Cross-national differences in socioeconomic achievement inequality in early primary school: The role of parental education and income in six countries

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Research aims

Provide new evidence on inequalities in literacy and mathematics test scores among children aged 6-8 using data from six advanced industrialized countries – United States, United Kingdom, France, Germany, Netherlands, and Japan

Simultaneously consider the roles of both parental education and household income in the stratification of early achievement

Rationale

- Contributes to the small cross-national comparative evidence base on socioeconomic inequality in early childhood achievement

- Provides important information on the extent to which cross-national variation in achievement inequalities are already present when children have experienced at most two years of formal compulsory schooling

- Helps to isolate the contribution of influences during late childhood/ adolescence – including the institutional structure of secondary schooling – to attainment inequalities observed later in the educational career.

- Disaggregating and comparing the contribution of two major components of SES to overall stratification, throws light on:
  - ➢ the nature of the processes that link parental SES to children's learning,
  - ➢ the extent to which these differ across countries, and
  - ➢ the sorts of biases that are likely to occur when SES is operationalised solely in terms of income or in terms of parental education.

Cross-national differences in achievement inequalities at age 15

Table 1. Socioeconomic inequalities in achievement at age 15 in selected countries from PISA 2018

Country	% of variance in reading performance explained by ESCS (R2)		Gap in mean standardized reading score between top and bottom national quartile groups of ESCS		% of variance in maths performance explained by ESCS (R2)	
	%	S.E.	Score dif.	SE	%	S.E.
France	17.5	(1.3)	1.06	0.05	21.1	(1.5)
Germany	17.2	(1.4)	1.07	0.06	18.0	(1.6)
United States	12.0	(1.4)	0.92	0.06	16.1	(1.5)
Netherlands	10.5	(1.3)	0.84	0.06	13.5	(1.7)
United Kingdom	9.3	(1.0)	0.80	0.05	11.6	(1.1)
Japan	8.0	(1.2)	0.74	0.06	9.0	(1.4)
Canada	6.7	(0.6)	0.68	0.03	7.8	(0.7)
Australia	10.1	(0.6)	0.82	0.03	11.2	(0.7)
OECD average	12.0	(0.2)	0.89	0.01	13.8	(0.2)
OECD highest	Hungary		Hungary		Hungary	
	19.1	(1.7)	1.16	0.06	23.8	(1.9)
OECD lowest	Estonia		Estonia		Canada	
	6.2	(0.8)	0.65	0.05	7.8	(0.7)

Previous evidence

Passaretta et al. (2022) show gaps by parental education at age 5 and 7-8 are ordered:

GE > UK > NL

Lindberg et al. (2018) shows gaps at 6-7 by education ordered

GE > US

Bradbury et al. (2012, 2015, 2019) shows gaps at 5 by education OR income ordered

US > UK, AU > CA

No comparative evidence yet on interesting cases of France and Japan

➤ Do France and Germany look as similar early on as they do at age 15?
➤ Is the internationally-low level of inequality in Japan already apparent at age 7-8?

DICE datasets and achievement measures

	FR	GE	JP	NL	UK	US
Data	DEPP panel primary school	NEPS SC2	JCPS	Generation R	MCS	ELCS-K: 2011
Birth cohorts	2005	2005-06	2002-2012	2002-06	2000-02	2005
Language achievement	Reading (CP, age 6)	Receptive vocabulary (adaptation of PPVT, Grade 1, age 6)	Vocabulary, grammar, reading, writing (Grade 1 or 2, age 7-8)	Receptive vocabulary (CITO TVK; Group 2, age 6)	Reading (BAS Word Reading, Year 2, age 7)	Grade 1, age 7
Math achievement	Math, numbers, geometry (CP, age 6)	Numbers, calculations, geometry (Grade 1, age 6)	Calculations, numbers, figures (Grade 1 or 2, age 7-8)	-	NFER PiM (Year 2, age 7)	Grade 1, age 7
Sample Size:						
baseline	15,188	6,734	TBC	7,853	18,552	15,750
analysis	9,231	5,365	829	5,400	13,798	10,300

Measures

Parental education: High, medium and low; equivalent to US 4-year college, some college, high school or less

- Highest parent but check with separate measures for mother and father

Income: Quintiles of equivalised household income at time of child assessment

Controls:

- Orthogonal variance: child age at test, gender, JCPS survey wave
- Parental non-socioeconomic resources: family structure, foreign-born parent, foreign language in home, mother's age at birth, race/ethnicity (NL, UK, US only), East/West Germany

Methods

Four models:

[M1] z_i = B0 + B1*controls

[M2] z_i = B0 + B1*controls + B2*education

[M3] z_i = B0 + B1*controls   + B3*income

[M4] z_i = B0 + B1*controls + B2*education   + B3*income

% variance explained by SES = partial η^2 = R2[M4] − R2[M1]

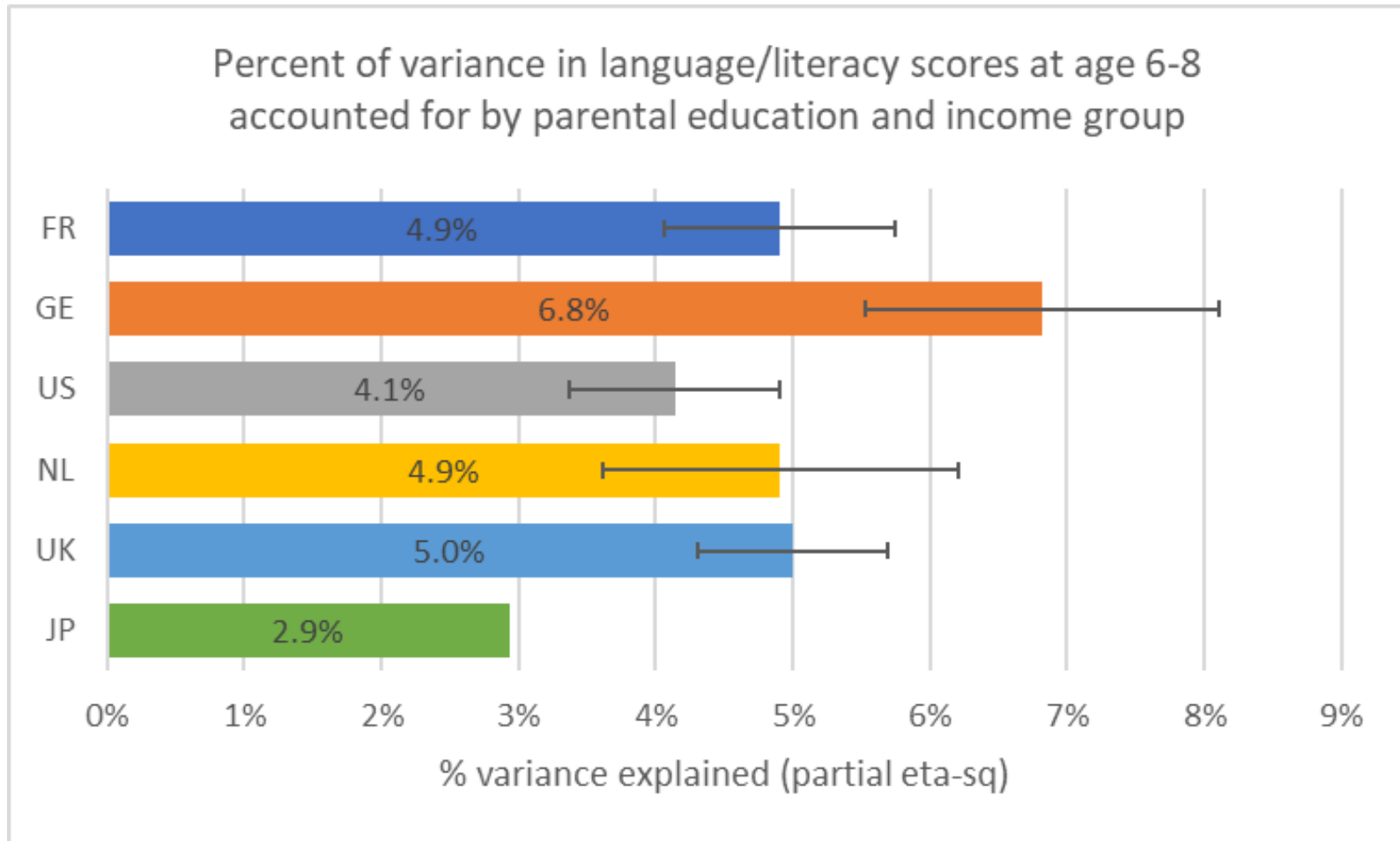% variance explained by education (gross) = R2[M2] − R2[M1]

% variance explained by education (net) = R2[M4] − R2[M3]

% variance explained by income (gross) = R2[M3] − R2[M1]

% variance explained by income (net) = R2[M4] − R2[M2]

Use multiple imputation and bootstrapping for η^2 confidence intervals

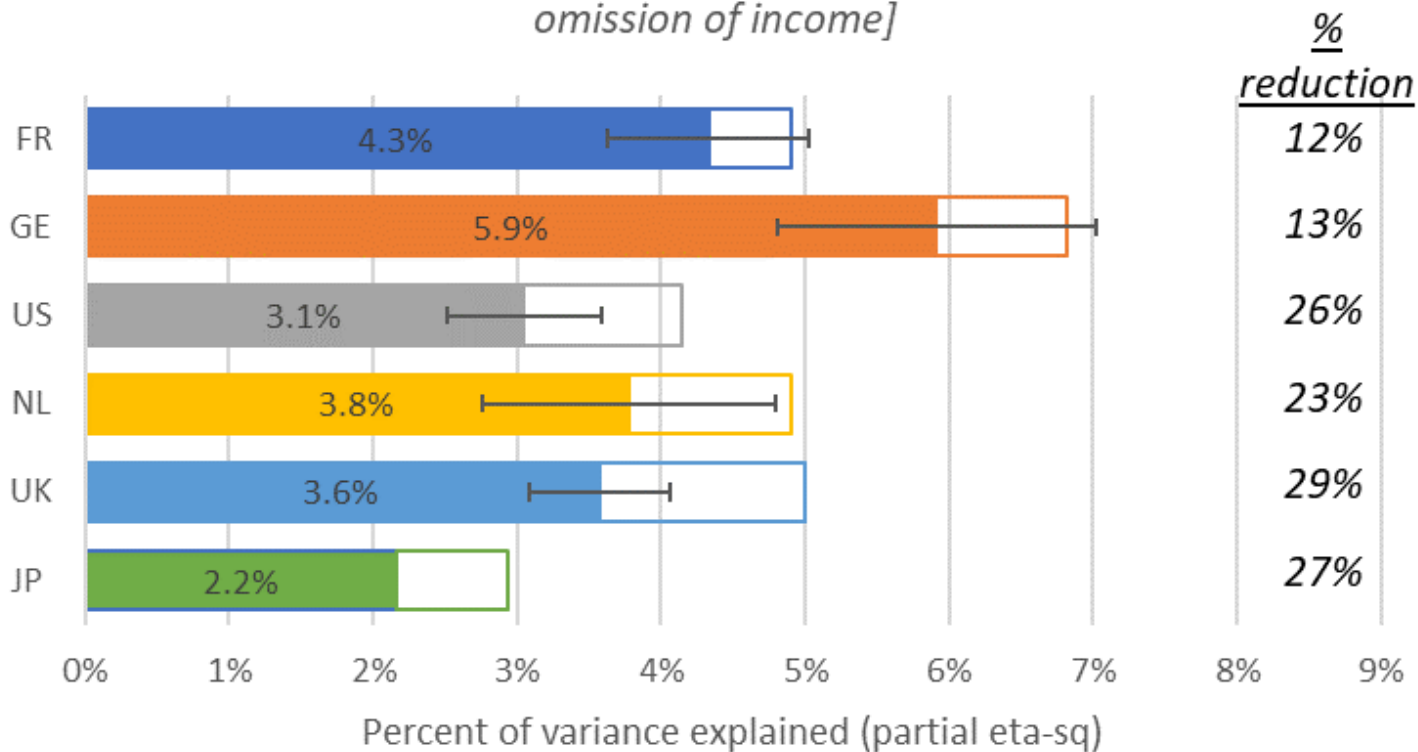# Results I: Joint contribution of education and income to variance

Percent of variance in language/literacy scores at age 6-8 accounted for by parental education and income group

FR	4.9%
GE	6.8%
US	4.1%
NL	4.9%
UK	5.0%
JP	2.9%

% variance explained (partial eta-sq)

Bars are R2[M4] − R2[M1]

Results II: Gross contribution of education to variance

(a) Percent of variance in language/literacy scores at age 6-8 accounted for by **parental education** [plus reduction due to omission of income]
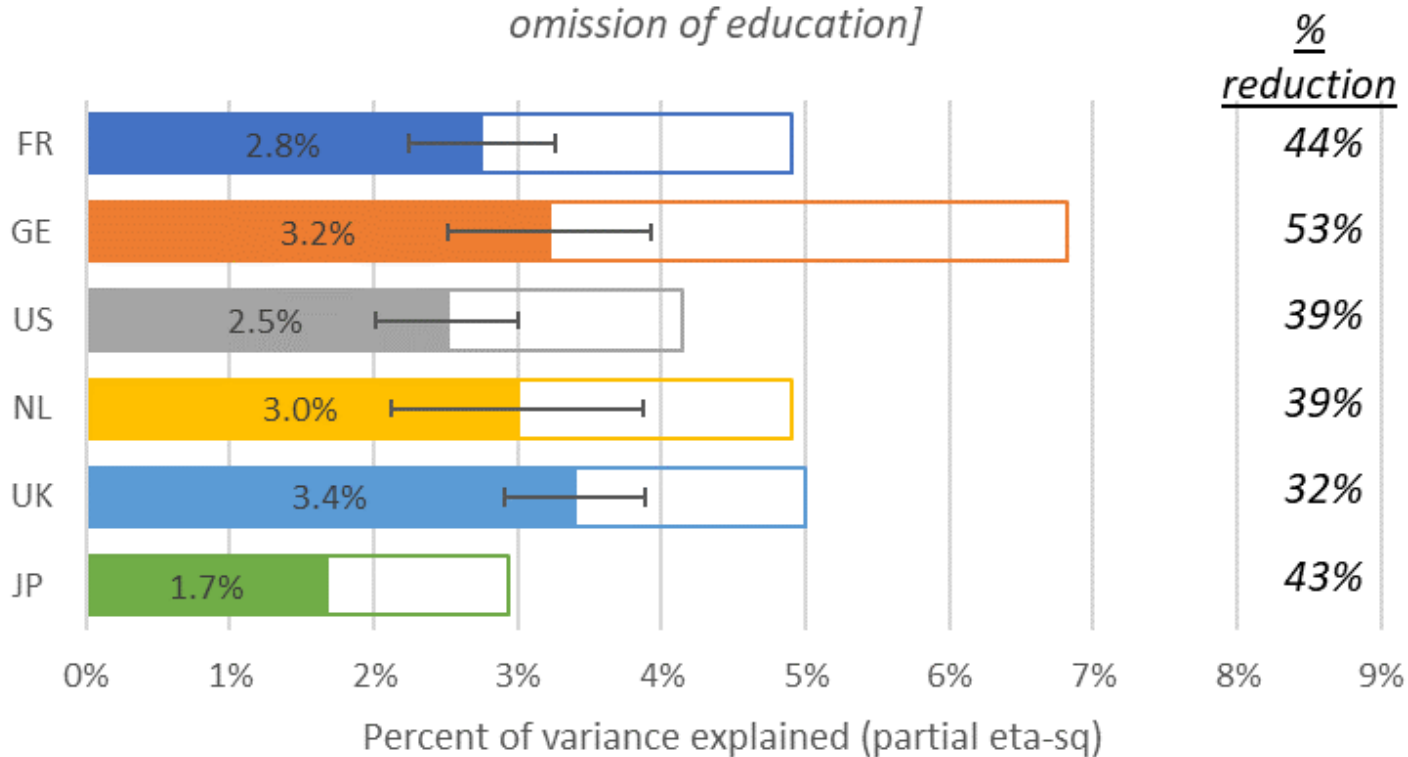

Total bars R2[M4] − R2[M1];
filled bars are R2[M2] − R2[M1]; open bars are R2[M4] − R2[M2].

Results III: Gross contribution of income to variance

(b) Percent of variance in language/literacy scores at age 6-8 accounted for by **income group** [plus reduction due to omission of education]

Total bars R2[M4] − R2[M1];
filled bars are R2[M3] − R2[M1]; open bars are R2[M4] − R2[M3].

Are we over-controlling?

And perhaps more seriously, over-controlling to different degrees across countries? -> Yes probably
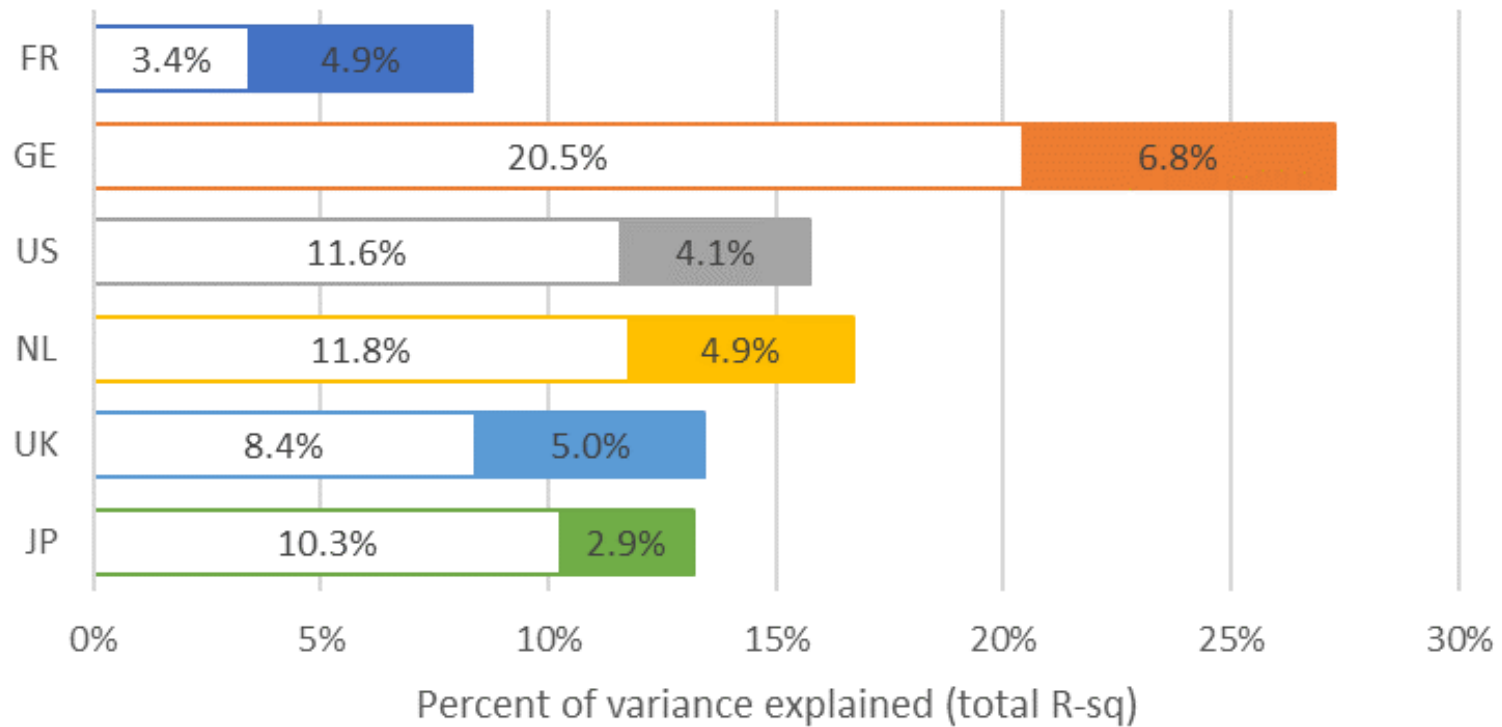
Next step is to check this

For example, we might suspect the inclusion of race/ethnicity in the US controls leads to "subtract off" more of the variance than in countries where ethnicity not controlled or where minorities are a smaller fraction of the population

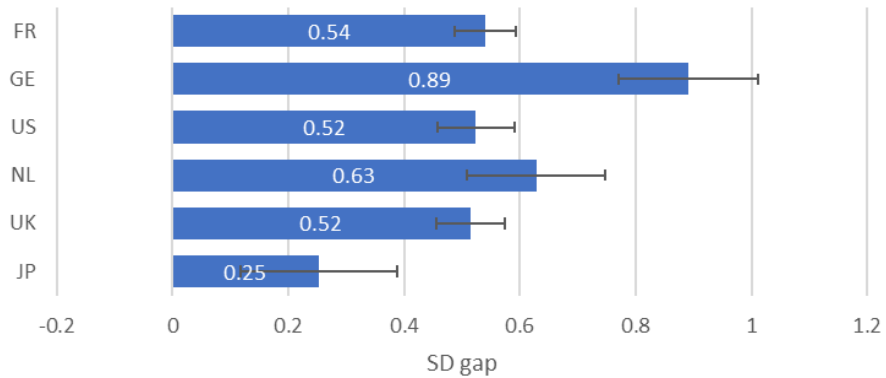However several points suggest it might not make much difference
- Variance explained by controls (M1) is largest in Germany, not disproportionately large in the US
- Gap estimates from the regression coefficients tell a similar story when only net rather than gross contribution of controls is removed
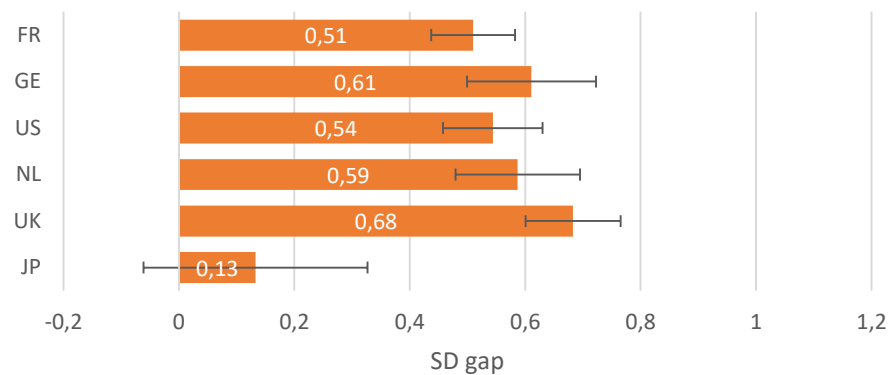
Total R-squareds from Model 4

☐ Explained by controls   ■ Increment explained by SES

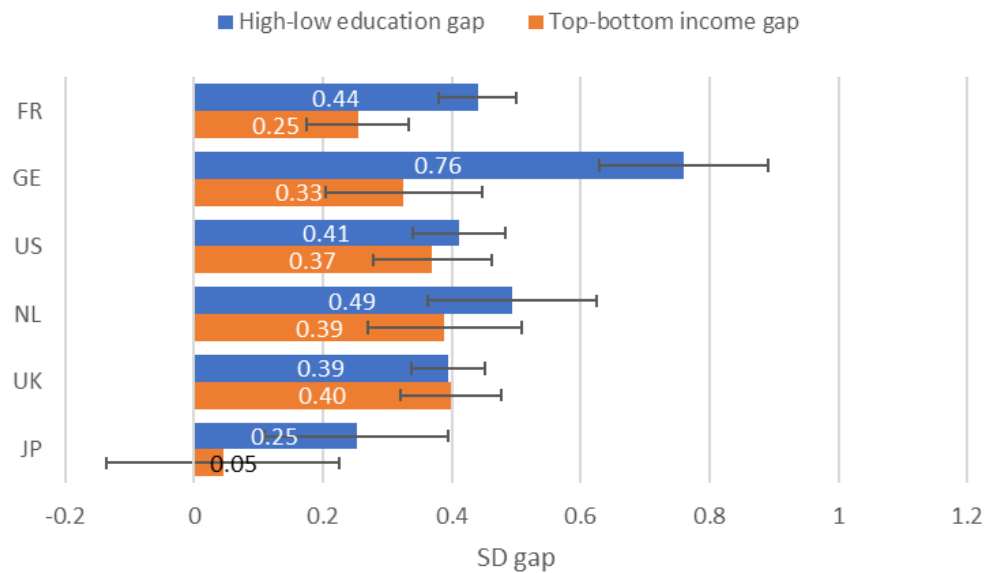| Country	Explained by controls	Increment explained by SES
FR	3.4%	4.9%
GE	20.5%	6.8%
US	11.6%	4.1%
NL	11.8%	4.9%
UK	8.4%	5.0%
JP	10.3%	2.9%

Percent of variance explained (total R-sq)

(a) High-low parental education gaps, baseline controls only (M2)

(b) Top-bottom income quintile gaps, baseline controls only (M3)

c) Education and income gaps, joint model (M4)

Further checks

Adding interactions between education and income makes little difference (most in Netherlands and Japan)

Replacing highest parent with separate measures of maternal and paternal education makes relatively little difference (most in Germany, least in Japan)

Results for maths (without NL) mostly similar but some differences

- Germany still most inequality but slightly less marked than for language/literacy
- Japan more similar to other Western countries

Conclusions

Parental income and education both make distinct contributions to the achievement variance but much larger role for education, particularly in France and Germany

- Education: stimulating interactions, help with homework, navigating education system
- Income: material resources, family stress, neighbourhoods

General impression of stability in cross-national patterns at ages 6-8 and 15

- Germany is a "poor performer" from the start; Japan is a "good performer" in terms of SES-related inequalities
- Consistent with other literature, the evolution of SES gaps after school entry is remarkably similar across countries, despite markedly different systems, e.g. in relation to tracking

Conclusions

France/Germany comparison is intriguing. Gaps at age 6-8 are 25% smaller in France but virtually identical by age 15

- Could be linked to very different ECEC systems
- But nature of schooling systems (comprehensive vs tracking) would predict weaker, rather than stronger, widening of inequalities in France after school entry

US (and Japanese) gaps are more muted in a relative sense than we might expect, given high levels of income inequality, child poverty rates, low public spending on the family, etc