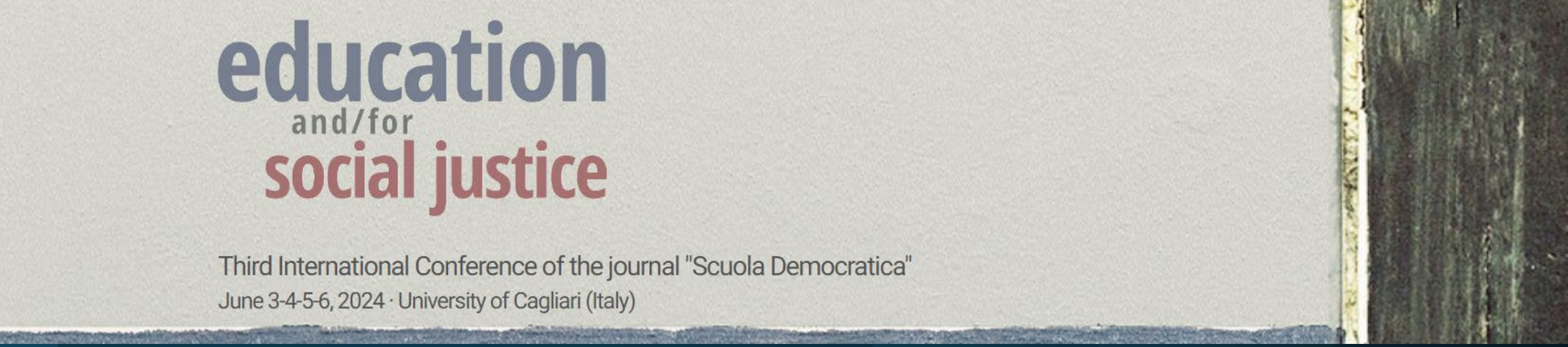

School Segregation And Compositional Effects

On Reading And Mathematics Performance Of Primary School Students In Europe

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School Segregation and Compositional Effects

On Reading And Mathematics Performance Of Primary School Students In Europe

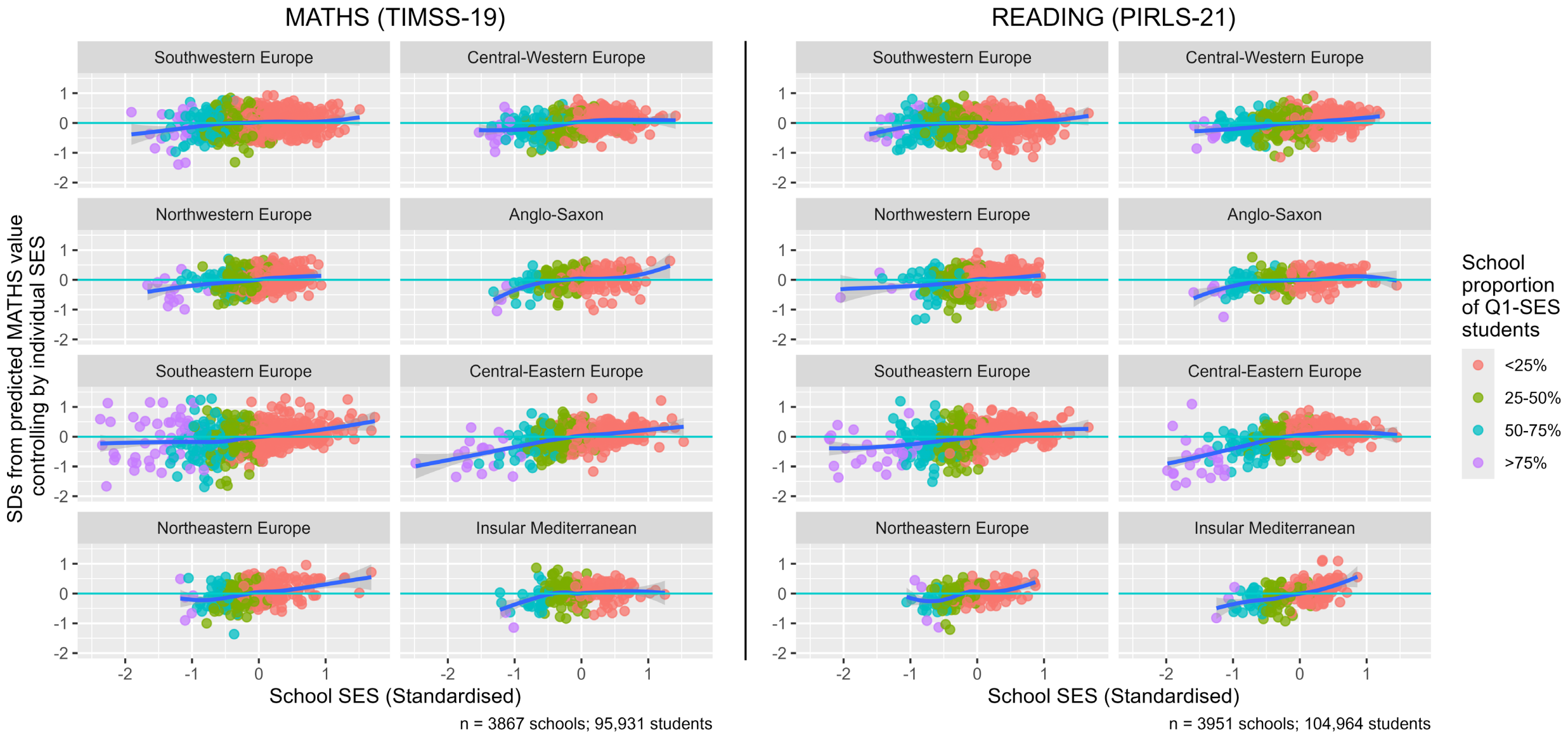
- **Objectives**

- **1)** to test the variability of SES Compositional Effects between national contexts, and…
- **2)** to what extend it is related to school segregation levels affecting lower-SES students.
- **3)** to explore if lower-SES students or some levels of performance are more sensitive to compositional effects (differential compositional effects)

- **Data & Methods**

- **96,860 students** in **3869** schools (TIMSS-2019), **106,278 students** in **3959 schools** (PIRLS-2021)
- **27 European countries** with valid cases for the IEA's SES variable
- **MLM's** to identify socioeconomic compositional (SEC) effects in **MATHS and READING** by country
- Multigroup MLM's to test for differential SEC effects between SES quintiles
- Multilevel Binomial Models for assessing non-linearities in SEC effects across levels of performance.

Student-SES residuals of Performance by *School-SES*



SW: Italy, Portugal, Spain; **CW**: Austria, Belgium (Fl.), France, Germany; **NW**: Denmark, Finland, Norway, Sweden; **AS**: Ireland, Northern Ireland;
SE: Albania, Bulgaria, Croatia, Montenegro, North Macedonia, Serbia; **CE**: Czech Republic, Hungary, Poland, Slovak Republic; **NE**: Latvia, Lithuania; **IM**: Cyprus, Malta

Compositional Effects in Europe

$$Y_{ij} = \beta_{0j} + \beta_1(SES_{ij} - \overline{SES_j}) + \beta_2(\overline{SES_j}) + r_{ij}$$
$$\beta_{0j} = \gamma_{00} + u_{0j}$$

→ STUDENT SES (School-Mean Centered)

→ SCHOOL MEAN SES

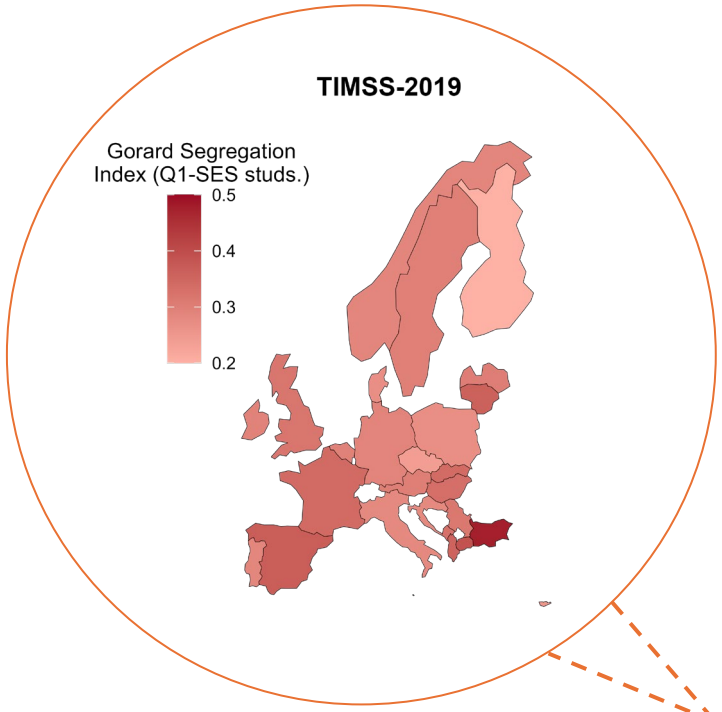
$$\textit{COMPOSITIONAL EFFECT} = \beta_2(\overline{SES_j}) - \beta_1(SES_{ij} - \overline{SES_j})$$

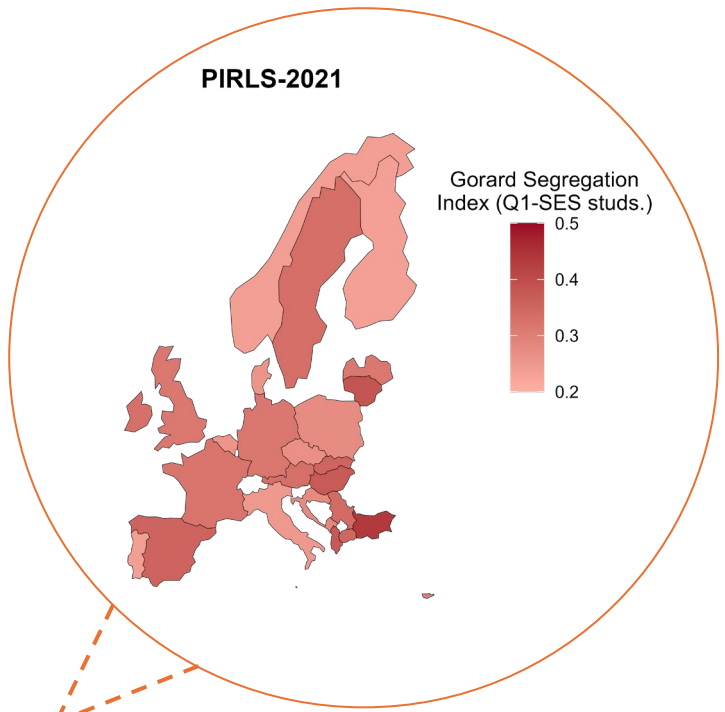
	MATHS (μ = 500, σ = 100)		READING (μ = 500, σ = 100)	
	Model 1		Model 1	
	β	*Std.β*	*β*	*Std.β*
Intercept	501.9*	0.019	499.5*	-0.005
Student SES (ctred.)	37.7*	0.298*	35.9*	0.291*
School SES	66.2*	0.331*	66.3*	0.323*
Compositional Effect	**28.5**		**30.4**	
β School SES - β Stu. SES				
ICC	0.28		0.28	
% Between-School Variance Explained	40.2%		38.8%	
Num.Obs.	96860		106278	
* p < 0.001				

	WESTERN EUROPE	
	MATHS	***READING***
	β	*β*
Intercept	509.4*	504.6*
Student SES (ctred.)	35.8*	35.2*
School SES	61.5*	57.6*
Compositional Effect	**25.7**	**22.4**
ICC	0.239	0.213
% Sch. Var. Explained	39.8%	37.8%
Num.Obs.	45168	57347
* p < 0.001		

	EASTERN EUROPE	
	MATHS	***READING***
	β	*β*
Intercept	493.7*	493.2*
Student SES (ctred.)	39.7*	36.9*
School SES	68.8*	74.1*
Compositional Effect	**29.1**	**35.1**
ICC	0.309	0.343
% Sch. Var. Explained	41.4%	40.5%
Num.Obs.	51692	48931
* p < 0.001		

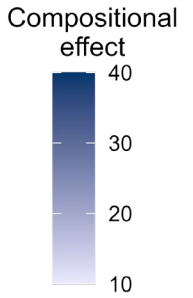
School segregation and Compositional effects in Europe

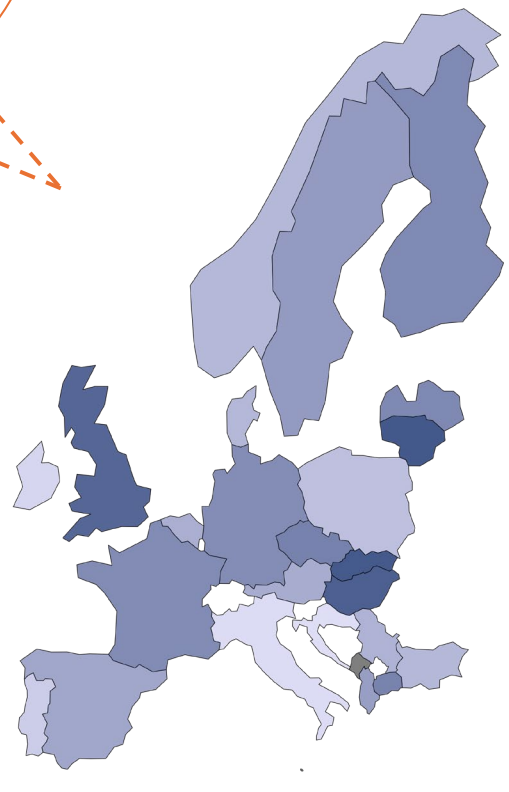


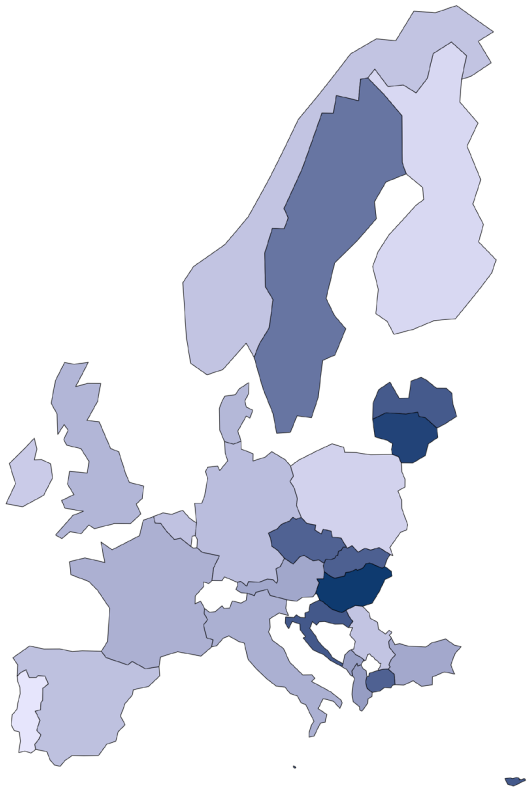


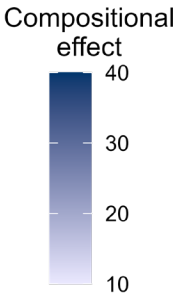
MATHS (TIMSS-2019)

READING (PIRLS-2021)

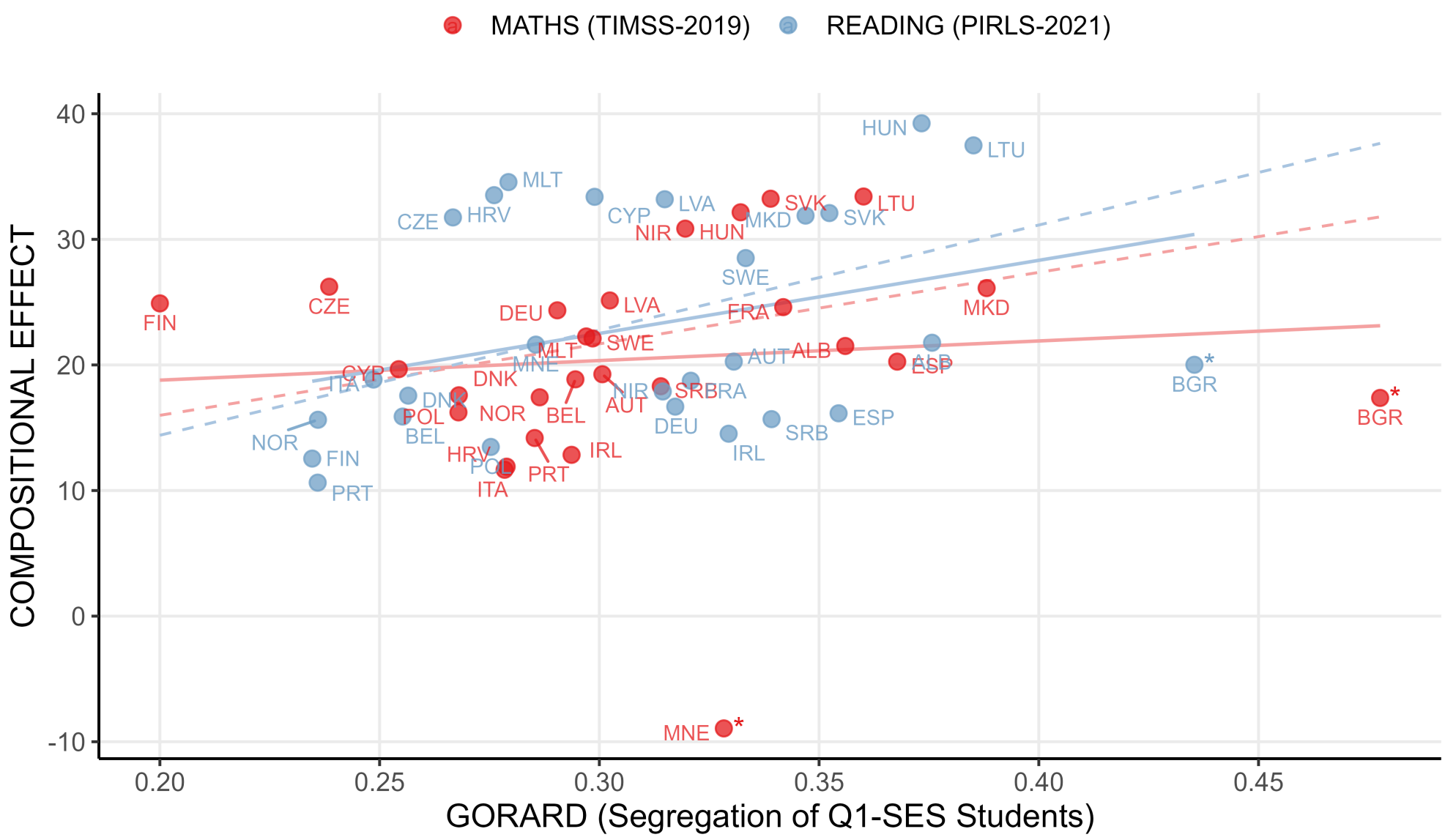








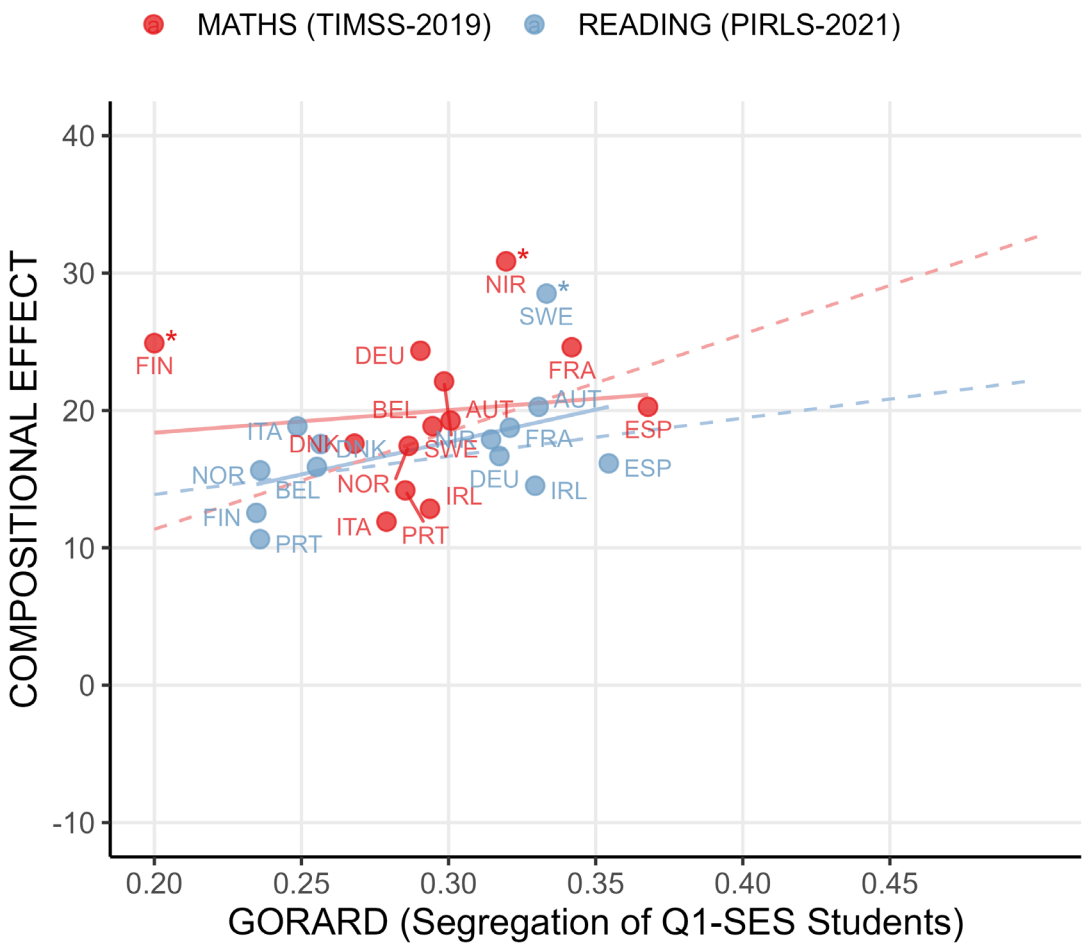
Compositional effect and segregation of Q1-SES students by country



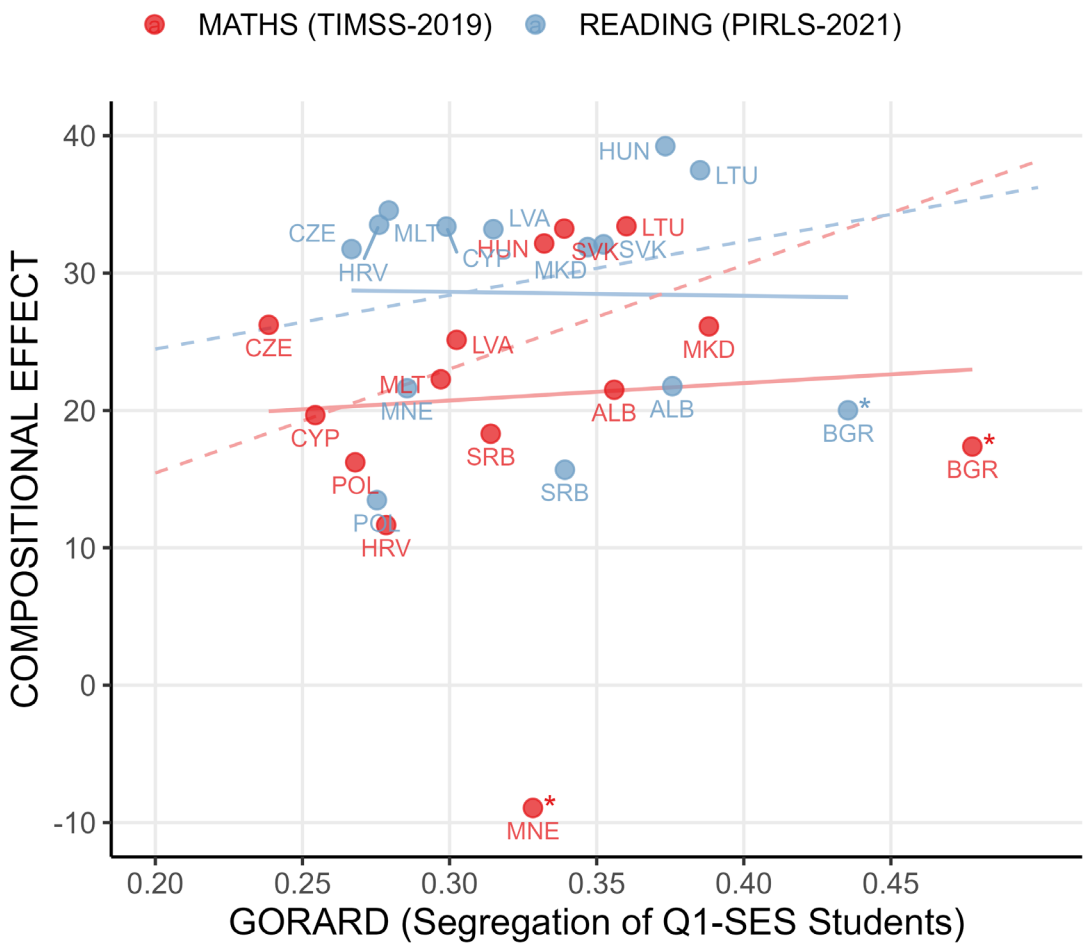
* Dashed lines indicate the fit lines excluding the countries marked with an asterisk (*)

Compositional effect and segregation of Q1-SES students by area

WESTERN EUROPE



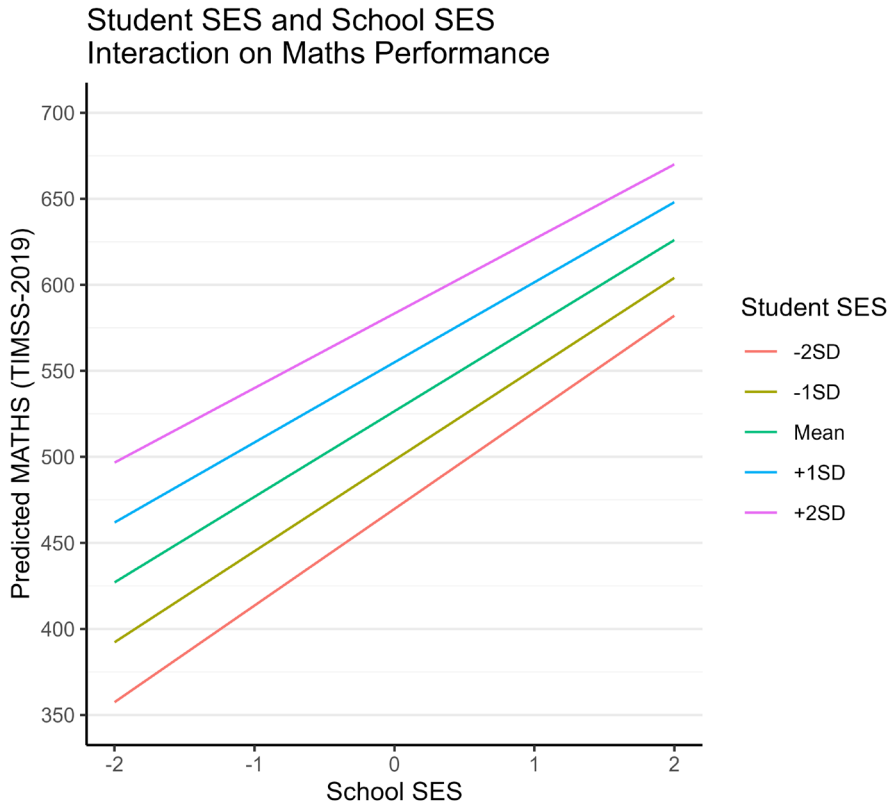
EASTERN EUROPE



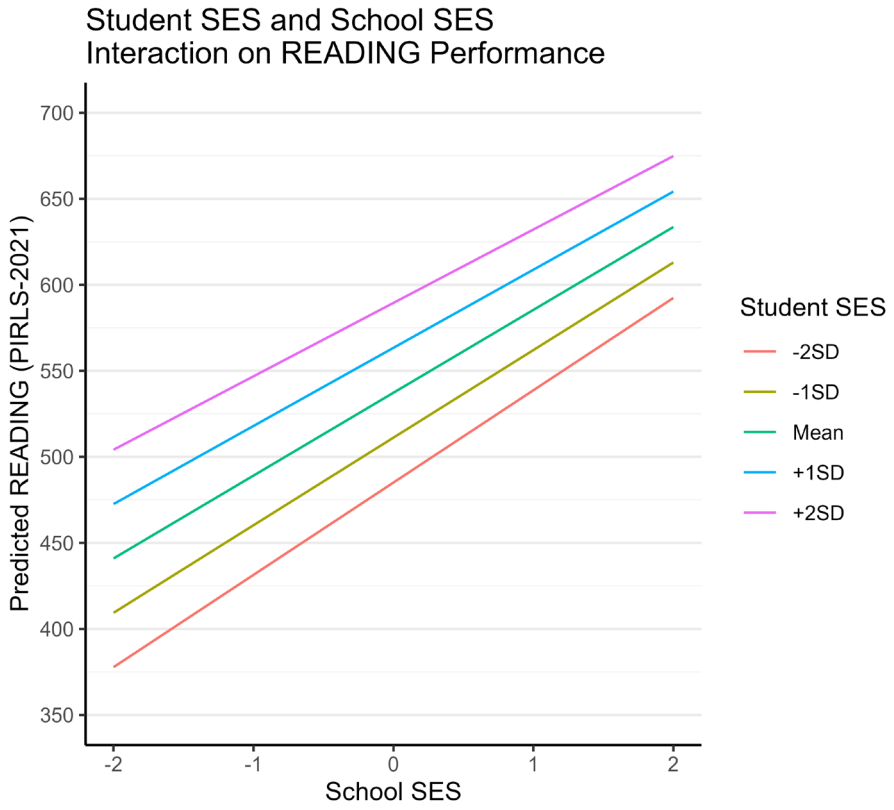
* Dashed lines indicate the fit lines excluding the countries marked with an asterisk (*)

Differential Compositional Effects

Student-SES x School-SES Cross-Level Interaction on Achievement

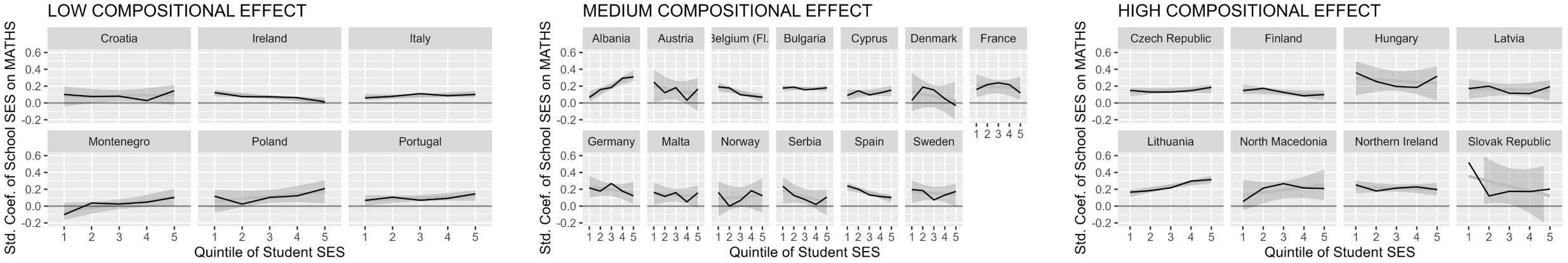


	MATHS	
	β	*Std.β*
(Intercept)	501.9*	0.019
Student SES (ctred.)	37.8*	0.299*
School SES	66.2*	0.331*
Stu. SES x School SES	**-4.3***	-0.017*
Num.Obs.	96860	

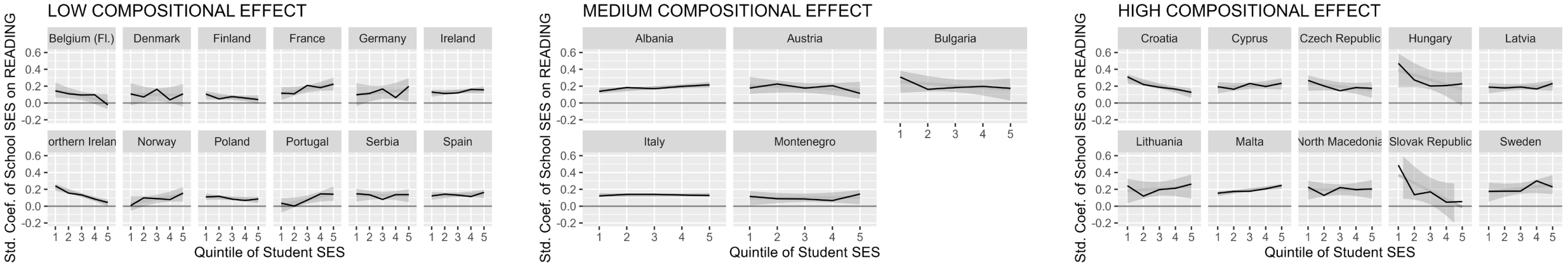


	READING	
	β	*Std.β*
(Intercept)	499.5*	-0.005
Student SES (ctred.)	35.9*	0.291*
School SES	66.3*	0.323*
Stu. SES x School SES	**-3.8***	-0.015*
Num.Obs.	106278	

MATHS DIFFERENTIAL COMPOSITIONAL EFFECTS BY COUNTRY



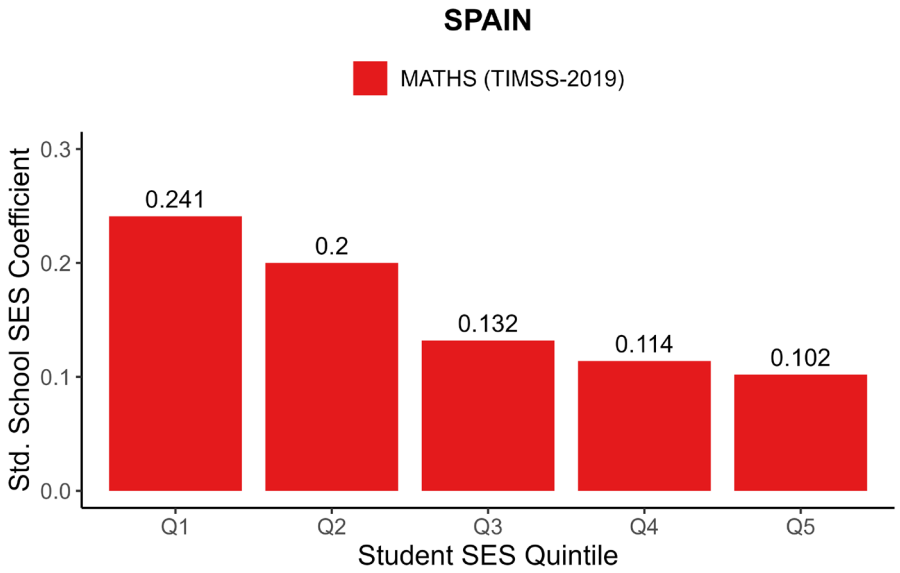
READING DIFFERENTIAL COMPOSITIONAL EFFECTS BY COUNTRY

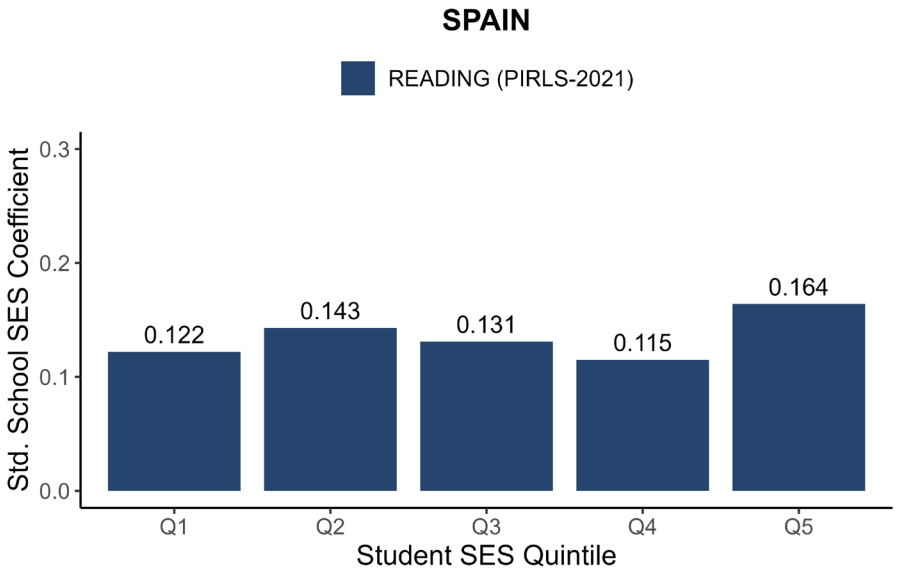


A closer look at *Differential Compositional Effects*. **SPAIN.**

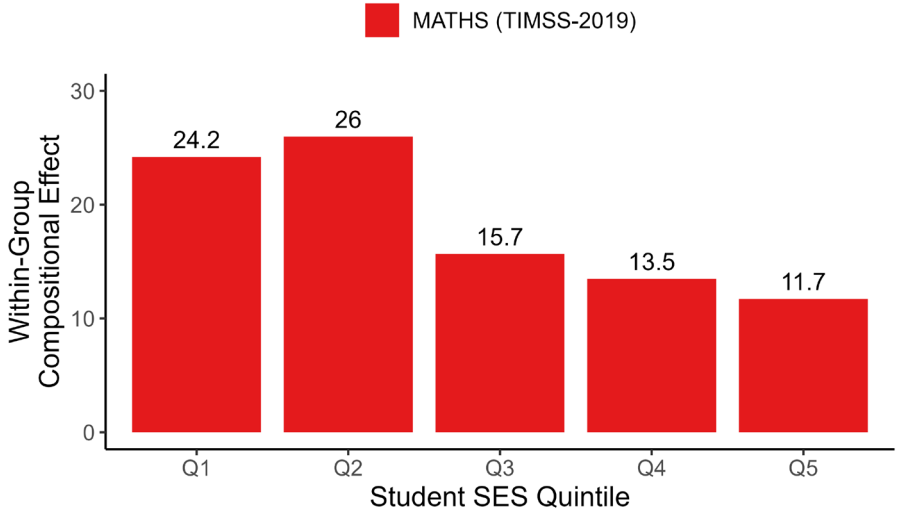
Multi-Group Multilevel Model

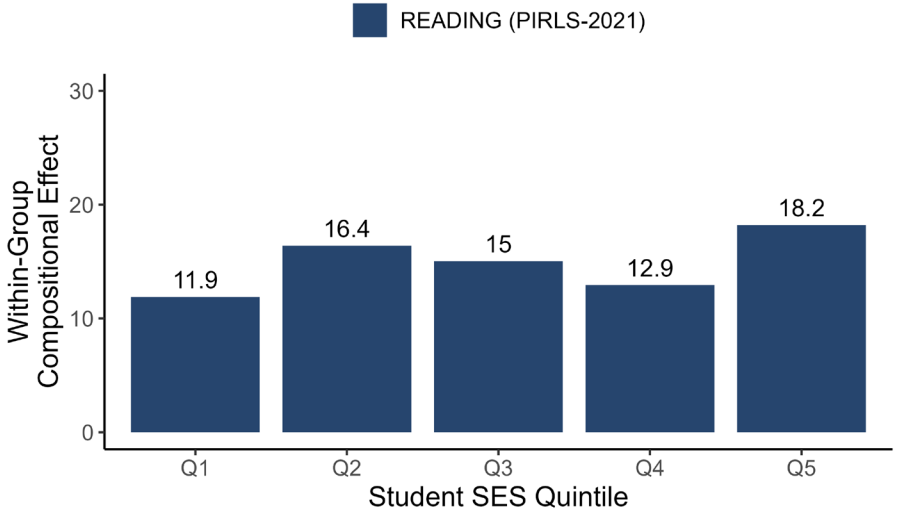
Std. School SES Coefficient by group





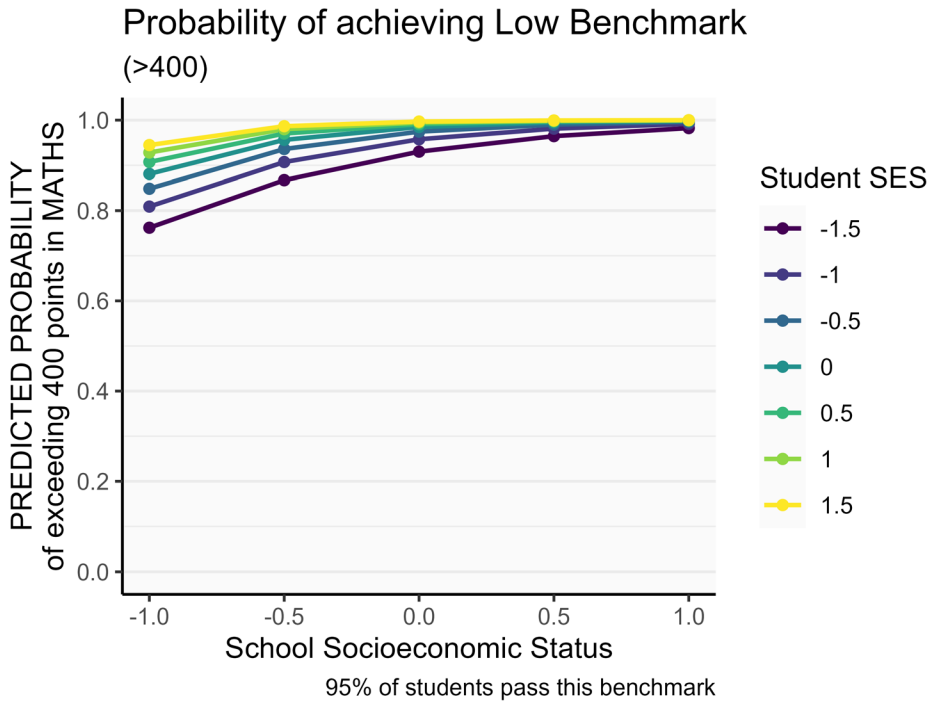
Within-Group compositional effect

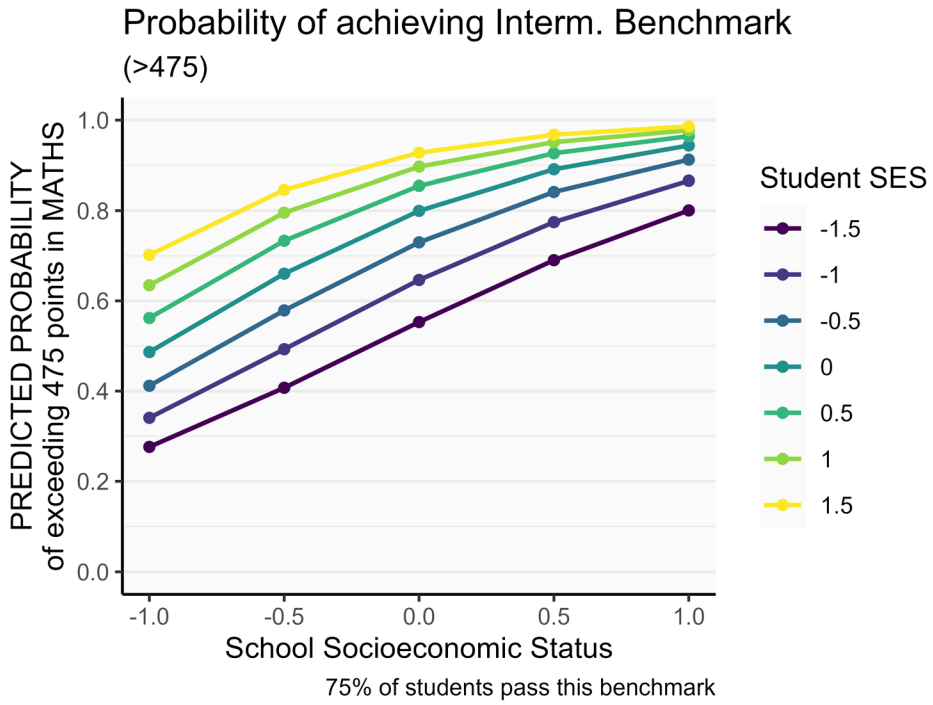


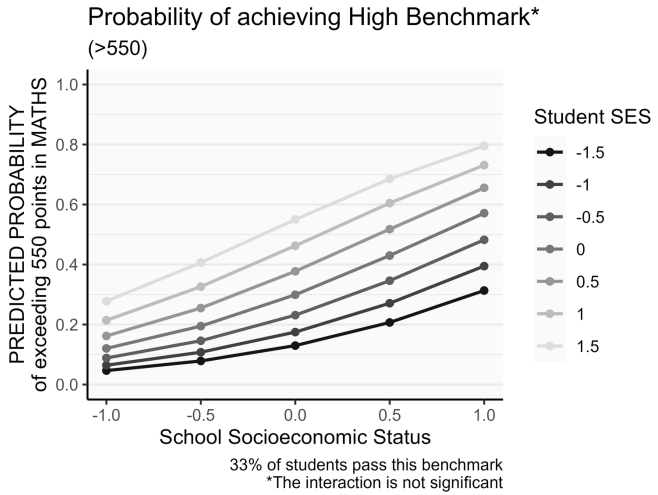


Differential Compositional Effects. **Spain**

Testing non-linear effects (Multilevel Logistic Regressions, **MATHS** benchmarks).



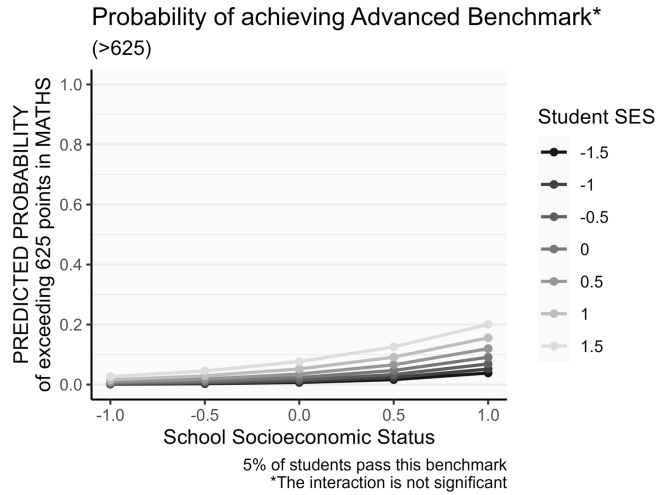




-The risk of not-achieving basic skills for lower-SES students descends faster than for higher SES students along School-SES levels.

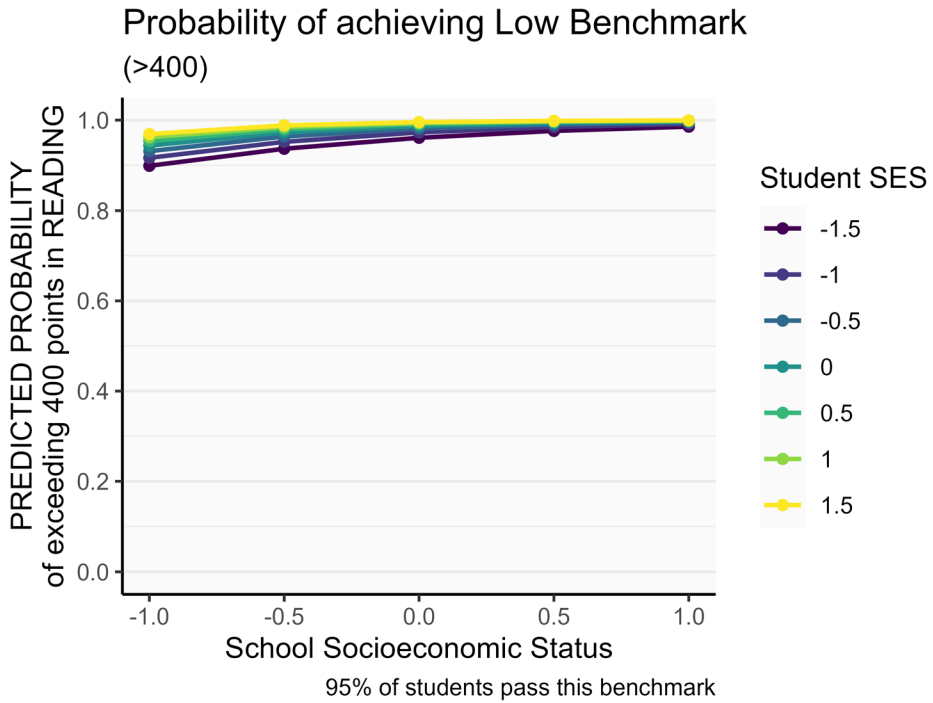
-The probability of achieving intermediate skills for lower-SES students increases faster as school-SES increases.

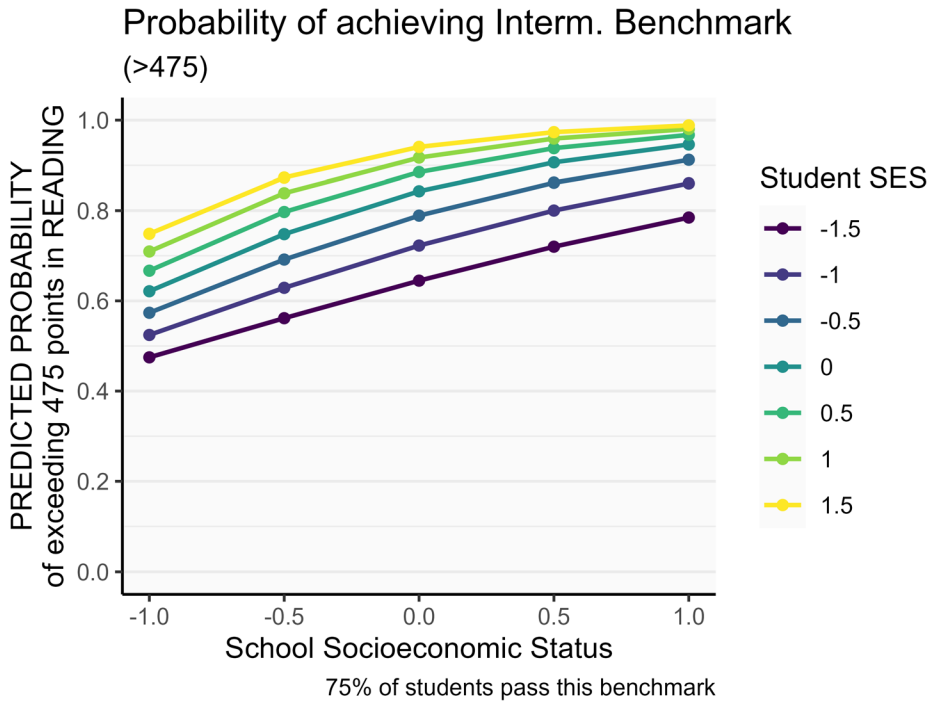
-This interaction was non-significant for the two highest benchmarks.

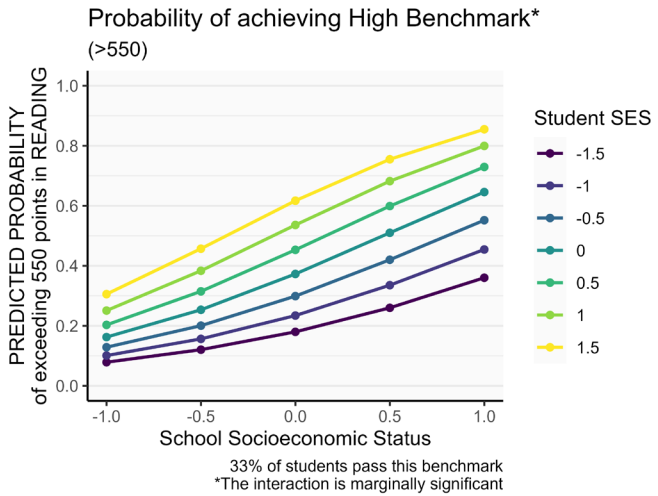


Differential Compositional Effects. **Spain**

Testing non-linear effects (Multilevel Logistic Regressions, **READING** benchmarks).



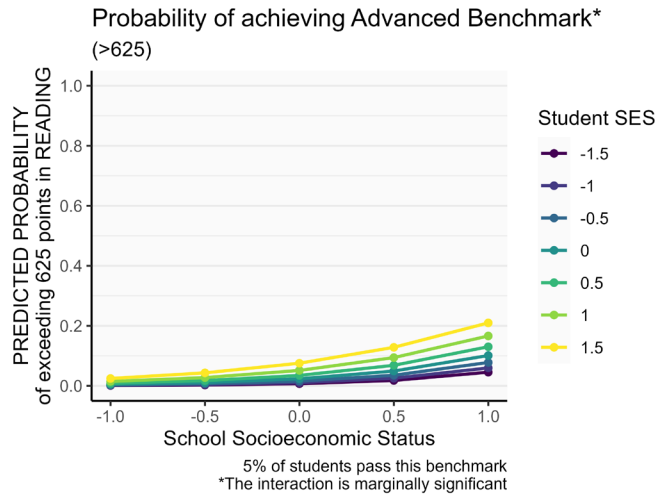




-In Reading, more students pass the first two benchmarks, so the estimated diff. comp. effect 'compresses' in the lowest levels of school SES, compared to Maths.

-The probability of achieving intermediate skills for lower-SES students shows an almost linear change along school-SES levels.

-Marginally significant interactions for the 2 highest benchmarks.



Conclusion

- **Socioeconomic compositional (SEC) effects** vary across European countries:

- Both Reading and Maths SEC effects are higher in Eastern Europe, especially Reading SEC.
- In Western Europe, Maths SEC effects are slightly higher than those of Reading.

- **Compositional effects** slightly tend to increase with **school segregation**, both in Maths and Reading.

- Evidence of **differential SEC effects**:

-According to the **level of SES**

→ A small but significant higher sensitivity of low-SES students to school context, varying by country.

→ In the case of Spain, we found this effect in maths, but not in reading.

-According to the **level of achievement:**

→The growth in the probability of acquiring basic skills across school SES levels is higher for lower-SES students.

→ The growth in the probability of acquiring intermediate skills for lower-SES students becomes higher than for higher-SES students from average-SES schools onwards.

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APPENDIX

Compositional Effects in Europe

$$\textit{COMPOSITIONAL EFFECT} = \beta_2(\overline{SES}_j) - \beta_1(SES_{ij} - \overline{SES}_j)$$

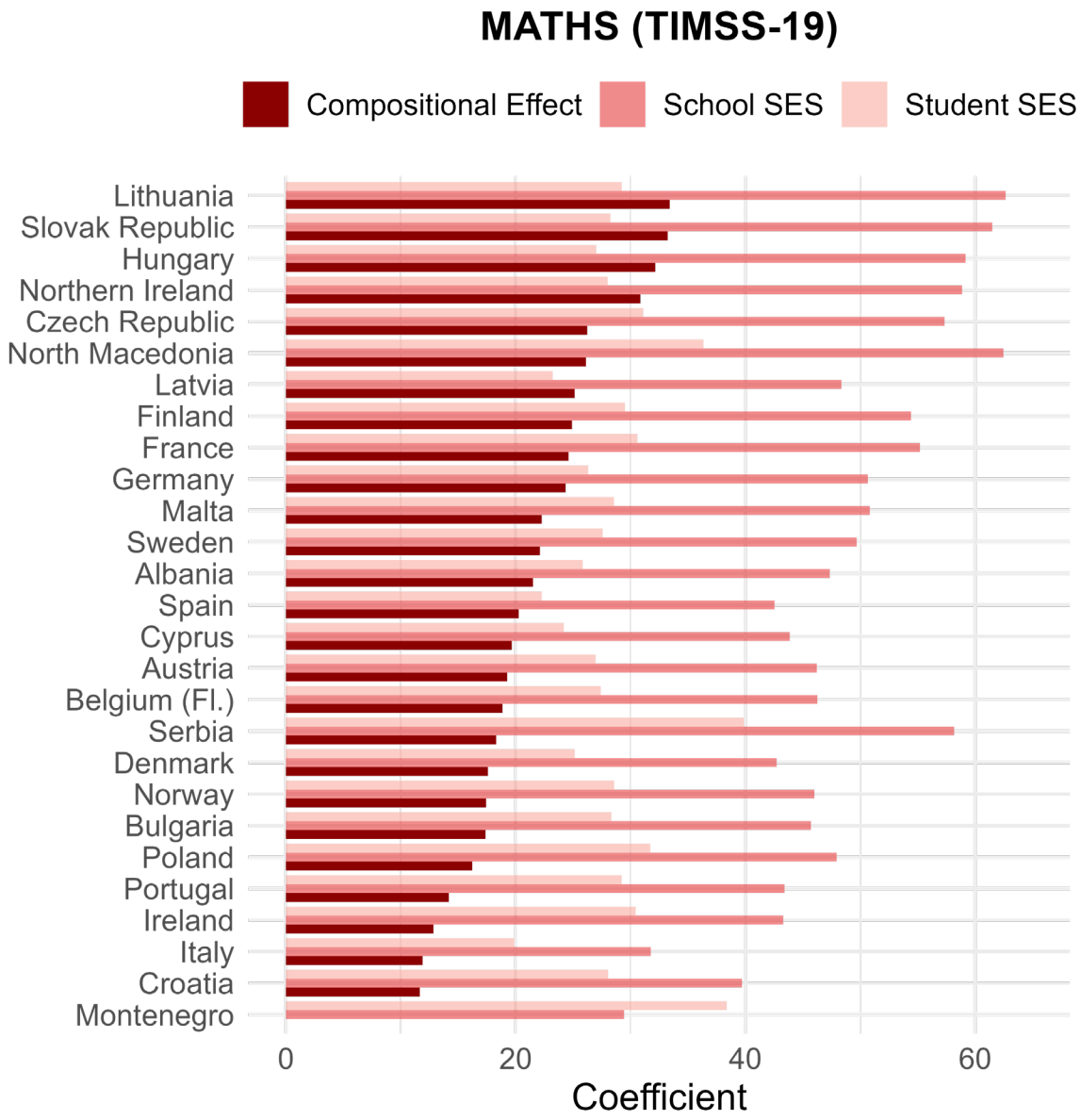
MATHS

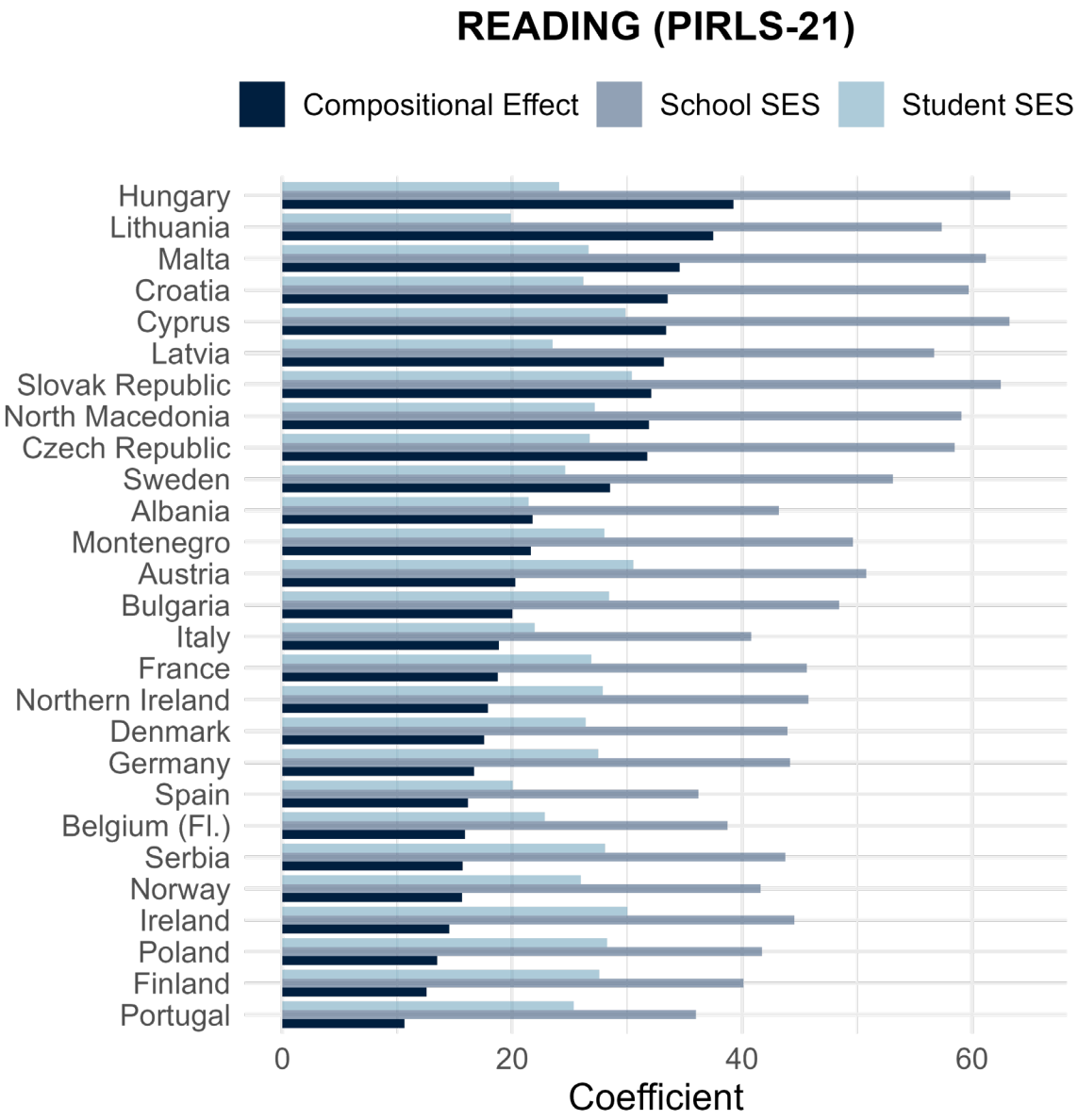
	Southwestern Europe	Central-Western Europe	Northwestern Europe	Anglo-Saxon	Southeastern Europe	Central-Eastern Europe	Northeastern Europe	Insular Mediterranean
(Intercept)	493.417	502.767	522.250	554.698	470.328	503.745	531.39	502.873
Student SES (ctred.)	31.593	37.361	37.479	39.614	43.417	39.175	33.79	34.368
School SES	55.241	67.512	66.041	67.881	62.115	75.864	74.46	62.219
Compositional Effect	**23.65**	**30.15**	**28.56**	**28.27**	**18.70**	**36.69**	**40.67**	**27.85**
ICC	*0.207*	*0.266*	*0.141*	*0.204*	*0.323*	*0.250*	*0.23*	*0.154*
R2 Marg.	0.183	0.241	0.177	0.219	0.196	0.262	0.19	0.154
R2 Cond.	0.288	0.385	0.246	0.321	0.402	0.349	0.29	0.234
Num.Obs.	15600	13299	10522	5747	22522	16268	6713.00	6189

READING

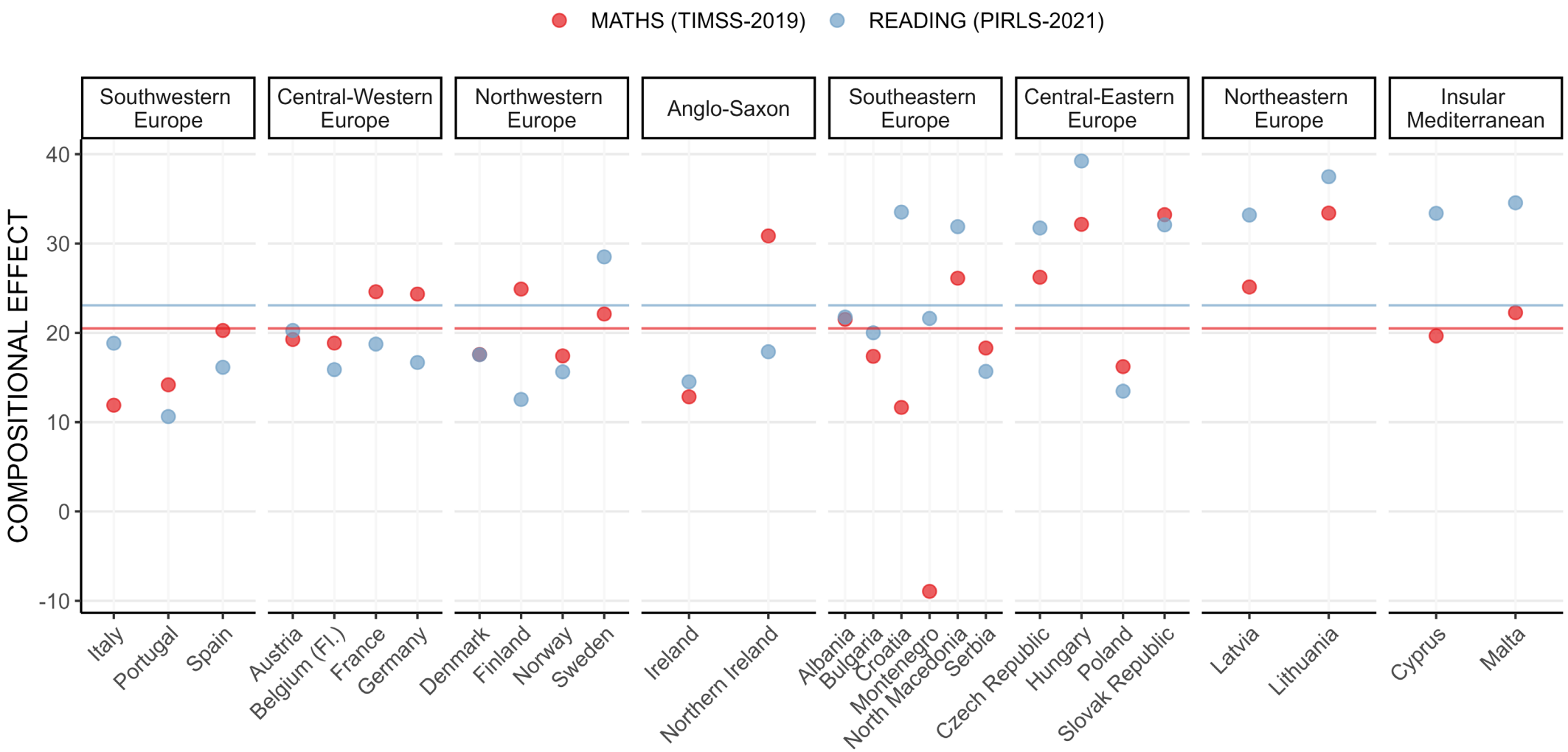
	Southwestern Europe	Central-Western Europe	Northwestern Europe	Anglo-Saxon	Southeastern Europe	Central-Eastern Europe	Northeastern Europe	Insular Mediterranean
(Intercept)	488.174	488.455	518.279	559.470	477.216	511.452	519.54	475.046
Student SES (ctred.)	30.674	36.961	36.320	40.226	36.506	37.571	31.49	39.675
School SES	50.443	63.691	62.047	61.830	65.052	81.792	81.76	86.505
Compositional Effect	**19.77**	**26.73**	**25.73**	**21.60**	**28.55**	**44.22**	**50.27**	**46.83**
ICC	*0.184*	*0.200*	*0.124*	*0.143*	*0.400*	*0.274*	*0.23*	*0.175*
R2 Marg.	0.160	0.254	0.161	0.241	0.162	0.270	0.17	0.214
R2 Cond.	0.263	0.333	0.225	0.268	0.448	0.355	0.27	0.269
Num.Obs.	18345	14740	17677	6585	21046	17075	4585.00	6225

School SES, Student SES and Compositional Effects

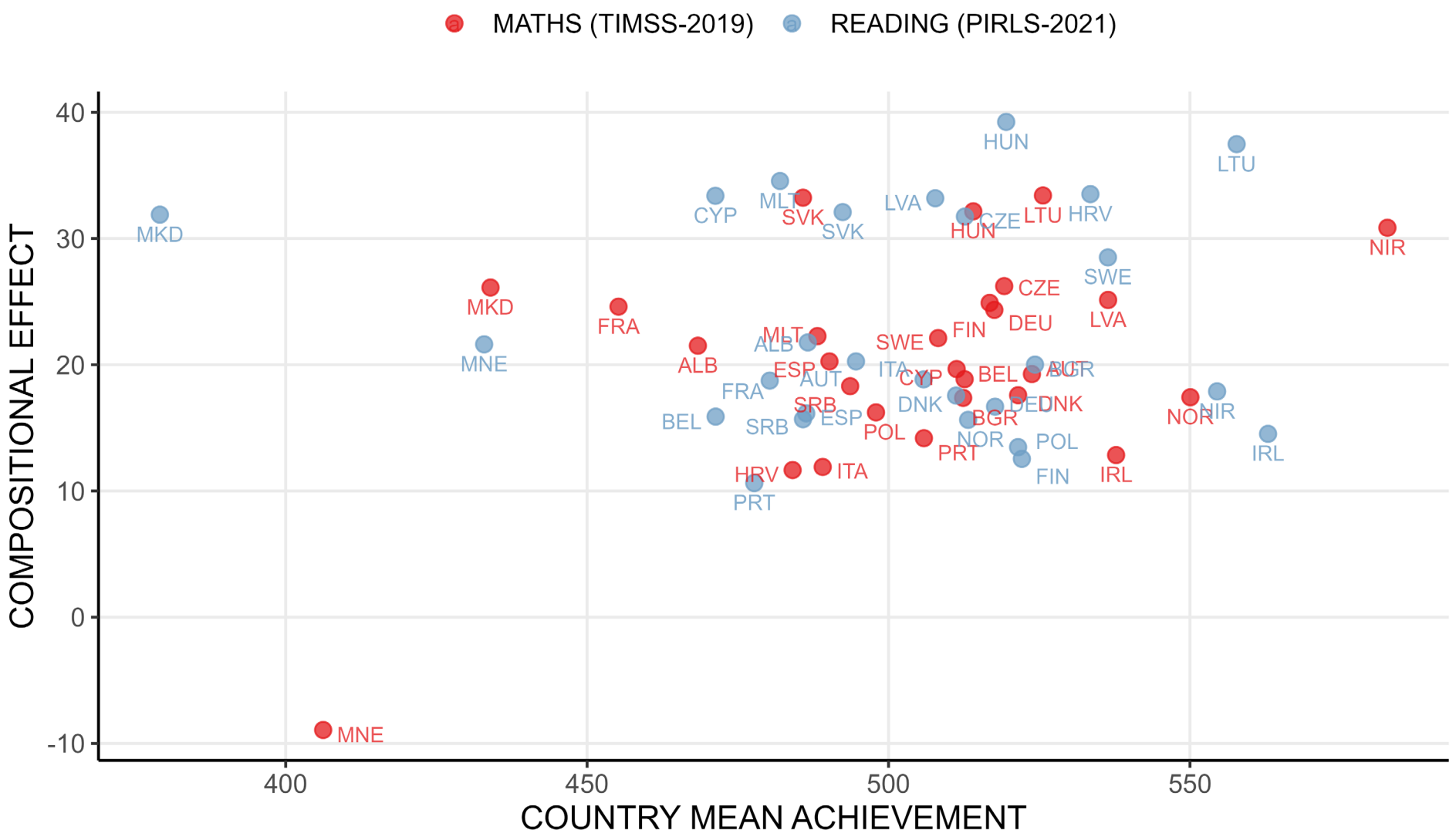




Compositional effect by area



Compositional effect by **COUNTRY AVERAGE ACHIEVEMENT**



Country descriptives of achievement

MATHS (TIMSS-19)					
COUNTRY	Mean	SD	Mean Q1SES	Mean Q5SES	Difference Q5-Q1
Italy	516.9	61.6	489.1	543.9	54.8
Portugal	529.6	71.8	483.9	574.1	90.2
Spain	517.8	66.3	474.1	553.3	79.2
Austria	543.0	61.2	499.9	587.7	87.7
France	491.5	76.3	433.6	548.7	115.1
Germany	538.3	62.8	493.2	573.2	80.0
Belgium (Fl.)	534.6	63.1	493.0	571.7	78.7
Denmark	541.3	67.8	508.4	571.1	62.8
Finland	537.7	71.0	497.3	575.2	77.9
Norway	562.8	68.9	518.5	601.7	83.2
Sweden	531.3	68.9	481.9	574.2	92.3
Ireland	553.5	71.9	501.2	594.9	93.7
Northern Ireland	587.3	81.0	528.8	636.8	108.0
Albania	501.4	79.1	458.0	562.3	104.3
Bulgaria	534.4	75.0	461.7	579.3	117.5
Montenegro	454.7	79.6	409.9	497.4	87.6
Serbia	520.4	76.8	458.5	569.4	110.9
North Macedonia	475.5	93.4	409.3	535.6	126.2
Croatia	513.2	62.5	477.0	547.6	70.6
Czech Republic	539.6	67.9	498.7	581.3	82.6
Hungary	535.7	73.1	473.8	587.9	114.1
Poland	523.6	73.3	477.0	570.1	93.1
Slovak Republic	514.5	70.5	451.0	558.4	107.4
Latvia	552.5	62.4	515.4	582.0	66.6
Lithuania	544.4	69.3	494.2	585.9	91.7
Cyprus	533.6	73.9	495.8	569.1	73.4
Malta	516.3	70.6	473.2	553.1	79.9

READING (PIRLS-21)					
COUNTRY	Mean	SD	Mean Q1SES	Mean Q5SES	Difference Q5-Q1
Italy	541.9	61.1	510.4	574.5	64.1
Portugal	521.5	66.9	484.9	561.5	76.6
Spain	527.7	64.5	492.4	564.0	71.6
Austria	533.7	64.5	477.9	582.8	104.9
France	523.3	64.3	476.7	570.7	94.0
Germany	550.5	66.1	501.8	588.9	87.1
Belgium (Fl.)	516.8	62.1	480.9	549.9	69.1
Denmark	545.8	67.4	502.7	580.2	77.5
Finland	553.7	68.4	514.7	585.6	70.9
Norway	547.2	68.3	505.9	582.6	76.7
Sweden	564.1	71.0	513.8	604.9	91.1
Ireland	583.3	70.0	532.8	629.9	97.1
Northern Ireland	577.2	74.6	527.1	622.0	94.9
Albania	527.9	69.4	487.2	574.4	87.2
Bulgaria	555.3	77.6	478.7	600.0	121.2
Montenegro	489.0	72.4	450.1	523.0	72.9
Serbia	527.3	64.2	483.0	563.3	80.3
North Macedonia	449.9	83.3	392.6	499.1	106.5
Croatia	562.0	63.7	524.0	595.1	71.0
Czech Republic	546.8	66.4	501.7	581.1	79.5
Hungary	551.8	76.3	482.0	598.6	116.7
Poland	553.2	65.9	511.4	590.4	79.0
Slovak Republic	532.1	73.7	463.3	576.2	112.9
Latvia	543.3	66.7	503.8	574.5	70.7
Lithuania	579.6	65.3	535.1	605.4	70.3
Cyprus	516.8	71.9	465.6	561.0	95.4
Malta	524.6	75.6	488.3	567.0	78.7

Differential Compositional Effects

Testing non-linear interactions (quintile by quintile)