Acta oeconomica et informatica 1
Nitra, Slovaca Universitas Agriculturae Nitriae, 2007, s. 1–5

DEMOGRAPHIC AGEING AND THE DEVELOPMENT OF BURDEN CARRIED BY THE PRODUCTIVE POPULATION IN NUTS II – SOUTH-EAST

DEMOGRAFICKÉ STÁRNUTÍ OBYVATELSTVA A VÝVOJ ZATÍŽENÍ PRODUKTIVNÍ POPULACE V PODMÍNKACH VYŠŠÍHO ÚZEMNĚ SPRÁVNÍHO CELKU JIHOVÝCHOD

Lubomír VOŠTA, Bohumil MINAŘÍK

Vysoká škola polytechnická Jihlava, Czech Republic

The paper reports on the development of characteristics of the burden carried by the productive population in consequence of the demographic ageing of population in the conditions of the higher territorial administrative unit South-East (consisting of two NUTS III units – the South Moravian and Vysocina regions) in the past 12 years. Population was divided into age groups and the burden on the productive population was analysed using burden coefficients, age index and coefficients describing the dynamics of burden changes, specifically the inflow, outflow and substitution coefficients. It is stated in the work that there is a gradual deterioration of all coefficient values in accordance with the current trend, which more and more resembles the situation in developed European countries. Both the initial and current situation of most indicators are a bit better in the Vysocina region. However, this region is inhabited by a smaller portion of the unit's population so that indicators of NUTS II correspond more significantly with the situation in the South Moravian region. Over next years there is nothing else to expect than further deterioration of the situation, in which an increase in the burden on the productive population will be (as a result of the expected decrease in the proportion of the pre-productive population) more and more imposed by the post-productive component of the population.

Key words: population, demographic ageing, productive population, burden coefficients, NUTS II, NUTS III

In the past years the demographic reproduction in the Czech Republic has not been developing positively, as far as the number of the population or its age structure are concerned. The demographic behaviour of the population is consistent with to the development in the developed Western democracies. This phenomenon has brought about both negative and positive effects, which are related to the faster economic growth and the corresponding social development (Dufek, 2001). The population has been conforming to the trends of Western civilization, which is among others connected with the decreasing marriage and birth rates as the productive part of the population aims for self-fulfilment. A decline in birth rate and the prolonged middle age cause the gradual ageing of population, where the proportion of the productive population is decreasing and that of the post-productive population is increasing.

In the conditions of the region being studied there was a decrease of 1.9 % in population (2.2 % in the South Moravian region, 1 % in the Vysocina region), and the average age increased from 37 to 40 in the South Moravian region and from 36 to 39 in the Vysocina region in 1993–2004. The structure and proportions of the pre-productive, productive and post-productive populations at the beginning and at the end of the period under investigation for both regions and the unit as a whole are shown in Fig. 2.

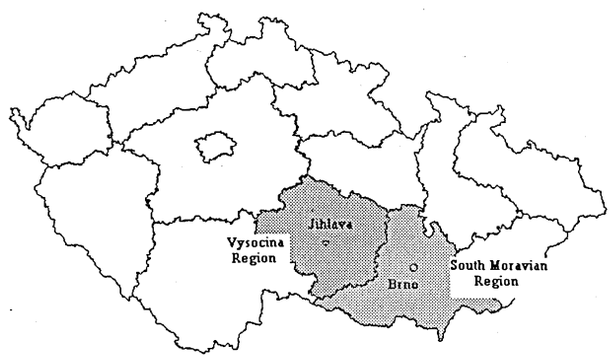

Figure 1 Map of NUTS II — South-East
Obrázek 1 Mapa NUTS II – Jihovýchod
kraj Vysočina – Vysocina region, Jihomoravský kraj – South Moravian Region

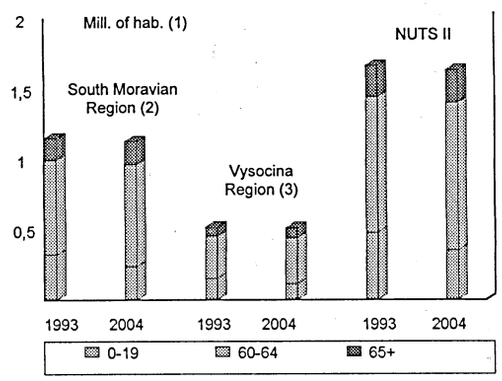

Figure 2 Population age structure at the beginning and at the end of the period being investigated
Obrázek 2 Věková struktura populace na začátku a na konci sledovaného období
(1) počet obyvatelstva v mil., (2) Jihomoravský kraj, (3) kraj Vysočina

The fact that the characteristics of the burden on the productive population are worsening is a considerable issue which is relevant to all aspects of social life and it also affects the economic and social spheres. Therefore, the authors of the paper aimed at charting the situation in the actual NUTS II (South-East) and in both its NUTS III parts – the South Moravian Region and the Vysocina Region – during the last 12 years. The work broadens the knowledge gained through the analysis carried out in the South Moravian region (Hudečková, 2005, Minařík and Hudečková, 2006), and in the whole of the Czech Republic (Dufek, 2006).

Material and methods

The basic methodical instrument to evaluate the burden carried by the productive population is the age structure coefficient reflecting the proportions of the basic population age groups. The population is divided into the pre-productive, productive and post-productive segments.

Indicators of the burden on the productive population used in this work are in accord with the generally used methodology, e.g. Roubíček (1996), Hrubý and Felsen (2000), Dufek (2001) and they include these coefficients:

- Coefficients of total burden on the productive population imposed by both the pre-productive and post-productive populations. The critical limit for the transfer to the productive population is specified either in biological (the age of 15) or economic (the age of 20) terms. The biological and economic limits for the transfer to the post-productive population are then 60 and 65 years of age, respectively. In order to conform to the methods used in the European Union and by the valid WHO methodology, the age of 65 is considered the transfer limit for the post-productive population, as it corresponds to the real end of economic activity in economically developed countries. These coefficients of the total dependence, which are usually stated in per cents, can be interpreted as sums of:
  - the coefficients of the burden on the productive population imposed by the pre-productive population with the critical biological or economic age limits – the coefficients of young people dependence, and
  - the coefficient of the burden on the productive population imposed by the post-productive population (because of the above-mentioned reason, with the critical age limit of 65) – the coefficient of old people dependence.
- The age index is defined as the ratio of the number of people at the post-productive age to that of people at the pre-productive age, which again can be specified by the biological (15) or economic (20) critical limits, usually expressed as percentages.
- A group of coefficients connected with the dynamics of a change to the burden on the productive population, specifically:
  - the inflow coefficient defined as a proportion of the part of the pre-productive population which is just about to enter the productive population,
  - the outflow coefficient defined as a proportion of the part of the post-productive population which is just about to leave the productive population,
  - the substitution coefficient defined as the ratio of the numerators of the previous coefficients, all of them usually stated in per cents.

Results and discussion

The burden on the productive population was analysed using the burden coefficients. The populations of the South Moravian region, the Vysočina region and the South-East unit in 1993–2004 was divided into age groups, namely into the pre-productive, productive and post-productive segments. For selected coefficients, the critical limit for the transfer to the productive segment is either biological (the age of 15) or economic (the age of 20). For the transfer to the post-productive age the limits of the ages of 60 and 65 are considered. To conform to the methods used in the European Union and by the valid WHO methodology, the age of 65 is considered to be the transfer limit for the post-productive population. The coefficients are expressed as percentages.

The old people dependence coefficient in the South Moravian region remained quite the same during all the period being studied, whereas in the Vysocina region it increased by 1.5 percentage points in 2004, as compared with the initial status in 1993. The result is a 0.5 percentage point increase in the unit as a whole. It means, in 2004 there were more than 20 people older than 65 for each 100 economically active inhabitants.

The young people dependence coefficient was decreasing during the observed years, both with the biological and economic limits. Decrease values can be seen in the last line of Table 1. In 2004 there were 21 people younger than 15 per 100 economically active inhabitants. The coefficient with the economic limit also decreased, twice as fast. It reached higher values than for the biological limit, which is definitely caused by the fact that at the beginning of the 1990s the strong generation of the 1970s entered the productive population over 15 years of age. Calculating with the economic limit, there were almost 34 young people dependent per 100 economically active people.

The coefficient of total burden on the productive population imposed by the pre-productive and post-productive populations in a period covering 1993–2004 was gradually decreasing, specifically by about 8 percentage points for the biological limit and by 16 percentage points for the economic one.. There were 42 young and old people dependent on 100 productive inhabitants calculated with the biological limit and more than 56 people calculated with the economic limit.

The development of these characteristics (with the exception of the old people dependence) is parallel in both regions and it is, as expected, unfavourable. The number of post-productive inhabitants is rising and even when there are moments of a temporary increase, the number of people at the productive age is falling in the long term. The coefficients of the burden imposed by the pre-productive population (young people dependence coefficients) are decreasing, and as a result, the burden on the productive population imposed by young people is being reduced. As far as the development is concerned, this fact negatively influences the proportion of the productive population, which is going down, i.e. the total burden is increasing.

There is still another indicator showing the demographic ageing – **the age index,** again both with the biological and economic limits. The age index was rising linearly at the same pace in both the regions and the unit as a whole, so in 1993–2004 it showed a growth; it increased by 29 percentage points for the biological limit and nearly 29 percentage points

Table 1 The coefficients of the burden on the productive population in both regions and NUTS II in 1993–2004 in %

Year (1)	$CD_{(old)}$			$C_{D(y)}$						$C_{D(ov)}$					
				biological limit (2)			economic limit (3)			biological limit (2)			economic limit (3)		
	SMR	VR	NUTS II	SMR	VR	NUTS II	SMR	VR	NUTS II	SMR	VR	NUTS II	SMR	VR	NUTS II
1993	20.4	19.1	20.0	29.2	31.2	29.8	48.5	51.7	49.5	49.6	50.3	49.8	72.0	73.8	72.5
1994	20.4	19.1	20.0	28.1	30.2	28.7	46.7	49.9	47.7	48.5	49.3	48.8	70.0	71.9	70.6
1995	20.5	19.3	20.1	27.1	29.2	27.8	44.7	47.9	45.7	47.7	48.5	47.9	68.0	70.0	68.6
1996	20.6	19.5	20.2	26.2	28.4	26.9	42.8	45.9	43.7	46.8	47.8	47.2	66.0	68.0	66.7
1997	20.7	6	20.4	25.4	27.5	26.0	40.9	44.1	41.9	46.1	47.2	46.4	64.2	66.3	64.8
1998	20.7	19.8	20.4	24.6	26.7	25.3	39.2	42.4	40.2	45.3	46.6	45.7	62.4	64.6	63.1
1999	20.6	19.9	20.4	23.8	26.0	24.4	37.5	40.8	38.5	44.4	45.9	44.9	60.5	63.0	61.3
2000	20.6	20.0	20.4	23.0	25.2	23.6	36.3	39.5	37.2	43.6	45.2	44.0	59.1	61.8	59.9
2001	20.6	20.0	20.4	22.4	24.5	23.0	35.4	38.6	36.4	43.0	44.5	43.4	58.2	60.9	59.0
2002	20.6	20.1	20.4	21.9	23.8	22.5	34.5	37.5	35.4	42.5	44.0	42.9	57.2	59.9	58.0
2003	20.6	20.2	20.4	21.2	23.1	21.8	33.6	36.5	34.5	41.8	43.3	42.3	56.2	58.9	57.0
2004	20.6	20.4	20.5	20.8	22.6	21.4	32.8	35.7	33.7	41.4	43.0	41.9	55.4	58.3	56.3
Change 2004–1993 in p.p. (4)	+0.2	+1.3	+0.5	-8.4	-8.6	-8.4	-15.7	-16.0	-15.8	-8.2	-7.3	-7.9	-16.6	-15.5	-16.2

$C_{D(old)}$ – old people dependence coefficient, $C_{D(y)}$ – young people dependence coefficient, $C_{D(ov)}$ – coefficient of total burden, SMR – South Moravian region, VR – Vysocina region

$C_{D(old)}$ – koeficient závislosti (stařílidé), $C_{D(y)}$ – koeficient závislosti (mladí lidé), $C_{D(ov)}$ – koeficient celkového zatížení, SMR – Jihomoravský kraj, VR – kraj Vysočina

Tabulka 1 Koeficienty zatížení produktivní populace v obou krajích a NUTS II v letech 1993–2004 v %
(1) rok, (2) biologická hranice, (3) ekonomická hranice, (4) změna v 2004–1993 v %

for the economic limit. The growth occurred as a consequence of a lower proportion of children and a higher proportion of the oldest segment of the population. In 2004 there were 96 people older than 65 per 100 people in the 0–14 age category, or 67 people older than 65 per 100 people in the 0–19 age category.

When studying the burden on the productive population, it is also suitable to watch the dynamics of burden change, which is connected with the inflow, outflow and substitution coefficients.

The inflow coefficient states the ratio of the pre-productive population which is just about to enter the productive population to the productive population; the outflow coefficient states the ratio of the post-productive population which is just leaving the productive population to the productive population, and the substitution coefficient states the ratio of the numerators of the previous coefficients.

Development of the inflow coefficient (Fig. 3) can be characterized as a decrease which is slowing down for both the regions and the unit as a whole. This indicator fell under 10 people at the ages between 15 and 19 per 100 people in the productive segment in the South Moravian region and NUTS II as early as in 2000, in the Vysocina region the same happened in 2002. It is obvious that fewer and fewer people enter the productive age.

The outflow coefficient (Fig. 4) was decreasing until the second half of the 1990s and it has been rising again since 2000. It means there is a rise in the number of people leaving the productive age for the post-productive one, which is even more distinct in the South Moravian region.

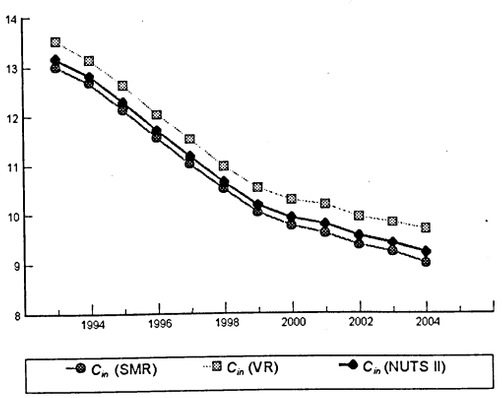

Figure 3 Inflow coefficients in 1993–2004 in %
C_{in} – inflow coefficient, SMR – South Moravian Region, VR – Vysocina Region

Obrázek 3 Koeficienty přílivu v období 1993–2004 v %
C_{in} – koeficient přílivu, SMR – Jihomoravský kraj, VR – kraj Vysočina

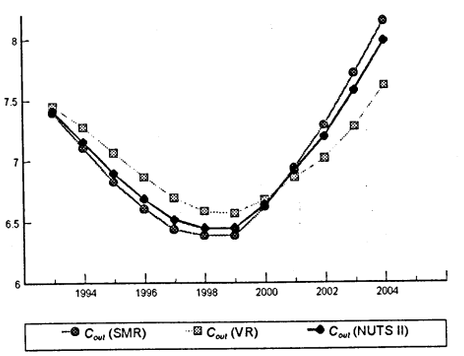

Figure 4 Outflow coefficients in 1993–2004 in %
C_{out} – outflow coefficient, SMR – South Moravian Region, VR – Vysocina Region

Obrázek 4 Koeficienty odlivu v období 1993–2004 v %
C_{out} – koeficient odlivu, SMR – Jihomoravský kraj, VR – kraj Vysočina

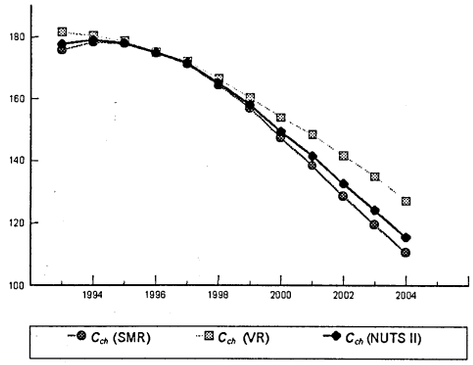

Figure 5 Substitution coefficients in 1993–2004 in %
C_{ch} – change coefficient, SMR – South Moravian Region, VR – Vysocina Region

Obrázek 5 Koeficienty výměny v období 1993–2004 v %
C_{ch} – koeficient výměny, SMR – Jihomoravský kraj, VR – kraj Vysočina

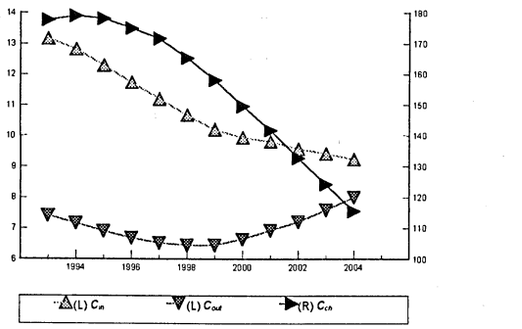

Figure 6 Dynamics of change coefficients in NUTS II in 1993–2004 in %
C_{in} – inflow coefficient, C_{out} – outflow coefficient, C_{ch} – change coefficient, L – left, R – right

Obrázek 6 Dynamika koeficientů změny v NUTS II v období 1993–2004 v %
C_{in} – koeficient přílivu, C_{out} – koeficient odlivu, C_{ch} – koeficient výměny, L – osa vlevo, R – osa vpravo

The substitution coefficient (Fig. 5) is the sum of the effects of the inflow and outflow coefficients and it is also of a declining character. While this indicator value was almost the same in both the regions in the mid – 1990s, the development has diverged in both regions since 2000, which together with the development of the outflow coefficient shows a certain difference in the demographic situations in both of the regions in the period, when the generation entering the productive age nowadays was born.

While at the beginning of the period being investigated the inflow coefficient exceeded the outflow coefficient by nearly 6 percentage points, at the end of 2004 it was only 1 percentage point. It means the inflow of economically active people is still higher than the outflow; however, both the coefficients have been converging in the past years.

The development of the burden on the productive population in NUTS II and both its parts does not contradict the long-term development in the Czech Republic, as stated in the Conclusion.

Conclusion

In accordance with similar findings in other cases, the development of all characteristics of the burden on the productive population in NUTS II and both its regions is very negative. When there are some more favourable values found in the Vysocina region, as compared to the South Moravian region, it is the same trend, only one up to three years delayed. Due to the rising number of the inhabitants at the post-productive age and, in contrast, the falling number of the inhabitants at the productive age in spite of a temporary increase, the negative trend is reflected in the increasing coefficient of the burden on the productive population imposed by the post-productive population (the old people dependence coefficient). The coefficients of the burden imposed by the pre-productive population (the young people dependence coefficient) are developing in the same negative way, just in the opposite direction. They are falling as is the burden on the productive population placed by the young; however, in the long term this has an adverse influence on the proportion of the productive population, which is decreasing, and the total burden is then rising. The development of the age index, the inflow and outflow coefficients is also alarming. In particular, the age indices demonstrate a dramatic growth (29 and 20 percentage points for the biological and economic limits, respectively).

Table 2 Temporal and spatial comparison of the results achieved

	I_{AGE}(ec)	$C_{D(old)}$	$C_{D(y\text{-}ec)}$	$C_{D(ov\text{-}ec)}$	C_{in}	C_{out}
SMR 2004	69.1	20.6	32.7	55.4	9.0	8.1
VR 2004	63.1	20.4	35.7	58.3	9.7	7.6
NUTS II 2004	67.1	20.5	33.7	56.3	9.2	8.0
CZ 2004	64.1	19.6	33.8	55.4	9.2	7.6
CZ 1960	29.2	14.8	57.3	74.1	11.6	8.1
CZ 1970	40.6	18.2	51.1	71.9	12.7	9.1
CZ 1980	44.9	21.3	53.0	76.8	10.5	5.4
CZ 1990	42.3	18.9	51.1	72.7	10.2	7.8
CZ 2010	83.9	23.1	29.8	54.9	6.3	10.4
CZ 2020	117.9	33.4	30.5	66.5	7.4	9.4
CZ 2030	139.7	37.9	29.4	70.4	7.1	10.2

I_{AGE} (ec)– age index, $C_{D(old)}$ – old people dependence coefficient, $C_{D(y\text{-}ec)}$ – young people dependence coefficient, $C_{D(ov\text{-}ec)}$ – coefficient of total burden, C_{in} — inflow coefficient, C_{out} – outflow coefficient, SMR – South Moravian Region, VR – Vysocina Region, CZ – Czech Republic

I_{AGE} (ec) – index stáří, $C_{D(old)}$ – koeficient závislosti (stáří lidé), $C_{D(y\text{-}ec)}$ – koeficient závislosti (mladí lidé), $C_{D(ov\text{-}ec)}$ – koeficient celkového zatížení, C_{in} – koeficient přílivu, C_{out} – koeficient odlivu, SMR – Jihomoravský kraj, VR – kraj Vysočina, CZ – Česká republika

Tabulka 2 Časové a územní porovnání dosažených výsledků

A wider overview of the values gained and their comparison with the data for the whole of the Czech Republic in the long term are presented in Table 2. There are also values of selected indicators, which were gained through calculations based on the long-term projection of the population of the Czech Republic until 2003 (Aleš and Šimek, 1999), specifically on the medium version of the prognosis (see also Minařík and Hudečková, 2001).

The table shows that the current values for NUTS II correspond with the situation in the whole of the Czech Republic. The exception is a considerably higher age index in the South Moravian region. According to the prognoses, we can expect further deterioration of the age structure in the Czech Republic will be characteristic in these ways:

- the age index will continue in its dramatic growth, which will then break the psychological limit of 100 % around 2015,
- the total burden on the productive population will gradually increase up to the values which used to be recorded in the past, but the burden imposed by the post-productive population will gradually prevail (after 2015),
- outflow coefficients will exceed the values of inflow coefficients, which is expected as early as 2010.

Considering the development so far, the situation in the region being studied can be expected to resemble the state-wide development. Furthemore, we can expect that the values will be reached or exceeded first in the South Moravian Region and only later, with a certain delay, in the Vysocina Region.

Souhrn

Příspěvek se zabývá vývojem charakteristik zatížení produktivní populace v podmínkách vyššího územně správního celku Jihovýchod (tvořeného dvěma jednotkami NUTS III — krajem Jihomoravským a krajem Vysočina) v období uplynulých 12 let, a to v důsledku demografického stárnutí obyvatelstva tohoto regionu. Obyvatelstvo bylo rozděleno do věkových skupin a zatížení produktivní populace bylo analyzováno pomocí koeficientů zatížení, indexu stáří a koeficientů popisujících dynamiku změn zatížení, konkrétně pomocí koeficientu přílivu, koeficientu odlivu a koeficientu výměny. Práce konstatuje postupné zhoršování hodnot všech koeficientů v souladu s trendem, který stále více kopíruje situaci ve vyspělých evropských zemích, přičemž výchozí i aktuální situace u většiny ukazatelů je poněkud lepší v kraji Vysočina. Tento kraj ovšem obývá menší část populace regionu, takže ukazatele za jednotku NUTS II korespondují výrazněji se situací Jihomoravského kraje. V příštích letech nelze než očekávat další zhoršování situace, kdy růst zatížení produktivní populace půjde (v důsledku očekávaného snižování podílu předproduktivní populace) stále více na vrub zatížení poproduktivní složkou populace.

Klíčová slova: populace, demografické stárnutí, produktivní populace, koeficienty zatížení, NUTS II, NUTS III

Supported by the Ministry of Education of the Czech Republic (Grant no. MSM 6215648904)

References

ALEŠ, M. – ŠIMEK, M. 1996. Projekce obyvatelstva České republiky 1995–2030 (The Projection of the Czech Republic Population 1995–2030), In: Demografie, roč. 38, 1996, s. 1–17.

DUFEK, J. 2001. Prognóza zatížení produktivní populace v České republice (The Prognosis of Burden on the Productive Population in the Czech Republic). In: Acta univ. agric. et silvic. Mendel. Brun., roč. 49, 2001, č. 2, s. 19–25.

DUFEK, J. 2006. Age structure and the burden carried by the productive population of the Czech Republic. In: Agricultural Economic – Czech, vol. 52, 2006, no. 2, p. 67–75.

HRUBÝ, J. – FELSEN, M. 2000. Procesy starnutia a zatiaženia produktívnej populácie SR (The Process of Ageing and the Burden on the Productive Population of the SR). In: Medzinárodné vedecké dni 2000, Nitra : SPU, p. 31–35

HUDEČKOVÁ, J. 2005. Sociálně demografická analýza Jihomoravského kraje (Social Demographic Analysis of the South Moravian Region). Doctoral thesis. MZLU Brno, 167 s.

KOSCHIN, F. 2003. Struktury obyvatelstva (Population Structures), In: Demografie, roč. 45, 2003, s. 249–255.

MAŠKOVÁ, M.1993. Demografické aspekty stárnutí obyvatelstva České republiky (Demographic Aspects of the Czech Republic Population Ageing), In: Demografie, roč. 35, 1993, č. 4, s. 236–246.

MINAŘÍK, B. – HUDEČKOVÁ, J. 2001. Zatížení produktivní populace ČR v dlouhodobém pohledu (Burden on the Productive Population in the CR in the Long Term). In: Acta univ. agric. et silvic. Mendel. Brun., vol. 49, 2001, no. 6, p. 95–102.

ROUBÍČEK, V. 1996. Základní problémy obecné a ekonomické demografie (Basic Issues of General and Economic Demography). Praha : Vysoká škola ekonomická, 271 s.

Contact address:
Mgr. Lubomír Vošta, Vysoká škola polytechnická Jihlava, Tolstého 16, 586 01 Jihlava, Czech Republic, e-mail: vosta@vspji.cz