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ORIENTATION, FORMATIONS,
INSERTION : **QUEL AVENIR POUR L'ENSEIGNEMENT PROFESSIONNEL ?**

The Effects of Upper Secondary Education and Training Systems on Literacy and Numeracy Skills Inequality

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Research on Education System Effects on Skills Inequality

We know much about the effects on skills inequality of the different structures and practices in education prior to the end of lower secondary schooling.

Research suggests that more unequal outcomes are likely to occur in countries when there is:

- early selection to different tracks or types of school;
- a high proportion of privately funded schools;
- a lack of standardization in curricula and assessment;
- and in federal systems where funding is devolved to the regional level (Hanushek and Woßmann, 2006, 2010; Schuetz et al., 2008; OECD, 2010)

However, much less is known about the contribution of the next phase of education and training to skills distribution and about how different types of provision may affect this.

Theories of Effects of Upper Secondary Education and Training on Skills Inequality

- Boudonian 'positional' theory (1974) on school systems generally suggests that the more the 'branching points' in an education system the more likely there are to be secondary stratification effects whereby students from different social backgrounds make differential choices about educational pathways which will tend to increase inequalities. Greater standardization in curriculum is likely to reduce skills inequality.

- Previous research on upper secondary E and T (Lasonen and Young,1998; Raffe et al.,1998, 2001) suggests that where there is greater of parity of esteem between academic and vocation tracks this is likely to reduce skills inequality.

Hypotheses

1. High rates of completion of full ISCED level 3 upper secondary education and training programs will reduce skills inequality.

2. Compulsory core curricula including study of maths and national language will reduce skills inequalities.

3. Greater parity of esteem between the general and academic tracks will reduce skills inequality. This is most likely in upper secondary E and T systems with either a) Dual Systems of apprenticeship or b) integrated school-based general and vocational institutions.

4. HE participation rates will have non-linear effect on skills inequality. As participation rises it will increase skills inequality, then after a majority start participating inequality will come down. The effects are likely to be small because the least skilled do not participate and most of the variation of skills inequalities across countries is at the bottom end.

Types of Upper Secondary Education and Training System

Type 1. Predominantly **school-based systems** with general academic and vocational provision in different types of dedicated upper secondary institution and with apprenticeships representing separate but residual systems. (**Czech Republic, Denmark, Estonia, France, Finland, Greece, Italy, Japan, Poland and Russia.)**

Typically 3 yr programs organised according to subject specialisms but with common core curriculum, including maths and national language. Externally examined, Grouped awards requiring passes in core subjects

Type 2. **Comprehensive school-based** general and vocation provision in one institution.

similar to Type 1 but with greater integration of institutions and programs. Much greater institutional variation in North American that Scandinavian systems, so subdivided into:

Type 2a (**US and Canada** and Type 2b **(Sweden and Norway**)

Type 3. **Tracked** School-based general education and Dual Systems of Apprenticeship (**Austria, Germany**, **Switzerland**).

Generally 3 yr programs with common core subjects, but highly differentiated across academic tracks in terms of subject specialisms and forms of regulation – social partner organisation of apprenticeships, closely integrated with labour markets.

Type 4. **Mixed Systems** with high diversity of school- and employment- based programmes of variable length and quality but with dominant academic tracks. (**Australia, England, Northern Ireland, Ireland, Scotland, Spain and New Zealand**).

Programs generally organised on flexible modular basis with competence-based vocational programs of no fixed duration.

No common core – maths and national language not mandatory.

Market-oriented, with diversity providers, including private training organisations and private awarding bodies (UK).

Variables for System Characteristics

System Standardisation Variables:

- *Rates of upper secondary completion.*
- Extent of Maths and national language provision ie.
- *Mandatory Maths and Language Learning*
- *Maths Prevalence*

Parity of Esteem Variables:

- *Vocational Prevalence*
- *Social Mix of the Vocational*

Control Variables

- *HE Participation Rates*
- *Youth Unemployment Rate*

Methodology: A Pseudo-Cohort Approach

- Changes in literacy and numeracy skills inequality after lower secondary schooling are estimated using a pseudo cohort derived from 15 year olds in PISA 2000 and 27 year olds in the Survey of Adult Skills, conducted 11 years later (proxied by 25-29s).

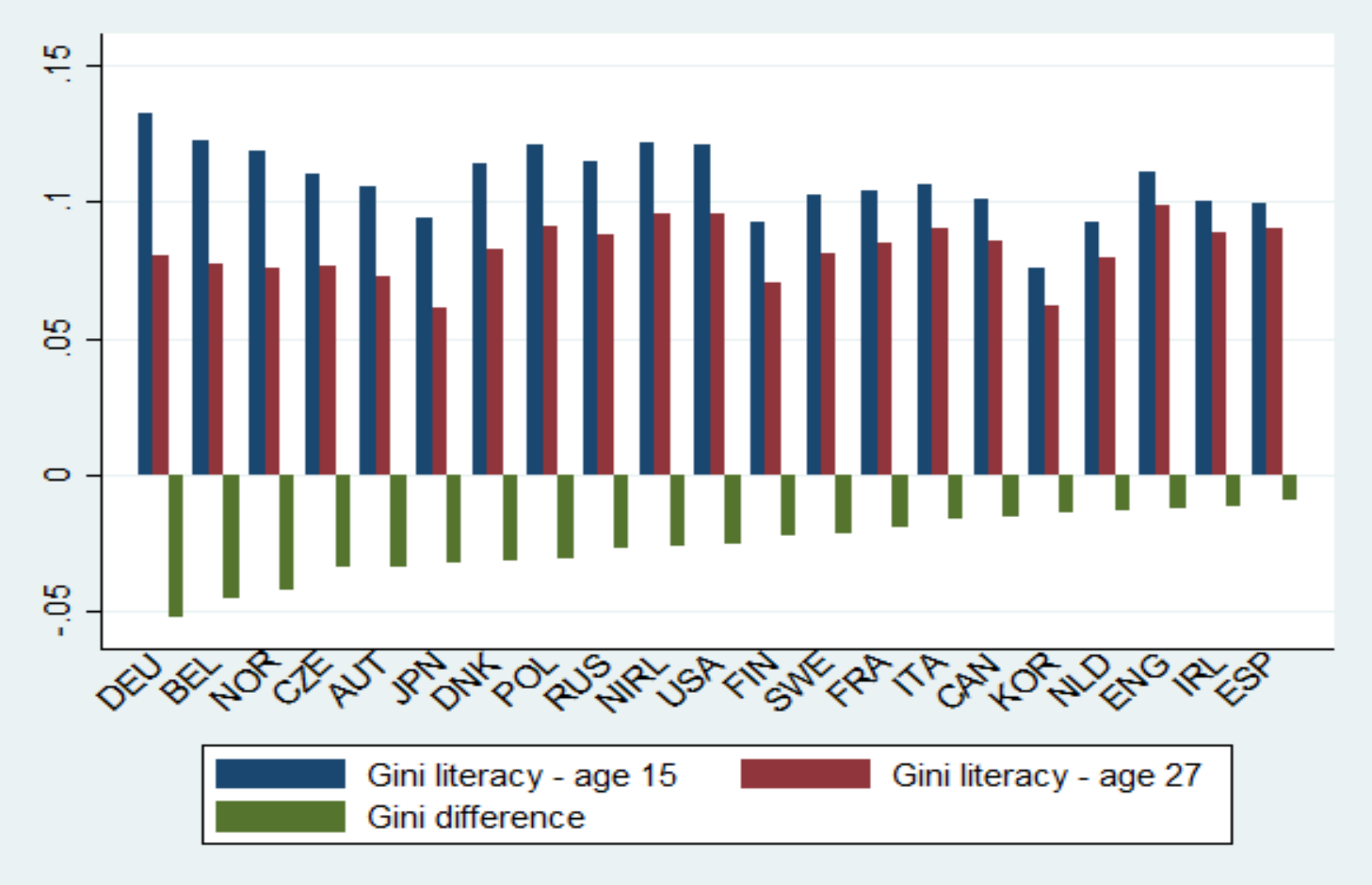
- The two surveys use different questions but are based on similar methodologies for measuring practical competences (using IRT etc). The two tests use different scales so comparing absolute scores is problematic but comparisons of distributions across the surveys is valid.

- Inequalities in skills outcomes (distributions) are measured using Skills Gini coefficients which control for scale differences in the scoring.

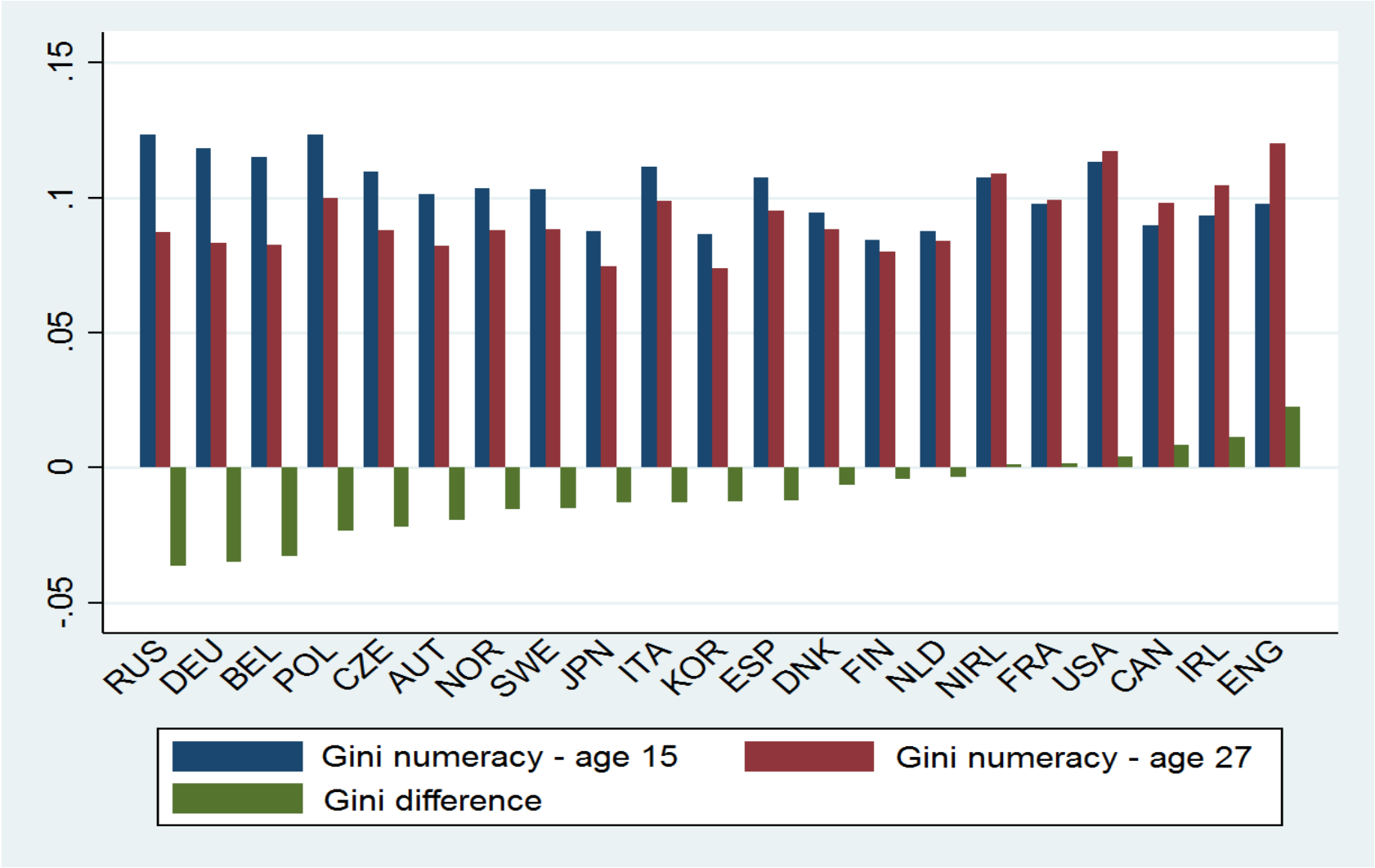
- Inequality of skills opportunity (the social gaps in achievement) is measured by comparing skills achievements of those with graduate parents compared to the those with parents with no more than lower secondary education. We comment here only on relative changes across countries.

- We find that some countries are considerably better than others in mitigating skills inequality between the ages of 15 and 27.

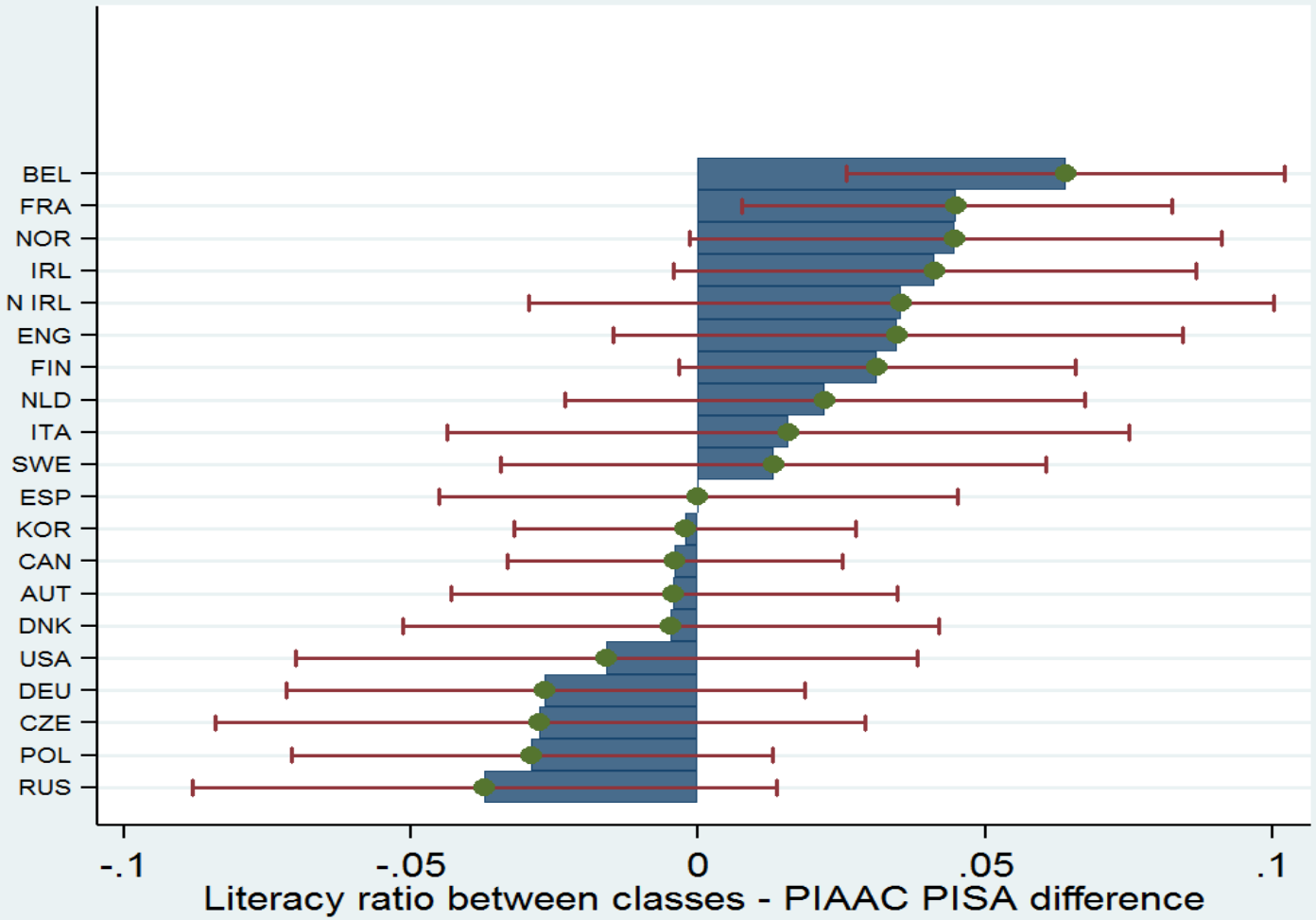
Change in Literacy Skills Ginis between 15 and 27



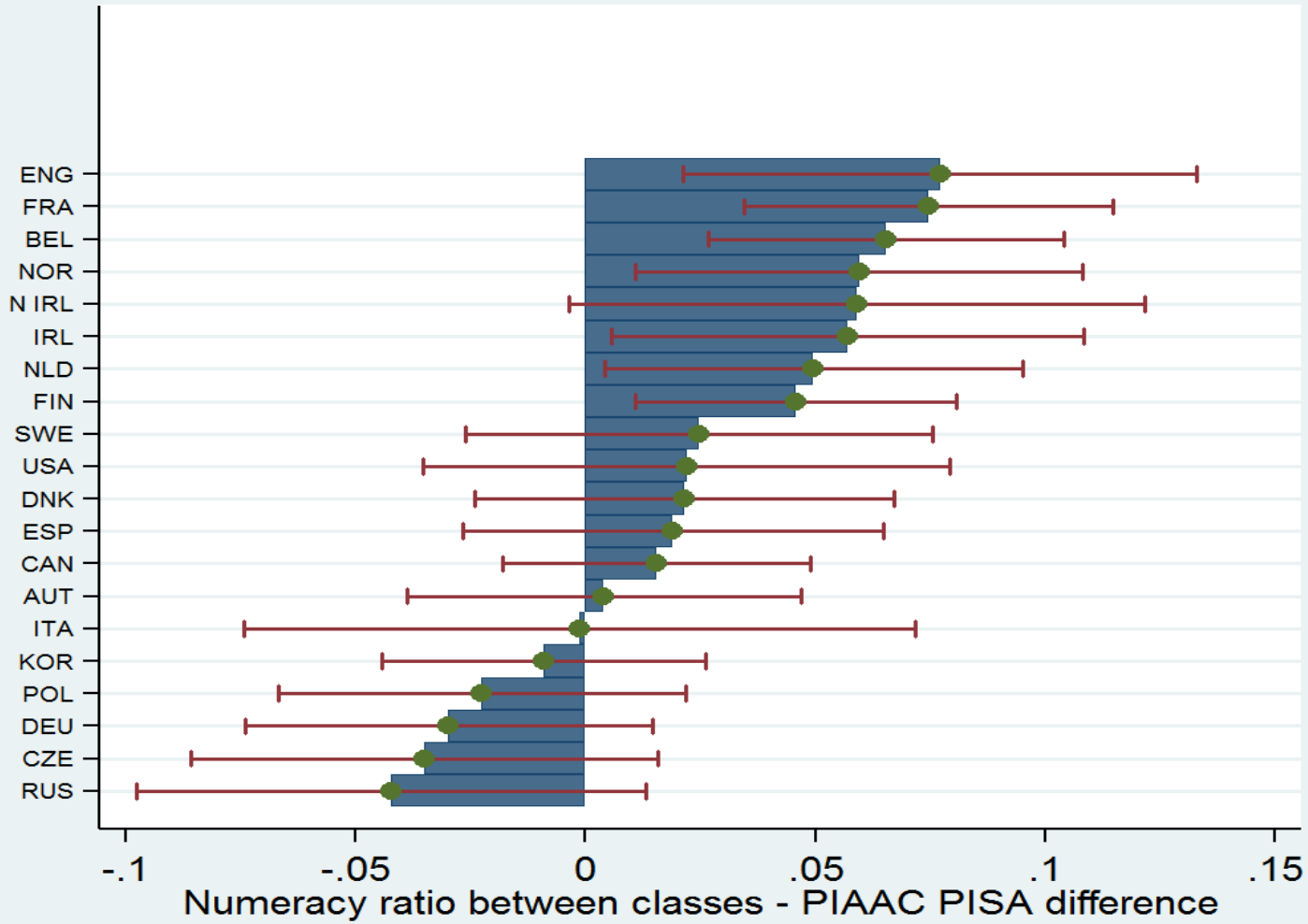
Change in Numeracy Skills Ginis between 15 and 27



Difference in Inequality of Opportunity in Literacy Skills



Differences in Inequality of Opportunity in Numeracy Skills



Difference-in-difference (DID) strategy

- DID consists in comparing the over-time change in inequalities across countries with different characteristics.

$$\gamma = (\bar{i}_{treat,after} - \bar{i}_{treat,before}) - (\bar{i}_{control,after} - \bar{i}_{control,before})$$

- It deals with unobserved time-constant country-level factors.

The Effects of System Types on Inequality of Numeracy and Literacy Outcomes

		Literacy	Numeracy
		DID estimate ($\gamma_1 Y.age27$)	DID estimate ($\gamma_1 Y.age27$)
Model 1 (N: 21)	Education system (Ref.: Differentiated)		
England, Ireland, N. Ireland, Spain	Mixed	0.0103847 *** (0.0050311)	0.0200053 **** (0.0081531)
Germany, Austria	Dual	-0.0173784**** (0.0082183)	-0.0128706** (0.0075919)
Sweden, Norway	Comprehensive (Nordic)	-0.0066884 (0.0062861)	-0.0008654 (0.004107)
US, Canada	Comprehensive(North America	0.0049557 (0.005184)	0.0206856 ***** (0.0044668)

Table 2: Effects of System Types on Inequality of Opportunities in Literacy and Numeracy

		Literacy	Numeracy
		DID estimate ($\gamma_1 Y.age27$)	DID ($\gamma_1 Y.age27$)
Model 1 (N: 21)	Education system (Ref.: Differentiated)		
England, Ireland, N. Ireland, Spain	Mixed	0.0257956 ** (0.0153532)	0.0414056 **** (0.018667)
Germany, Austria	Dual	-0.0174881 * (0.0151912)	-0.0246045 * (0.0197374)
Sweden, Norway	Comprehensive(Nordic)	0.0269098 ** (0.0177136)	0.0303923 ** (0.0200365)
US, Canada	Comprehensive(North America)	-0.0120852 (0.0130983)	0.0070817 (0.0144121)

The Effects of System Types on Inequality of Numeracy and Literacy Outcomes

As predicted in the original hypotheses, HE participation rates (Model 9) have no significant effects on changes in inequalities of skills opportunities or outcomes in either literacy and numeracy.

The DID regressions show that compared with the Type 1 systems, Type 2 systems do not have a consistently different effect on skills inequality.

- Type 2a systems show for both domains a non-significant negative effect on inequality of skills outcomes but a significant positive ($p < 0.2$) effect on inequality of skills opportunities.
- Type 2b systems show a positive effect on inequality of outcomes (which is only significant for numeracy – at the $p<0.05$ level) and no significant effects on inequalities of skills opportunities.

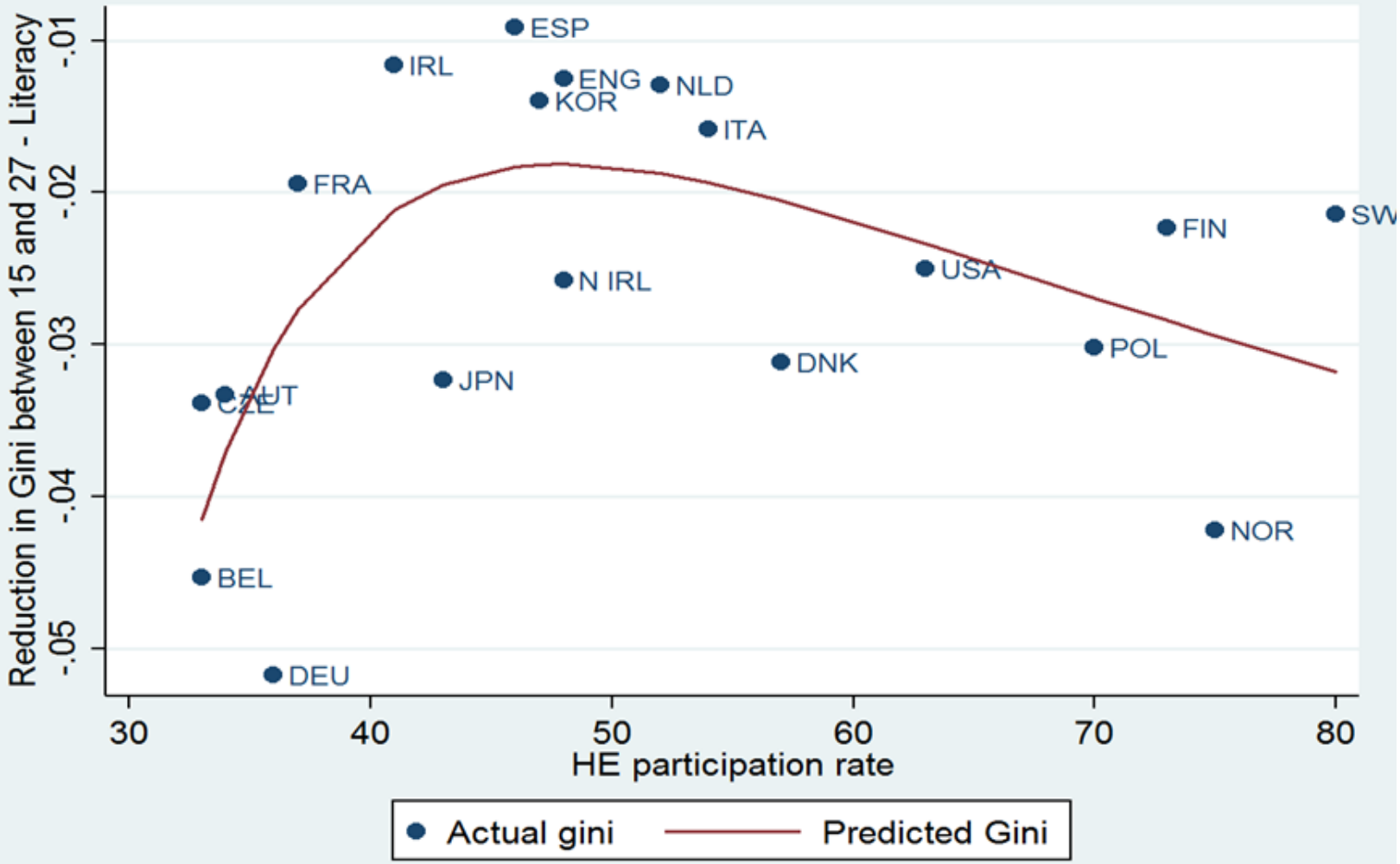
The Effects of System Types on Inequality of Numeracy and Literacy Outcomes

However, Type 3 and Type 4 systems do differ significantly from the reference case.

- Type 3 systems have significant negative effects on inequality of outcomes in literacy ($p < 0.05$) and numeracy ($p < 0.1$). They also have negative effects on inequalities of opportunity for numeracy and literacy skills, but only at the $p < 0.3$ level.

- Type 4 systems have significant positive effects on inequality of outcomes in both literacy ($p < 0.1$) and numeracy ($p < 0.05$) and on inequality of skills opportunities in both literacy and numeracy (at the $p < 0.05$ level).

HE Participation Rates and Literacy Skills Mitigation



The Effects of System Characteristics on Inequality of Numeracy and Literacy Outcomes

Model 2 (N: 18)	Vocational prevalence	-0.0385963 *** (0.0185493)	-0.0122034 (0.0314484)
Model 3 (N: 20)	ISCED3 completion	-0.0486412 **** (0.0215021)	-0.0722444 *** (0.0382777)
Model 4 (N: 17)	Social mix vocational track	-.0003294 * (0.0002874)	-0.0002594 (0.0002596)
Model 5 (N: 19)	ISCED3 social gradient	0.0024947 ** (0.0017545)	0.003043 *** (0.0014741)
Model 6 (N: 20)	Math and language (0: ref cat)		
	1	-0.0050595 (0.0088002)	-0.0234435 **** (0.0089809)
	2	-0.0124188 **** (0.0052845)	-0.0262719 ***** (0.0062045)
Model 7 (N: 21)	No Math	-0.0025277 ** (0.0016167)	-0.0047466 **** (0.0021075)
Model 8 (N: 21)	Youth unemployment (15-24, 2004)	-0.009342 (0.025895)	-0.0553222 ***** (0.0267629)
Model 9 (N: 20)	HE enrollment rate	0.0097084 (0.0192125)	0.0109703 (0.0206711)

***** p < 0.01, **** p<0.05, *** p<0.1, ** p < 0.2, * p < 0.3

Effects of System Characteristics on Inequality of Opportunities in Literacy and Numeracy

Model 2 (N: 17)	Vocational prevalence	0.0478344 (0.0561742)	0.0408097 (0.0778425)
Model 3 (N: 19)	ISCED3 completion	-0.1168168 ** (0.0495715)	-0.1763447 *** (0.0894423)
Model 4 (N: 16)	Social mix vocational track	0.0002567 (0.0007144)	0.0001697 (0.0009159)
Model 5 (N: 18)	ISCED3 social gradient	0.003513 * (0.0031732)	0.0056699 ** (0.0040376)
	Math and Language (0: ref. category)		
Model 6 (N: 20)	Mandatory in 1 core subject	-0.0043835 (0.01339)	-0.0122578 (0.0129844)
	Both core subjects mandatory	-0.0406949 ***** (0.0088289)	-0.0600176 ***** (0.011541)
Model 7 (N: 21)	No Math	-0.0087195 **** (0.0036245)	-0.0141271 ***** (0.0042384)
Model 8 (N: 21)	Youth unemployment (15-24, 2004)	-0.048641 (0.0982997)	-0.0928815 (0.0993261)
Model 9 (N: 20)	HE enrollment rate	0.0031892 (0.0520461)	0.0192176 (0.0590414)
***** p < 0.01, **** p<0.05, *** p<0.1, ** p < 0.2, * p < 0.3			

What Are the Upper Secondary Education and Training System Characteristics Associated with Mitigation of Skills Inequality?

DID Results

As the DID regressions in Tables 1 and 2 show, we find significant relationships between seven variables and changes in inequality of outcomes in either literacy or numeracy, but only four of these with both skills domains.

Four variables are significantly associated with changes in skills opportunities for both literacy and numeracy. The indicators for parity of esteem generally have weaker effects than the indicators for standardisation of curricula. We start with the latter.

Effects of Standardisation of Curricula

The strongest effects we find on the mitigation of skills inequalities come from variables for the prevalence of Maths and national language learning and completion rates for full upper secondary education.

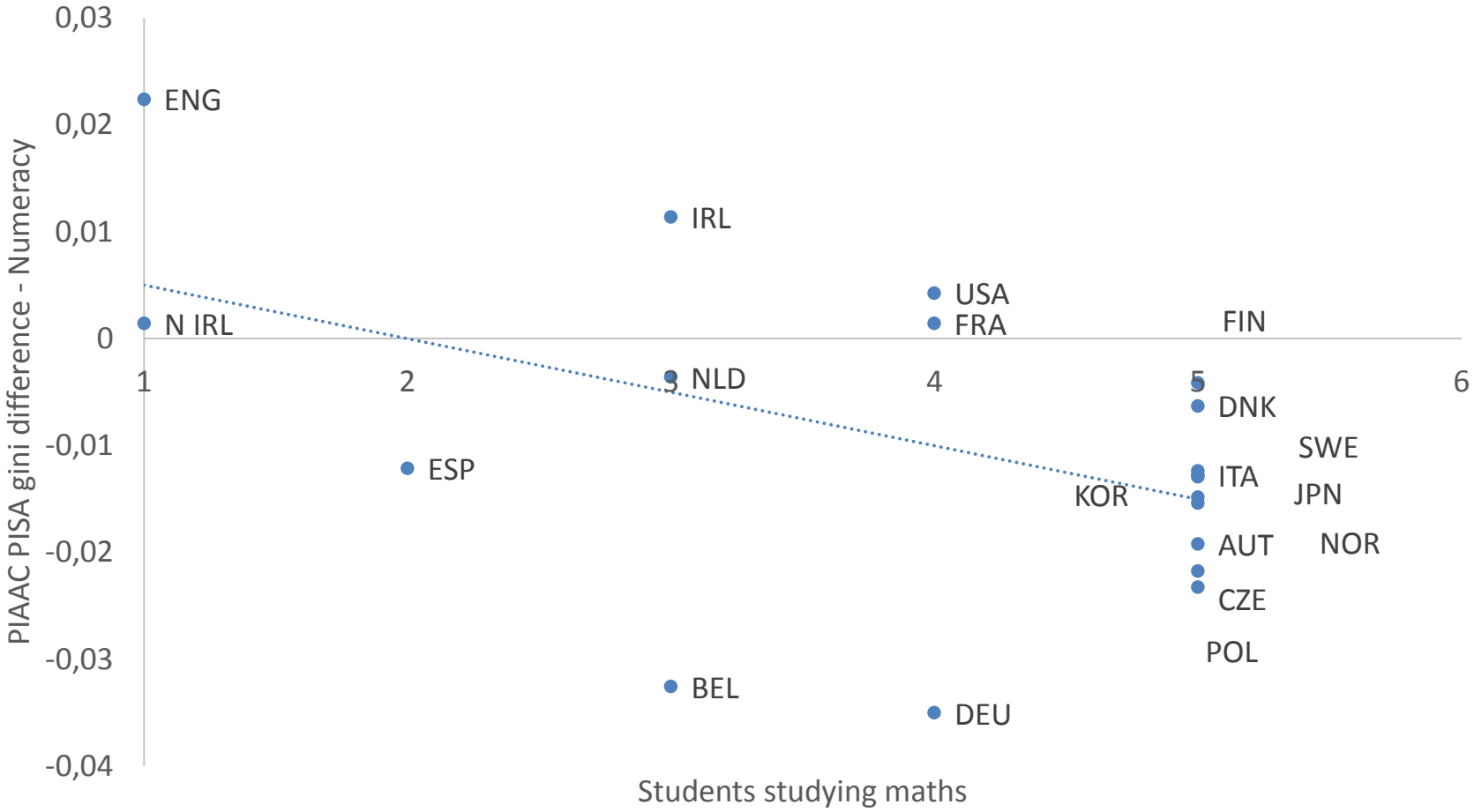
- Mandatory provision of both Maths and national language has a highly significant negative effect on inequality of skills outcomes in both literacy ($p<0.05$) and numeracy ($p < 0.01$).

- It also has a highly significant negative effect on inequalities of skills opportunities for both literacy ($p < 0.01$) and numeracy ($p < 0.01$).

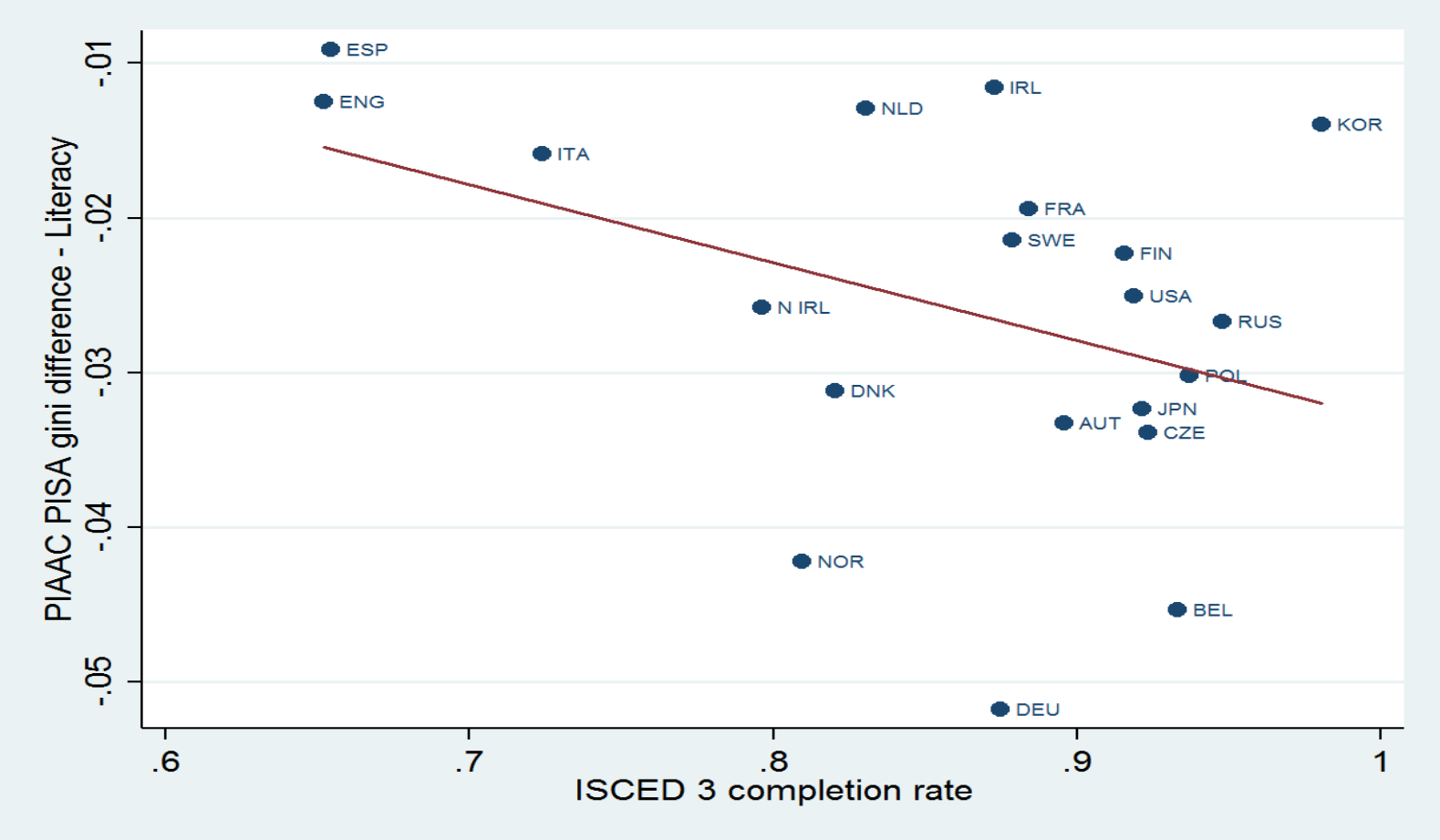
- Prevalence of Maths learning (see Figure 7) also has highly significant negative effects on inequality of skills outcomes in literacy and numeracy (both at the $p < 0.01$ level) and on inequalities of skills opportunities in both domains (both at the $p < 0.01$ level).

- Completion of full upper secondary education has significant negative effects on inequalities in skills outcomes both in literacy ($p < 0.05$) (see Figure 8) and numeracy ($p < 0.1$) and on inequalities of skills opportunities both in literacy ($p < 0.1$) and numeracy ($p < 0.1$).

Prevalence of Maths Study and Mitigation of Inequality in Numeracy



ISCED 3 Completion and Mitigation of Inequality in Literacy Skills



Effects of Parity of Esteem

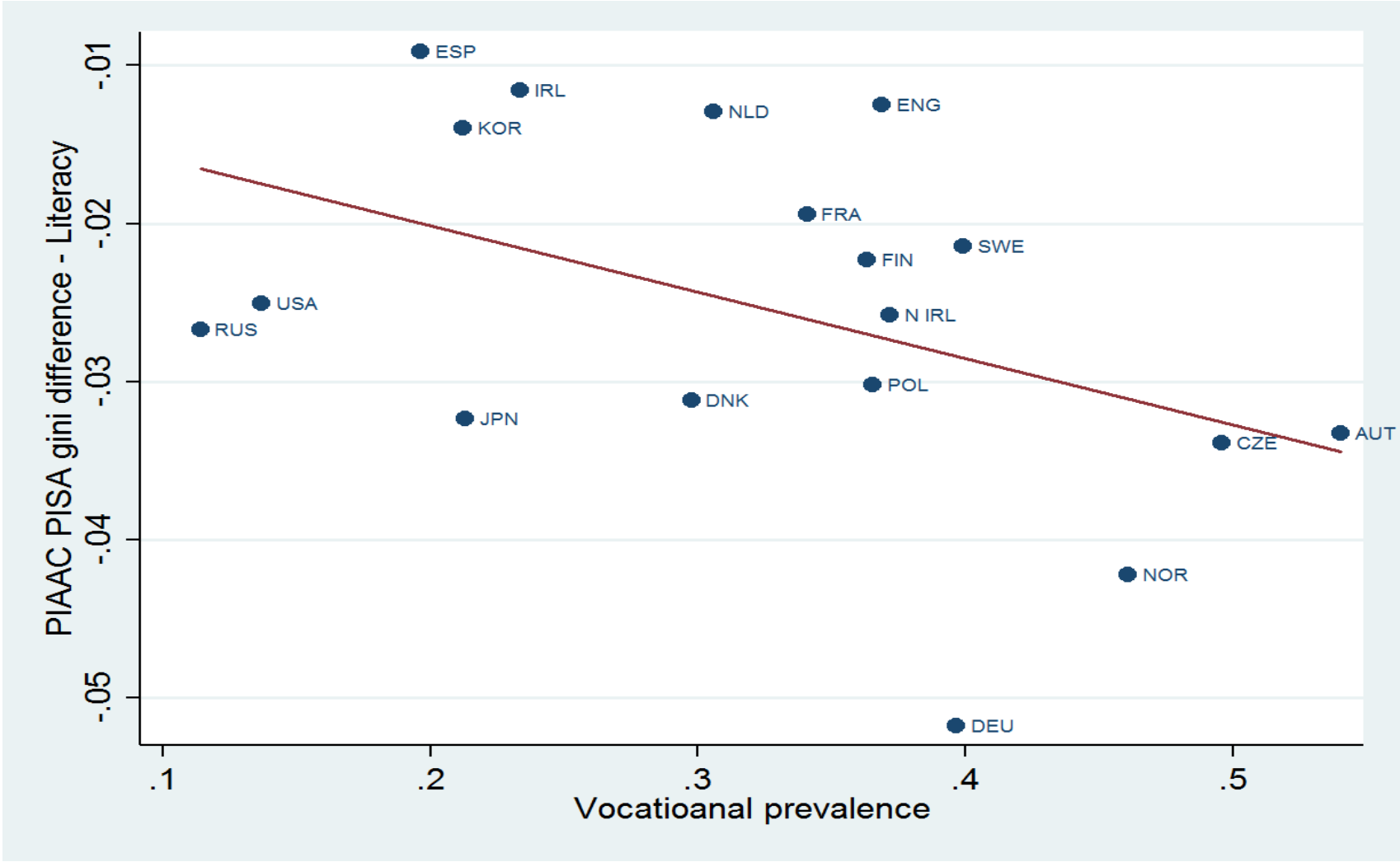
Our second hypothesis was that greater parity of esteem between the vocational and academic tracks would be likely to mitigate inequalities of skills. Our analysis only partially confirms the hypothesis.

- *Vocational prevalence* is positively associated with inequality mitigation of literacy skills outcomes ($p < 0.1$, Model 2). Countries where the proportion of students in vocational supper secondary programmes is higher tend to see greater mitigation in inequality of literacy skills outcomes, as, for instance, in Austria, Germany and Norway.

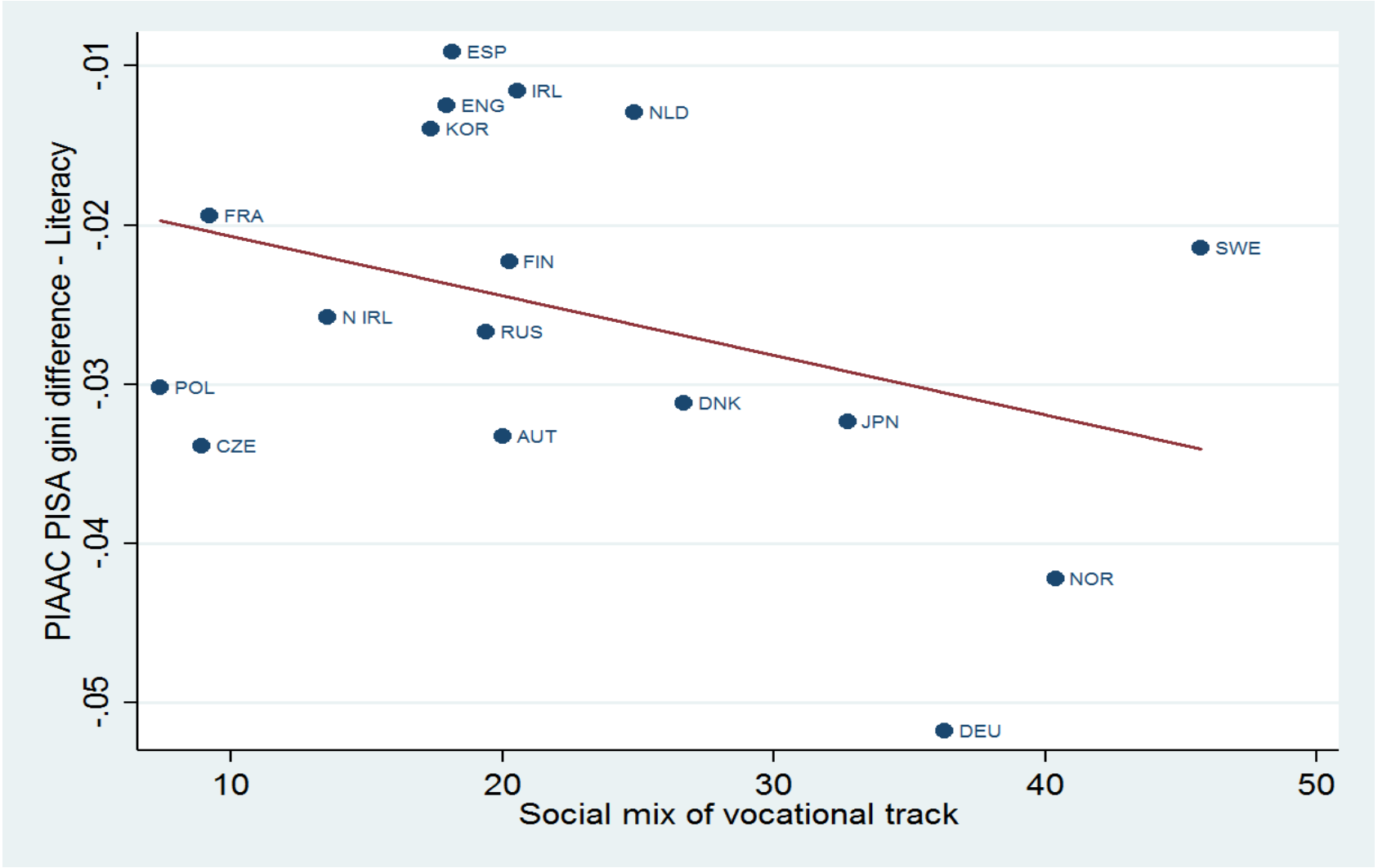
- The *social mix* of vocational programmes is also positively associated with mitigation of inequality of skills outcomes in literacy. Countries where vocational tracks are more prone to include children of graduate parents, such as Germany, Japan and the Scandinavian countries (except Sweden), do tend to show greater inequality mitigation in literacy skills whereas Anglophone countries, with less social mixing, tend to mitigate inequalities less.

- However, neither of these variables have significant effects on mitigating inequality of numeracy skills outcomes or inequality of opportunities for skills.

Vocational Prevalence and Changes in Inequality of Literacy Skills



The Social Mix of Vocational Programmes



Conclusions

- Countries vary considerably in how far they mitigate skills inequality during the life course between 15 and 27.

- This seems to have little to do with rates of unemployment and HE participation rates. Upper secondary education and training systems seem most responsible for changes in skills inequality.

- The system characteristics most associated with inequality mitigation are:
  - High rates of completion at the full ISCED Level 3;
  - Mandatory maths and national language learning on all programs;
  - Relative parity of esteem between vocational and academic programs

- Countries with Dual Systems (Austria and Germany) which combine all of these appear best at mitigating skills inequality.

- Central and eastern European countries with high level 3 completion and mandatory core learning also seem relatively successful, whatever their other systems characteristics.

- Countries with mixed systems with low level 3 completion, diverse program lengths and without mandatory maths and language learning are least successful.

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Relevant Publications:

Green, A. and Pensiero, N. (2016, accepted, forthcoming) 'The Effects of Upper Secondary Education and Training Systems on Skills Inequality. A Quasi-Cohort Analysis using PISA 2000 and the OECD Survey of Adult Skills.' ***British Education Research Journal***.

Green, A, Green, F. and Pensiero, N (2015) Cross-Country Variation in Adult Skills Inequality: Why are Skill Levels and Opportunities so Unequal in Anglophone Countries? **Comparative Education Review,** 59, 4 **(**featured article).

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