Inequality of Opportunity in Educational Achievement in Western Europe: contributors and channels

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In this research

We generate updated evidence about Inequality of Opportunity in Educational achievement (IOpE) in Europe

- Which share of total educational inequality is IOpE?

- Does having a lower IOpE necessarily imply having a lower average educational performance (opportunity – efficiency trade off)?

- Which circumstances are most important in determining IOpE?

- Through which channels are these circumstances translated into IOpE? → Possible educational public policy implications

The Inequality of Opportunity framework

1. Outcome: The outcome of interest. Often income, but in this case educational achievement (PISA score)

2. Circumstances: Variables outside the responsibility of the individual (student). In the educational context: gender, immigration status, parental education or occupation, family socioeconomic status. Inequality associated with circumstances can be considered inequality of opportunity.

3. Channels: Variables which are partly under the individual responsibility, but also connected both to circumstances and outcome (e.g.: reading habits). We aim to isolate only the connecting role of these variables in channelling circumstances into educational achievement.

Tackling channels of IOp Edu

Ways to address inequality of opportunity in educational achievement:

1. Modify circumstances:

    Long term policy --> could take a generation to smooth differences in parental characteristics (eg.: cultural background in the household)

2. Act on channels:

    Relatively straightforward and can have a quick impact on IOp. For example, to address differences in educational and occupational expectations and reading skills or habits.

IOpE in achievement literature

- Comparative evidence for Europe on IOp in terms of the level of skill acquisition and learning is relatively scarce

  - Shultz et al., 2008 (TIMSS and PIRLS data from 1995 - 1998) -> Measured the impact of socioeconomic status on results

  - Martins & Vega, 2010 (PISA 2003 Data) → Socioeconomic factors account for between 15-35% of the results (IOpE)

  - Ferreira & Gignoux, 2014 (PISA 2006 Data) → Find IOpE can represent up to 35% achievement differences and not correlated with GDP or with the average score.

  - Lasso de la Vega et al. 2020 (PISA 2012 Data) → Analysis of IOpE including school can lead to up to 50% share of inequality in some countries.

Research contribution

- We go beyond existing research in three fronts:

    - updated- estimates of IOpE in Western Europe

    - include a richer set of background circumstances (individual components of the ESCS and school characteristics) and assess the contribution of different groups of circumstances

    - identify mediating factors that channel background circumstances into educational outcomes

PISA database

- We use the latest wave of the Programme for International Student Assessment (PISA)

  - Students aged between 15 and 16 years

  - Repeated every three years since PISA 2000, latest available 2018

  - Assess performance in math, reading and **science**

  - Information of students' background and school characteristics

- We focus in 17 Western European countries

Set of circumstances

1. Individual characteristics

a.   Gender, immigrant status (1st and 2nd generation)

b.   ESCS index → Based on highest educational level of parents, highest occupational level of parents, household wealth index and number of books at home.

c.   Mother and father education (primary, secondary, tertiary), Mother and father occupation (low, medium, high ISCO-08), Wealth index at home (WEALTH)Number of books at home, cultural possessions index (CULTPOS)

2. School characteristics

•   Peer effect (average ESCS at school) and school type (public/private), both conditional on individual socioeconomic circumstances → capturing the *differential* peer effect, excluding confounding effect with students own circumstances.

IOpE estimation

- To estimate IOpE for each country, we apply the parametric approach proposed by Ferreira & Gignoux (2014)

    - Estimate the *smoothed distribution* of the achievement level ($\hat{y}$) using the OLS model $\hat{y}_i = \hat{\beta}_k C_{ik}$

- IOpE is obtained by comparing the total inequality I(y_i) with inequality in the smoothed distribution I($\hat{y}_i$), using the variance as the inequality index:

$$0 \leq \theta_{IOpE} = \frac{I(\hat{y})}{I(y)} = \frac{Var(\hat{y})}{Var(y)} \leq 1 \qquad (1)$$

- This is a lower bound of the true IOpE, since we only include a set of circumstances that can observe and measure.

- We estimate alternative models considering different C_{ik}.

IOpE under different models

- <u>3 models:</u> including gender, migrant status and ESCS (M1), including gender, migrant status and socioeconomic variables independently (M2), considering also school characteristics (M3)

- Although the ranking of countries remains almost invariant, including **disaggregated family's circumstances duplicate**, on average, the level of IOpE compared with the baseline model (OCDE)

- Taking into account **school's characteristics**, leads to great heterogeneity in the share of total IOpE that this factor represents, and that it is **especially relevant for central-European countries**

IOpE Results
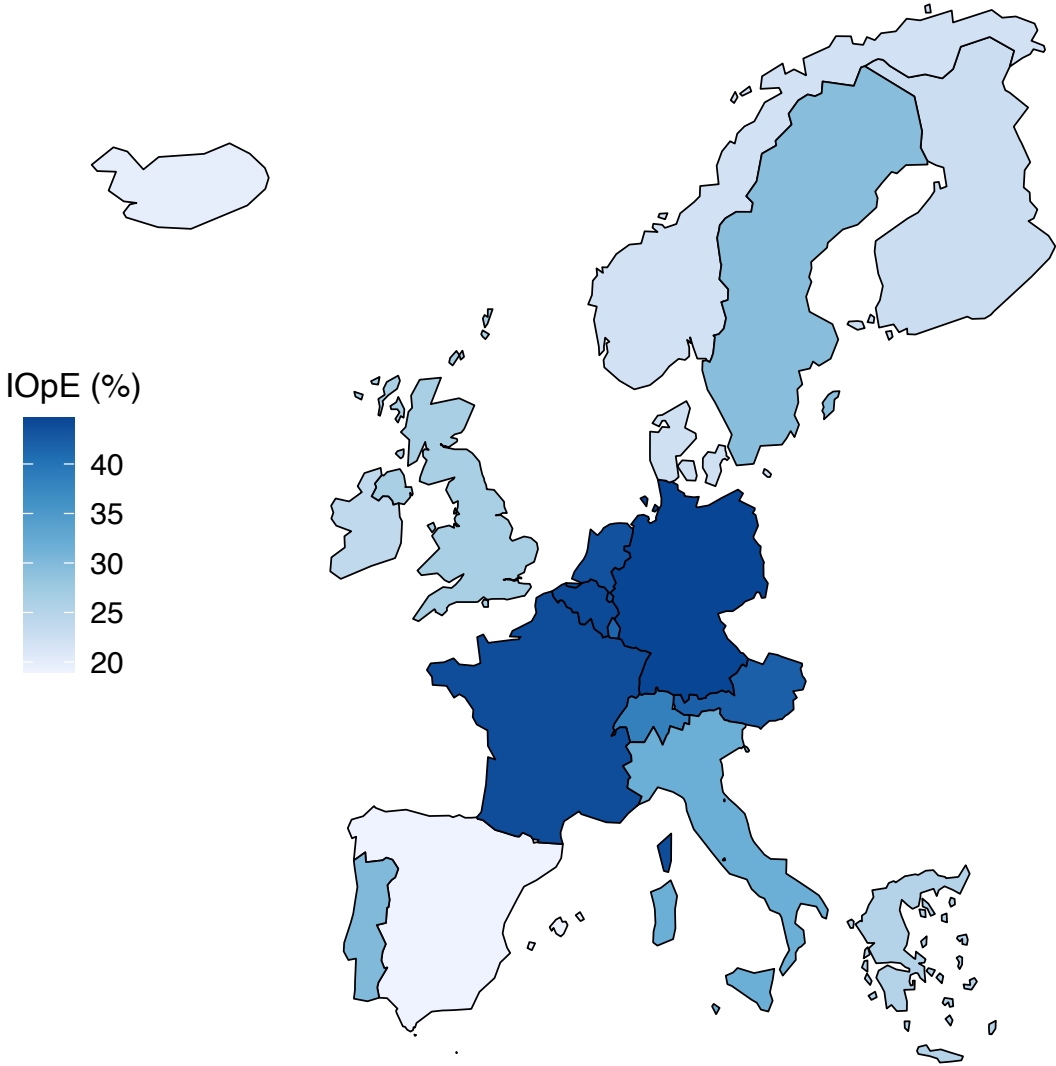
Country		SCIENCE		
		Model 1	Model 2	Model 3
Nordic	Denmark	13.6	21.6	22.4
	Finland	14.7	22.3	22.8
	Sweden	18.2	27.9	29.5
	Iceland	9.9	19.7	19.9
	Norway	10.6	21.5	22.0
Mediterranean	Spain	10.6	18.2	19.0
	Portugal	17.0	26.9	30.1
	Greece	13.1	18.8	25.2
	Italy	10.8	19.4	31.9
Anglo-Saxon	United Kingdom	11.3	20.5	26.4
	Ireland	11.4	22.3	23.9
Continental	France	21.8	34.3	43.9
	Luxemburg	21.8	32.6	41.5
	Switzerland	19.5	30.5	38.4
	Netherlands	17.2	26.2	43.5
	Belgium	22.6	31.1	44.3
	Austria	19.9	30.6	42.1
	Germany	22.0	32.7	44.7
Western Europe		15.9	25.4	31.8

IOpE changes 2006-2018

- Not fully comparable variable set, but quite.

- <u>Ferreira Gignoux (2012; PISA 2006):</u> gender, father's and mother's education, father's occupation, language spoken at home, migration status, access to books at home, durables owned by the households, cultural items owned, and the location of the school attended (used as an indicator or a rural or urban upbringing).

- <u>This study (PISA 2018).</u> Our model 2 including gender, immigrant status, mother and father education, mother and father occupation, the household wealth index, the household cultural resource index and the number of books at home.

IOpE changes 2006-2018

INEQUALITY OF OPPORTUNITY IN EDUCATIONAL ACHIEVEMENT 2006 - 1018
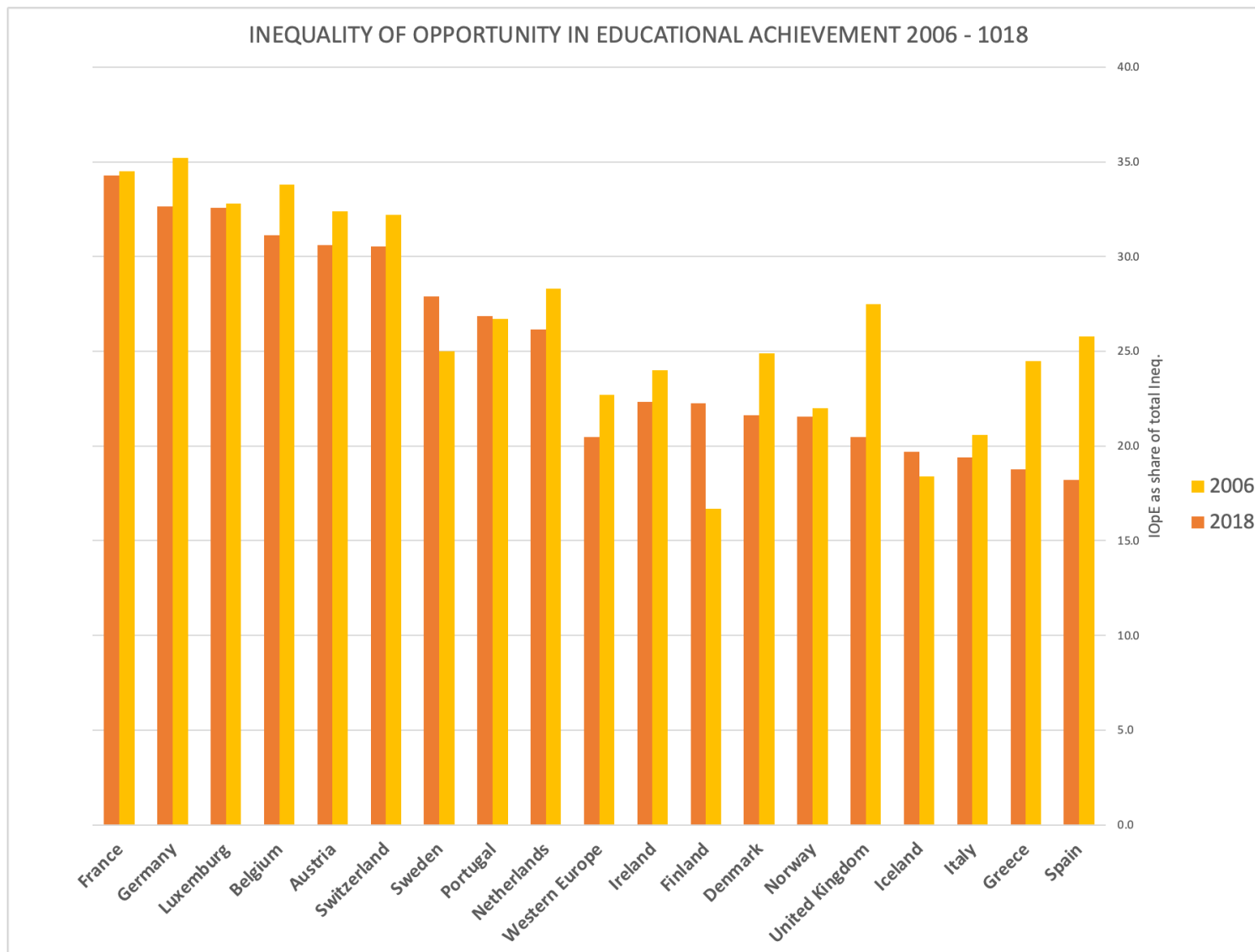
Does having a lower IOpE imply having a lower average educational performance?

$R^2 = 0.0268$

No trade-off
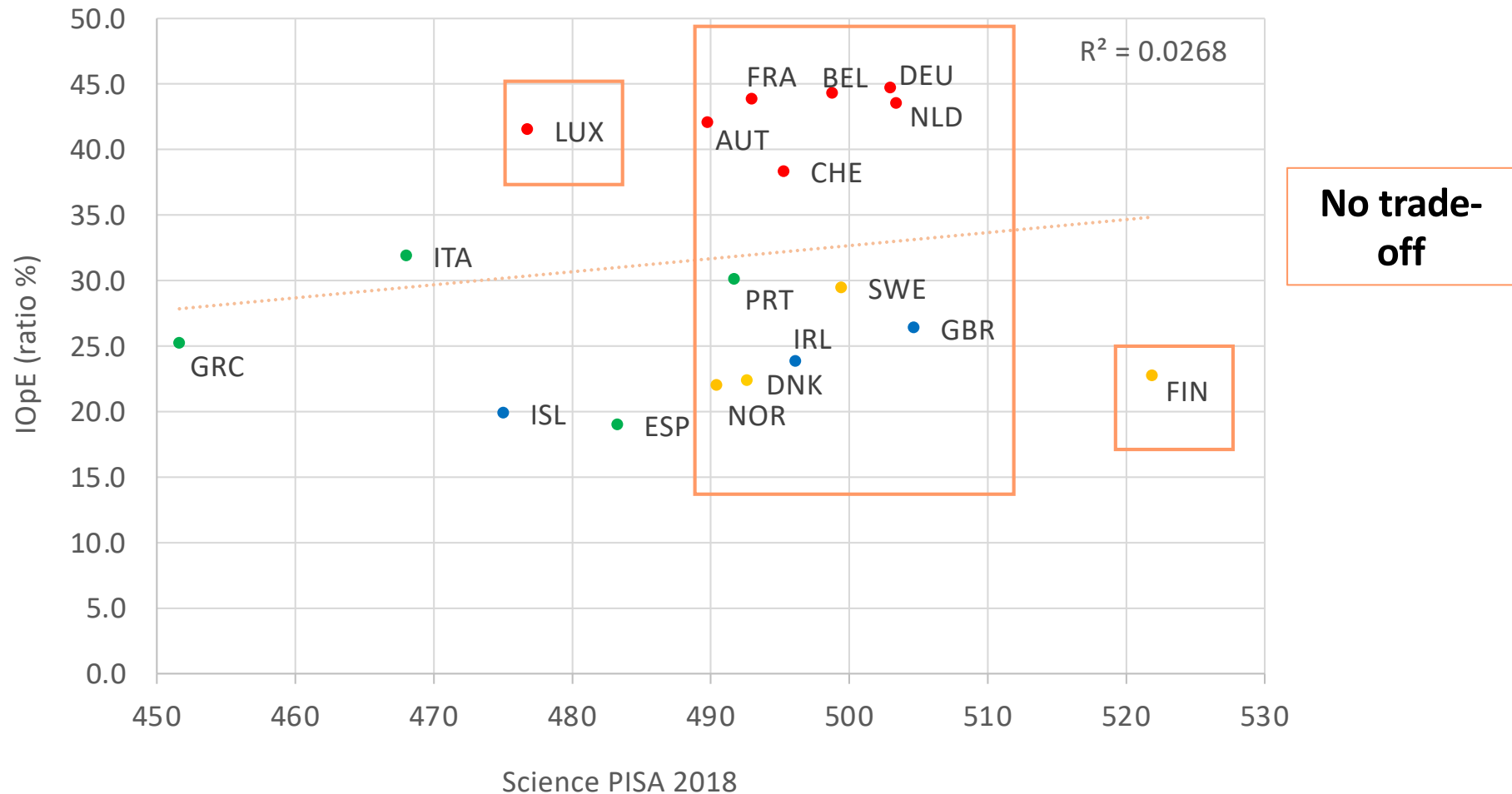
IOpE decomposition

- To estimate the relative contribution of each circumstance C_k on IOpE, we use a regression-based decomposition approach proposed by Fields (2003), and used in Brewer and Wren-Lewis (2016).

- Given OLS estimation in (eq.1), the *relative factor inequality weight* for each circumstance C_k is given by

$$s_k = \text{cov}\left[\hat{\beta}_k C_k, \hat{y}\right] / \hat{\sigma}_{\hat{y}}^2 \ , \quad \sum s_k = 1 \quad (2)$$

- We can obtain the *relative factor inequality weight* of a particular set of factors by just adding their corresponding individual shares s_k

Decomposition of IOpE

		Gender	Migrant status	Home Wealth	Parental education	Parental occupation	Cultural environment	School characteristics
Nordic	Denmark	0	11	4	11	27	44	3
	Finland	4	12	2	8	31	41	2
	Sweden	0	20	3	12	21	40	5
	Iceland	0	5	9	37	42	4	3
	Norway	0	8	13	7	31	39	2
Mediterranean	Spain	0	3	-1	4	29	61	4
	Portugal	0	1	4	4	39	40	12
	Greece	1	11	1	5	29	29	25
	Italy	0	8	0	4	21	28	40
Anglo - Saxon	United Kingdom	1	3	-1	6	27	44	21
	Ireland	0	1	1	13	24	55	6
Central	France	0	5	0	3	26	46	21
	Luxemburg	0	2	-1	1	27	47	23
	Switzerland	0	8	1	8	26	37	20
	Netherlands	0	8	2	1	20	30	39
	Belgium	0	7	1	5	30	28	30
	Austria	0	12	0	2	21	38	27
	Germany	0	11	4	5	19	33	27
Average		0	8	2	8	27	38	17

Most relevant circumstance

Parental occupation is relevant in all countries

Schools characteristics more relevant in countries with high IOpE and Italy

Channels of IOpE

- To identify the main channels behind observed educational inequalities, we combine two approaches (Fields, 2003 and Palomino et al., 2019).

- A variable is channelling IOpE if it is related to the circumstance-conditioned outcome (i.e.: Is connected *both* to circumstances and outcome).

- We estimate by OLS the relation between the channels Z_{ni} and the student's achievement *associated with her circumstances* ($\hat{y}_i$):

$$\hat{y}_i = \alpha + \sum_{n=1}^{N} \hat{\gamma}_n Z_{ni} + \nu_i \qquad (3)$$

- The proportion of the IOpE channelled by our **entire set of channels**:

$$IOpE_c = \frac{Var\ (\hat{E}_i | Z_{ni})}{Var\ (\hat{E}_i)} \ x\ 100 \qquad (4)$$

- Following Fields (2003), we can estimate the contribution of each channel

$$s_n^Z = \hat{\gamma}_n \ \frac{\sigma_{Z_{ni}}}{\sigma_{\hat{E}_i}} \ \sigma_{\hat{E}_i, Z_{ni}} \qquad (5)$$
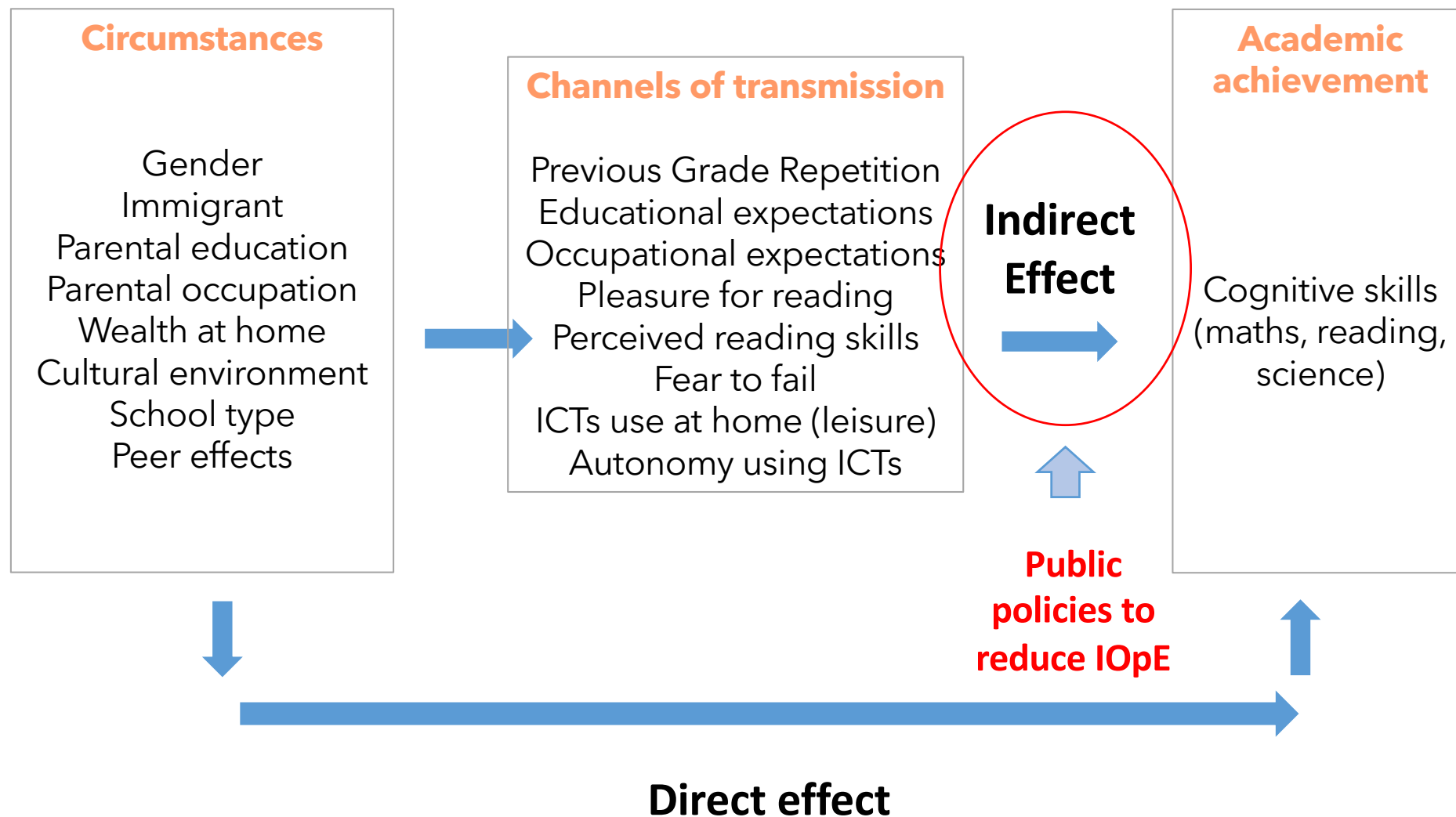
Channels first necessary condition: correlation with circumstances

- R-square (x100) of regressing potential channels on the whole set of circumstances:

Enjoyment of reading	19
Occupational expectations	17
Educational expectations	16
Repetition	12
Metacognition skills	10
Ability in reading	8
Fear of failure	7
Autonomy in the use of ICTs	6
ICTs use at home for pleasure	6

- Other potential channels discarded in the first stage:

Arrive late to school	4
ICTs use at home for school	3
Skip class	3
Motivation to master tasks	3
Resilience	3
Study time at home	3
Value of schooling	3
Exposure to bullying	2

Through what channels are these circumstances translated into IOpE?

Circumstances

Gender
Immigrant
Parental education
Parental occupation
Wealth at home
Cultural environment
School type
Peer effects

Channels of transmission

Previous Grade Repetition
Educational expectations
Occupational expectations
Pleasure for reading
Perceived reading skills
Fear to fail
ICTs use at home (leisure)
Autonomy using ICTs

Indirect Effect

Academic achievement

Cognitive skills (maths, reading, science)

Public policies to reduce IOpE

Direct effect

Results
Channels of IOpE

Expectations are a relevant channel in all countries

IT access/use is not a relevant channel

Repetition is an important channel in most Mediterranean countries and FR, LU, BE

Reading and metacognition are relevant channels in all countries except Mediterranean countries

		Total share of IOpE channelled (% of IOpE)	% of total IOpE channelled			
			Repetition	Expectations	Reading skills	ICTs use at home for pleasure
Nordic	Denmark	10.9	6	45	50	0
	Finland	19.7	5	37	56	0
	Iceland	15.9	2	36	60	2
	Sweden	13.7	15	17	66	1
	Norway	11.4	0	35	65	0
Mediterranean	Spain	17.4	45	38	16	0
	Portugal	28	41	48	10	0
	Greece	22	27	57	14	0
	Italy	26.3	12	74	14	0
Anglo-Saxon	United Kingdom	12.5	0	47	50	1
	Ireland	18.8	1	38	58	2
Central	France	28.7	45	28	26	0
	Luxemburg	24	29	32	36	3
	Switzerland	24.2	12	49	35	3
	Netherland	26	4	56	35	0
	Belgium	22.1	53	26	20	1
	Austria	27.2	14	52	33	2
	Germany	29.6	11	52	31	5
Average		**21**	**18**	**43**	**38**	**1**
Reading	**Average**	25.6	15	38	41	3
Maths	**Average**	19.6	17	44	36	2

Results
Channels of IOpE

- Repetition, student's educational and occupational expectations, the pleasure of reading and perceived reading ability, channel between **11% and 30%** of IOpE in Europe, with important differences between countries.

  - Expectations are a relevant channel in all countries

  - Reading habits and skills are a sizeable link between circumstance and outcome in most countries (except Mediterranean).

  - Repetition in previous years appears to be a crucial channel in Spain, France, Portugal, Belgium, Greece and Luxemburg

  - IT access/use is not a relevant channel (note: pre-covid)

Concluding remarks

- Great heterogeneity across European countries in terms of IOpE (average 32%, range 19-45%)

- Using the ISEC index as a proxy or socio-economic circumstances tends to yield underestimations in all countries

- Cultural environment plays a key role in almost all countries

- School characteristics are especially relevant circumstances in Central-European countries with high IOpE (early tracking and school segregation by achievement!)

Concluding remarks

- Promoting equal opportunities requires **targeted and compensatory policies** –rather than universal programs (equality vs equity/fairness!)

  - Career guidance program to work over expectations and aspirations in all countries

  - Early-age interventions to encourage the habit of reading and reading abilities in most countries

  - Early detection of the student with the greatest probability of repetition to provide tutoring and continuous feedback for parents in Mediterranean and some Central-European (FR,BE,LU) countries

- No trade-off between equality of opportunities and average achievement

- Future research: explore non-linear estimations in both IOpE and channel variables estimation (ML techniques).

Thank you!