Inequality of Opportunity in Education: the Visegrad Countries Case

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Received 19.12.2022, **Accepted** (reviewed) 20.1.2023, **Published** 16.6.2023

Abstract

In the run-up to launching the «Next Generation EU» large-scale recovery plan aimed at overcoming the Covid-19 pandemic consequences it becomes important to analyse the pre-Covid development problems, including those in the field of education. The purpose of this work is to study the dynamics of inequality in educational achievements and opportunities in the Visegrad Group countries based on the PISA data from 2003–2018 period. The results obtained by our research team suggest that Hungary has the highest level of inequality of opportunity among the Visegrad Group countries, followed by Slovakia. Meanwhile, individual factors contributing to the overall level of inequality of opportunity have both features common to all countries and unique features.

Keywords	***DOI***	***JEL code***
Inequality of opportunity in education, individual achievements, circumstance factor, effort factor, PISA, the Visegrad countries	*https://doi.org/10.54694/stat.2022.57*	*I24, D63*

INTRODUCTION

The Covid-19 pandemic has turned out to be a serious challenge to social and economic well-being of people globally, including the EU countries. In response to the challenge, a «reset» plan was adopted, dubbed «Next Generation EU» (*Europe's moment,* EC, 2020). Its main goal is to help the EU Member States make up for the economic and social damage caused by the pandemic and ensure a better future for the oncoming generation of Europeans. The «reset» plan implies subsidies to be allocated to specific

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reform and investment programs developed by recipient countries. This refers to complex social, economic, and environmental transformations, including the climate warming control, health care development, support for backward regions, and so on.

Prior to making out national plans of reforms it is necessary to thoroughly analyse the dynamics and current state of things in all public spheres. National education system is a key element that determines development prospects for the entire set of social and economic relations, therefore, the study of education trends and underlying factors is of great importance for understanding and long-term forecasting of social development.

Our study is focused on education development trends in the Visegrad Group countries, applying the theory of equal opportunities. The paper is based on data by the Program for International Student Assessment of educational achievements (PISA).

The paper briefly discusses main ideas of the theory and the impact of educational opportunities on setting further economic and social inequality at later stages of life. A review of works on inequality of opportunity in the Visegrad countries is given as well as description of the study's calculation method and information base. The last section describes the results of assessing inequality of educational achievements and opportunities in the countries under review and the contribution of certain groups of circumstance factors thereto. This study continues the series of articles written by the authors and covering the theory and practice of measuring inequality of opportunity (Ibragimova and Frants, 2020; Pauhofova et al., 2020; Ibragimova and Frants, 2021a; Ibragimova and Frants, 2021b).

1 THEORETICAL OVERVIEW

1.1 Theoretical background of the inequality of opportunity problem studies

The work by Rawls (1971) on distribution of rights and resources between society members is the seminal research on inequality of opportunity. Based on the idea that individuals should be responsible for their life views and respective personal objectives, aspirations and behavior, the following concept of social justice was substantiated: if rights and resources are equally distributed among members of society, then differences in their well-being, resulting from different views on life and, hence, different behavior, refer to personal responsibility and cannot be deemed unfair. Further on, works by Dworkin (1981a, 1981b), Arneson (1989), Cohen (1989), Roemer (1993) proposed to replace the inequality of «resources» with the inequality of «opportunity». To the forefront came the idea that any individual should be responsible for what he/she controls. Therefore, the differences in wealth inequality caused by factors entirely dependent on an individual (effort factors) are just and should not be compensated (the natural reward principle). On the contrary, wealth differences caused by factors outside an individual's control (circumstance factors) are unfair and subject to compensation in a just society (the compensation principle).

The circumstance factor classification proposed by Barros (Barros et al., 2009) singles out the category of basic opportunities or conditions, which include circumstances present at the early stages of an individual's formation and having a significant impact on his/her chances to succeed in life. Providing all children with the equal opportunity to receive quality school education falls under the category of basic opportunities – since schooling takes place earlier in life and has a significant impact on the later life path: inequality in getting a school education produces inequality in access to higher levels of education. Further on, the highest level of education attained makes a major determinant of other individual achievements later in life, including the economic (e.g., earnings, access to quality jobs), political and social ones.

Thus, the inequality in school education opportunities is translated further into the inequality of economic, political, social opportunities and achievements. Therefore, the inequality of education opportunities in schooling sets barriers to economic and social mobility in the perspective and preserves socio-economic stratification. Besides, it hinders individuals from fully realizing their potential and thus

slows down social development. For these reasons, studying the inequality of education opportunities, including those at the school level, is of paramount importance for the understanding and long-term forecasting of social processes.

1.2 Review of works on inequality of opportunity in the Visegrad Group countries

Practical application of the equal opportunity theory to the study of inequality required some clarification and mathematical formalization of the ideas described. Roemer (1993, 1998) and Van de Gaer (1993) made a huge contribution thereto, having laid basis for measuring inequality of opportunity. A vast amount of research has been published by now that proposes different estimation methods and measures inequality of opportunity across different countries and regions in respect of various benefits that are meaningful to all or the majority. Of course, most of the works are devoted to inequality of opportunity referring to income. Research on inequality of opportunity in education is less numerous, but it is also being actively developed. In this review, we will limit ourselves to works that provide estimates of inequality of opportunity in all four countries of the Visegrad Group, first in terms of income, then in terms of education.

Table 1 Inequality of opportunity input to inequality of income across the Visegrad Group countries (in %)

Source	Assessment technique	Inequality index	Information basis	Circumstance factors	Income measure	Outcome, %
Transition report (2016–17)	Parametric, ex-ante	Gini	LITS III, 2015–2016	Parent's education and membership in the Communist Party, birthplace, gender, ethnicity	Average monthly personal earned income	HUN: 40.3 SVK: 46.4 POL: 36.8 CZE: 41.9
Ibragimova and Frants (2021)	Parametric, ex-ante ex-post	Gini, GE(0)	LITS III, 2015–2016	Parent's education, birthplace, gender, ethnicity	Average monthly personal earned income	Gini HUN: 37.7 SVK: 36.2 POL: - CZE: 38.75 GE(0) HUN: 13.9 SVK: 12.79 POL: - CZE: 14.45
Marrero and Rodriguez (2012)	Parametric, ex-ante	GE(0)	EU-SILC, 2005	Parent's education and family wealth, father's professional status, birth country	Annual equivalent disposable income	HUN: 11.6 SVK: 3.6 POL: 10.27 CZE: 5.85
Brzeziński (2015)	Parametric, ex-ante	GE(0)	EU-SILC, 2004, 2010	Parent's education, father's professional status, birth country	Annual equivalent disposable income	2004: 00.00 HUN: 11 SVK: 2.5 POL: 11 CZE: 6 2010: 00.00 HUN: 15 SVK: 7.5 POL: 10 CZE: 9
Checchi, Peragine, Serlenga (2010)	Parametric, ex-ante	GE(0)	EU-SILC, 2005	Parent's education, father's professional status, birth country, birthplace, gender	Personal earned income after tax	HUN: 10.1 SVK: 13.3 POL: 9.1 CZE: 10.7

Source: Author's computations

As seen from Table 1, estimates of the inequality of income opportunity in the Visegrad countries often turn out to be close when the circumstances include the location factor (type of community – birth place of an individual). Unless the location factor is taken into account, the inequality of opportunity in terms of income in Slovakia and the Czech Republic turns out to be noticeably lower than in Poland. Table 1 also shows that the measure of inequality used has a significant impact on the assessment outcome – the contribution of inequality of opportunity to income inequal ity is much higher when using the Gini index as compared to the Theil L-index (GE0). This point is reviewed in more detail in our paper (Ibragimova and Frants, 2021b).

Educational achievements and opportunities are given a significant share of studies in official publications under the PISA project (OECD, UNESCO, 2003; OECD, 2004; OECD, 2007; OECD, 2010; OECD, 2013b; OECD, 2016; OECD, 2020) for all years, and the focus is made on cross-country differences, but not on change dynamics over time in each individual country. Results of assessing the impact of economic, social and cultural status of students' families on educational achievements in the Visegrad countries are shown in Table 2.

Table 2 Inequality of opportunity input to inequality of educational achievements across the Visegrad Group countries, based on the PISA data

Publication	Assessment technique	Circumstance factors	Outcome*		
Official publications by PISA	Percentage of explained variance	ESCS index (index of economic, social and cultural status	**2003** HUN: 27, –, – SVK: 22, –, – POL: 17, –, – CZE: 19, –, – **2012** HUN: 23, 20, 22 SVK: 25, 24, 26 POL: 17, 13, 14 CZE: 16, 15, 14	**2006** HUN: –, –, 21 SVK: –, –, 19 POL: –, –, 14 CZE: –, –, 16 **2015** HUN: –, –, 21 SVK: –, –, 16 POL: –, –, 13 CZE: –, –, 19	**2009** HUN: –, 26, – SVK: –, 15, – POL: –, 15, – CZE: –, 12, – **2018** HUN: –, 19, – SVK: –, 17, – POL: –, 12, – CZE: –, 16, –
Ferreira and Gignoux (2014)	Parametric, ex–ante	Parent's educational, professional and migration status, native tongue, number of books at home, material wealth, cultural resources, school locality type, gender	**2006** HUN: 33, 34, 33 SVK: 32, 29, 30 POL: 24, 27, 24 CZE: 27, 30, 28		
Luongo (2015)	Parametric, ex–ante	Parent's education and professional status, gender	**2003** HUN: 19, 18, 15 SVK: 16, 16, 16 POL: 12, 16, 12 CZE: 12, 12, 10 **2009** HUN: 19, 24, 18 SVK: 10, 18, 10 POL: 13, 20, 12 CZE: 9, 15, 8	**2006** HUN: 16, 18, 14 SVK: 1, 15, 13 POL: 11, 15, 12 CZE: 9, 11, 8 **2012** HUN: 15, 19, 14 SVK: 17, 21, 1 POL: 13, 17, 12 CZE: 10, 13, 9	
Vega (2013)	Parametric	Native tongue, family composition, ESCS index, classroom atmosphere, gender	**2009** HUN: –, 34, – SVK: –, 30, – POL: –, 27, – CZE: –, 20, –		

Note: * the first measurement refers to mathematical literacy, the second – reading literacy, the third – natural science literacy.
Source: Author's computations

The methodological approach to assessing inequality of opportunity in educational achievements in keeping with the «spirit and letter» of the equal opportunity theory was proposed by Ferreira and Gignoux (2014) and tested on PISA-2006 data. Later on, using the same methodology, Luongo (2015) measured the inequality of educational opportunities in different countries over time based on the PISA 2003, 2006, 2009, 2012 data. A slightly different methodology, also based on regression analysis, was used by Vega (2013) to assess inequality of opportunity in terms of reading literacy based on the PISA-2009 data. The estimates obtained in these works for the Visegrad countries are also presented in Table 2.

As shown in Table 2, the inequality of opportunity analysis always includes family background factors and gender as uncontrollable individual characteristics. Locality and schooling factors are taken into account «optionally», but their inclusion leads to a significant rise of the assessment value. Comparison of inequality of opportunity in different countries shows that its level in Hungary and Slovakia is higher than in Poland and the Czech Republic.

2 OBJECTIVE, INFORMATION BASE AND RESEARCH METHODOLOGY

Our work is intended to study the dynamics and make a comparative analysis of the inequality of educational achievements and opportunities in the Visegrad Group countries based on the data from the Program for International Student Assessment (PISA) project.

The PISA project aims at studying educational achievement of students aged 15. The data on student educational achievements has been collected for every three year period since 2000. The Visegrad countries have participated in all waves of the project. In addition to per se testing of students, the project accumulates contextual data as per the model structuring educational performance factors (OECD, 2013a). All the project wave data and questionnaires are freely available on the OECD website (OECD, n.d.)

Table 3 Variables used in the study as circumstance factors

Short name in DB	Item	Type	Derivation method
Family background parameters			
HOMEPOS	Household property	Continuous	The variable derived from answers to questions on family's home appliances and computer machines, cars, books, musical instruments, and housing peculiarities.
CULTPOSS	Cultural resources of the family	Continuous	The variable computed from answers to questions about family's classical literature, books on arts and music, pieces of art and musical instruments.
HEDRES	Family educational resources	Continuous	The variable computed from answers to questions about available learning conditions, computer, educational literature in the family.
HISEI	Parents professional status	Continuous	The variable computed from answers to questions about parent employment and work details.
HESCED	Parents education level	Discrete	The variable computed on the basis of answers to questions about parent education and the ISCED 1997 educational level classification.
Location parameters			
SC004Q001	Type of school location	Discrete	Question on the type of community where the school is located (answering options: village, little town, medium town, major city, megalopolis).
Individual peculiarities			
ST004Q001	Student's gender	Discrete	Male/female

Note: The variables names may differ in various year DBs, the table has them as per the 2018 data base.
Source: Author's computations

When selecting the variables engaged in the analysis as circumstance factors, we sought to include various kinds of circumstances: family background factors, location characteristics, and individual peculiarities. We also aimed at avoiding any variables risking a significant subjective component (e.g., assessment of teaching quality by students). Besides, we limited ourselves to the variables present in all the effected waves to ensure comparability of results from year to year. The analysis-engaged circumstance factors are shown in Table 3.

As follows from Table 3, there is a certain bias towards the family background parameters. However, this gives additional interest to the study – it allows a more subtle analysis of which exactly family peculiarities have greater impact in terms of influencing a child's educational achievements. Various mechanisms of family background influencing the academic performance have been identified on the theoretical level. Firstly, the economic factor is singled out: in richer families a child is provided with better support (primarily in terms of nutrition and medical care) in prenatal life, childbirth, and the early years, which is crucial for setting cognitive abilities. In addition, better-off population segments bear lower relative expenses on education, which ensures a better material support for the educational process. Secondly, the cultural and educational factor does also matter: it is believed that the education-biased environment is in itself inherent to the culture of wealthy and well-educated segments of the population, so children with a good family background adapt more easily. Thirdly, there is also a psychological factor – it is believed that the parents education serves as a "reference point" for the child – if a person does not reach his/her parent educational level, then this is perceived as a social failure. The desire to avoid such failure makes a strong motivation to study.

Since the relation of educational achievement to continuous variables (HOMEPOS, CULTPOSS, HEDRES, HISEI) may be of not linear type, these indices were discretized. HOMEPOS, CULTPOSS, HISEI were categorized into three levels: low (less than the lower quartile), medium (from the lower to the upper quartile), high (above the upper quartile of distribution). When evaluating regressions, the medium level was taken as the baseline. HEDRES was categorized into two levels: low (below the median), high (equal to and above the median), the low level was taken as the baseline in the regression.

Due to rare occurrence of the HESCED variable categories, they were combined. The calculations covered three levels of education: ISCED3B_C and below, ISCED3A_4_5B, ISCED5A and above. The ISCED3A_4_5B category was used as the basis.

The type of school location area and schoolchildren gender were used without any modification. Medium-size town and male gender were used as base categories.

The PISA data set has a number of features essential for its statistical processing. These features are detailed in OECD (2009), while in this study we just enumerate briefly those which matter herein:

1. In the PISA database, an individual's educational performance in each area of literacy is described not by a single variable, but by an entire set of variables. Based on the respondents' answers to the test items and on the difficulty thereof, the characteristics of distribution of unobserved individual literacy levels are estimated using IRT-theory models, after which ten (or five in earlier waves of the project) random values are extracted from this distribution. This results in the necessity to make the educational achievement-related calculations several times, with subsequent averaging the results.

2. The PISA study used a two-stage sampling design. In the first stage, an educational institution was randomly selected, whereas in the second stage it was students who were selected. That sampling design results in the conventional methods for estimating standard errors and confidence intervals being incorrect. In this connection, a specific procedure of balanced repeated replication with Fay's adjustment is used to estimate variation statistics, and the data array contains special variables – weights needed to implement this procedure.

These features are quite complex from the calculation point of view, but up to date some specialized packages have already been developed and are freely available, which greatly simplify the implementation

of processes described when working with the PISA data. We have applied REPEST module developed and maintained by Francesco Avvisati and Francois Keslair (Avvisati and Keslair, 2014) and recommended on Official Cite of PISA.[4]

The PISA database has an immense advantage of significant volume of observations and little number of gaps in the data. The table shows both the total number of tested schoolchildren by all the project waves and the number of observations remaining after deleting data with gaps in the variables listed in Table 4.

Table 4 Volume of observations

Year	2003	2006	2009	2012	2015	2018
HUN						
Total number of observations	4 765	4 490	4 605	4 810	5 658	5 132
Sample volume after deleting observations with gaps	4 606	4 369	4 546	4 653	5 226	5 025
SVK						
Total number of observations	7 346	4 731	4 555	4 678	6 350	5 965
Sample volume after deleting observations with gaps	7 308	4 703	4 524	4 606	6 036	5 600
POL						
Total number of observations	4 383	5 547	4 917	4 607	4 478	5 625
Sample volume after deleting observations with gaps	4 383	5 469	4 807	4 438	4 319	5 504
CZE						
Total number of observations	6 320	5 932	6 064	5 327	6 894	7 019
Sample volume after deleting observations with gaps	6 042	5 656	5 653	4 501	6 529	6 650

Source: Author's computations

As can be seen from Table 4, the loss due to deleting observations caused by data gaps is negligible.

The technique used herein was first proposed in the paper by (Ferreira and Gignoux, 2014). It was chosen due to its having been developed to handle peculiarities of the PISA data. This technique is based on the ex-ante criterion of equality of opportunity and the parametric approach to describing the relation between achievement and circumstance factors. The parametric approach implies the use of particular equation that describes the dependence of achievement on uncontrollable circumstances. The work (Ferreira and Gignoux, 2014) uses a linear equation and the estimation of regression coefficients by the ordinary method of least squares, and we also follow this strategy. Predicted values $\hat{y}_i$, derived from the regression, represent conditional average of an achievement for a fixed set of circumstance factor values. According to the ex-ante criterion, in case the equality of opportunity is achieved, there should be no variation in the distribution of $\bar{y}_i$. The use of variance as a measure of inequality leads to the situation

[4] How to prepare and analyse the PISA database (OECD): <*https://www.oecd.org/pisa/data/httpoecdorgpisadatabase-instructions.htm*>.

when the determination coefficient R^2, which is the ratio of predicted values variance to the actual values variance, can be interpreted as a relative measure of inequality of opportunity, reflecting the contribution of inequality of opportunity to inequality of achievement.

The relative importance of circumstance factors was estimated using Shapley decomposition, which comes to be the most universal procedure to solve this task. A detailed description of this method of factorial decomposition is given in (Shorrocks, 2012). The Shapley decomposition has many attractive features, however, it has one significant drawback – it is computationally expensive in case the factors are numerous. In this connection, we have pooled the model factors into a few groups (household material wealth, cultural, educational resources; educational and professional status of parents; type of area where the school is located; gender of the student) and have done the decomposition by these groups.

3 RESULTS AND DISCUSSION

Means (M) and standard deviations (SD) of student educational achievements in three subjects – math, reading and science – are shown in Table 5.

Table 5 Educational achievements

	2003		2006		2009		2012		2015		2018	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
HUN												
Math	490.01	93.51	490.93	91.01	490.17	92.07	477.04	93.62	476.83	93.79	481.08	91.14
Reading	481.87	91.98	482.37	94.35	494.17	90.18	488.46	91.85	469.52	97.03	475.98	97.58
Science	503.27	97.27	503.93	88.17	502.64	86.49	494.30	90.15	476.74	96.33	480.91	93.85
SVK												
Math	498.18	93.31	492.10	94.53	496.68	96.09	481.64	100.84	475.23	95.43	486.16	99.57
Reading	469.16	92.52	466.35	105.07	477.44	90.19	462.77	104.28	452.51	104.23	457.98	100.33
Science	494.86	102.19	488.43	93.14	490.26	95.43	471.19	101.18	460.77	98.93	464.05	95.83
POL												
Math	490.24	90.24	495.42	86.52	494.80	88.35	517.50	90.37	504.47	87.64	515.65	90.09
Reading	496.60	95.92	507.64	100.22	500.47	89.16	518.18	87.29	505.69	89.58	511.85	97.33
Science	497.78	102.40	497.80	89.88	508.07	86.87	525.82	86.35	501.43	90.79	511.03	91.51
CZE												
Math	516.45	95.94	509.86	103.17	492.81	93.19	498.95	94.94	492.32	90.68	499.46	93.16
Reading	488.54	95.51	482.71	111.26	478.18	92.28	492.89	88.70	487.25	100.45	490.22	97.33
Science	523.25	100.64	512.86	98.45	500.49	97.33	508.30	90.58	492.83	92,.6	496.79	94.49

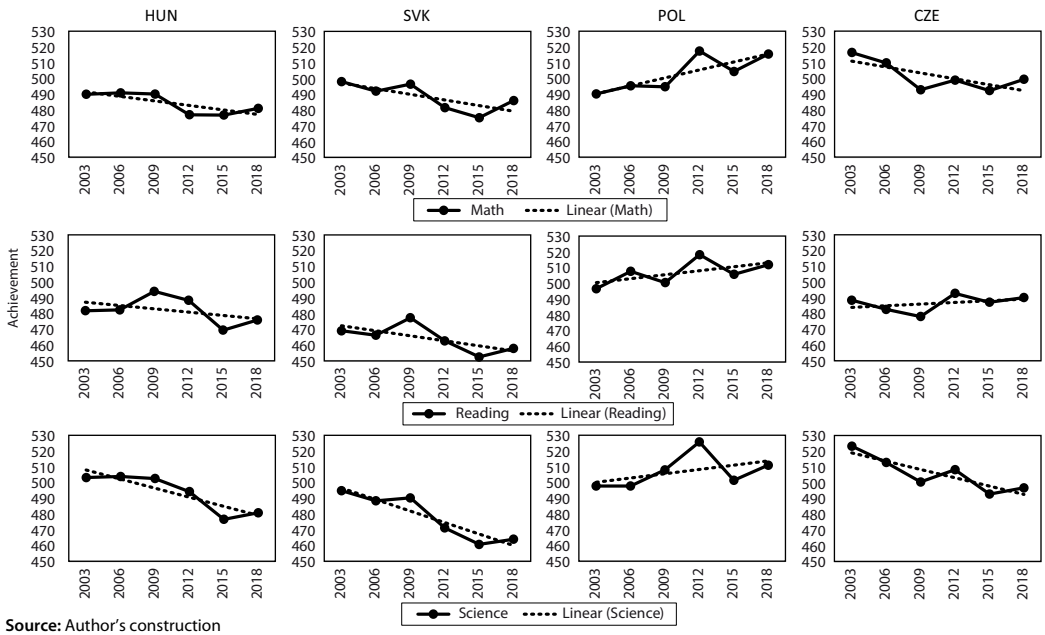
Note: M – mean grade, SD – standard deviation.
Source: Author's computations

As follows from Figure 1, the dynamics of mathematical literacy in the Visegrad Group countries differs significantly. The Czech Republic, which was the undisputed leader earlier in the period under review, has lost the leading position to Poland, which, being an outsider at the beginning, took the lead due to a steady positive trend in terms of mathematical literacy. Slovakia and Hungary show a negative trend in mathematical literacy, due to which their lagging behind the leaders increases.

Through the entire period under review the Polish schoolchildren show the highest level of reading literacy with a tendency to improve, due to which the gap from the rest of the Visegrad Four countries is only increasing. Reading achievements by the Czech and Hungarian schoolchildren were close

in 2003–2012, then Hungary began to lag behind the Czech Republic. Slovakia was a sheer outsider at the beginning of the period under review, and its falling behind the leaders only intensified due to negative trends in reading literacy among schoolchildren.

Figure 1 Literacy dynamics in the Visegrad Group countries



Source: Author's construction

As follows from Figure 1, there is a steady positive trend in science literacy in Poland only, which allowed this country to move from an outsider to a leader. The Czech Republic, which was in the lead at the beginning, showed a negative trend, due to which it lost its leading position and moved to the second place. Through the entire period under review, the educational achievements of the Slovak schoolchildren in science literacy have been lower than those of students from other countries, and the negative dynamics leads to further falling behind.

The educational literature accounts the steady progress in educational achievements by Polish schoolchildren for the consistent implementation of education development program, in the first place (Csapó et al., 2019), and secondly, for the high level of government spending on education (Pelle and Kuruczleki, 2016).

The influence of uncontrolled circumstance factors on educational achievements of schoolchildren was studied using regression analysis. Because of the large number of estimated regression models, it is not possible to show all the tables in their entirety. Tables A1–A3 in the Appendix show the results of regression analysis based on the 2018 data. As follows from the results, in most cases, the factors involved do demonstrate the expected impact on students' educational achievements. A low level of Household property produces a meaningful negative effect on educational achievements by students, whereas a high level thereof has a significant positive effect, and that refers to all types of literacy. In Hungary and Poland, a high level of Cultural resources of the family improves – while a low level thereof deteriorates – the educational results of schoolchildren, but in Slovakia and the Czech Republic this factor does not seem to play a significant role. A high level of home educational resources has a meaningfully positive effect on the educational achievements of students in Hungary and the Czech Republic, to a lesser extent

in Poland, and is virtually insignificant in Slovakia. A low professional and educational status of parents has an essentially negative impact on educational performance in all countries. In Slovakia, Poland and the Czech Republic, a high level of parental education facilitates improving the educational performance. The rural location of schools significantly impairs educational achievements in all countries. The size of cities does matter in Hungary and Slovakia, while in Poland and the Czech Republic this factor is insignificant. The gender of students is meaningful in terms of reading literacy – in all countries girls demonstrate better reading results than boys, with other conditions being equal. Achievements in mathematics are better for boys than for girls in Hungary and the Czech Republic, while in Slovakia and Poland the gender factor is insignificant. In Hungary only, boys perform better than girls in natural science, other conditions being the same.

The gender gap in reading literacy occurs nearly worldwide. The PISA official publications assign the existence of this gap to reading habits and the maturity of teaching strategies for handling texts (OECD, 2019). Besides, there are works explaining this phenomenon with differences in the socialization of boys and girls at home and at school (see, for example, Hadjar et al., 2014).

The dynamics of inequality of opportunity in respect of educational achievements of students is shown in Table 6.

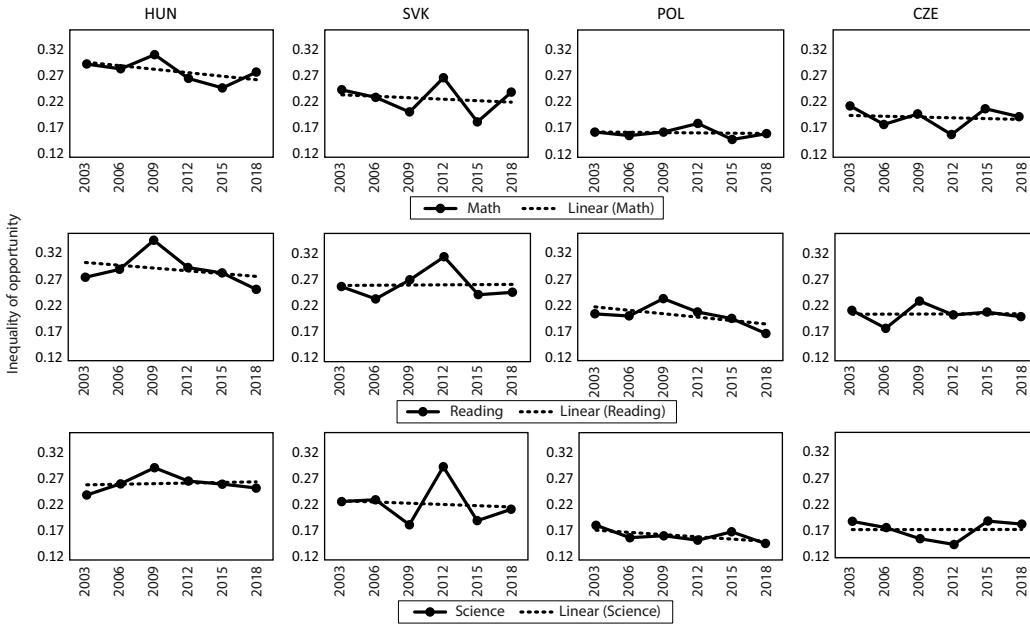
Table 6 Inequality of opportunity as for educational achievements by schoolchildren in Visegrad Group countries

		2003	2006	2009	2012	2015	2018
HUN	Math	0.2947	0.2855	0.3126	0.2672	0.2490	0.2792
	Reading	0.2759	0.2911	0.3467	0.2946	0.2843	0.2528
	Science	0.2407	0.2621	0.2930	0.2674	0.2615	0.2541
SVK	Math	0.2454	0.2310	0.2030	0.2685	0.1839	0.2409
	Reading	0.2583	0.2347	0.2713	0.3154	0.2428	0.2474
	Science	0.2280	0.2313	0.1835	0.2946	0.1914	0.2132
POL	Math	0.1646	0.1579	0.1646	0.1812	0.1504	0.1617
	Reading	0.2059	0.2018	0.2349	0.2095	0.1969	0.1681
	Science	0.1827	0.1589	0.1625	0.1541	0.1702	0.1478
CZE	Math	0.2147	0.1791	0.1993	0.1598	0.2092	0.1940
	Reading	0.2129	0.1786	0.2307	0.2042	0.2096	0.2008
	Science	0.1897	0.1776	0.1564	0.1454	0.1903	0.1844

Source: Author's computations

As can be seen from Figure 2, Hungary has the highest level of inequality of opportunity among the Visegrad Group countries, followed by Slovakia. This conclusion is in good agreement with the calculations made by other researchers (see Table 2). In terms of reading and science literacy, the levels of inequality of opportunity in the Czech Republic and Poland are close, but in terms of mathematical literacy, the inequality of opportunity in the Czech Republic is higher than in Poland. In most cases, the highest level of inequality of opportunity occurs in reading literacy. Maybe this is due to the fact that innate abilities, which are not taken into account in this work, are more important for mathematical and natural science literacy, while reading literacy is largely shaped by social environment, primarily the family background. There are no clear trends of increasing or decreasing inequality of opportunity in any of the countries reviewed.

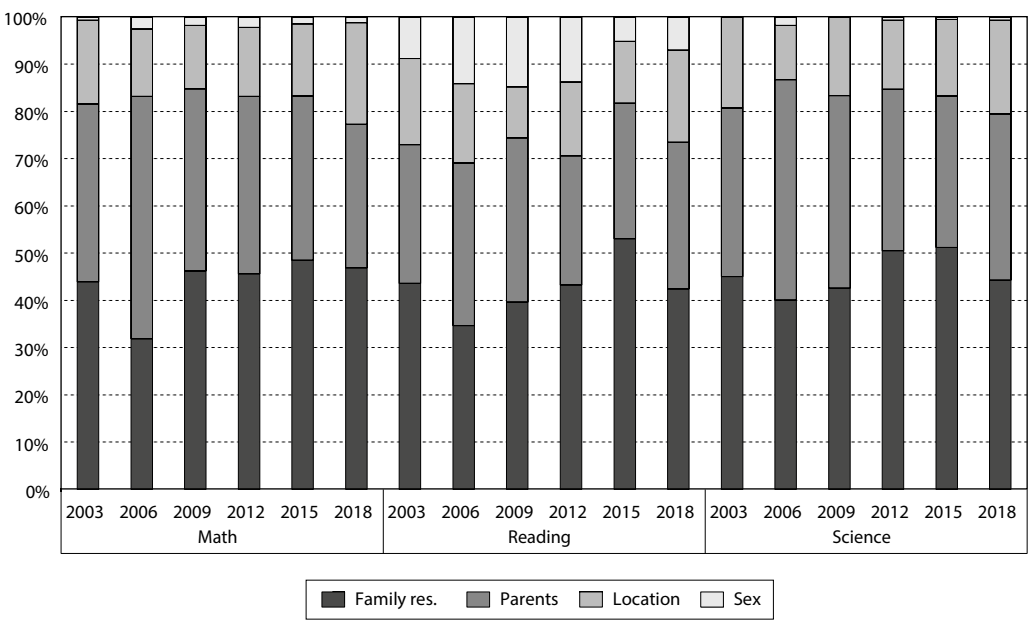
Figure 2 Dynamics of inequality of opportunity in the Visegrad Group countries



Source: Author's construction

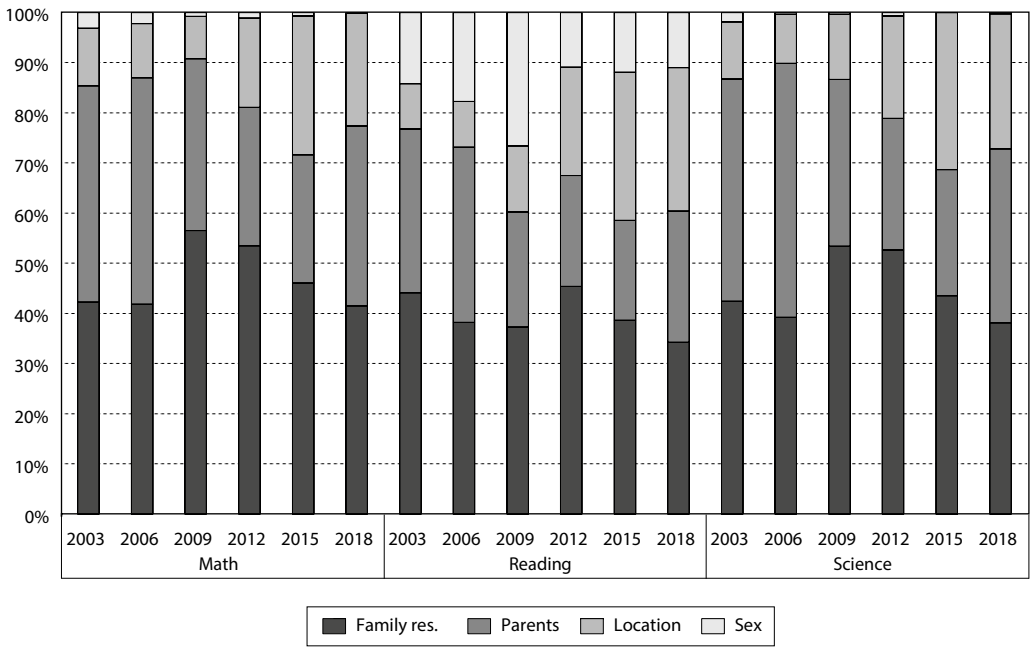
The input of individual factors to the overall level of inequality of opportunity is shown in Figures 3–6.

Figure 3 Input of individual circumstance factors to inequality of educational opportunities in Hungary



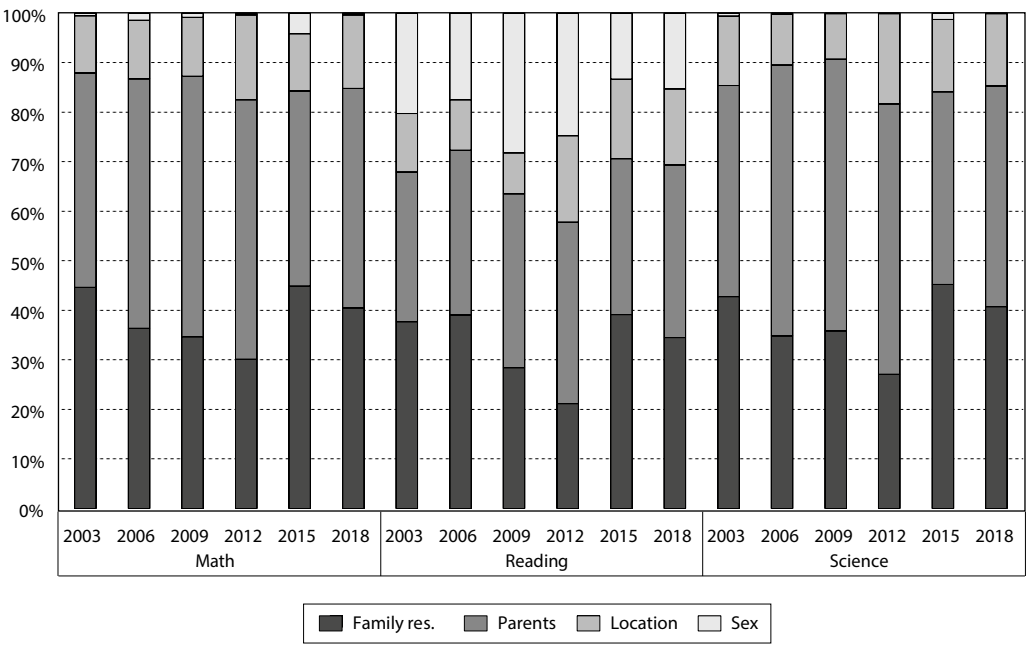
Source: Author's construction

Figure 4 Input of individual circumstance factors to inequality of educational opportunities in Slovakia



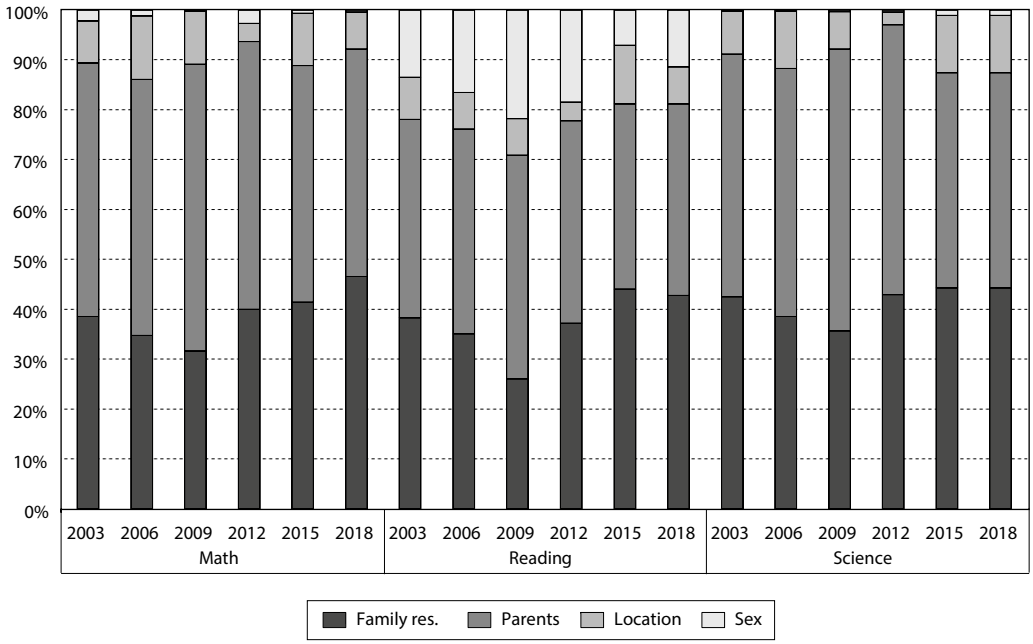
Source: Author's construction

Figure 5 Input of individual circumstance factors to inequality of educational opportunities in Poland



Source: Author's construction

Figure 6 Input of individual circumstance factors to inequality of educational opportunities in the Czech Republic



Source: Author's construction

As follows from Figures 3–6, the input of individual factors to the overall level of inequality of opportunity has both the features common for all countries and unique features. In all countries reviewed, student gender contributes significantly to inequality of opportunity in terms of reading literacy and does not matter much for the math and science literacy. Regression analysis results show that girls demonstrate better achievements in terms of reading literacy compared to boys.

The role of location factor has an express increasing tendency in relation to all types of literacy in Slovakia. Other countries do not show such trend. The role of location factor is higher in Hungary compared to Poland and the Czech Republic.

In all countries, the impact of family background is great. This can be partially explained by the fact that family background parameters are more fully taken into consideration herein. At the same time, all countries show considerable importance of both components – family material resources, and the parent educational and professional status. However, in Slovakia and Hungary, the role of material component prevails, while in the Czech Republic and Poland more significant is the contribution by non-material factors – education and professional status of parents.

CONCLUSION

This paper uses the PISA database to analyse the inequality of educational achievement and opportunity in the countries of the Visegrad Group. The following parameters were taken into account as circumstance factors: educational and professional status of parents, family material, cultural and educational resources, location of school and gender of students. The methodology used can be characterized as a parametric one based on the ex-ante approach.

The 2003–2018 educational performance by schoolchildren was found to tend towards worsening in Hungary, the Czech Republic and Slovakia, which points to the need for an in-depth analysis

of reasons behind this deterioration and for adopting strategies to improve national systems of education. Otherwise, in the long run, these processes will result in lower competitiveness and economic potential.

It was also found that the inequality of educational opportunities is noticeably higher in Hungary and Slovakia than in Poland and the Czech Republic. All countries showed a slight trend towards decreasing the inequality of opportunity. This can be accounted for general long-term opportunity-equalizing trends, like growing levels of education, urbanization, a more even localization of educational establishments across the countries, reduced size of families, development and spread of digital technologies overall and particularly in education.

The remaining inequality of educational opportunities necessitates monitoring the situation and making efforts to reduce it due to the fact that schooling provides initial levels of education, so inequality in schooling produces inequality in access to higher educational levels. Further on, since the level of education achieved becomes the most important determinant of other individual achievements, the inequality of educational opportunities carries over to the inequality of economic, political, social opportunities and achievements, setting up barriers to economic and social mobility and preserving socio-economic stratification. This is why monitoring the dynamics of inequality of opportunity in education is of paramount importance for the understanding and long-term forecasting of social processes.

ACKNOWLEDGMENTS

The reported study was funded by the Slovak project 1/0034/23 VEGA Methodological and Empirical Aspects of Subjective Welfare Measurement. The authors would like to thank the reviewers for useful and meaningful comments, which helped improve the paper's final version to a great extent.

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APPENDIX

Table A1 Results of the OLS-regression of the educational achievement on circumstance-factors (Math)

Independent variables	HUN	SVK	POL	CZE
Household property				
Low	–32.64***	–54.03***	–21.25***	–33.25***
High	14.90***	25.38***	12.54***	16.29***
Cultural resources of the family				
Low	–16.48***	11.24***	–19.47***	–1.64
High	13.02***	–3.87	6.37	4.74
Family educational resources				
High	10.79***	1.80	5.99	19.37***
Parents professional status				
Low	–27.69***	–34.40***	–9.96***	–19.88***
High	8.64*	–7.44**	–0.82	5.87*
Parents educational level				
ISCED3B_C and below	–19.27***	–40.61***	–16.18***	–23.08***
ISCED5A and above	0.54	15.62***	31.09***	22.16***
Type of school location				
Village	–65.67***	–35.26***	–13.01***	–34.17***
Little town	–19.81**	–12.07*	–4.49	–9.07*
Major city	6.34	23.37***	14.13**	9.29
Megalopolis	23.53***	–	8.09	5.84
Gender				
Female	–12.58***	–3.13	–3.9	–7.32**
Constant				
Const.	494.26***	504.84***	514.31***	488.22***
R^2	0.2792	0.2409	0.1617	0.1940

Notes: *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's calculations

Table A2 Results of the OLS-regression of the educational achievement on circumstance-factors (Reading)

Independent variables	HUN	SVK	POL	CZE
Household property				
Low	–28.63***	–49.71***	–16.86***	–28.03***
High	11.29***	15.73***	5.43	14.11**
Cultural resources of the family				
Low	–20.78***	4.07	–24.81***	–5.09
High	14.21***	–0.22	9.77**	5.50
Family educational resources				
High	7.78**	3.8	9.15***	23.04***
Parents professional status				
Low	–32.25***	–34.75***	–12.15***	–20.14***
High	9.63**	9.71***	–7.21*	6.21*
Parents educational level				
ISCED3B_C and below	–22.11***	–34.75***	–17.16***	–23.45***
ISCED5A and above	–3.50	9.71***	30.10***	17.39***
Type of school location				
Village	–63.70***	–47.85***	–20.79***	–35.42****
Little town	–20.24*	–18.98***	–11.14*	–8.12
Major city	1.85	28.47***	11.25	9.47
Megalopolis	22.96***	–	–3.22	9.32
Gender				
Female	22.42***	33.90***	29.49***	29.16***
Constant				
Const.	478.57***	461.99***	500.07***	469.21***
R^2	0.2528	0.2478	0.1681	0.2008

Notes: *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's calculations

Table A3 Results of the OLS-regression of the educational achievement on circumstance-factors (Science)

Independent variables	HUN	SVK	POL	CZE
Household property				
Low	–26.49***	–47.16***	–17.23***	–31.60***
High	10.15***	17.84***	7.03*	18.70***
Cultural resources of the family				
Low	–22.16***	7.88*	–24.44***	–2.47
High	15.13***	–2.45	9.65**	0.32
Family educational resources				
High	8.63**	2.76	6.22*	16.83***
Parents professional status				
Low	–31.66***	–31.02***	–12.32***	–21.95***
High	8.64**	–5.88*	–5.46	5.76*
Parents educational level				
ISCED3B_C and below	–26.72***	–33.45***	–17.64***	–25.03***
ISCED5A and above	–2.84	14.47***	29.67***	19.87***
Type of school location				
Village	–53.39***	–39.90***	–14.41***	–29.81***
Little town	–18.19*	–13.63**	–4.97	–6.68
Major city	3.21	23.60***	12.35*	10.00
Megalopolis	24.64***	–	–6.60	13.35
Gender				
Female	–10.21***	5.94*	–2.65	–2.01
Constant				
Const.	498.38***	477.49***	513.55***	494.53***
R^2	0.2541	0.2132	0.1478	0.1844

Notes: *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's calculations