PROBLEMS OF INTERPRETING THE RESULTS OF POPULATION ESTIMATES

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Abstract

The paper deals with a description of the issues we may encounter when interpreting the results of estimated number of population. Numerical results are based on the example of the Slovak Republic with a time period estimation to the year 2080.

The estimation rate may be of the type "little" or "a lot" and the like. Its disadvantage is the high uncertainty of the specific value of the estimation type "little" or others. Another issue may be the expression of number of population by a permanent number of inhabitants. Distortions are due to a potential neglect of the administrative duty to report the residence by migrating part of the population. An important aspect of migration movements is the stability of the area of residence. At present, it is a serious problem to move beyond greater security, usually connected with a higher standard of living and crossed by the geopolitical movements of large religious groups. Far beyond reach may be World War III or pestilence-type epidemics. Larger or smaller, deliberate or unintentional computational errors may occur.

Due to the sensitivity of population number estimation to variety of manifestations affecting demographic stability when presenting population number estimation, the authors recommend increased caution when presenting the results of estimations.

Key words: permanently living population, mortality, specific fertility, probability of survival

JEL Code: J11, J13

Introduction

The development of the population of a certain spatial unit may be with the existing unit of permanent residents, usually living residents and temporary residents always interesting.

To determine the population as "many", "little", "adequate" or "inappropriate" to circumstances, etc. is relatively a simple matter. This is the situation with the laic part of respondents. Disadvantage is for example, that the statement "little "may be even one million

inhabitants. It is more complicated with the professional respondents. The notion "little", has to be exactly defined for professionals. How much is "little?" When defining "little", the statistical distribution of specific numbers "little" must be taken into account (Wimmer, 2000)

However, such simplification of the situation is little productive. The solution to the problem in which units measure the number of inhabitants is realized by the number of permanent residents (Bleha & Vano 2007), (Eurostat, 2009), (Löster, Řezanková & Langhamrová, 2009) (Chajdiak, 2009). This number represents a significant share of the population concerned; it requires recording the natural and mechanical movement of the population in a sufficiently long time period (Novotný & Bleha, 2007).

These operations are carried out by registry offices, residence reports and population censuses. If the declared place of permanent residence of a resident and the place of actual residence are in conformity, the total number of identical stays can be taken, on the basis of which we calculate the permanent residents.

In the record of the natural movement of the population (number of births and the number of deaths) it seems that there are no bigger problems. However, in recent times, the problem is in Slovakia. There is a certain part of the population with permanent residence in Slovakia, which does not announce its migration movement. After the accession of Slovakia to the European Union, the movement in the European Union is basically without problems for the citizens. Freedom of movement generates neglecting of administrative duty among the population.

In the introduction of the paper are listed gradually emerging types of inhabitants. It seems that the most appropriate motif is the work available and wages, and it corresponds to the type of permanent population (Rezankova & Löster, 2013) (Páleník, Radvanský & Slobodníková, 2010). This is due to the large number of homes and apartments that the population does not deserve to leave. If at home are present adequate jobs and the sufficient wages, then conditions for virtually zero migration are appropriate. Unfortunately, the current migratory wave illustrates the interest of our young people in both work and wages but not in an administrative permanent residence (Fiala, Langhamrová & Löster, 2013).

1   Evidence of migratory movement

It should be seen that "Migration activity of women in Slovakia on long term basis is higher than men's migration activity. In the monitored period (2006-2015), the proportion of female migration of all migrants was 53-54%" (Podmanická, 2017).

The problem of migration wave is that its size cannot be accurately determined. One of its parts is based on the number of administratively registered migrants and the second part is based on the administratively non-registered migrants. Part of this second part can be found in population censuses either by answering a straightforward question or by indirect calculation.

This will partly solve the problem of determining the territoriality of children born to Slovak residents which for long-term or lifelong have activities abroad, while being reported as permanent residents of Slovakia (Megyesiova & Lieskovska, 2012). We emphasize that the population, expressed as the number of permanent residents, seems to be the most accurate estimate of the total population.

Another problem is the number of deaths of Slovaks travelled with the knowledge of our offices about this fact and also with the unfamiliarity of our offices about this fact, who die abroad (Radvansky & Lichner 2013). Due to the negligible amount of such cases, this is not the most important problem, but it could be more important in the future.

2   Aspects of migration

The total population consists of:

- the amount of permanent residents

- the amount of permanently living with temporary

- residence;

- the number of permanent residents residing abroad

- population with unannounced residence.

Migration has two aspects. One represents the migration of the Slovak population abroad the other represents the migration of foreigners to us. "In the long term, foreign migration has the largest share the residents moving "from" and "to" countries within Europe.

In 2015, immigrants from European countries created up to 91% from of all immigrants to the territory of Slovak Republic. Most of the population moved to Slovakia from the Czech Republic (1441) and the United Kingdom (792). European countries were the main target countries also for 90% of the emigrants from the Slovak Republic. The most moved to the Czech Republic (1112), Austria (789), ... (Podmanická, 2017).

The problem of population movement has another three important aspects. The first is to define what is Slovakia, how will the territory of Slovakia develop? In the 20th century, Slovakia was part of the Austro-Hungarian Empire until 1918, then it was the part of the first Czechoslovak Republic, from 1939 to 1945, then it was the first Slovak Republic. Since 1945,

the second Czechoslovak Republic follows. On the first January 1993 the Czechoslovakia was splitting and in 2004 it was entering the European union.

All these changes were accompanied by changes of the territory or number of population and their structure. As the number of inhabitants grows, their number is converted to actual administrative delimitation and assuming territorial development by experts would be too adventurous.

The second aspect is movement to more secure places, usually connected with a higher standard of living, connected with the geopolitical movements of large religious groups. Its part may also include the forced movement. At present, the development of the immigration from North Africa till Afghanistan, including the population confessing Islam, will be not only demographically interesting.

The third aspect represents the emigration of our fellow citizens for work and in totalitarian times also for freedom. All aspects do not have a sufficiently reliable starting database, and therefore we usually detach from them when estimating the evolution of the number of permanent residents.

3   Extraordinary situations

Humankind is an extremely militant animal species. We live in anticipation of the World War the third. With the threat we remember the plague in the Middle Ages. The history confirms that the occurrence of such events is possible. For "certainty "we put them into the background. Probably some departments of the defence or offensive industry of the USA, Russia, or other countries have some adjustments to the demographic implications of such phenomena.

4   The calculation of the permanent residents till the year 2080

The indisputable demographic terms or phenomena and their specific interpretation include:

1 Notion the inhabitant of the Earth (person) = living person of age x and gender male or female;

2 Specific fertility - the probability that woman at age x at time t will give birth to an alive child;

3 Mortality - the likelihood that a resident

(person) at age x will not live up to the age x + 1;

4 The proportion of boys and the proportion of girls in a thousand births.

We will use each of them for the calculation.

The source of the original data is www.infostat.sk/slovakpopin in version 26/2/2016.

4.1 Calculation procedure

We will start from the concrete form of the first notion of the phenomenon, i.e. from the permanent residents for men Sx to 1/1/2015 in the Slovak Republic and from women at the age of x (x = 0, 1, ..., , 99 +) . Thus, the permanent living population will be together the sum of men and women in the age of x.

The permanently living population in the state of 1 January 2015 gradually expires. Survival rate is probability (pr (x) = (1-q)) for men and for women.

The lunar year (10 lunar months, each of 28 days) and the calendar year are slightly different. To simplify the calculation, we will abstract from this difference.

The number of children born to mothers of unknown age less than 15 years or more than 44 years we will estimated for the entire calculation period by one constant (90 children for the entire calculation period, namely 41 boys and 49 girls).

To calculaten life births we will use specific fertility and the number of women in fertile age (Sprocha, et al., 2016). We will use the empirical relationship to divide the born or estimated children to boys and girls S_0 (number of births) = 0,513* S_0 + 0,487 *S_0

The population (1) in the year t and the age x is the sum of men and women aged x and in the era of year t:

$$S_{Total}^{t}(x) = S_{men}^{t}(x) + S_{women}^{t}(x), \qquad x = 0,1,2,...,100 \qquad (1)$$

The number of males (x + 1) at time (t + 1) or women of age (x + 1) v at time (t + 1

$$S_{men}^{t+1}(x+1) = Pr_{men}^{t}(x) * S_{men}^{t}(x) \qquad x = 0,1,2,...,100 \qquad (2)$$

The likelihood that a person of the male or the female sex will accomplish in the era (t + 1) of the age (x + 1) if she accomplished in the era t the age x:

$$Pr_{men}^{t}(x) \qquad x = 0,1,2,...,99 +$$

$$Pr_{women}^{t}(x) \qquad x = 0,1,2,...,99 + (3)$$

Number of children Nt (x(born to mothers in the age x in the year t

$$N^{t}(x) = f^{t}(x) * F^{t}(x) \qquad (4)$$

Number of children born in the year t

$$N^t = 90 + \sum_{j=15}^{44} \left(f^t(j) * F^t(j) \right) \quad (5)$$

Number of boys or girls in thousands of children born in the year t

$$B^t = 49 + 0,513 * S_0^t$$

$$G^t = 41 + 0,487 * S_0^t \quad (6)$$

Number of zero aged citizens S_0^t in the year t

$$S_O^t = B^t + G^t = 0,513 * S_0^t + 0,487 * S_O^t + 90 \quad (7)$$

Specific fertility will be considered as an exogenous variable which values we will determine in two versions:

   a)   specific fertility used in the Eurostat and Eurostat population projections;

   b)   modal specific fertility of 140 children per thousand women until 2080

The Eurostat forecast represents a professional prognosis and the second approach represents the development simulation by the authors. The professional version takes into account the majority of amateur abstractions. Indicator population of Slovakia is represented in the permanent resident population. The main difference in versions was that in the amateur simulation, the maximum specific fertility rate of 140 live births per thousand of women of the respective age group of women was chosen for the entire population estimation period.

4.2   Problems of interpretation

Calculations use population units. We can use multiple shapes when interpreting them. Table 1 shows the part of the version of the results of the estimate of the population of Slovakia up to 2075 by Eurostat. There is presented 6 versions of the same estimate. Each version is designed for your potential subscriber. It is intended by the character of the use estimation results. The basic formof a presentation is the first column in Table 1 Eurostat estimate. Similar are presentations of Eurostat estimates in the second and third columns in which the same result is entered in a different form (in millions and in thousands of inhabitants, possibly with the number of decimal places).

Tab. 1: Estimate of population of Slovakia according to Eurostat and version 140

year	Eurostat in mil.	Eurostat in mil.	Eurostat in thousand	Eurostat in thousand	Eurostat in mil	Eurostat in mil
2015	5421349	5 421 349	5421,349	5421	5	5,4
2025	5477691	5 477 691	5477,691	5478	5	5,5
2035	5423894	5 423 894	5423,894	5424	5	5,4
2045	5320539	5 320 539	5320,539	5321	5	5,3
2055	5194494	5 194 494	5194,494	5194	5	5,2
2065	5016733	5 016 733	5016,733	5017	5	5
2075	4805282	4 805 282	4805,282	4805	5	4,8

Source: own processing

In Table 2, a version to compare two or more estimates is analogously processed.

**Tab. 2: Comparison of the two estimates (Eurostat and f140)**

year	Eurostat in resp.	f140 in resp.	f-E in resp.	f-E in resp.	f-E in thousand	f-E in thousand
2015	5421349	5483398	62049	62 049	62,049	62
2025	5477691	5508050	30359	30 359	30,359	30
2035	5423894	5345143	-78751	-78 751	-78,751	-79
2045	5320539	5106747	-213792	-213 792	-213,792	-214
2055	5194494	4856488	-338006	-338 006	-338,006	-338
2065	5016733	4549581	-467152	-467 152	-467,152	-467
2075	4805282	4293763	-511519	-511 519	-511,519	-512

Source: own processing

In tab1 and Table 2 shows the shortened forms of development of population estimates. Shortening is implemented to sequence every 10 years. With this reduction, we must ensure that the step in the time series is not too long. (we should have many periods of time in which

virtually nothing is important) and vice versa, if the step in the time line was too short (we should have a lot of events for the time period).

Fig. 1: The Reality and Forecasts of Population Development in the Slovak Republic
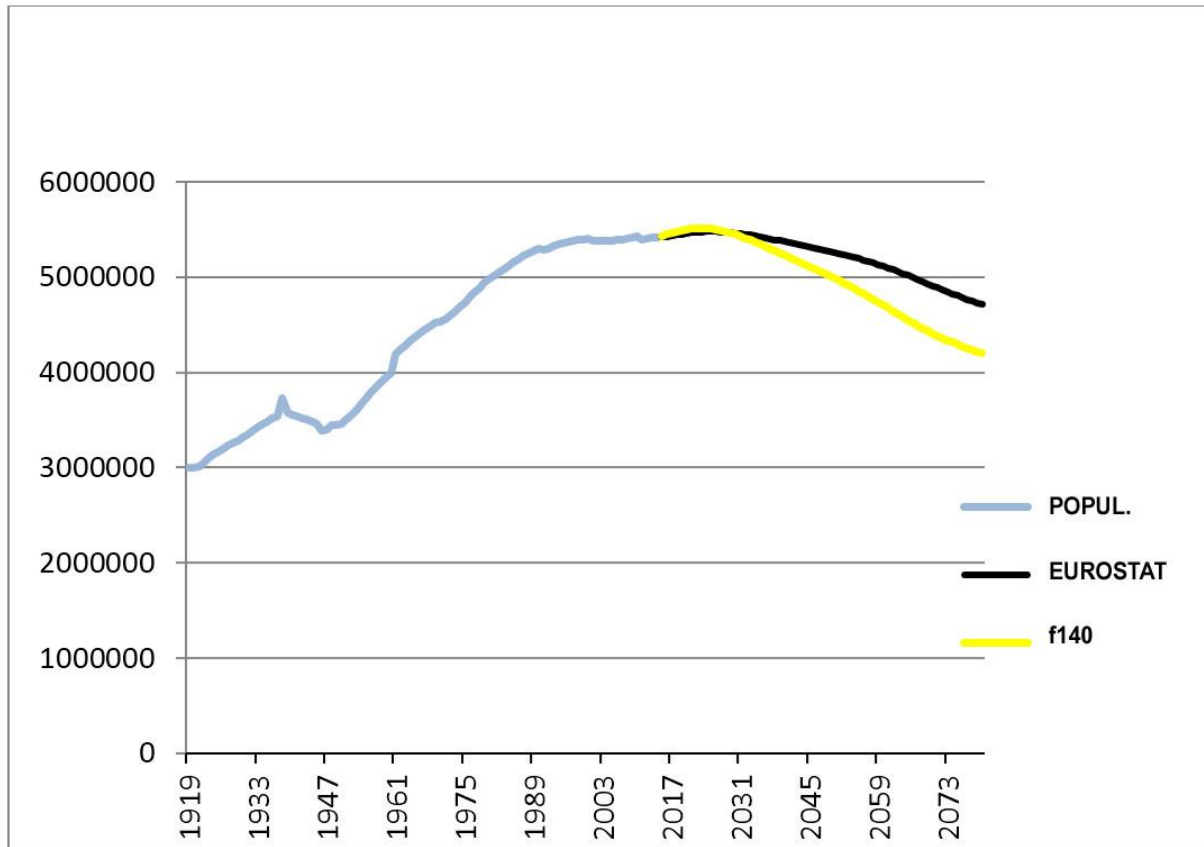
Source: own processing

Figure 1 shows the evolution of the annual values of the estimated population (in fact between 1919 and 2015 and an estimate from 2015 to 2080). The difference in estimates is half a million people or the difference in estimates is 511,519 five hundred and eighteen thousand five hundred and fifteen residents.

Conclusion

The population of the Slovak Republic will moderate slightly according to the medium-term estimate (slightly optimistic conclusion). It is assumed that a nuclear war will not emerge between the powers (the population would decrease significantly with a potential up to the zero level of Homo sapiens). At the same time, the assumptions that healthcare is confronted with

the task of rapidly eradicating "plague" diseases and that the population from North Africa to Afghanistan does not go to Slovakia (the population would increase) is also met. The probability of occurrence of these events is already quite high even when estimated at one hundred years ahead. The occurrence of these events is usually not taken into account when calculating the estimates.

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