Appendix
Sensitivity Check

A.1 Index Sensitivity Check

To check the sensitivity of our results regarding the way in which the SES* index was constructed (simple-sum, unweighted, which allows for a straightforward interpretation of the index points), we constructed a second SES* measure based on the first principal component from a principal component analysis (PCA). The objective of PCA is to explain the variance-covariance structure of a set of variables through linear combinations of the variables that contain most of the variance. Although there are as many principal components as there are variables in the analysis, the first principal component always contains the most variance. In this study, the first principal component contained almost half of the variance (45%) and it was the only component with an eigenvalue (1.801) larger than 1. By using the *predict* command in the *pca* module in Stata 14 (StataCorp 2015), we computed the first principal component score for all respondents using the eigenvectors (Table A.1) and used it as a second measure of SES*. In short, this alternate measure of SES* is a weighted sum of the standardized variables:

$$SES^{*} = 0.572 \times Z_{parent\ educ} + 0.432 \times Z_{computer} + 0.520 \times Z_{books} + 0.465 \times Z_{desk}$$

We generated education system and year-specific cut-offs for the principal component score and compared the trend results based on the two different measures. The results suggested that the way the SES* measure was constructed did not change the general trend that we observed for the countries that showed significantly widening mathematic achievement gaps between high- and low-SES students (Fig. A.1). This was expected, given that, according to Wainer (1976), choosing a certain weighting scheme of the components in a sum score over another should in general have limited impact if the components are correlated. However, results could still be sensitive to the way high- and low-SES* groups were constructed. We thus performed a cut-off sensitivity check.

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Table A.1 Principal component analysis of the SES* index

Eigenvalues	Coefficient	Standard error	p > t	[95% confidence intervals]	
Component 1	1.801	0.005	0.000	1.791	1.810
Component 2	0.844	0.002	0.000	0.840	0.849
Component 3	0.778	0.002	0.000	0.774	0.782
Component 4	0.577	0.002	0.000	0.574	0.580
Principal component score					
Parental education	0.572	0.001	0.000	0.569	0.574
Computer	0.432	0.002	0.000	0.428	0.437
Number of books at home	0.520	0.002	0.000	0.517	0.523
Study desk	0.465	0.002	0.000	0.461	0.468

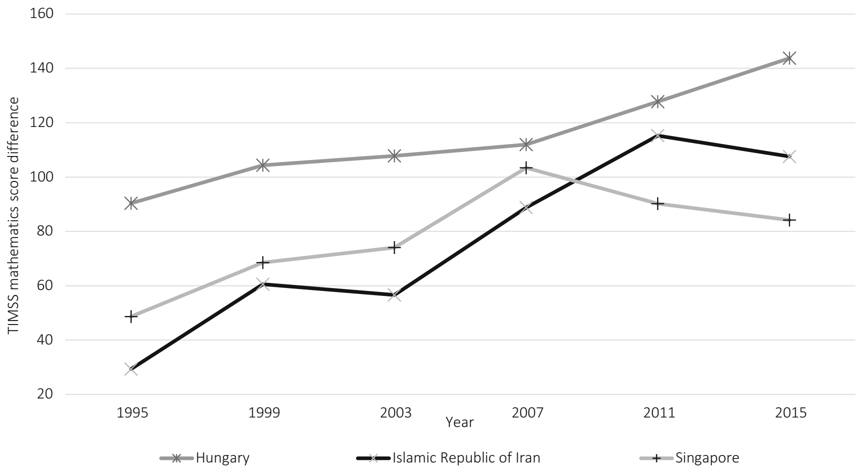
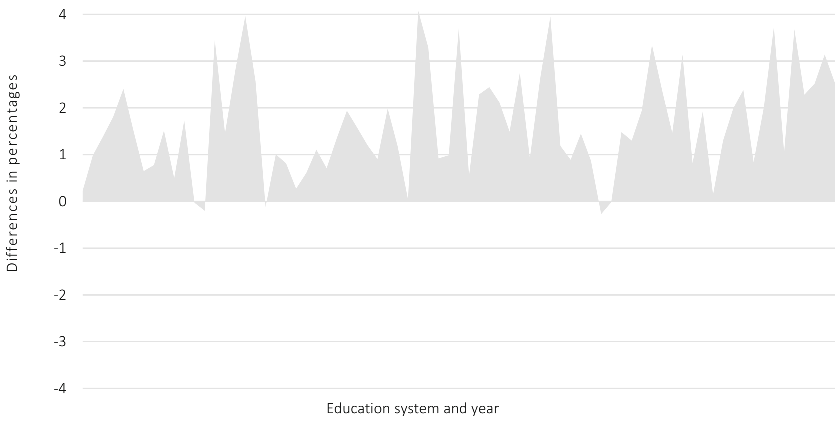


Fig. A.1 Increasing mathematics score difference between high- and low-SES* students using SES* measure constructed by PCA, by education system and year

A.2 Cut-off Sensitivity Check

As an additional sensitivity check, we compared the impact of choosing a different definition of low- and high-SES* groups by using quintiles instead of quartiles as cut-offs. In general, we observed minor differences between these two approaches, and none that would change the general trend pattern. For mathematics, we repeated the analysis of the percentage of students in the low-SES* groups performing at or above the TIMSS intermediate benchmark (based on quartiles) with the SES groups now defined by quintile cut-offs. On average, among the 13 education systems across all cycles of TIMSS, using quintile cut-offs resulted in about a 2% reduction in the percentage of students achieving at or above the TIMSS intermediate



Note The calculation subtracts quintile cut-off from the quartile cut-off for the percentages of low-SES* students performing at or above the TIMSS mathematics intermediate benchmark.

Fig. A.2 Differences in percentage of low-SES* students achieving at or above the TIMSS mathematics intermediate benchmark: quartile versus quintile cut-offs, by education system and year

benchmark. No change went beyond a four-percentage point difference (see Fig. A.2). Therefore, we concluded that using quintile cut-offs would not have changed the patterns of our findings in any fundamental way.

References

StataCorp. (2015). *Stata 14 Base Reference Manual*. College Station, TX: Stata Press.

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