–64) to seniors (65+), i.e. old-age dependency ratio increases.

In case of the Slovak Republic it is clear that population structure is younger (SDR in 1990 was 0.160) but ageing process is faster and no slowdown is visible in the period of 2045–2060. Slovak population will reach old-age dependency ratio 0.33 in 2035, which is less than the Czech Republic or EU average. But in 2050 will be this ratio already above EU average (0.514) and will grow constantly till 0.618. At this time, Slovakia is projected to be one of the "oldest" populations in EU, together with Latvia (0.680), Romania (0.648) and Poland (0.646).

Another example of EU country is presented in the figure: Germany. It belongs to countries with old age structure but its trend slows down since 2035 and further grows by 1.14 p.b. each five years (on average). In 2060 there is old-age dependency ratio on the level 0.599. On the other hand, Ireland, reaches the lowest level from EU countries: 0.367. In case of Ireland, Greece and Spain it is projected that trend decreases at the end of period.

3.1   Increment of Old-age Dependency Ratio

Following figure presents increment of old-age dependency ratio in the period of 1990–2009 versus period 2010–2060 for EU countries. EU average is positioned in the middle: the old-age dependency ratio increased by 5.1 p.b. between 1990 and 2009 and is projected to increase by 26.6 p.b. from 2010 till 2060.

Fig. 2: Increment of old-age dependency ratio (1990-2009 versus 2010–2060) in p.b.
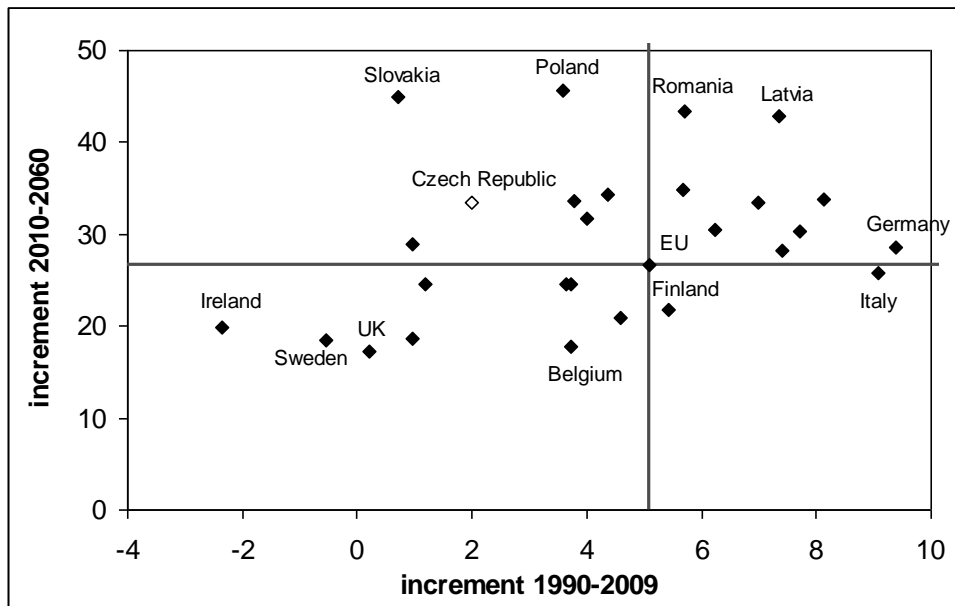
Source: EUROSTAT, own calculation

Countries in the lower left quadrant grew slowly and will continue in gradual growth, two of them should see even improvement of situation – proportion of people aged 65+ to productive part of population aged 15–64 will even decrease (Ireland, Sweden). Upper right quadrant joins countries with fast ageing process and fast increase of old-age ratio. Whereas lower right and upper left quadrants present those countries

- where ageing was already fast and will continue with lower dynamics (Finland, Italy),
- where ageing process went slowly last 20 years but will speed up according to EUROSTAT projection (Poland, Slovakia, Czech Republic, Hungary, Cyprus and Spain).

Conclusion

Ageing is a process ongoing in all European countries. In some of them proportion of older people (defined by age: 65+) grows very quickly and is projected to grow further constantly, in some countries rate of velocity will slow down. Proportion of people aged 80+ grows as well. It is projected to increase by 7.6 p.b. in European Union.

Old-age dependency ratio (senior dependency ratio) that was commented in the article shows how many individuals aged 65+ has to be supported by people in productive age (according to Eurostat methodology defined as 15–64). It will grow by 33.4 p.b. in the Czech

Republic and 26.6. p.b. in EU between years 2010 and 2060. The fastest growth is projected for Poland (+45.6 p.b.).

Acknowledgment

References

Arltová, Markéta, Langhamrová, Jitka. *Migration and ageing of the population of the Czech Republic and the EU countries.* Prague Economic Papers, 2010, Vol. 19, No. 1, pp. 54–73. ISSN 1210-0455.

EUROSTAT http://epp.eurostat.ec.europa.eu/

Fiala, Tomáš, Langhamrová, Jitka, Langhamrová, Jana. *Changes in the Age Structure of the Population in the Czech Republic and its Economics Consequences.* Uherské Hradiště 27.08.2009 – 28.08.2009. In: AMSE 2009 Applications of Mathematics and Statistics in Economy. [online] Praha : Oeconomica, 2009, s. 137–148. ISBN 978-80-245-1600-4. URL: http://amse2009.vse.cz/proceedings.pdf.

Langhamrová, Jana, Langhamrová, Jitka, Miskolczi, Martina. *Application of demographic Projections for Modelling of Economic and Social Dependency in the Czech Republic.* Prague, 27.06.2011 – 29.06.2011. In: The 31st Annual International Symposium on Forecasting: Forecasting in a Disruptive World, pp.182. ISSN 1997-4116.

Langhamrová, Jitka, Fiala, Tomas. *The Ageing of the Population and its Consequences.* Forum Statisticum Slovacum, 2007, Vol. III., No. 6, pp. 79–83. ISSN 1336-7420.

Langhamrová, Jitka, Fiala, Tomas, Langhamrová, Jana. *Ageing of the Population of the Czech Republic and its Economic Consequences in the Sphere of Pension Security and Financing of Health Care.* Marrakech 27.09.2009 02.10.2009. In: XXVI International Population Conference [CD-ROM]. [online] Paříž : IUSSP, 2009, pp. 1–12. URL: http://iussp2009.princeton.edu/download.aspx?submissionId=90582.

Martin, L. G., Preston, S. H.: *Demography of Aging.* Committee on Population, National Research Council. ISBN-13: 978-0-309-05085-2.

Contacts

Martina Miskolczi

University of Economics in Prague, Faculty of Informatics and Statistics, Department of Demography

nám. W. Churchilla 4, Praha, Czech Republic

martina.miskolczi@vse.cz

Jitka Langhamrová

University of Economics in Prague, Faculty of Informatics and Statistics, Department of Demography

nám. W. Churchilla 4, Praha, Czech Republic

langhamj@vse.cz

Jana Langhamrová

University of Economics in Prague, Faculty of Informatics and Statistics, Department of Statistics and Probability

nám. W. Churchilla 4, Praha, Czech Republic

xlanj18@vse.cz