

Projection of Czech agricultural workers' gender structure

Ondřej Šimpach¹ and Marie Pechrová²

¹University of Economics Prague, Faculty of Informatics and Statistics, Department of Statistics and Probability, W. Churchill sq. 4, 130 67 Prague 3, Czech Republic

ondrej.simpach@vse.cz

²CULS Prague, Faculty of Economics and Management, Department of Economics, Kamýčká 129, 165 21 Prague 6 - Suchbátka, Czech Republic

mariepechrova@gmail.com

Annotation: Considerable number of researches related to the gender issues in agriculture shows the importance of this topic. Especially in the agriculture of developing countries a various global organizations (FAO, World Bank, UN etc.) highlight the importance of women empowerment, but the knowing the age-and-sex structure of the agricultural workers population is also important in developed countries. The current structure of the population and of the workers in agriculture, fishery and forestry is surveyed by Czech Statistical Office (CZSO) in periodic Census. While, the future population development is a subject of many studies, the research on males and females agricultural gender inequalities still missing. It is due to the obstacles in methodology of projection of particular population group. Therefore, the aim of the paper is to project the age-and-sex structure of agricultural economically active workers and agricultural economically active policymakers and managers in the Czech Republic. The calculations use cohort-component method with certain assumptions. The data from 2011 Census (by CZSO) are used and the calculations for following 35 years (i.e. until 2046) in 5 years interval are done. The development of important statistics arising from the projection shows not only the changes in the proportions of male and female workers (or policymakers and managers as well), but also changes in average ages and female longevity.

Key words: gender structure, agricultural workers, agricultural policymakers and managers.

JEL classification: J11, J16, Q01

1 Introduction

According to Food and Agriculture Organization (FAO), females comprise, on average, 43% of the agricultural labour force in developing countries and thus make significant contributions to the rural economy in those regions. In developed countries, the situation is different. Not only in terms of the female employment in agriculture but also overall decrease of employment in agriculture is visible. The Czech Republic belongs in terms of the share of the agriculture on employment to the developed countries of the EU with the highest decrease of agricultural workers. The highest reduction appeared especially after the revolution in 1989, when in 5 years, the number of agricultural workers declined almost by a half. Regarding the employment of females, Czech Republic belongs to countries with lower share of working females (approximately 30% in comparison with 38% in the EU) (Doucha et al., 2014). Females were also more seriously affected by the decrease of employment in agriculture. In 2004 their share was still 35.1%, but in 2006 to 2008 was already lower than 31%, in 2010 achieved 33.4% (Spěšná et al., 2009). This is in line with findings of Haghghat (2002), who analysing the effect of economic growth on the share of female employment in three sectors in 136 countries, noted that the effect of economic development on the female share of employment in agricultural is negative. Also the character

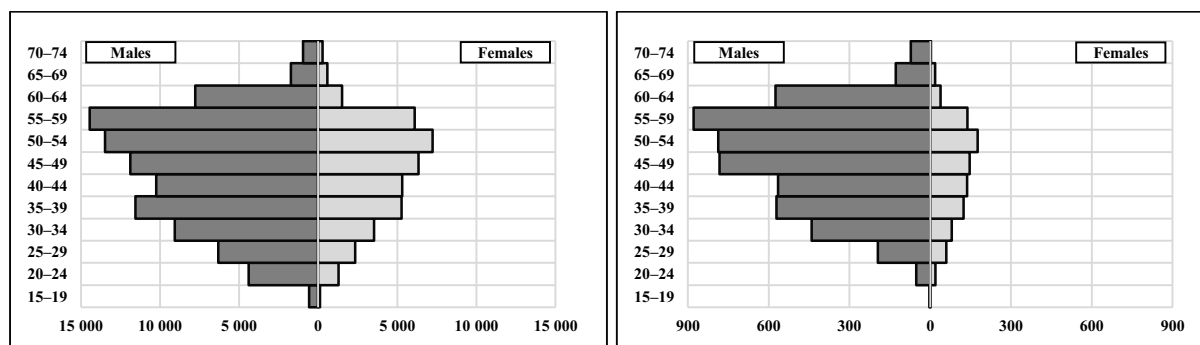
of the work in agriculture is changing. See e.g. the study of Rendall (2013), who found out that female employment opportunities increase as the available jobs become more intellectually, as opposed to physically demanding. The future development is unknown, but the decrease of the need of non-qualified workers in agriculture (and especially of females) is expected in the Czech Republic. It is related to the still continuing decrease of the volume of animal production, where the jobs are traditionally more occupied by female workers with lower qualification. Regarding the management of the firms and the leadership positions at the authorities, a widely discussed topic are the quotas on the representation of the females on those positions. The EU recently proposed that at least one third of employees in the management should be occupied by females. Therefore, the attention is paid not only to the development of the number of workers, but also to the category of policymakers and managers.

The aim of the paper is to project the age-and-sex structure of agricultural **economically active workers** and agricultural economically active **policymakers and managers** in the Czech Republic. First, used methods of population projection and the assumptions are introduced. Then the results are presented and the impacts are discussed. Last section draws the conclusions for policy makers are made.

2 Materials and Methods

Given that the researchers from CZSO construct a fairly accurate population projection in three different scenarios, we calculate on the basis of component method (Keyfitz, 1964) the estimates of the age-and-sex structures of these economically active persons with great precision up to the year 2046 (i.e. $T = 35$ years long horizon after latest available empirical data). The conditions of our calculations are as follows: (I) selected scenario of the population projection by CZSO is medium variant. This is because the low and high variant is rather referred to as lower and upper bound. (There are studies, which predict that the most probable future development of our population will be low variant; see e.g. Šimpach, Langhamrová, 2014, or Šimpach, 2015, but for the case of agriculture we set our assumptions on the medium variant). (II) The calculation assume the same decline in mortality over time, which is expected by CZSO (i.e. the increase in life expectancy at birth of males (females) from 74.70 (80.82) years in 2011 to 82.30 (87.41) years in 2046 and linear increase in the total fertility rate from the value of 1.43 in 2011 to 1.55 in 2046. Finally, it is important to note that (III) calculations cannot take into account dramatic change in the behaviour of immigration and emigration of these workers and policymakers and managers. (The sum of immigrated persons is the same as the sum of emigrated ones). Census 2011 was processed by the CZSO's methodology (CZSO, 2012), (final census' results of the economically active workers in Czech agriculture, forestry and fishery and economically active policymakers and managers used is displayed in Fig. 1).

Fig. 1. Empirical data of economically active workers in the field of agricultural, forestry and fishery in total (left chart) and economically active agriculture policymakers and managers (right chart) by Census 2011.



Source: data CZSO (2012), authors' illustration

Estimation of age-and-sex specific structure of agricultural population is not simple, as several important aspects have to be taken into account. The first is the saturation point because agriculture has a particular employee capacity which will probably not be exceeded in the future. The second is the proportion of females in the agricultural population. The last aspect is the issue of small population when the pure statistical methods cannot be used as it is not possible to apply the law of large numbers (Gardner Jr. and McKenzie, 1985). In this paper we follow the study by Fiala and Langhamrová (2011), who calculated projections of ICT experts in various economic fields. The results of Census 2011 (CZSO, 2012) state the total number of persons in the population ($S_{x,t}$) in 5-year age groups ($x-x+h-1$) at time $t = 2011$ by sex (M - male or F - female), the number of economically active workers in the field of agriculture, forestry and fishery in total, (respectively the number of Czech economically active agricultural policymakers and managers), also in 5-year age groups ($x-x+h-1$) at time $t = 2011$ by sex, where x is completed age and h is the width of age interval 5 years. All the numbers of economically active agricultural workers are considered in the age interval from 15–19 to 70+ years. Census 2011 has higher intervals for the total number of persons in the population ($S_{x,t}$), i.e. 70–74, 75–79 ... 100+, but because the number of economically active agricultural workers in the highest age group is relatively small (see Fig. 1), we consider interval 70+ from the groups of agriculture workers as comparable with the interval 70–74 from ($S_{x,t}$) group. This measure is commonly used in similar analyses and as previously stated Fiala, Langhamrová (2011) or Šimpach, Langhamrová (2014) this will not lead to a significant distortion of the results. Component method of population projection stands on the assumption that the person at the exact age of x will be with a certain probability next year exactly one year older (Keyfitz, 1964). The exceptional situations are when a person dies, emigrates, or someone else immigrates.

Table 1. Males' EA agricultural workers in absolute numbers (EA_AGRI), males' EA agricultural policymakers and managers in absolute numbers (EA_AGRI_P+M) and proportions in % with saturation points.

Age group	S	EA_AGRI	EA_AGRI_P+M	EA_AGRI (%)	EA_AGRI_P+M (%)
15–19	297 860	568	3	0,191177	0,001010
20–24	354 381	4 394	52	1,267627	0,015002
25–29	387 292	6 307	194	1,682845	0,051763
30–34	463 655	9 066	440	1,992006	0,096678
35–39	459 293	11 546	571	2,539502	0,125589
40–44	364 367	10 229	565	2,834547	0,156567
45–49	356 929	11 873	782	3,347723	0,220493
50–54	338 051	13 484	787	3,998754	0,233389
55–59	369 091	14 444	879	3,905399	0,237666
60–64	353 635	7 763	575	2,186274	0,161936
65–69	250 635	1 733	128	0,688764	0,050872
70–74	163 771	967	72	0,589235	0,043873
TOTAL	4 158 960	92 374	5 048	2,221084	0,121376

Source: data CZSO (2012), authors' calculations and illustration

Table 2. Females' EA agricultural workers in absolute numbers (EA_AGRI), females' EA agricultural policymakers and managers in absolute numbers (EA_AGRI_P+M) and proportions in % with saturation points.

Age group	S	EA_AGRI	EA_AGRI_P+M	EA_AGRI (%)	EA_AGRI_P+M (%)
15–19	282 322	116	1	0,041153	0,000355
20–24	333 971	1 292	20	0,391212	0,006056
25–29	359 138	2 335	60	0,660977	0,016984
30–34	435 335	3 539	80	0,823880	0,018624
35–39	432 522	5 261	124	1,223949	0,028848
40–44	343 645	5 319	137	1,555923	0,040075
45–49	342 704	6 331	147	1,854472	0,043059
50–54	336 610	7 226	176	2,153024	0,052440
55–59	386 841	6 102	138	1,577698	0,035680
60–64	391 152	1 512	39	0,386089	0,009959
65–69	302 702	569	18	0,188025	0,005948
70–74	220 356	269	3	0,122091	0,001362
TOTAL	4 167 298	39 871	943	0,956759	0,022629

Source: data CZSO (2012), authors' calculations and illustration

According to methodology of Fiala, Langhamrová (2011) it is supposed that each population (economically active workers in the field of agriculture, forestry and fishery (labelled *EA_AGRI*) and economically active agricultural policymakers and managers (labelled *EA_AGRI_P+M*)) has its own saturation point in particular age group which achieves and which also will not exceed in the future. These saturation points, calculated as the proportion of economically active persons in the particular field (*EA_AGRI* and *EA_AGRI_P+M*) to the total population (*S*) by age group are highlighted in the Tab. 1 for males / Tab. 2 for females. At the same time it is assumed that every person works in his / her profession until he / she dies or until he / she reaches the retirement age. (Retirement was set at the middle of the last economically active age interval from Census 2011 results (i. e. 72.5 years) both for males and for females. It is due to the uncertainty about the retirement age settings in 2046 and later – see e.g. study by Krebs and Průša (2013) about solidarity issues in Czech society. Due to the zero migration balance assumption the proportion of economically active male workers in each cohort after the saturation point will remain at the level of 3.999% (*EA_AGRI* males), 0.238% (*EA_AGRI_P+M* males) until he reaches the retirement age and at the level of 2.153% (*EA_AGRI* females), 0.052% (*EA_AGRI_P+M* females) until she reaches the retirement age.

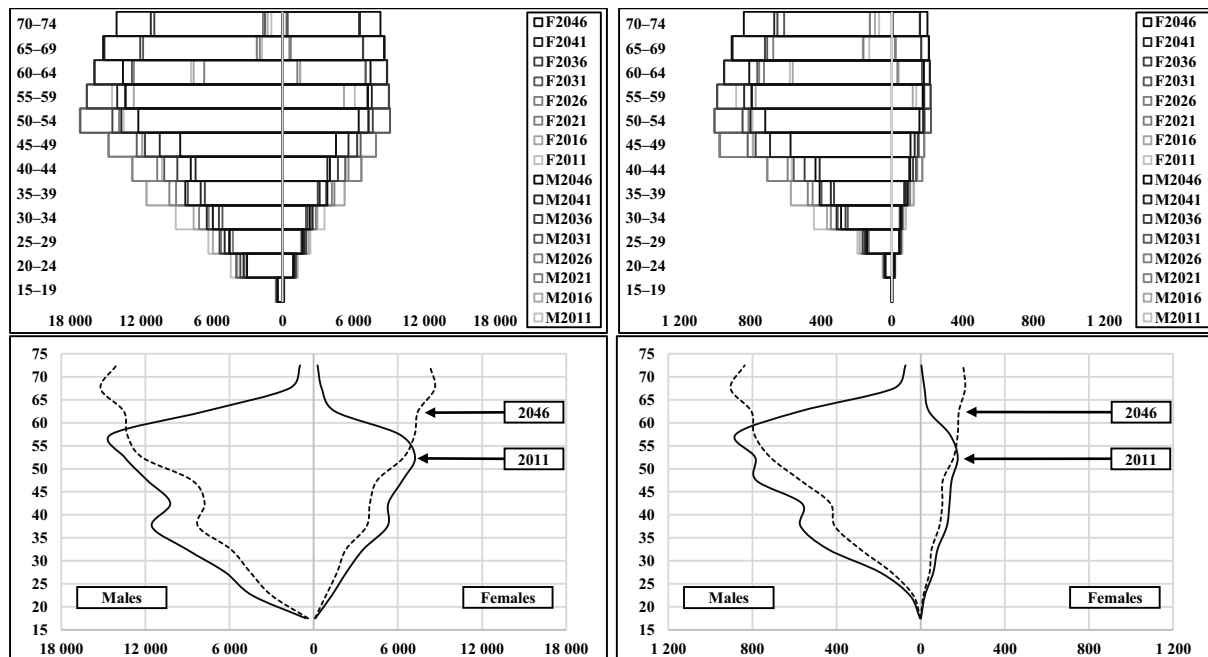
3 Results and Discussion

Using cohort component method with above mentioned assumptions we calculate the estimates of the economically active agricultural, forestry and fishery workers in total

and the number of economically active agricultural policymakers and managers on the 1st January 2016–2046. The results are presented in multi-tree charts. The lightest shade represents presence, the darkest far future. The results of population projection present Fig. 2. For better illustration of the results there are the current age-and-sex specific population structures of 2011 shown together with the projection of 2046 in bottom charts in the Fig. 2. It is obvious that the future structures will be narrower at its base. This is mainly caused by low total fertility rate of Czech females, which will be below the level of simple population replacement. Consequently less young people will arrive in agricultural sector. Older agricultural workers either stay in their profession until retirement, or change their profession and will be replaced by workers from other sectors, or they die. From Fig. 3 where the total numbers of the economically active workers in the field of agriculture, forestry and fishery and of agricultural policymakers and managers are shown, it is possible to observe that the peak will occur between 2031 and 2036. After 2036 the total numbers will continue to decline, because our population will be regressive with not enough of young people. Regarding the gender structure, the share of the woman on the total number of agricultural workers will be developing in a positive way, *ceteris paribus*. The projection shows that the share of females will increase by the year 2046 on 34.06%. However, it is more given by the decrease of the number of male workers. In absolute terms the number of female workers will be mildly decreasing until 2016 and increasing significantly only until 2036.

Consequently the increase will be modest and there will be even less females in 2046 than in 2041. The number of male workers will be slightly decreasing until 2021, will decrease mildly till 2036, but the decrease is expected onwards. This situation will be favourable for the share of females in the total agricultural workforce. Their share will be the highest in 2036 (34.11%). Of course, the problem of female employment in agriculture is not that urgent in the Czech Republic and other developed countries where the majority of jobs is generated in other sectors of national economy. The situation is different in developing countries. As FAO (2003) states, “the women represent a substantial share of the total agricultural labour force, as individual food producers or as agricultural workers”. According to their data around two-thirds of the female labour force in developing economies is engaged in agricultural work. This is in contrast to the Czech Republic where it is less than one third. However, due to technical advancement, it is not necessary to employ more. The share of the females on the number of policy makers will follow the same trend. In 2011, the females were represented in policymaking and managerial positions only from 15.74%. The share will even decrease by 2016 (15.73%).

Fig. 2. Projection of population structure of EA agricultural workers in total (top left) and projection of EA agricultural policymakers and managers up to the year 2046 in 5-years' time intervals (top right). Bottom left and bottom right is highlighted current population structure and the projection in 2046 only.



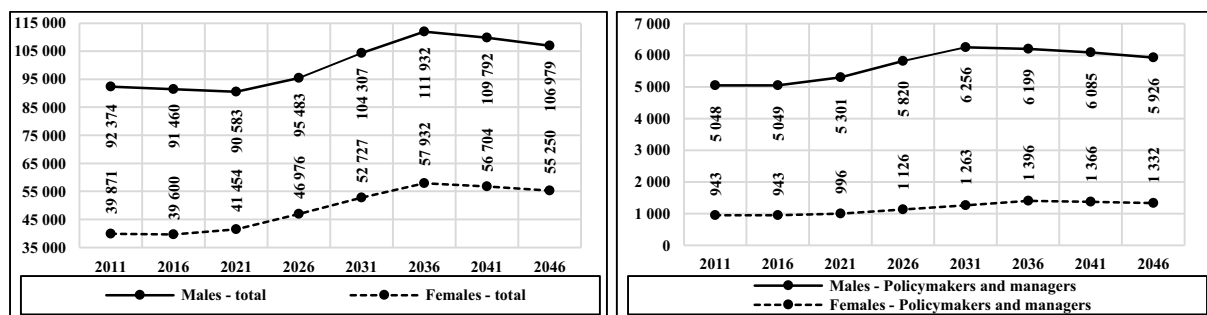
Source: authors' calculations and illustration

This will be caused by the increase of males on those positions. The absolute number of females will remain the same (943). Only after this year, it will start to increase. As the pace of increase of females will be higher than of males, it will cause the increase of the share. The highest share of female policymakers and managers on the total number of the policymakers and managers in agriculture will be the highest in 2036 (18.38%). Until 2046 it will fall to 18.36% as there might be 1 332 female and 5 926 male policymakers and managers. This shows that if the quotas on the managers of firms or authorities were set, the Czech Republic would not be able to fulfil them, nor nowadays nor in the future (if we consider only natural development). Certain policies would have to be put in place to attract more females in managerial and policymaking positions. For example in Italy, the quotas in local elections were set in 1993 and abolished in 1995. They had positive effect as according to the research of Baltrunaite et al. (2014) there was an increase in the quality of elected politicians in terms of the increase of years of education. Presented results raise some serious issues for the discussion. Who will work in the Czech agriculture, forestry and fishery 20 years after and later, and who will manage this sector if the need for the workforce would be the same? Both male and female population of agricultural workers will be older (see Fig. 4, where the results of estimated weighted average ages of males and females are presented). If females – policymakers and managers get older according to the set scenario, it is possible that in the year 2046 the average age of males and females policymakers and managers will be almost equal (this conclusion also stated e.g. Šimpach, Pechrová, 2014 in their study). This is mainly due to the fact that there are currently very few young females in the agricultural sector. Most of female workers are in the middle ages, and therefore the increase of their average age would be dramatic. Besides, financial support scheme is implemented via Rural Development Programme in the framework of Common Agricultural Policy. So-called New Entrant Scheme has already succeeded for example in Ireland “in encouraging younger people

to enter the dairy industry, acting as a more effective reform vehicle than counterpart schemes which aim to motivate older people to exit farming” (McDonald et al.,2014).

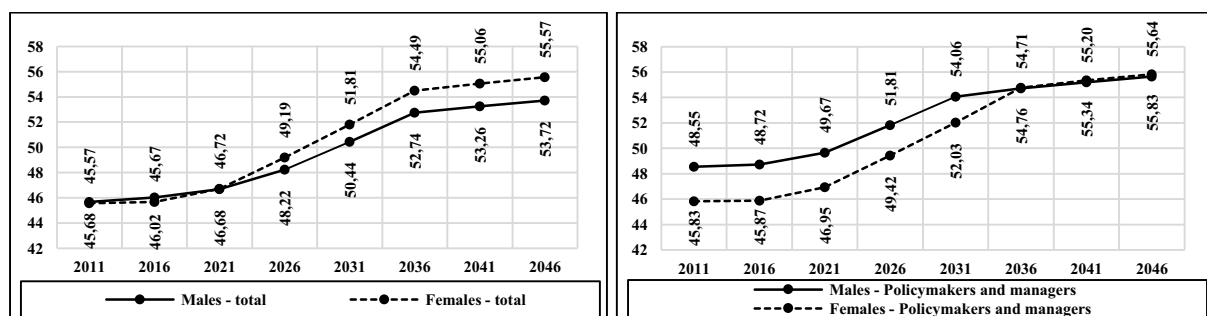
Also the financial incentive implemented in Greece attracted the females into agriculture as head of farm holdings and helped them to pass through unemployment or the lack of alternative employment opportunities (Kazakopoulos and Gidakou, 2003). We have to highlight that the research is strictly based on the ceteris paribus assumptions. It provides the information about the workforce according to the population projections. It does not tackle the issues of the need of jobs in agriculture. With technical advancement and changes in used technologies it is probable that the demand for labour in agriculture will decrease in the future. Also the character of the work will continue to change from physically demanding to more intellectual. This will also affect the demand for male and female workforce. As stated e.g. Zagata et al. (2015) who dealt about problem of the ageing population of farmers: “exact analysis and evaluation of the situation in the Czech Republic is difficult, due to the methods used in the survey.” It is important to note that these difficulties are issues also of other EU countries. Therefore, the challenge for future research is to project the number of needed labour in agricultural, compare it with projected numbers and to draw to answer the question whether the Czech agriculture will have sufficient number of workers in the future (in desirable age structure).

Fig. 3. Projection of the total numbers of EA agricultural workers (left) and also the projection of total numbers of EA policymakers and managers up to the year 2046 in 5-years’ time intervals (right).



Source: authors’ calculations and illustration

Fig. 4. Projection of the weighted average age of EA agricultural workers (left) and also the projection of the weighted average age of EA policymakers and managers up to the year 2046 in 5-years’ time intervals (right).



Source: authors’ calculations and illustration

4 Conclusion

The aim of the paper was to project the age-and-sex structure of agricultural workers and a policymakers and managers in agriculture in the Czech Republic based on the data from 2011 Census. There will be changes in the proportions of male and female workers, but not that dramatic as the share of females on agricultural workforce will not exceed 35% by 2046 and the share of policymakers and managers will stay lower than 19%. Currently the shares are slightly above 30% and almost 16%. The more important are the changes in average ages and female longevity. The results are worrying in terms of an increase in the number of agriculture workers and policymakers and managers in the highest age groups – slimming of the base of the population pyramids (due to low level of Czech total fertility rate) and increasing of the average age of the economically active agriculture workers and policymakers and managers as well. Higher number of older workers in the field of agriculture, forestry and fishery may have implications for the Czech agriculture competitiveness in the future (with assumption that the number of total population is the same as today and with no technological progress).

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