

How Many Secondary School Students and Leavers Will there Be in the Next 20 Years?

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Abstract

The article analyzes the impact of the low number of births at the turn of the millennium in the Czech Republic on the number of students and leavers of secondary schools finished by the school leaving exam. The drop in births mentioned followed in lower number of students admitted to secondary schools at present time. The analysis based on available data until 2011 is supplemented by the estimate of the development in next two decades based on authors' demographic projection of the population of the Czech Republic (see Fiala, Langhamrová, Průša, 2011). In this decade we can expect decline in the annual numbers of leavers (taking school leaving exam) by almost 25% and a return to present values is not expected until the late twenties. The annual number of leavers taking school leaving exam will thus be in three years lower than the present annual numbers or students registered for daytime tertiary education courses. The universities and technical colleges should probably have to reduce the number of students.

Keywords

Age structure, secondary school, school leaving exam, student, school leaver, population projection

JEL code

I29, J11

INTRODUCTION

The irregular development of the number of live births in the Czech Republic is the main cause of the irregularities in the age structure of the population. The alternation of numerically stronger and weaker birth generations appears after the appropriate lapse of time in the alternation of larger and smaller numbers of potential pupils or students of the appropriate levels of education.

This article deals with the influence and consequences of the drop in the number of births in the Czech Republic in the second half of the nineties on the number of students and leavers of secondary schools finished with the school-leaving exam in the past 10 years and expected further development in the years up to 2030. This is a forecast from the pure demographic point of view, it does not suppose any possible changes in the system of secondary education which can be predicted very difficult at present time.

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1 METHODOLOGICAL NOTES AND DEMOGRAPHIC DEVELOPMENT

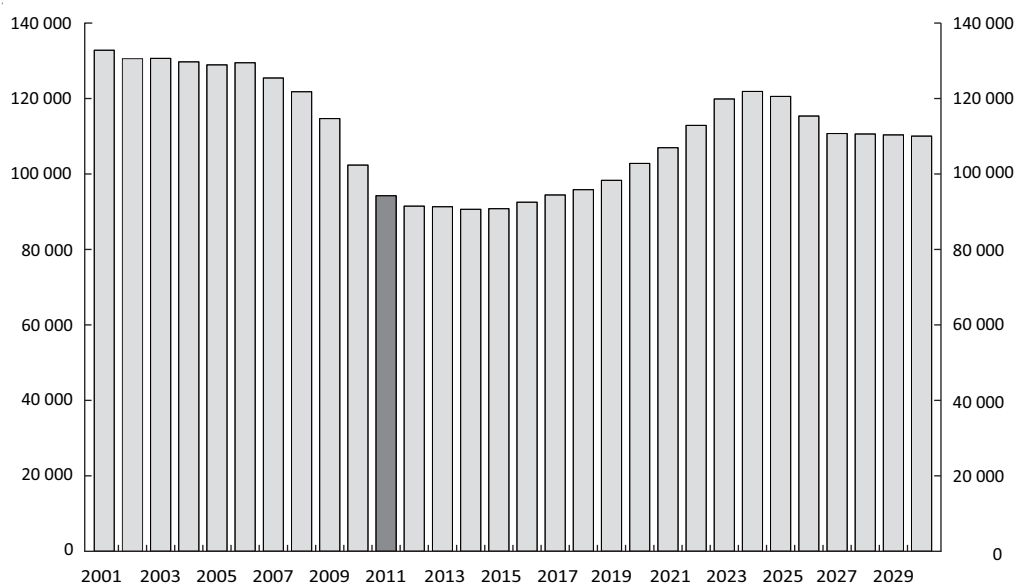
Obligatory school attendance in the Czech Republic begins at the start of the school year following the date on which the child reaches the age of six. This means that in each calendar year all the children who have reached their sixth birthday by 31st August should start attending elementary school. Cases where a child starts school a year early are quite exceptional. On the other hand it is possible to defer school attendance (usually by one year), this possibility is utilized by the parents of slightly less than 20% of children. As the months of July and August make up roughly 17% of the year, we often assume for the sake of simplicity that in each calendar year it is those children who have reached the age of 6 years by 30th June who start school, whereas children born in July and August always start a year later, in other words at the age of 7 years. Such assumption was employed, for instance, in Langhamrová, Fiala (2009).

In calculating the estimated number of pupils on the basis of the age structure of the population we therefore consider the age structure of the population in each year as of 1st July – the so-called mid-year population – and assume that all children who were 6 on 1st July of the given year began attending school on 1st September.

In the normal course of school attendance (i.e. without interruption or the repeating of a year) it emerges from these assumptions that 11-year-olds may transfer to an 8-year grammar school and 13-year-olds to a 6-year grammar school. Secondary education at a 4-year grammar school or a secondary vocational school with school-leaving exam begins at the age of 15 years and the age of secondary school leavers with school leaving exam (in other words those with potential interest in starting university studies) is 19 years.

The estimate of the trend in the development of the number of potential students in the first year of four-year secondary schools will therefore be based mainly on the development trend of the numbers of 15-year-olds; the estimate of the trend in the development of the number of potential students in the first year of a bachelor's degree course or a 4-6-year master's degree course of study at universities will then be based on the development trend of the number of 19-year-olds before the start of the appropriate school year.

Figure 1 Development of the number of 15-year-olds (as of 1st July each year)

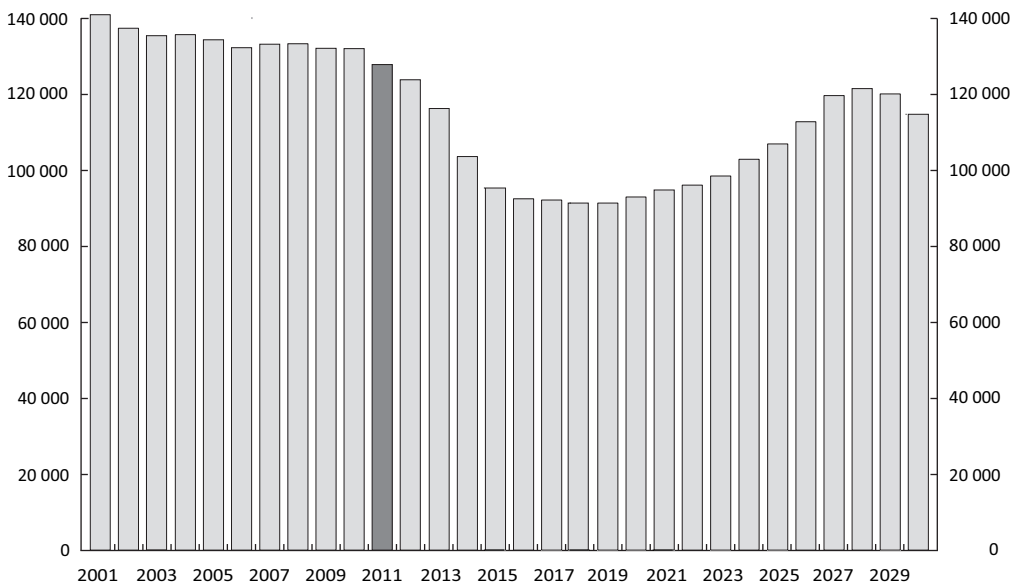


Source: Up to 2010: Czech Statistical Office (CZSO, 2012), from 2011: own projection (Fiala, Langhamrová, Průša, 2011)

In 2011 the number of 15-year-olds was already almost at its minimum and in further years it will stagnate or drop only slightly. In the twenties an increase may be expected, but the number of 15-year-olds will probably no longer reach such high values as at the beginning of this millennium. It can therefore be assumed that in future years the number of those interested in daytime studies at secondary schools will no longer be much lower than in the 2011 / 2012 school year, and that in roughly 5 years time the number of students interested in secondary school studies should gradually begin to rise with each year. Development after 2025 depends first and foremost on how the number of births develops in the next few years in the Czech Republic. It is highly probable, however, that there will again be a continuing decline (see Figure 1).

The development of the number of 19-year-old persons (those potentially interested in the daytime form of university studies) is naturally roughly 4 years "behind" the development of the number of 15-year-olds. In the next 5 years one can therefore expect a relatively rapid decline and a gradual increase will not occur until in around 10 years' time, and even then the numbers of 19-year-olds will probably not reach the values from the beginning of this century. At the end of the twenties one may expect that the number of persons of this given age will again decline (see Figure 2).

Figure 2 Development of the number of 19-year-olds (as of 1st July each year)



Source: Up to 2010: Czech Statistical Office (CZSO, 2012), from 2011: own projection (Fiala, Langhamrová, Průša, 2011)

2 DEVELOPMENT OF THE NUMBERS OF STUDENTS IN SECONDARY SCHOOLS WITH SCHOOL-LEAVING EXAM FROM 2002

The numbers of 15-year-olds can be regarded as the (very rough) upper estimates of the numbers of potential students for the first year classes of four-year secondary schools, similarly the numbers of 19-year-olds can be regarded as the upper estimates of potential students of the first years of bachelor degree courses or 4-6-year master degree courses. Neither secondary nor tertiary education is obligatory and only part of the population will participate in it. On the other hand some admitted students (especially at tertiary education) are older than the usual age of study. The condition for admission to the majority

of secondary schools or universities is not only the successful completion of the appropriate education of the lower level, but at some schools also the taking of entry examinations.

A condition for admission to university is the taking of the school-leaving examination. In our analysis we therefore concentrate only on the development of the number of students and leavers of secondary schools finished with the school-leaving examination, which are the grammar schools (8-year, 6-year and 4-year) and the vocational secondary schools.

More than 95% of students (see ÜIV, 2012) study at secondary schools finished with the school-leaving exam in the daytime form of study. Because of this fact we shall analyze the numbers of students of this form of study only. We consider the age as of 31st December (not of 1st September) of the appropriate year t .

We can see (Table 1) that most newly admitted students are of the age usual for beginning to study the appropriate type of school (i.e. 15–16 years for the four-year grammar schools and the vocational secondary schools with school-leaving exam, 13–14 years for the six-year grammar schools or 11–12 years for the eight-year grammar schools). Almost no students are younger but some students are of higher age. Most of the students admitted have not repeated any year at elementary school and entered secondary education immediately after completion of basic school attendance, or directly after completing the 5th year of elementary school (8-year grammar schools), or directly after completing the 7th year of elementary school (6-year grammar schools).

For each age interval we calculate the relation of the number of newly admitted students to the number of all persons according to the formula:

$$a_{t,x} = \frac{S_{t,x}^{(adm)}}{S_{t,x}}, \tag{1}$$

where:

$S_{t,x}^{(adm)}$ is the number of students of the age x admitted in the year t ,

$S_{t,x}$ is the number of persons of the age x in the year t . See Table 2.

Table 1 Newly admitted students by age

Age	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
4years study (grammar and vocational schools)										
-13	-	-	9	1	1	-	-	-	-	-
14	53	61	15	49	6	9	9	9	11	16
15	39 258	40 718	39 501	39 791	41 428	38 104	38 241	33 853	29 105	27 592
16	32 493	32 491	33 960	33 857	37 142	36 773	36 899	36 799	31 956	29 181
17	2 312	2 160	2 234	2 323	2 711	3 208	2 848	3 064	3 013	2 557
18	837	799	975	921	786	862	867	978	956	848
19	494	439	510	612	465	480	445	585	614	542
20	239	367	325	205	155	210	204	251	306	319
21+	-	-	-	170	211	272	265	333	467	522
Total	75 686	77 035	77 529	77 929	82 905	79 918	79 778	75 872	66 428	61 577

Table 1 Newly admitted students by age

Continued

Age	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
6year grammar schools										
-11	-	-	-	-	1	-	-	1	-	-
12	1	1	1	22	1	3	3	1	-	3
13	1 026	1 113	1 026	1 150	1 178	1 199	1 213	1 221	1 146	1 209
14	887	937	1 005	1 043	1 021	1 127	1 122	1 109	1 021	997
15	23	22	63	24	21	16	34	18	20	11
16	1	1	3	2	2	5	2	2	1	-
17	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	1	-	-	-
19	-	-	1	-	-	-	-	-	-	-
Total	1 938	2 074	2 099	2 241	2 224	2 350	2 375	2 352	2 188	2 220
8year grammar schools										
-10	30	68	79	80	22	8	35	12	18	19
11	4 965	4 895	4 919	4 910	4 678	4 714	4 834	4 831	4 676	4 954
12	4 499	4 567	4 545	4 824	4 546	4 632	4 271	4 284	4 338	4 152
13	101	78	120	54	148	95	48	65	35	50
14	6	3	4	7	6	8	7	1	2	2
15	2	-	1	2	1	1	-	-	-	1
16	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	2	-	-
20	-	-	-	-	-	-	-	1	-	-
21+	-	-	-	-	-	-	-	15	-	-
Total	9 603	9 611	9 668	9 877	9 401	9 458	9 195	9 211	9 069	9 178

Source: Yearbook of Institute for Information in Education (ÚIV 2011), year 2011: Ministry of Education, Youth and Sports (MŠMT 2012)

The drop in the number of persons of the appropriate age in the population naturally does not necessarily have to result in an appropriate drop in the number of newly admitted students. In the numerically weaker generations admission to the more attractive schools (which undoubtedly includes schools ending with school-leaving exam) may be slightly easier and the ratio $a_{t,x}$ of the number of students admitted to the total number of persons of the appropriate age may be higher.

Table 2 bears witness to this. Whereas in 2002 roughly only 3.87% of 11-year-olds entered the 8-year grammar schools, from the year 2007 this share was more than 5%. The proportion of 16-year-olds entering the 4-year study rose gradually from 24.64% to over 30%.

Table 2 Proportions of newly admitted students from the whole population (in %)

Age	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
4years study (grammar and vocational schools)										
-13	-	-	0.01	0.00	0.00	-	-	-	-	-
14	0.04	0.05	0.01	0.04	0.00	0.01	0.01	0.01	0.01	0.02
15	30.30	30.92	30.92	30.58	32.14	31.23	31.45	31.40	30.02	30.15
16	24.64	25.05	25.76	26.47	28.53	28.44	30.15	30.19	29.57	30.03
17	1.72	1.64	1.72	1.76	2.11	2.45	2.19	2.49	2.46	2.36
18	0.62	0.59	0.74	0.71	0.59	0.67	0.66	0.75	0.77	0.69
19	0.37	0.32	0.38	0.46	0.35	0.36	0.34	0.44	0.47	0.44
20	0.17	0.27	0.24	0.15	0.12	0.16	0.15	0.19	0.23	0.24
21+	-	-	-	0.12	0.15	0.20	0.19	0.24	0.35	0.39
6year grammar schools										
-12	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	-	0.00
13	0.81	0.86	0.80	0.95	0.97	1.12	1.26	1.34	1.26	1.33
14	0.68	0.73	0.77	0.81	0.84	0.93	1.04	1.15	1.12	1.09
15+	0.02	0.02	0.05	0.02	0.02	0.01	0.03	0.02	0.02	0.01
8year grammar schools										
-10	0.02	0.06	0.07	0.08	0.02	0.01	0.04	0.01	0.02	0.02
11	3.87	4.04	4.07	4.59	4.88	5.20	5.32	5.33	5.22	5.45
12	3.48	3.56	3.74	3.99	4.25	4.81	4.69	4.71	4.78	4.63
13	0.08	0.06	0.09	0.04	0.12	0.09	0.05	0.07	0.04	0.06
14+	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00

Source: Own calculation

Each year about ten thousands of students are repeating some year of study. See Table 3.

Table 3 Students repeating some year of study

Year of study	2006	2007	2008	2009	2010	2011
1st year	3 386	4 133	4 253	4 251	4 537	4 507
2nd year	2 436	2 816	2 878	2 898	3 243	3 647
3rd year	2 085	2 507	2 336	2 745	2 900	3 238
4th year	1 032	1 063	1 093	1 187	1 399	1 568
5th year	34	31	33	21	38	40
6th year	29	35	30	30	36	48
7th year	37	34	46	46	83	55
8th year	17	18	32	21	35	38
Total	9 056	10 637	10 701	11 199	12 271	13 141

Source: Yearbook of Institute for Information in Education (ÚIV 2011), year 2011: Ministry of Education, Youth and Sports (MŠMT 2012)

The proportion of students repeating in the year t the year of study y is:

$$r_{t,y} = \frac{R_{t,y}}{S_{t-1,y}}, \tag{2}$$

where $S_{t,y}$ ($R_{t,y}$) is the number of students studying (repeating) in the school year $t / (t + 1)$ the y -th year of study. The numbers of repeaters are not distinguished according to the lengths of study. Because the proportions of repeaters in 1st – 4th years of study are several times higher than those in 5st – 8th years we have supposed that proportion of repeaters in 1st – 4th years in 6year or 8year grammar schools are as low as in higher years of study. See Table 4.

Table 4 Proportion of students repeating a year of study (in %)

Year of study	2006	2007	2008	2009	2010	2011
4years study (grammar and vocational schools)						
1st year	4.22	4.86	5.17	5.19	5.82	6.56
2nd year	3.20	3.70	3.61	3.79	4.26	5.01
3rd year	2.80	3.41	3.16	3.58	3.90	4.37
4th year	1.43	1.45	1.51	1.65	1.86	2.14
6year grammar schools						
1st year	0.30	0.26	0.25	0.12	0.20	0.33
2nd year	0.30	0.26	0.25	0.12	0.20	0.33
3rd year	0.30	0.26	0.25	0.12	0.20	0.33
4th year	0.30	0.36	0.26	0.29	0.32	0.45
5th year	0.42	0.40	0.53	0.52	0.96	0.63
6th year	0.18	0.21	0.37	0.25	0.40	0.44
8year grammar schools						
1st year	0.30	0.26	0.25	0.12	0.20	0.33
2nd year	0.30	0.26	0.25	0.12	0.20	0.33
3rd year	0.30	0.26	0.25	0.12	0.20	0.33
4th year	0.30	0.26	0.25	0.12	0.20	0.33
5th year	0.30	0.26	0.25	0.12	0.20	0.33
6th year	0.30	0.36	0.26	0.29	0.32	0.45
7th year	0.42	0.40	0.53	0.52	0.96	0.63
8th year	0.18	0.21	0.37	0.25	0.40	0.44

Source: Own calculation

Not every student admitted completes his studies successfully. This can be seen from the data on the number of students in the individual years of study (see Table 5). We record $S_{t,y}$, or $S_{t,leav}$, the numbers of students who entered year of study y in calendar year t or who successfully completed their studies in the year t .

For each year we record:

the ratios of the number of students in first years (excluding repeaters) to the number of students admitted,

$$p_{t,1} = \frac{S_{t,1} - R_{t,1}}{S_{t,adm}}, \tag{3}$$

the ratios of the number of students of a certain year of study y (excluding repeaters) in the given year t to the number of students of the preceding year of study in the previous year:

$$p_{t,y} = \frac{S_{t,y} - R_{t,y}}{S_{t-1,y-1}}, \tag{4}$$

and finally the ratios of the number of leavers in a given year t to the number of students of final year of study in the previous year:

$$p_{t,leav} = \frac{S_{t,leav}}{S_{t-1,n}}, \tag{5}$$

(where n is the final year of study in the appropriate school).

Table 5 Numbers of students and leavers at individual types of secondary schools with school-leaving exam

Year of study	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
4year grammar schools										
Admitted	13 746	14 603	14 776	15 123	15 830	14 664	14 688	13 472	12 262	11 740
1st year	13 819	14 676	14 868	15 221	15 928	14 779	14 781	13 559	12 360	11 830
2nd year	13 708	13 692	14 503	14 588	14 932	15 569	14 510	14 490	13 287	12 174
3rd year	12 457	13 564	13 599	14 412	14 486	14 747	15 451	14 458	14 411	13 237
4th year	12 915	12 276	13 389	13 463	14 271	14 342	14 588	15 260	14 284	14 176
Leavers	11 586	12 768	12 108	13 360	13 249	13 975	14 037	14 145	14 007	13 560
6year grammar schools										
Admitted	1 938	2 074	2 099	2 241	2 224	2 350	2 375	2 352	2 188	2 220
1st year	1 942	2 079	2 101	2 256	2 227	2 355	2 378	2 355	2 198	2 230
2nd year	1 772	1 965	2 101	2 105	2 254	2 237	2 333	2 392	2 350	2 199
3rd year	1 741	1 717	1 882	2 069	2 054	2 144	2 167	2 266	2 243	2 186
4th year	1 826	1 676	1 684	1 841	2 006	1 984	2 078	2 064	2 118	2 126
5th year	2 034	1 791	1 681	1 675	1 863	1 993	1 951	2 064	2 014	2 093
6th year	2 550	1 988	1 755	1 631	1 641	1 819	1 947	1 931	2 003	1 990
Leavers	2 525	2 412	1 967	1 713	1 622	1 608	1 852	1 915	1 849	1 952
8year grammar schools										
Admitted	9 624	9 626	9 682	9 890	9 401	9 458	9 195	9 211	9 069	9 178
1st year	9 631	9 631	9 691	9 897	9 405	9 468	9 205	9 216	9 074	9 182
2nd year	9 541	9 647	9 627	9 734	9 890	9 390	9 451	9 209	9 212	9 108
3rd year	9 443	9 483	9 576	9 572	9 652	9 790	9 229	9 329	9 083	9 131
4th year	9 593	9 385	9 418	9 550	9 537	9 589	9 734	9 138	9 235	9 035
5th year	9 666	9 096	8 937	8 995	9 228	9 037	9 124	8 956	8 354	8 435
6th year	9 823	9 448	8 844	8 713	8 768	9 018	8 722	8 790	8 629	8 081
7th year	10 735	9 733	9 328	8 767	8 593	8 649	8 853	8 614	8 722	8 482
8th year	8 358	10 602	9 663	9 269	8 715	8 537	8 542	8 811	8 580	8 647
Leavers	3 412	8 473	10 619	10 236	9 130	8 610	8 395	8 439	8 342	8 350
Vocational schools										
Admitted	62 247	62 778	63 138	62 838	67 075	65 254	65 090	62 400	54 166	49 837
1st year	63 345	63 952	64 283	64 066	68 420	66 845	66 815	63 971	55 806	51 434
2nd year	57 222	59 831	60 562	60 425	60 406	63 391	61 572	61 040	58 814	50 585
3rd year	52 735	54 950	57 728	58 743	58 179	58 155	60 859	59 307	58 887	56 311
4th year	50 903	50 859	53 167	56 096	57 054	55 963	56 079	58 478	56 987	56 577
Leavers	49 493	48 407	48 649	50 542	53 050	53 429	52 657	52 101	50 604	46 263
All schools										
Leavers total	67 016	72 060	73 343	75 851	77 051	77 622	76 941	76 600	74 802	70 125

Source: Yearbook of Institute for Information in Education (ÚIV 2011), year 2011: Ministry of Education, Youth and Sports (MŠMT 2012)

The values of the ratios are in Table 6. Some times their values are a little bit higher than 100%, it can be caused by migration.

We may consider $p_{t,y}$ as the estimate of the so-called coefficients of progress, i.e. the probability that a student in year t will progress from the $(y - 1)$ -th to the y -th year of study; $p_{t,leav}$ is then the estimate of the probability that a student of the final year will successfully complete his studies (i.e. will take the school-leaving examination) in year t . Students may of course to repeat some year of study or to move from one school to another school in the course of their studies.

From this table there can be seen relatively clearly the reduction in the proportion of leavers in last two years in vocational schools.

Table 6 Coefficients of progress in individual types of secondary schools with school-leaving exam (in %)

Year of study	2003	2004	2005	2006	2007	2008	2009	2010	2011
4year grammar schools									
1st year	96.5	96.4	96.5	96.6	95.5	95.4	94.9	94.4	93.9
2nd year	95.9	95.8	95.0	95.0	94.3	94.4	94.3	93.4	93.1
3rd year	96.4	96.5	96.7	96.5	95.5	96.2	95.8	95.6	94.9
4th year	97.1	97.4	97.6	97.7	97.6	97.4	97.2	96.8	96.2
Leavers	98.9	98.6	99.8	98.4	97.9	97.9	97.0	91.8	94.9
6year grammar schools									
1st year	100.0	99.8	100.4	99.8	100.0	99.9	100.0	100.2	100.1
2nd year	100.9	100.8	99.9	99.6	100.2	98.8	100.5	99.6	99.7
3rd year	96.6	95.5	98.2	97.3	94.9	96.6	97.0	93.6	92.7
4th year	96.0	97.8	97.6	96.7	96.2	96.7	95.	93.2	94.4
5th year	97.6	99.8	99.0	100.8	99.0	97.8	98.9	96.6	98.2
6th year	97.5	97.8	96.8	97.8	97.5	97.3	98.7	96.7	98.4
Leavers	94.6	98.9	97.6	99.4	98.0	101.8	98.4	95.8	97.5
8year grammar schools									
1st year	99.8	99.8	99.8	99.7	99.9	99.9	99.9	99.8	99.7
2nd year	99.9	99.7	100.1	99.6	99.6	99.6	99.9	99.8	100.0
3rd year	99.1	99.0	99.1	98.9	98.7	98.0	98.6	98.4	98.8
4th year	99.1	99.0	99.4	99.3	99.1	99.2	98.9	99.8	99.1
5th year	94.5	94.9	95.2	96.3	94.5	94.9	91.9	91.2	91.0
6th year	97.4	96.9	97.2	97.2	97.4	96.3	96.1	96.0	96.3
7th year	98.6	98.3	98.7	98.2	98.3	97.7	98.2	98.3	97.7
8th year	98.6	99.1	99.2	99.2	99.1	98.4	99.3	99.2	98.7
Leavers	101.4	100.2	105.9	98.5	98.8	98.3	98.8	94.7	97.3
Vocational schools									
1st year	97.6	97.5	97.6	98.0	97.3	97.3	97.0	96.2	95.9
2nd year	91.6	91.7	91.0	91.3	89.4	88.7	87.9	87.9	85.4
3rd year	93.4	93.9	94.3	93.6	93.0	93.1	92.8	92.7	91.4
4th year	95.1	95.4	95.9	95.8	94.8	95.0	94.6	94.3	94.0
Leavers	95.1	95.7	95.1	94.6	93.6	94.1	92.9	86.5	81.2

Source: Own calculation on basis of data in Table 3 and 5

3 ESTIMATE OF THE DEVELOPMENT OF THE NUMBER OF SCHOOL-LEAVERS WITH SCHOOL-LEAVING EXAM UP TO 2030

What will be the future development of the number of secondary school leavers, meaning those potentially interested in university studies? To what extent will the influence of the weak generations be felt? On the basis of the above-mentioned calculations it is possible to make an estimate of the development of the number of students and leavers of secondary schools in further years (projection of such type has

been published e.g. in Doucek et al., 2012). The development in 2010 and 2011 indicate that the proportions of admitted students are ceasing to grow and the proportions of repeaters as well as the proportion of students who will continue to a higher year and also the proportions of leavers are relatively stable or even decreasing. In the calculation of the estimated numbers of future students we shall assume, for the sake of simplicity that the given proportions will remain the same as in 2011 for future years. The estimate of numbers of students and leavers in the following years will be carried out according to the following equations:

estimate of the number of students admitted:

$$S_{t,adm} = \sum_x S_{t,x} a_{2011,x}, \quad (6)$$

estimate of the number of first-year students:

$$S_{t,1} = S_{t,adm} p_{2011,1} + S_{t-1,1} r_{2011,1}, \quad (7)$$

estimate of the number of students in higher years of study:

$$S_{t,y} = S_{t-1,y-1} p_{2011,y} + S_{t-1,y} r_{2011,y}, \quad (8)$$

and estimate of the number of school leavers:

$$S_{t,leav} = S_{t-1,n} p_{2011,leav}, \quad (9)$$

where n is the final year of study in the appropriate school.

Table 7 Expected development of the number of 10–21-year-old persons in the Czech Republic in the years 2011–2030

Age	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
10	92 757	94 525	95 509	99 441	104 451	107 712	116 291	121 669	120 228	119 022
11	90 830	92 858	94 630	95 617	99 551	104 559	107 816	116 390	121 765	120 321
12	89 612	90 933	92 964	94 740	95 730	99 661	104 665	107 918	116 489	121 860
13	90 857	89 721	91 045	93 080	94 860	95 846	99 774	104 774	108 025	116 592
14	91 303	90 980	89 850	91 179	93 218	94 994	95 977	99 901	104 898	108 144
15	91 510	91 463	91 147	90 024	91 358	93 394	95 166	96 145	100 065	105 057
16	97 162	91 739	91 702	91 397	90 284	91 614	93 644	95 412	96 386	100 301
17	108 384	97 493	92 088	92 068	91 778	90 660	91 985	94 010	95 772	96 742
18	122 917	108 801	97 937	92 556	92 557	92 263	91 140	92 460	94 479	96 236
19	124 248	123 432	109 352	98 520	93 168	93 163	92 863	91 735	93 047	95 060
20	132 117	125 066	124 285	110 244	99 448	94 079	94 055	93 736	92 589	93 881
21	134 372	133 107	126 100	125 357	111 357	100 540	95 149	95 100	94 755	93 583
Age	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
10	117 240	115 823	114 391	112 941	111 468	109 950	108 483	107 037	105 567	104 033
11	119 112	117 328	115 907	114 472	113 019	111 544	110 022	108 552	107 103	105 631
12	120 414	119 202	117 415	115 991	114 553	113 098	111 619	110 095	108 622	107 170
13	121 959	120 510	119 295	117 505	116 079	114 638	113 179	111 698	110 170	108 694
14	116 707	122 071	120 619	119 401	117 608	116 178	114 734	113 272	111 788	110 257
15	108 300	116 858	122 217	120 761	119 540	117 743	116 310	114 863	113 398	111 910
16	105 288	108 526	117 078	122 432	120 972	119 747	117 946	116 509	115 057	113 588
17	100 650	105 631	108 863	117 409	122 756	121 292	120 062	118 256	116 815	115 359
18	97 200	101 103	106 077	109 303	117 841	123 183	121 714	120 479	118 669	117 223
19	96 809	97 767	101 662	106 629	109 848	118 377	123 711	122 237	120 996	119 180
20	95 874	97 603	98 541	102 415	107 361	110 559	119 066	124 379	122 886	121 626
21	94 849	96 815	98 519	99 431	103 278	108 196	111 367	119 847	125 131	123 614

Source: Own population projection (Fiala, Langhamrová, Průša, 2011)

The estimated number of persons of the appropriate age in the years 2011–2030 was taken from a demographic projection (Fiala, Langhamrová, 2011), Czech Statistical Office variant (see Table 7). The results of the estimate of the expected number of students and leavers of secondary schools with school-leaving exam are shown in the table Table 8.

Table 8 Expected development of the number of students of secondary schools with school-leaving exam in the years 2011–2030

Year of study	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
4year grammar schools										
Admitted	11 740	11 354	11 278	11 173	11 165	11 342	11 561	11 728	12 020	12 540
1st year	11 830	11 433	11 336	11 231	11 216	11 382	11 597	11 769	12 054	12 560
2nd year	12 174	11 625	11 228	11 117	11 014	10 995	11 148	11 357	11 527	11 801
3rd year	13 237	12 130	11 560	11 159	11 036	10 933	10 910	11 055	11 259	11 429
4th year	14 176	13 044	11 954	11 382	10 984	10 857	10 755	10 731	10 870	11 069
Leavers	13 560	13 457	12 383	11 348	10 805	10 427	10 307	10 210	10 187	10 319
6year grammar schools										
Admitted	2 220	2 201	2 207	2 248	2 294	2 327	2 391	2 500	2 599	2 749
1st year	2 230	2 211	2 217	2 258	2 305	2 338	2 401	2 511	2 610	2 761
2nd year	2 199	2 230	2 212	2 217	2 259	2 305	2 338	2 402	2 511	2 611
3rd year	2 186	2 046	2 074	2 058	2 062	2 101	2 144	2 175	2 234	2 336
4th year	2 126	2 072	1 940	1 966	1 950	1 955	1 991	2 032	2 061	2 117
5th year	2 093	2 101	2 049	1 918	1 943	1 928	1 932	1 968	2 008	2 037
6th year	1 990	2 068	2 076	2 024	1 896	1 920	1 905	1 909	1 944	1 984
Leavers	1 952	1 939	2 015	2 023	1 973	1 848	1 871	1 856	1 860	1 895
8year grammar schools										
Admitted	9 178	9 349	9 541	9 679	9 942	10 398	10 812	11 434	12 126	12 301
1st year	9 182	9 353	9 545	9 683	9 946	10 402	10 815	11 437	12 129	12 306
2nd year	9 108	9 216	9 387	9 580	9 719	9 982	10 439	10 854	11 478	12 172
3rd year	9 131	9 028	9 134	9 305	9 495	9 633	9 893	10 346	10 758	11 375
4th year	9 035	9 082	8 980	9 085	9 254	9 444	9 581	9 839	10 289	10 699
5th year	8 435	8 253	8 295	8 203	8 298	8 452	8 625	8 751	8 986	9 396
6th year	8 081	8 156	7 982	8 022	7 933	8 024	8 173	8 340	8 462	8 689
7th year	8 482	7 945	8 016	7 846	7 883	7 797	7 885	8 031	8 195	8 315
8th year	8 647	8 410	7 880	7 947	7 779	7 816	7 730	7 817	7 962	8 125
Leavers	8 350	8 415	8 185	7 668	7 734	7 571	7 606	7 523	7 608	7 748
Vocational schools										
Admitted	49 837	48 200	47 877	47 430	47 396	48 148	49 076	49 786	51 026	53 231
1st year	51 434	49 578	49 146	48 690	48 627	49 345	50 280	51 023	52 261	54 455
2nd year	50 585	46 441	44 649	44 191	43 778	43 704	44 313	45 142	45 817	46 908
3rd year	56 311	48 680	44 560	42 742	42 244	41 846	41 760	42 313	43 095	43 746
4th year	56 577	54 147	46 921	42 893	41 098	40 592	40 206	40 118	40 635	41 381
Leavers	46 263	45 930	43 957	38 091	34 821	33 364	32 953	32 640	32 568	32 988
All schools										
Leavers total	70 125	69 742	66 540	59 131	55 333	53 209	52 737	52 229	52 224	52 950
Index with relation to 2011 (%)	100.0	99.5	94.9	84.3	78.9	75.9	75.2	74.5	74.5	75.5

Table 8 Expected development of the number of students of secondary schools with school-leaving exam in the years 2011–2030 Continued

Year of study	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
4year grammar schools										
Admitted	13 034	13 742	14 566	14 838	14 727	14 566	14 384	14 216	14 042	13 861
1st year	13 058	13 755	14 574	14 883	14 799	14 643	14 461	14 292	14 118	13 936
2nd year	12 286	12 773	13 447	14 243	14 571	14 510	14 361	14 184	14 018	13 847
3rd year	11 697	12 169	12 652	13 312	14 097	14 442	14 398	14 255	14 082	13 916
4th year	11 237	11 499	11 958	12 433	13 079	13 847	14 196	14 162	14 024	13 854
Leavers	10 508	10 668	10 916	11 352	11 803	12 416	13 146	13 477	13 444	13 313
6year grammar schools										
Admitted	2 914	2 955	2 923	2 886	2 847	2 812	2 777	2 741	2 704	2 667
1st year	2 927	2 968	2 937	2 899	2 860	2 825	2 789	2 753	2 716	2 680
2nd year	2 761	2 927	2 968	2 937	2 900	2 861	2 826	2 790	2 754	2 717
3rd year	2 428	2 568	2 722	2 761	2 732	2 697	2 661	2 628	2 595	2 562
4th year	2 213	2 301	2 433	2 580	2 617	2 590	2 557	2 523	2 491	2 460
5th year	2 092	2 187	2 274	2 404	2 549	2 586	2 560	2 528	2 494	2 463
6th year	2 013	2 067	2 161	2 246	2 375	2 518	2 555	2 530	2 497	2 464
Leavers	1 933	1 961	2 014	2 106	2 189	2 315	2 454	2 490	2 465	2 434
8year grammar schools										
Admitted	12 171	12 016	11 855	11 709	11 562	11 413	11 261	11 109	10 960	10 811
1st year	12 177	12 022	11 861	11 715	11 568	11 419	11 267	11 114	10 966	10 817
2nd year	12 351	12 222	12 068	11 906	11 759	11 612	11 462	11 309	11 156	11 007
3rd year	12 063	12 242	12 115	11 962	11 802	11 657	11 510	11 362	11 210	11 059
4th year	11 312	11 996	12 176	12 051	11 899	11 739	11 595	11 449	11 302	11 151
5th year	9 771	10 331	10 955	11 121	11 008	10 869	10 723	10 591	10 458	10 323
6th year	9 085	9 447	9 988	10 591	10 753	10 645	10 511	10 370	10 242	10 114
7th year	8 538	8 926	9 282	9 812	10 405	10 567	10 463	10 331	10 192	10 067
8th year	8 244	8 464	8 848	9 201	9 726	10 314	10 476	10 374	10 243	10 106
Leavers	7 907	8 023	8 237	8 611	8 954	9 465	10 037	10 195	10 095	9 968
Vocational schools										
Admitted	55 330	58 336	61 833	62 988	62 518	61 835	61 061	60 349	59 610	58 840
1st year	56 611	59 634	63 184	64 524	64 162	63 483	62 697	61 962	61 206	60 418
2nd year	48 836	50 773	53 450	56 615	57 918	57 673	57 082	56 381	55 719	55 040
3rd year	44 771	46 577	48 426	50 953	53 955	55 277	55 111	54 563	53 899	53 265
4th year	42 009	42 986	44 705	46 480	48 894	51 768	53 071	52 943	52 426	51 790
Leavers	33 594	34 104	34 897	36 292	37 733	39 693	42 026	43 084	42 980	42 560
All schools										
Leavers total	53 942	54 756	56 064	58 361	60 680	63 888	67 662	69 246	68 985	68 275
Index with relation to 2011 (%)	76.9	78.1	79.9	83.2	86.5	91.1	96.5	98.7	98.4	97.4

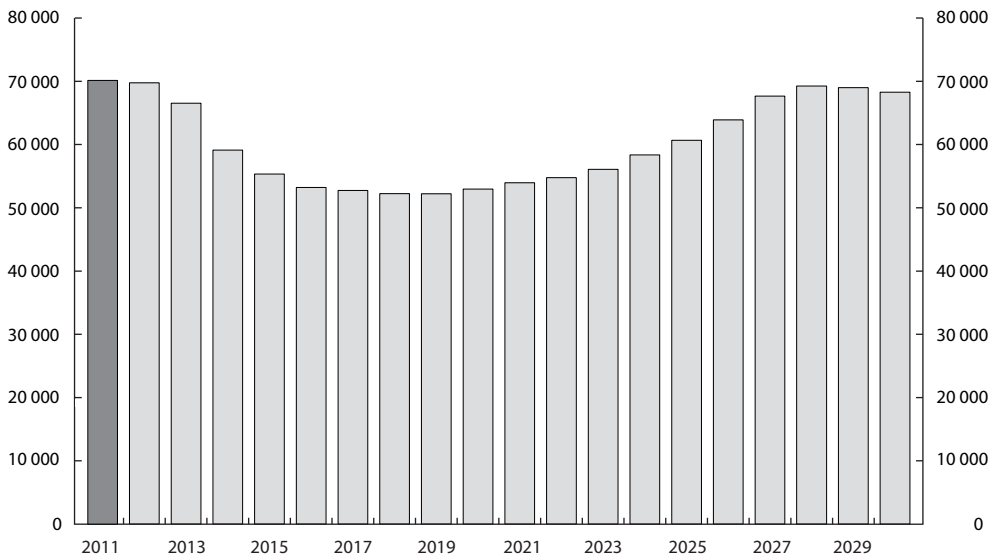
Source: Year 2011: Ministry of Education, Youth and Sports (MŠMT 2012), since 2012: own calculation of projection

It is evident that the number of newly admitted students will no longer decline to any marked extent, on the contrary they might again begin to rise as a result of the growth in the number of births in the Czech Republic since the year 2000. Naturally only on the assumption that the capacity of secondary schools will increase in keeping with the growing number of persons completing elementary school education.

The situation is quite different, however, in the case of the number of students graduating. Whereas in the years 2012 and 2013 it can be assumed that the school-leaving examination will be taken every year by around 70 000 students, in the second half of this decade the annual number of leavers will be only around 55 000, which is almost a quarter less than in 2011. Renewed growth will not take place for another 10 or so years and only at the end of the twenties can it be expected that the annual numbers of leavers will again reach roughly the present level, i.e. around 70 000.

This fact will naturally influence the number of those interested in university studies. In 2011 more than 80 000 students were for the first time registered for daytime bachelor degree courses or 4–6-year master degree courses at universities. About 53 000 of them were 20 years old or younger (see MŠMT 2012). While in 2014 it is expected that the number of secondary school leavers with school leaving exam will be slightly below 60 000 and it will drop to about 53 000, it may be assumed that the number of first-registered university students will begin to decline in further years. See Figure 3.

Figure 3 Expected development of the number of secondary school leavers with school-leaving exam



Source: Own calculation

CONCLUSION

Whereas the number of those interested in studying at secondary schools with school-leaving exam will probably not now drop too much and in the future might even begin to rise, the annual number of leavers will drop considerably in the next few years. A relatively strong drop can be expected in 2014 and a further drop after 2016. At the turn of the teens and twenties the annual number of secondary school leavers may be roughly 25% lower than it is at present, and a stronger revival cannot be expected until the second half of the twenties when the annual numbers of secondary school leavers might again draw close to present values.

With regard to the fact that the annual numbers of secondary school leavers will be lower from 2014 than the present annual numbers of first-time registered day students in bachelor and 4–6-year master degree courses of recent years, one may probably anticipate a decline in the number of students in the first years of universities.

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References

- CZSO. *Věkové složení obyvatelstva* (Age of the Population) [online]. Prague: Czech Statistical Office, 2012. [cit. 9.3.2012]. <<http://www.czso.cz/csu/2011edicniplan.nsf/p/4003-11>>.
- DOUCEK, P., MARYŠKA, M., FIALA, T., FISCHER, J., HANČLOVÁ, J., LANGHAMROVÁ, J., NOVOTNÝ, O., VLTAVSKÁ, K., VOŘÍŠEK, J. *Konkurenceschopnost českého ICT sektoru* (Competitiveness of the Czech ICT Sector). Prague: Professional Publishing, 2012. ISBN 978-80-7431-077-5.
- FIALA, T., LANGHAMROVÁ, J., PRŮŠA, L. Projection of the Human Capital of the Czech Republic and its Regions to 2050. *Demografie*, 2011, Vol. 53, No. 4, pp. 304–320. ISSN 0011-8265.
- LANGHAMROVÁ, J., FIALA, T. Zatížení školských zařízení v České republice z pohledu demografické projekce do roku 2060 (Burden of Schools in the Czech Republic According to the Population Projection until 2060). In: *Mezinárodní statisticko-ekonomické dny na VŠE v Praze, 17.09.2009–18.09.2009* (International Days of Statistics and Economics in Prague, 17.09.2009–18.09.2009), [CD-ROM]. Prague: Faculty of Informatics and Statistics, Faculty of Business Administration, University of Economics, Prague, 2009, pp. 1–7. ISBN 978-80-86175-66-9.
- MŠMT. *Statistická ročenka školství, Výkonové ukazatele. Data o studentech, poprvé zapsaných a absolventech vysokých škol* (Statistical Yearbook of Schooling, Performance Indicators, Data on Students First Time Registered Students and Graduates of Tertiary Education) [online]. Prague: MŠMT (Ministry of Education, Youth and Sports), 2012. [cit. 6.5.2012]. <http://dsia.uiv.cz/vystupy/vu_vs_f3.html>.
- MŠMT. *Statistická ročenka školství, Výkonové ukazatele. Tabulky výkonové ročenky 2011/12 za regionální školství* (Statistical Yearbook of Schooling, Performance Indicators, Tables of Performance Yearbook 2011/12 for Regional Schooling) [online]. Prague: MŠMT (Ministry of Education, Youth and Sports), 2012. [cit. 6.5.2012]. <<http://toiler.uiv.cz/ročenka/ročenka.asp>>.
- ÚIV. *Statistická ročenka školství, Výkonové ukazatele* (Statistical Yearbook of Schooling, Performance Indicators) [online]. Prague: ÚIV (Institute for Information in Education), 2011. [cit. 9.3.2012]. <<http://www.uiv.cz/rubrika/98>>.