

Final Report

The aim of the proposed research was to analyze the effect of the institutional setting of education and different educational reforms, with a strong emphasis on school choice, and teacher policy, on students' achievement and equality of opportunity regarding gender and social equity. The research used international data on students' performance: the OECD PISA data, the IEA TIMSS and PIRLS data and TALIS data.

We have compiled a comparable macro database on institutional settings of education and on education reforms in the last three decades which was also used for the analysis. The database covers all European countries. *This database is an additional result of the research; it can be used for further studies too.*

We investigated four questions. (1) The effect of school choice on students' performance; (2) the effect of teacher policies on students' performance; (3) the effect of teachers' gender on students' performance; (4) how educational institutions affect the gender test score gap.

(1) Public versus private school choice: performance and equality. A comparative analysis of school choice systems using PISA data

While many propagate the advantages or the disadvantages of choice within education, often individual (or market) choice is mingled with public choice. They are, however, far from being the same. Market system relies upon permitting the establishment of schools that meet the criteria set out by the state, where such entities can compete for students. Public choice system, on the other hand, is when the state finances and promotes more schooling alternatives. While both are choice systems, and thus several arguments about their impact on effectiveness and equality are valid on both, there are a couple of minor but important mechanisms that are valid only for the private or only for the public choice system.

This research established some hypotheses that are valid for only one or the other of these choice mechanisms and test these on a large scale cross-country comparative data, the OECD PISA data. While these results are far from being decisive, they provide some valuable insights to the debate on educational choice.

The paper utilized all available waves (2000-2012) of the OECD PISA data to test these two baseline hypotheses. It focused on the European countries as education systems on other continents or in developing countries can be quite different from these. There are 32 countries, 3741 schools and 883412 students in the pooled dataset. The paper used random effects panel

regressions to test the association of the institutional factors (private or public choice) on the level of student test scores (performance) and the effect of family background on test scores (equality). As robustness check to this method, we also used a simpler procedure, where the level of performance (test score means) and equality (an index of segregation) are regressed on the institutional setup.

We showed that while competition between schools is associated with higher school performance, this is likely due to selection between schools. The argument is, that while competition goes well together with both private choice and public choice, these latter two do not correlate with higher performance. However, both public and private choice correlate with increased inequalities, separately (they are not necessary but sufficient conditions for high inequality), which suggests that increased choice leads to greater selection between schools, and hence we observe competing schools to be of higher test score levels.

(2) The Effects of Policies Concerning Teachers' Wages on Students' Performance

The second study investigated how relatively short term changes in the level and structure of teacher salaries affect student performance. The analysis only considered European countries, assuming that the effect of teacher wages will be relatively homogenous for countries at a similar stage of economic development and with similar traditions of education. We analyzed the wage-effect separately for reading, maths and science performance, in order to investigate if there are differences between subjects. The research used country panel data of student achievement from PISA, 2003-2012 combined with national-level teacher salary data. Our results show that higher statutory teacher salaries and a larger growth in teacher salaries in the first part of teachers' careers increase students' maths and science performance, while we could not find a significant effect on reading performance. Teacher salaries may influence teacher quality and thus students' performance through various mechanisms. First, higher wages may have a selection effect at the beginning of teachers' careers, (both in the choice to undertake teacher training in the first place and later in finding employment as a teacher after finishing higher education); higher wages may also have an effect on the attrition of teachers. Second, higher wages may also have an incentive effect, in as much as higher paid teachers may make more effort to increase students' performance. Although selection and incentive effects could not be separated in this study, it seems a reasonable assumption that the differences between subjects are the results of the different outside labour market opportunities for teachers according to the various subjects taught. The results also show that an increase in teachers' wages lasting five years at the beginning of their career may have an immediate positive effect on students' maths and science performance. Nevertheless, based on the available data we cannot draw conclusions as to how wage increases in the second part of teachers' careers influence students' performance over the same period. The apparent lack of a significant effect

of teachers' salaries in the second part of their career may be an artifact of the lack of data on teachers' actual salaries.

(3) Does teacher gender matter in Europe? Evidence from TIMSS data

This research examined the effect of teacher gender on student achievement in 20 European countries.

We employed a student fixed effect approach to account for unobservable subject-invariant student ability and non-random student-teacher sorting. The results show that female teachers tend to increase students' test scores, especially for girls. However, this effect is far from universal; it is present in half of the countries in our sample. The female effect is likely to reflect selection into the teaching profession, as it is stronger in countries where the teacher wages about graduate wages are higher for women than for men. Having a teacher of the same gender also benefits students in Western Europe. We have further found that the female teacher effect is more pronounced for low achievers, and in Western Europe for students with an immigrant background.

(4) The gender test score gap and education institutions: exploring cross-country differences in Europe

The difference between the average performance of boys and girls in school, i.e. the gender test score gap varies widely across countries in Europe. This paper explored whether certain education system characteristics are related to the gender test score gap.

We addressed this question in two steps. First, we analyzed the correlations between the selected features of the education systems and gender disparity. This country-level analysis suggest that grade retention and early selection is related positively to the gender gap in some fields, i.e. these institutions tend to increase boys' relative advantage over girls, while the prevalence of student-oriented teaching practices helps girls to close the gap in math.

The second part of the analysis looked at the further evidence to validate the effects seen in the country-level correlations. An indirect test of grade retention and a diff-in-diff style estimation of the tracking effect revealed that these factors hardly explain the differences in the gender gap across countries. Widespread grade retention does not seem to have a direct effect, while early tracking rather closes than widens the gender gap if it has any effect.

In our interpretation, these seemingly contradictory results suggest that boys perform relatively better in more traditional education systems, which also use grade retention and early selection more often. At the same time, student-oriented teaching practices appear to benefit girls about boys both between and within countries.

The four research papers were published in the Budapest Working Papers on the Labour Market series of Institute of Economics, Centre for Economic and Regional Studies, Hungarian Academy of Sciences.

- (1) http://econ.core.hu/file/download/Horn/Public_vs_private_school_choice.pdf
- (2) <http://www.econ.core.hu/file/download/bwp/bwp1701.pdf>
- (3) <http://econ.core.hu/file/download/bwp/bwp1702.pdf>
- (4) http://econ.core.hu/file/download/hermann/gender_test_score.pdf

Three papers were submitted to international peer reviewed journals (*Education Research and Evaluation*). The fourth will be published in Hungarian in *Közgazdasági Szemle*.

We have presented research results at international and national conferences. Daniel Horn has presented his work at the following conferences: Efficiency in education workshop, September 19-20, 2014
ISA RC28 on Social Stratification and Mobility Annual Conference, May. 22-23, Tilburg. Júlia Varga has presented her results at

The first conference has directly led to a successful joint Horizon 2020 application with the Katholieke Universitaet Leuven, the University of Maastricht and Politecnico di Milano.