Institute of Economic Research
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Modelling the demand for teachers

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Motivation

- This work built on the cooperation of IER and the Institute of Educational Policy (IEP) at the Ministry of Education of the Slovak Republic.
- Creation of a microsimulation model for the needs of IEP for the purpose of making a prediction of (regional) education - "missing teachers in the regions".
- Creation of a tool to define the mismatch between the demand and supply for teachers.
- Possibility of use in ex ante analyses of the school system.

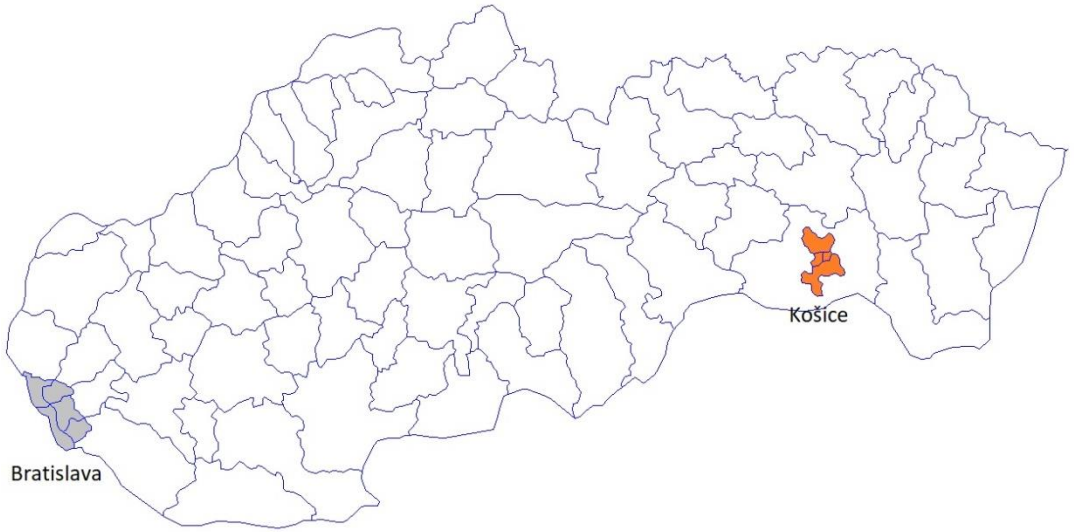
Literature

- Based on microsimulation model for Slovakia – SLAMM (Miklošovič, Štefánik; 2020)
- Model simulates lifetime educational behaviour - DREAM (Niels, Rasmussen, Stephensen; 2014)
- Includes transition probabilities – MOSART (Gjefsen; 2013)
- Creating detailed socio-demographic projections - DYNAMIS-POP (Spielauer, Dupriez; 2019)

Methodology

- The object of simulation is individuals.
- Input database is Census 2011 including sex, age, level of education, field of education, place of residence, employment status and employer's sector.
- Regional disaggregation at the NUTS IV level (from 79 to 72 districts).
- Demographic processes at the district level (mortality, fertility, external and internal mobility).
- Model created in the LIAM2.
- Model calibration performed using administrative data during the period 2011-2020.
- Base projection created until 2030.

Slovak districts



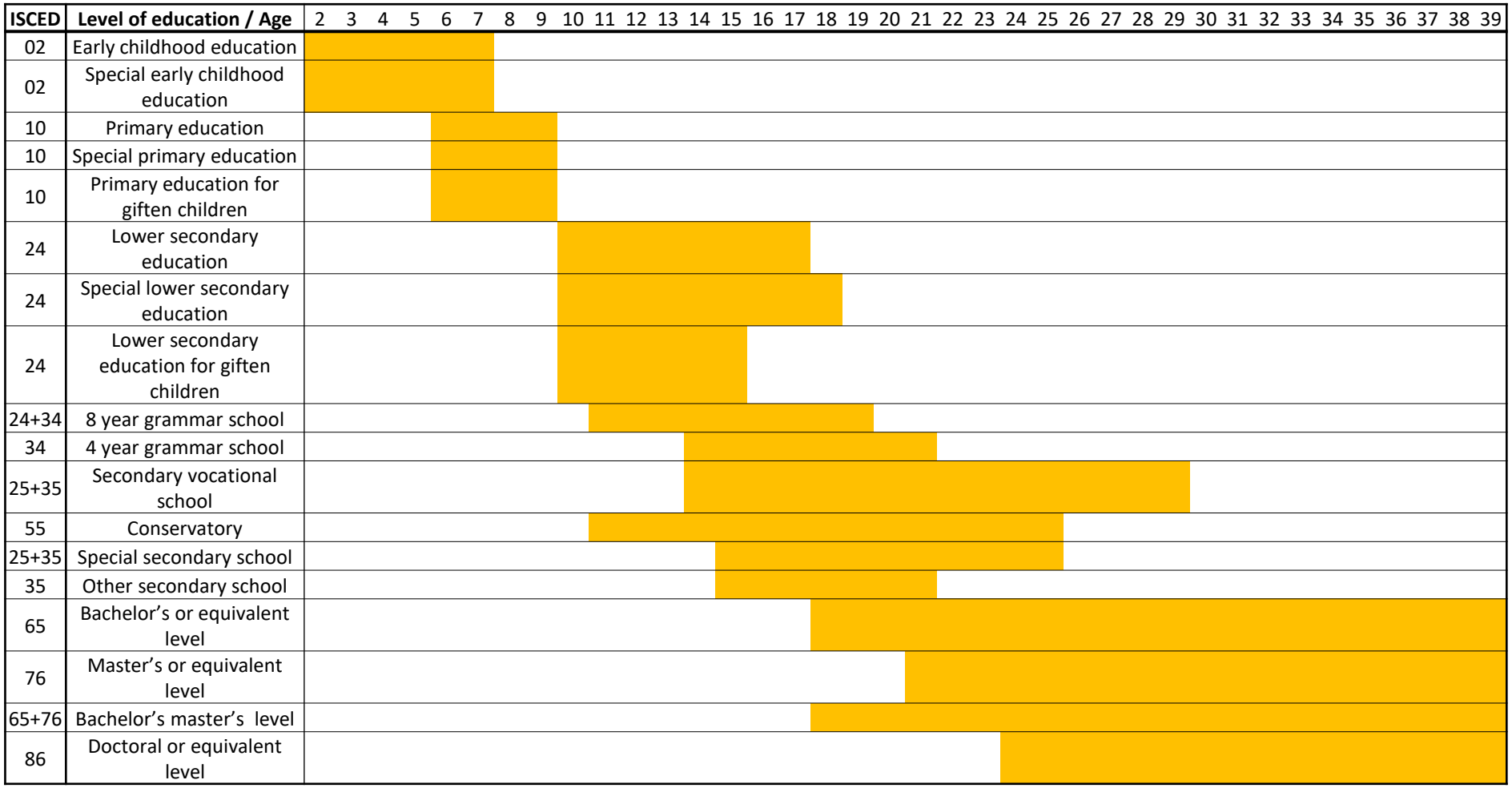
	Bratislava	Košice	District of Prešov	District of Košice - okolie	District of Žilina	District of Nitra	...	District of Stropkov	District of Poltár	District of Banská Štiavnica	District of Turčianske Teplice	District of Medzilaborce
Population	475 577	227 458	173 187	129 237	161 052	164 580	...	19 744	20 427	15 551	15 848	10 870
14 years or less	74 713	33 832	32 039	26 165	26 000	24 823	...	3 087	2 833	2 285	2 163	1 466
Ratio	16%	15%	18%	20%	16%	15%	...	16%	14%	15%	14%	13%

Source: SOSR
Note: year 2021

Types of models - goals

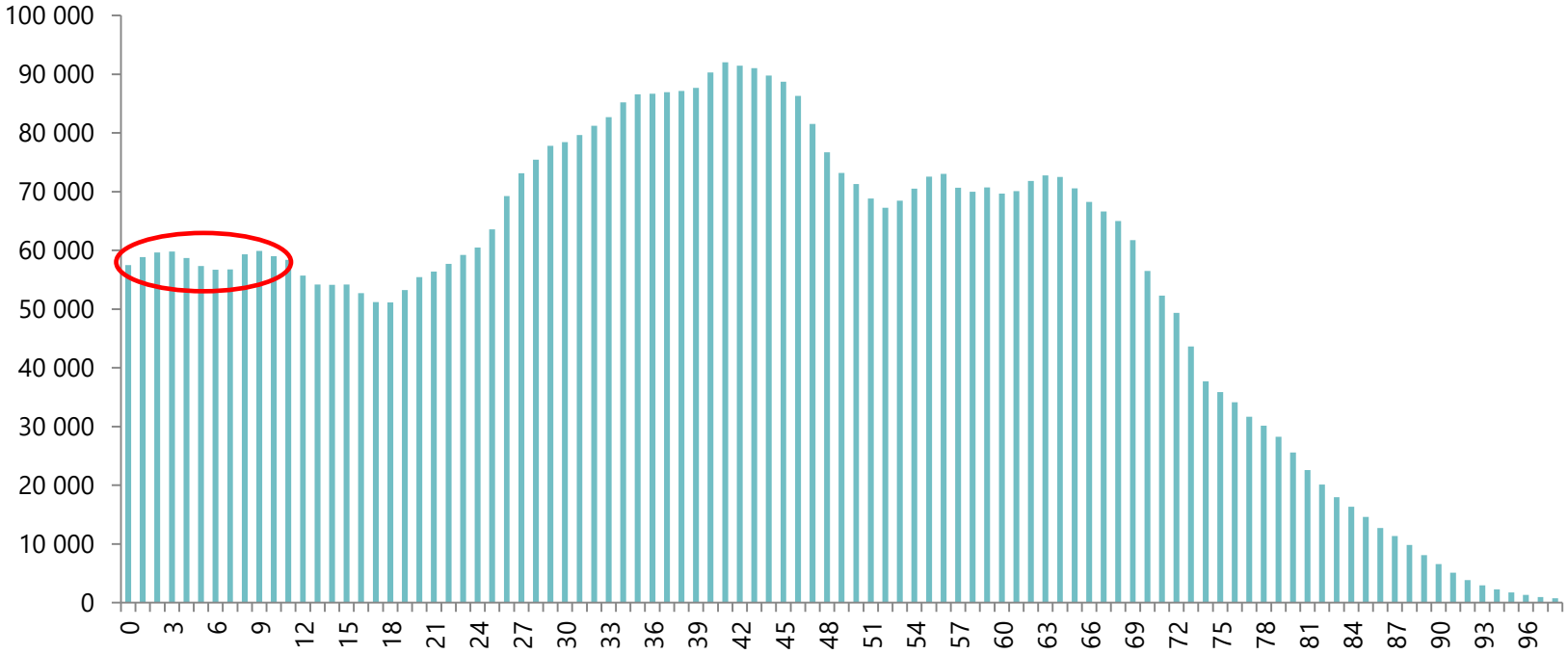
- 2 types of models: STUDENT and TEACHER
- Model STUDENT:
  - the number of students by level of education in regional education
  - number of students (graduates) according to level of education and field of education at universities
  - number of teachers (on the demand side) by education level and type in regional education
- Model TEACHER:
  - the number of teachers (on the supply side) who will retire by level of education in regional education
  - potential expansion: leaving to inactivity, maternity leave

Age structure of students by level of education



ISCED	Level of education / Age	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
02	Early childhood education																																						
02	Special early childhood education																																						
10	Primary education																																						
10	Special primary education																																						
10	Primary education for giften children																																						
24	Lower secondary education																																						
24	Special lower secondary education																																						
24	Lower secondary education for giften children																																						
24+34	8 year grammar school																																						
34	4 year grammar school																																						
25+35	Secondary vocational school																																						
55	Conservatory																																						
25+35	Special secondary school																																						
35	Other secondary school																																						
65	Bachelor’s or equivalent level																																						
76	Master’s or equivalent level																																						
65+76	Bachelor’s master’s level																																						
86	Doctoral or equivalent level																																						

Age structure of the Slovak population in 2020



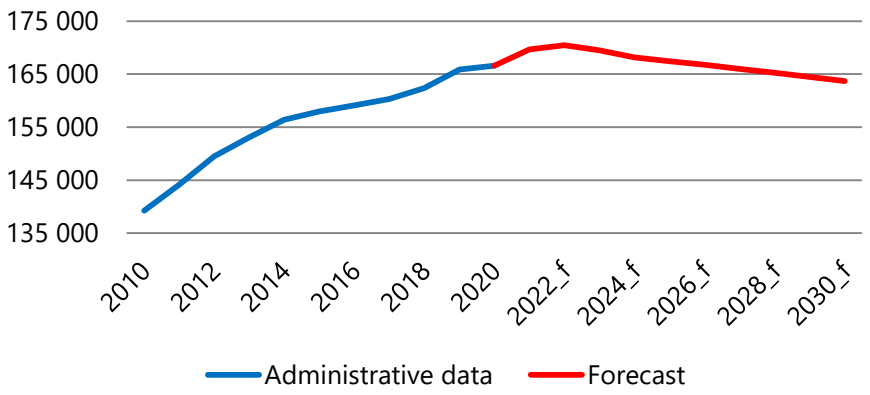
Source: SOSR

Model STUDENT

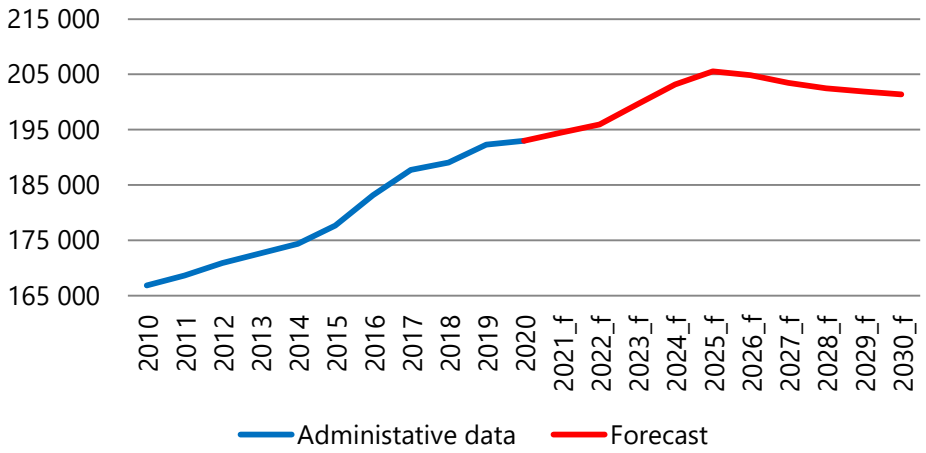
- Selected 18 types of education levels.
  - 14 regional (from early childhood education to secondary education)
  - 4 national (only university education)
- Includes demographic and educational modules.
- Model simulates the years 2012 to 2030.
- Real data are used in the years 2012-2020.

Results

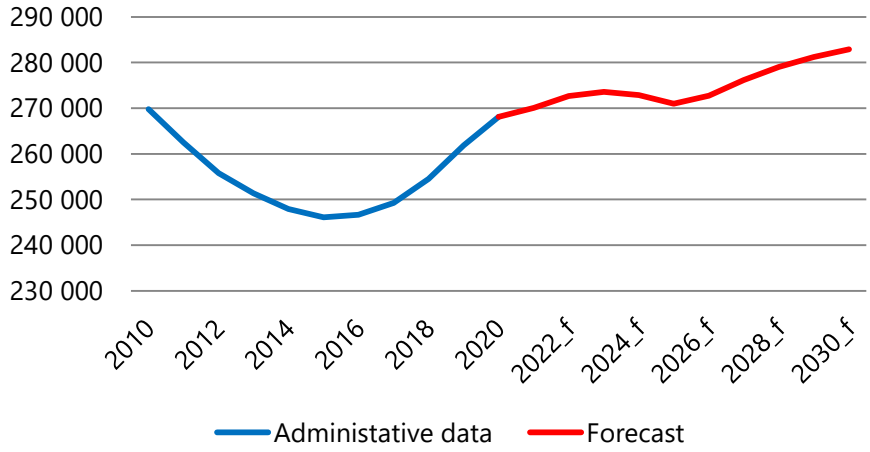
Early childhood education



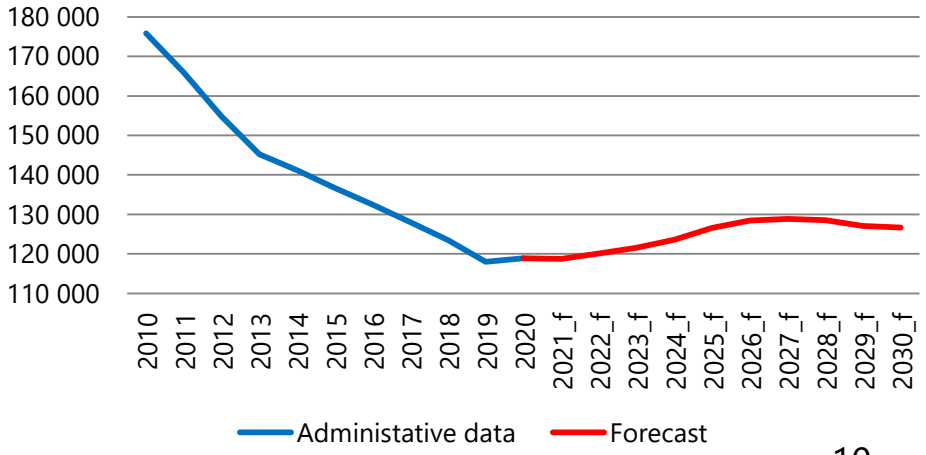
Primary education



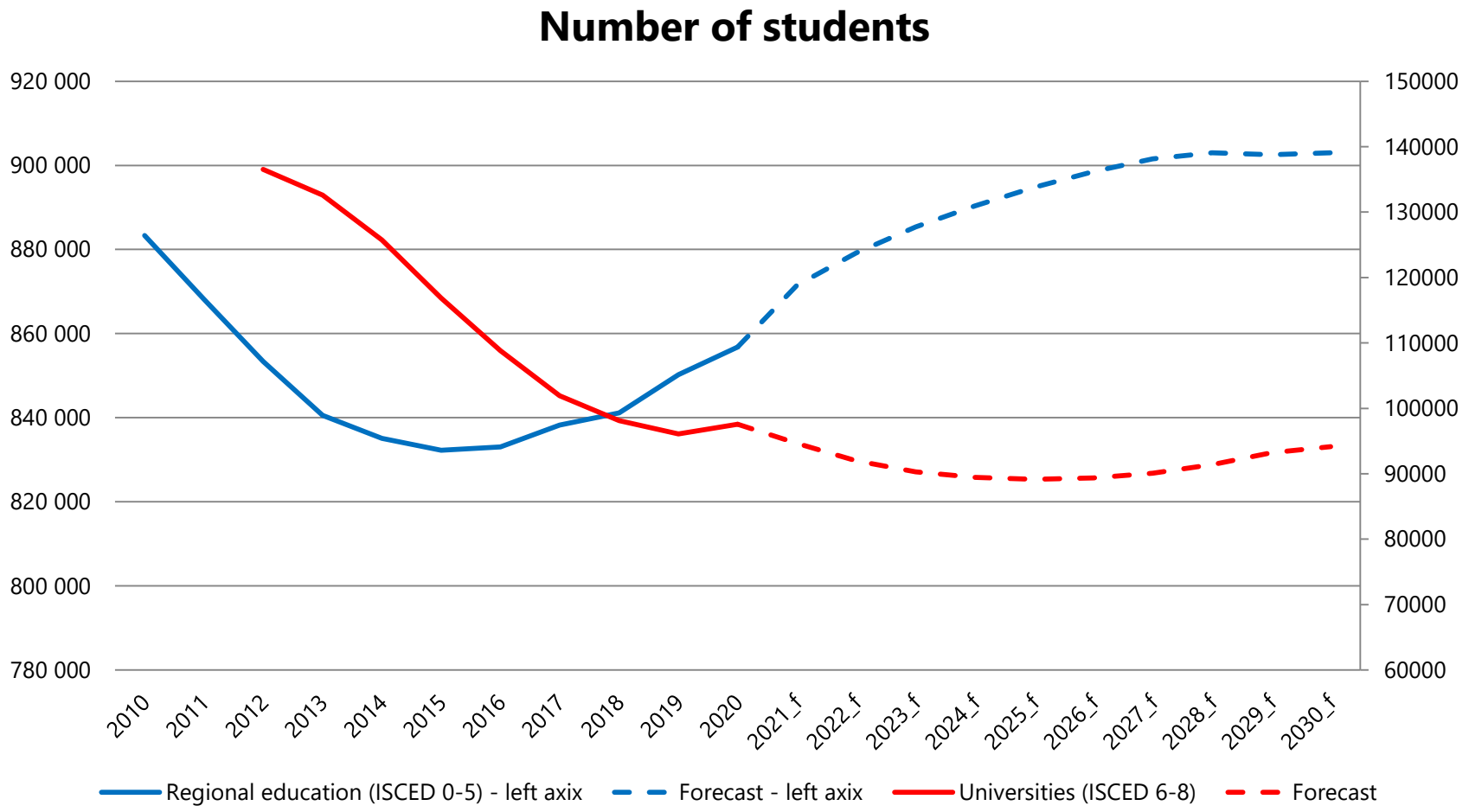
Lower secondary education



Secondary vocational school

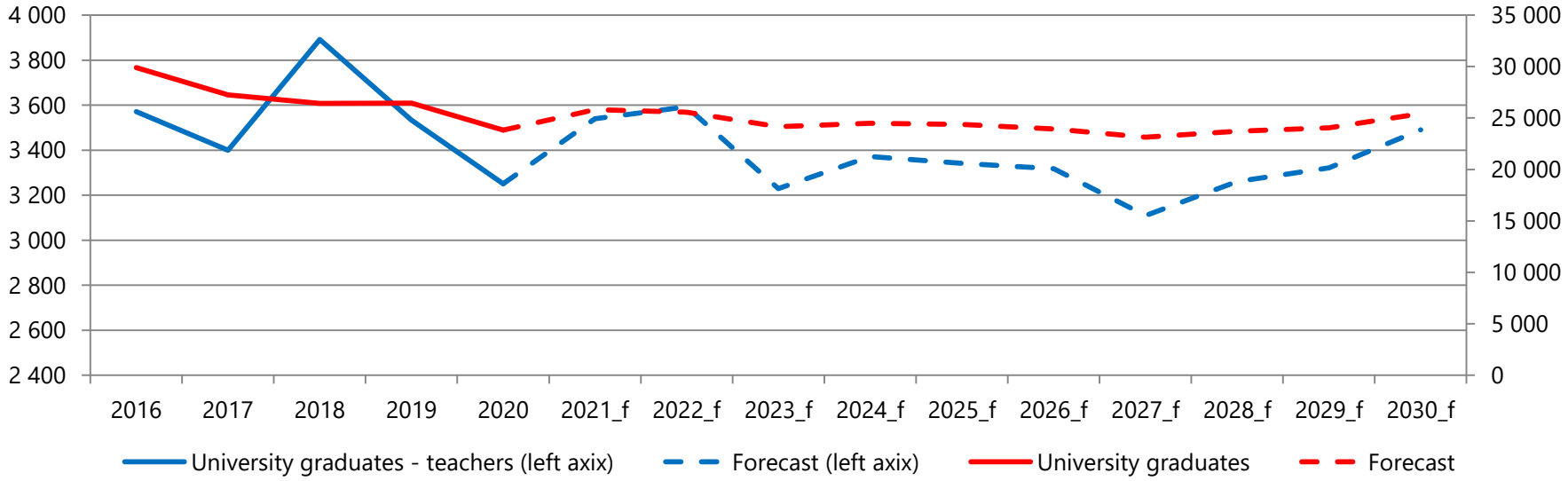


Results


Number of students
920 000
900 000
880 000
860 000
840 000
820 000
800 000
780 000
150000
140000
130000
120000
110000
100000
90000
80000
70000
60000
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021_f
2022_f
2023_f
2024_f
2025_f
2026_f
2027_f
2028_f
2029_f
2030_f
Regional education (ISCED 0-5) - left axix
Forecast - left axix
Universities (ISCED 6-8)
Forecast

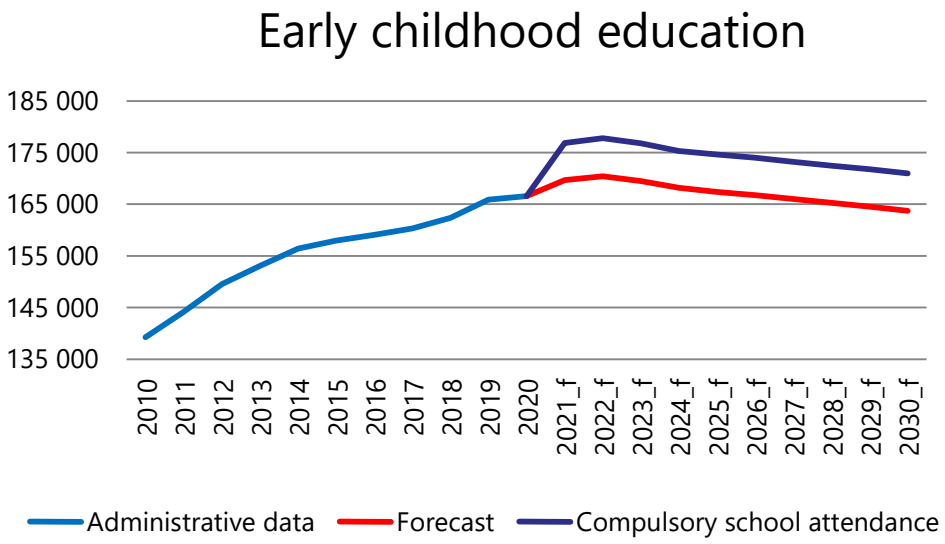
University graduates

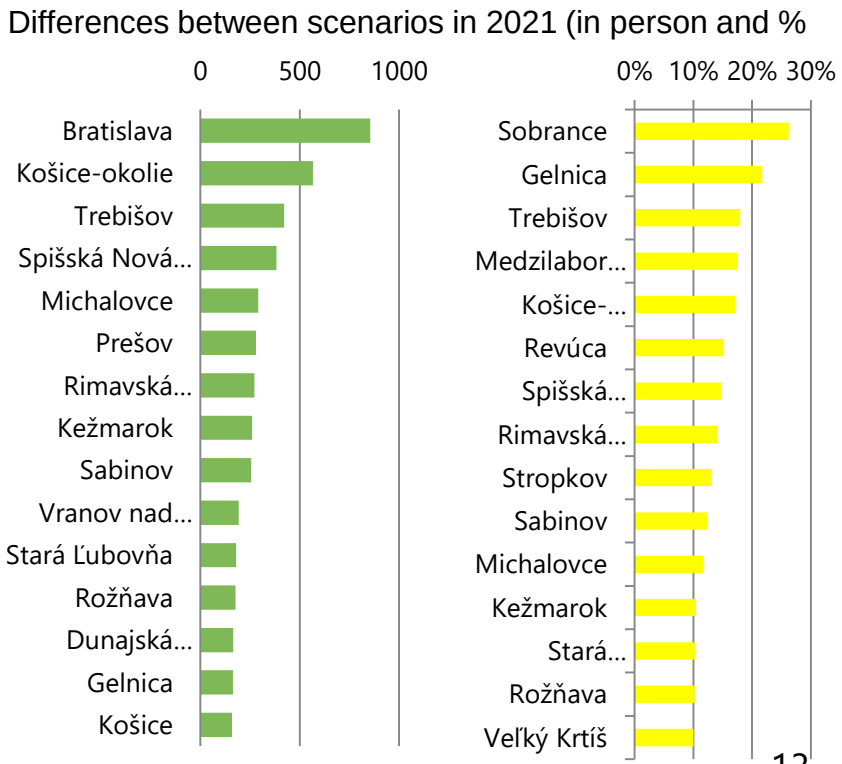
- The model STUDENT also predicts university graduates.
- Graduates are divided into 10 groups by fields of education.
- Information obtained on the basis of linking the register of university students and administrative data on teachers.



Ex ante simulation

- Introduced compulsory school attendance for 5-year-old children in 2021 (early childhood education).
- What is the necessary increase in capacity without limiting younger children?

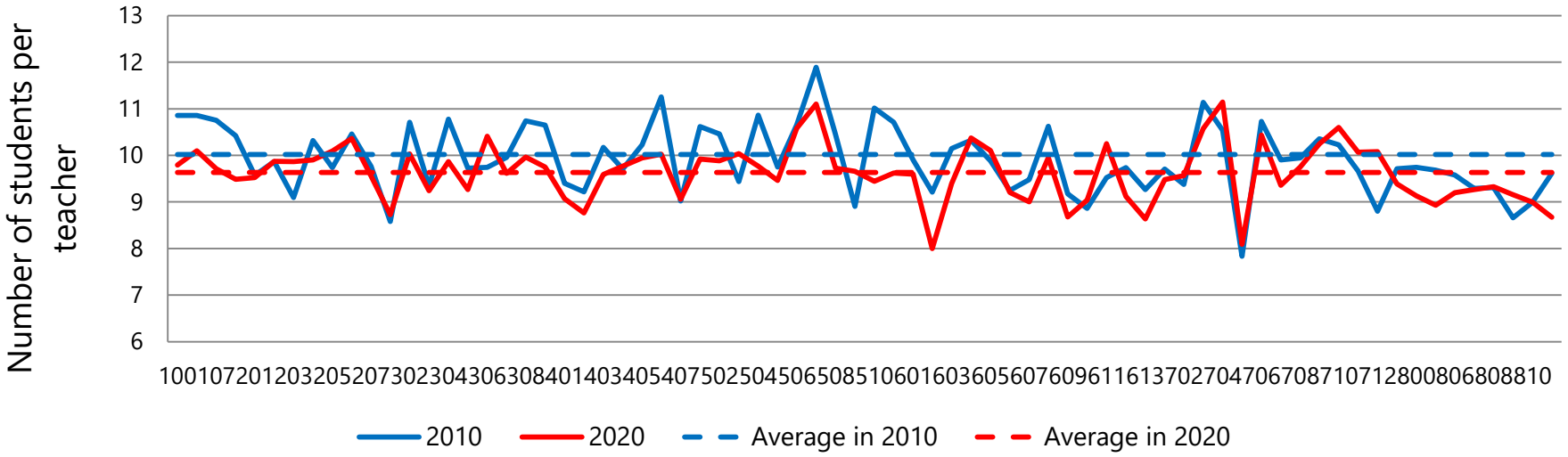


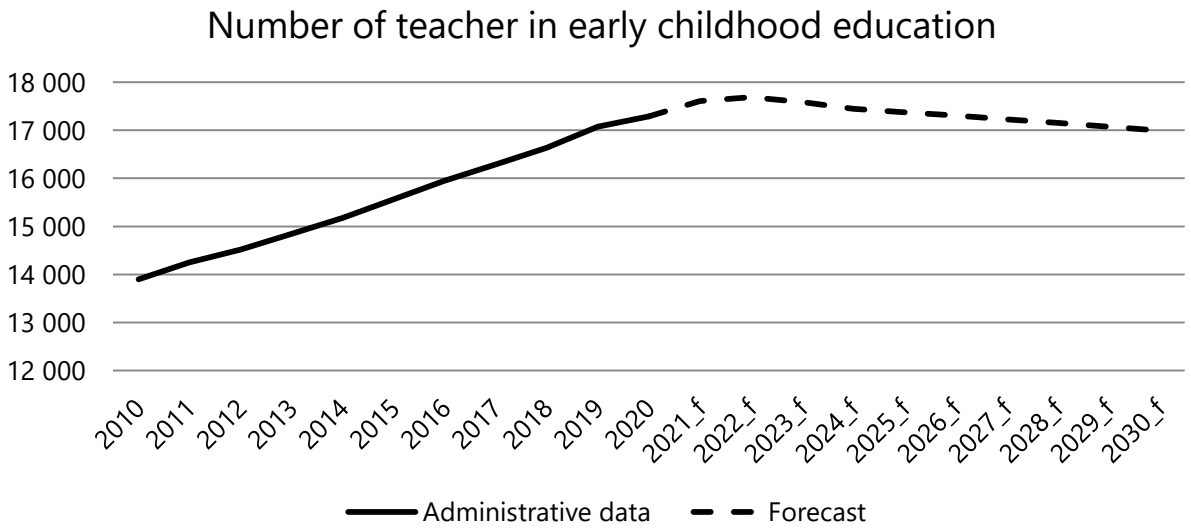


Demand for teachers

- Created toolkit in Excel to calculate the demand of teachers.
- Forecast of the demand for teachers created on the basis of the ratio of the number of students to the teacher (current values 2020).
- We also differentiate the type of teacher (general, specialist, ...) and type of contract (full time, part time).
- Combination of real data and prediction.

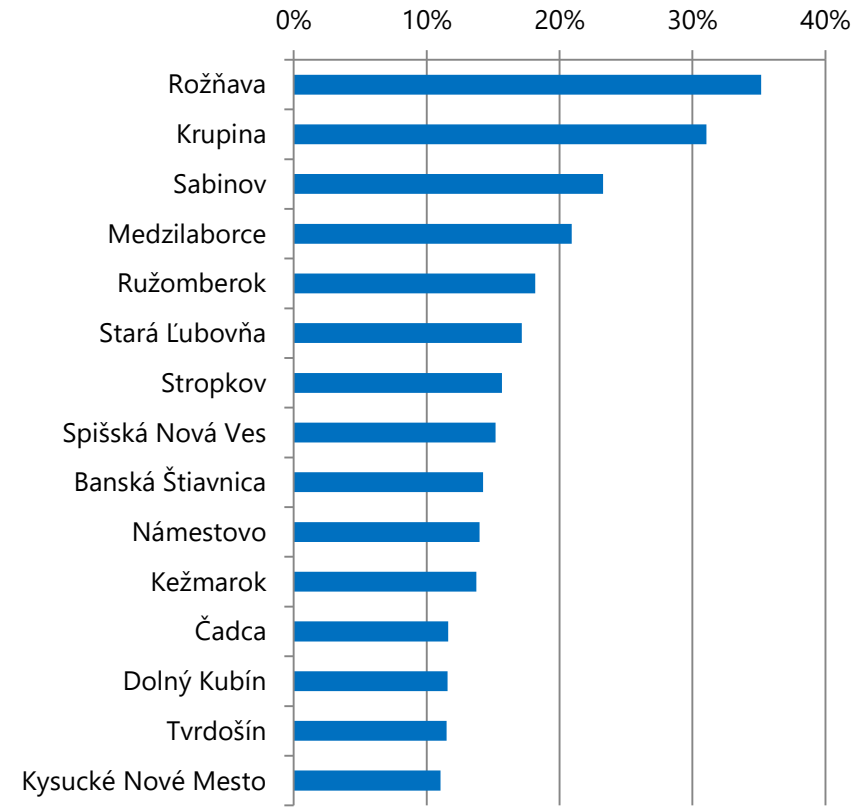
Demand for teachers (early childhood education)



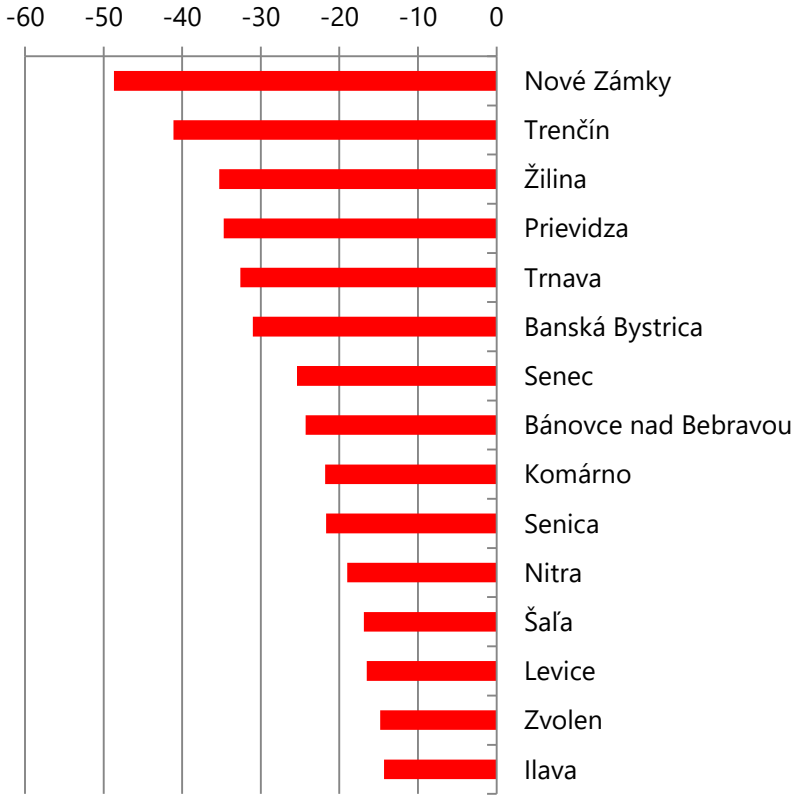


Demand for teachers (early childhood education)

Increased demand for teachers between 2030-2020 - top 15 (in %)



Decreased demand for teachers between 2030-2020 - 15 worst (in persons)

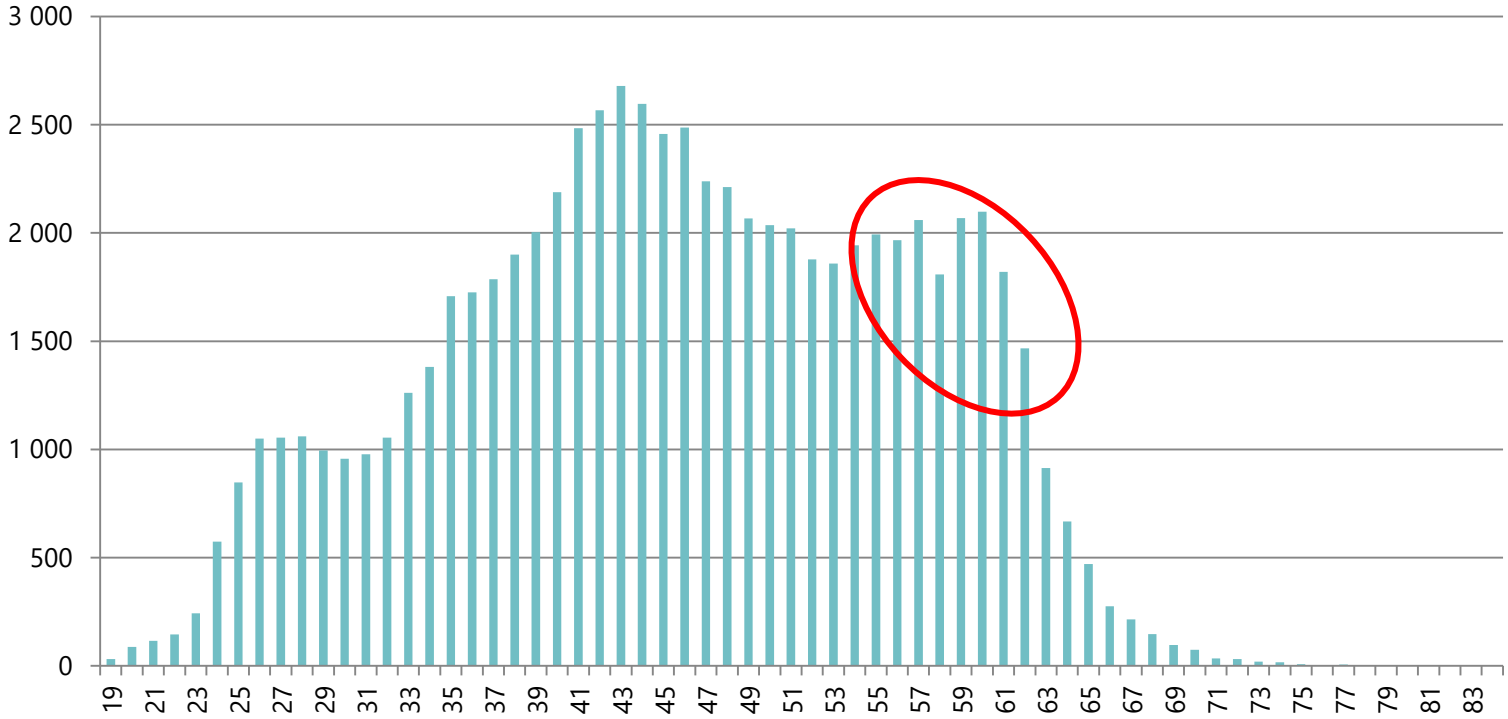


Model TEACHER

- This model was created to predict the status of teachers in the medium term.
- Input file - administrative data 2020.
- Includes an economic activity module.
- Simulation of the retirement process and the working retiree process.
- Possible supplement: leaving for inactivity, maternity leave, ...
- Division into 10 types of education level.
- Does not simulate entry into education (due to regional distribution).

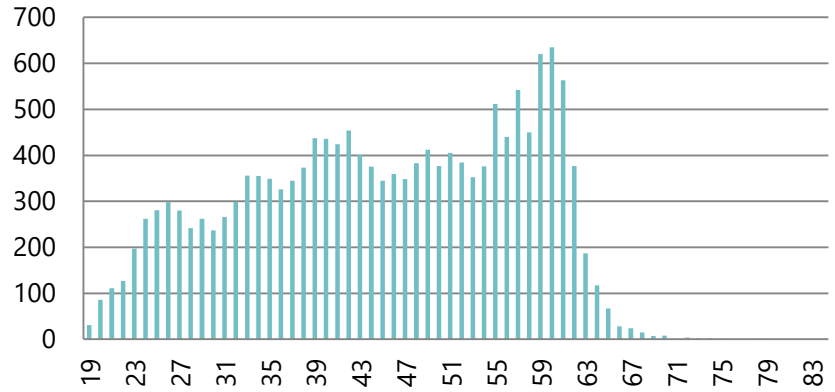
Age distribution of teachers in 2020

- We expect many teachers to retire in the next 10 years.
- The situation is different in individual levels of education.

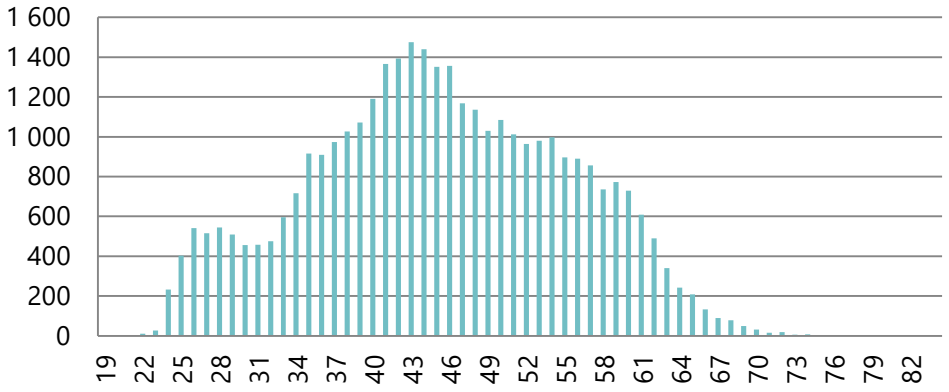


Age distribution of teachers in 2020

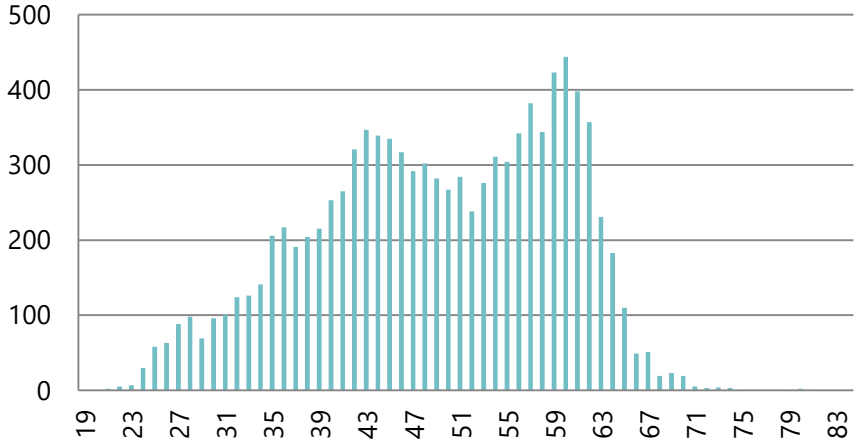
Early childhood education



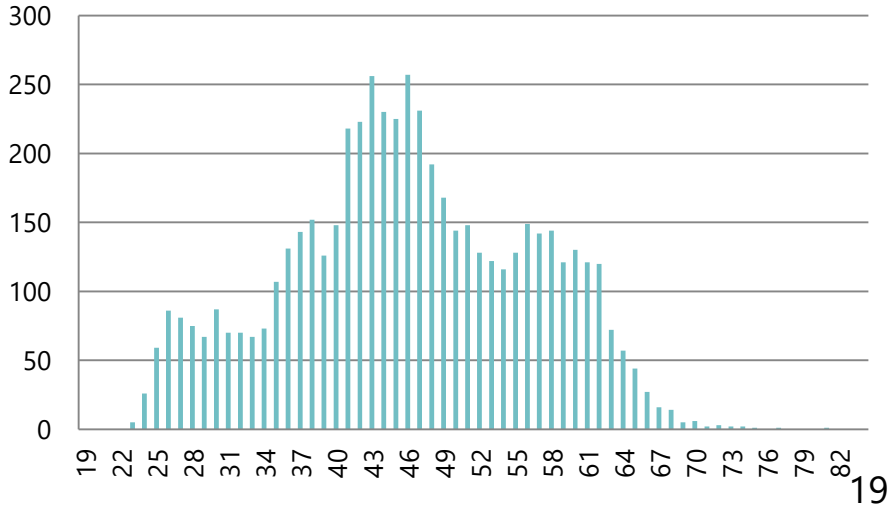
Primary and lower secondary education



Secondary vocational school



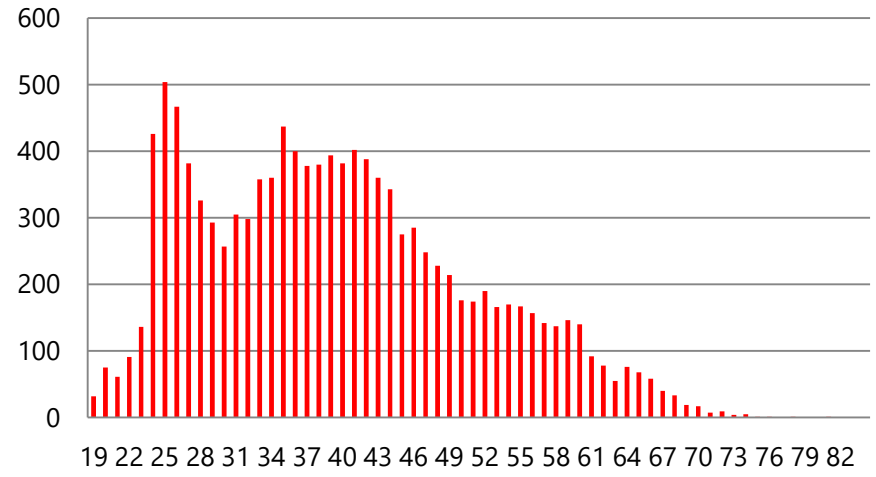
Grammar school



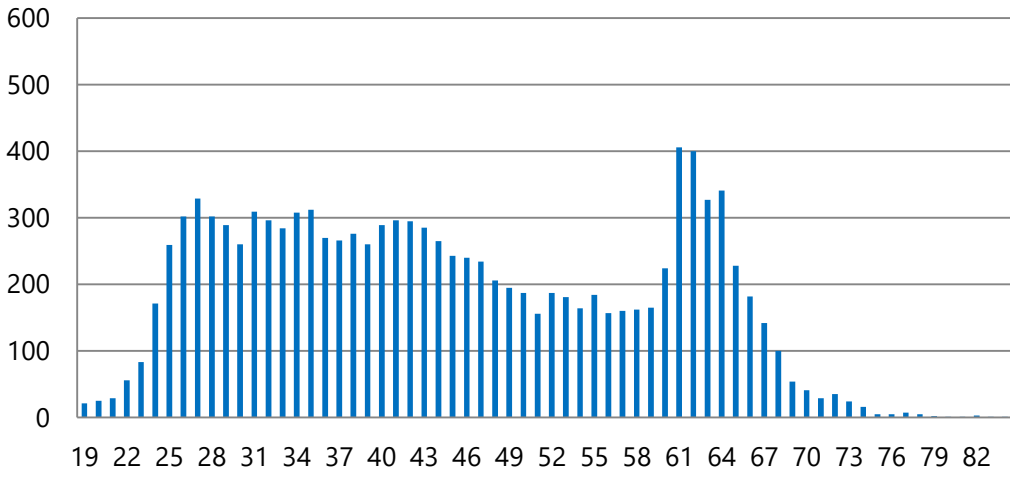
Change in the number of teachers in 2019-2020

- Data are available only for a short period (2019-2020).
- Possible expansion of departure and arrival processes in the model after data verification.

The arrival of teachers in education in 2020

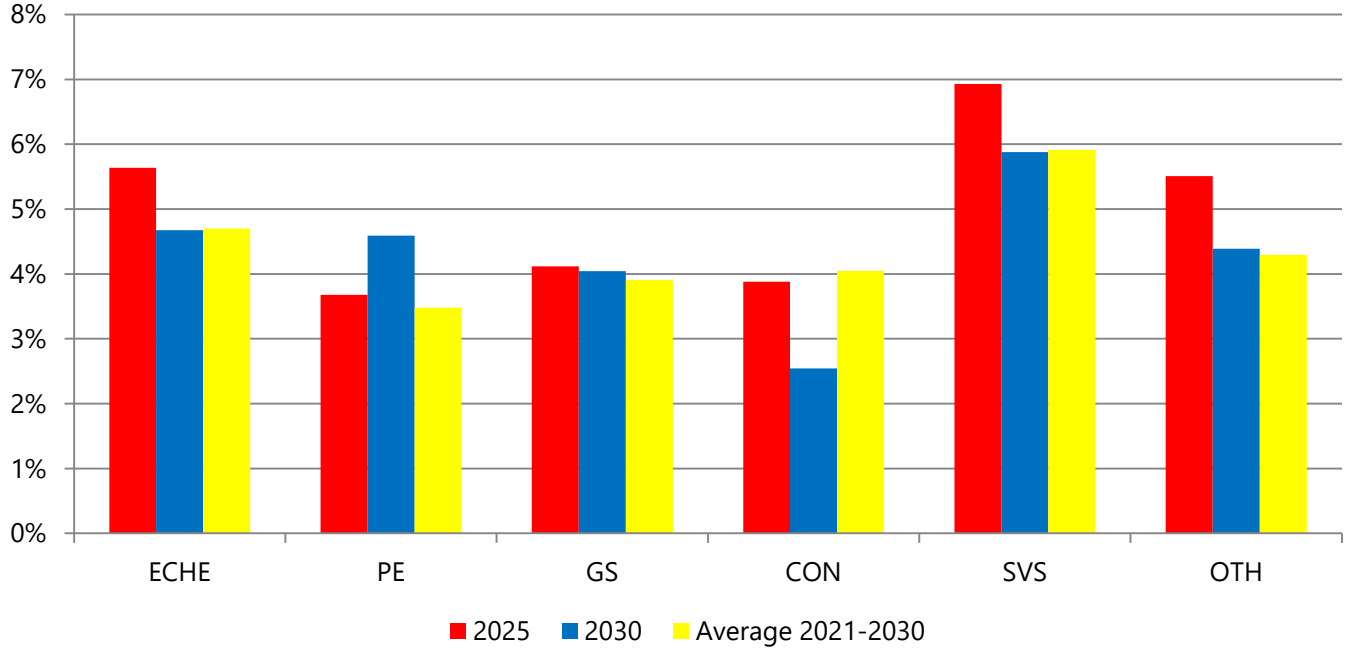


The departure of teachers from education in 2020



Results for model TEACHER

- The need for "replacement" of the teaching status varies by level of education



Note: ECHE – Early childhood education, PE – Primary education, GS – Grammar school, CON – Conservatory, SVS - Secondary vocational school, OTH - Others

Demand versus supply

	2021	2022	2023	2024	2025
Expansion demand	741	687	508	445	399
Replacement demand	1 491	2 142	2 982	3 465	3 420
Total yearly demand for teachers	2 232	2 829	3 490	3 910	3 819
Number of university graduates in the field of pedagogy	3 539	3 592	3 229	3 372	3 341
Only 36% (in 2020) will go to school	1270	1289	1159	1210	1199
The number of university graduates who did not study pedagogy and come to schools (1% in 2020)	153	151	144	145	144
Total yearly supply	1423	1440	1303	1355	1343
Difference between demand and supply	-809	-1 389	-2 187	-2 555	-2 476

Conclusion

- We constructed two microsimulation models for predicting the number of students and teachers at the regional level.
- The models were created based on cooperation with the decision-making sphere.
- They can be used in the case of ex ante scenarios within the framework of changes in educational policies.

Thank you for attention.

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Literature

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- Štefánik, M., Miklošovič, T. (2020). Modelling foreign labour inflows using a dynamic microsimulation model of an ageing country – Slovakia. In International Journal of Microsimulation, 2020, vol. 13, no. 2, pp. 102-113. ISSN 1747-5864. DOI: https://doi.org/10.34196/ijm.00220
- Hege Marie Gjefsen (2013). Educational behaviour in the dynamic micro-simulation model MOSART. Statistisk sentralbyrå, Reports 2013/15. ISSN 1892-7513. pp. 54