PISA 2012

Evaluating school systems to improve education

Embargo until
3 December
11:00 Paris time

Andreas Schleicher

OECD
BETTER POLICIES FOR BETTER LIVES

PISA in brief

- **Over half a million students…**
  - **representing 28 million 15-year-olds in 65 countries/economies**

… took an internationally agreed 2-hour test…

- **Goes beyond testing whether students can reproduce what they were taught…**
- **… to assess students' capacity to extrapolate from what they know and creatively apply their knowledge in novel situations**
- **Mathematics,** reading, science, problem-solving, financial literacy
- **Total of 390 minutes of assessment material**

… and responded to questions on…

- **their personal background, their schools and their engagement with learning and school**

- **Parents, principals and system leaders provided data on…**
  - **school policies, practices, resources and institutional factors that help explain performance differences .**

PISA in brief

- **Key principles**
  - **'Crowd sourcing' and collaboration**
    - PISA draws together leading expertise and institutions from participating countries to develop instruments and methodologies…
    - … guided by governments on the basis of shared policy interests
  - **Cross-national relevance and transferability of policy experiences**
    - Emphasis on validity across cultures, languages and systems
    - Frameworks built on well-structured conceptual understanding of academic disciplines and contextual factors
  - **Triangulation across different stakeholder perspectives**
    - Systematic integration of insights from students, parents, school principals and system-leaders
  - **Advanced methods with different grain sizes**
    - A range of methods to adequately measure constructs with different grain sizes to serve different decision-making needs
    - Productive feedback, at appropriate levels of detail, to fuel improvement at every level of the system .

Each year OECD countries spend 200bn$ on math education in school

What do 15-year-olds know…
…and what can they do with what they know?

Mathematics (2012)

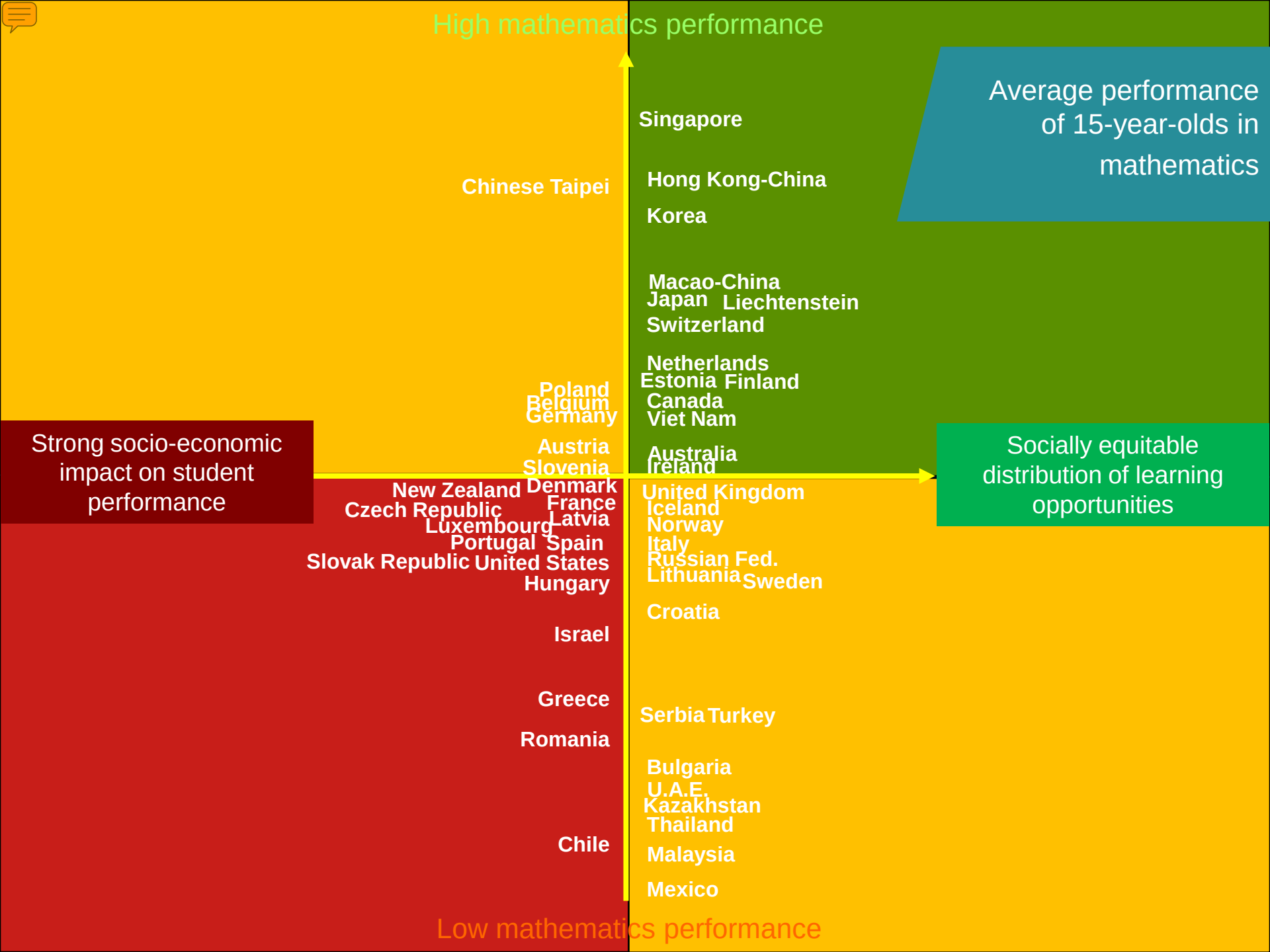
Average performance of 15-year-olds in Mathematics

Fig I.2.13

26% of American 15-year-olds do not reach PISA Level 2

(OECD average 23%, Shanghai 4%, Japan 11%, Canada 14%, Some estimate long-term economic cost to be US$72 trillion)

US


High mathematics performance
Average performance of 15-year-olds in mathematics
Singapore
Chinese Taipei
Hong Kong-China
Korea
Macao-China
Japan
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Finland
Poland
Canada
Belgium
Viet Nam
Germany
Strong socio-economic impact on student performance
Austria
Australia
Slovenia
Ireland
Socially equitable distribution of learning opportunities
New Zealand
Denmark
United Kingdom
Czech Republic
France
Iceland
Latvia
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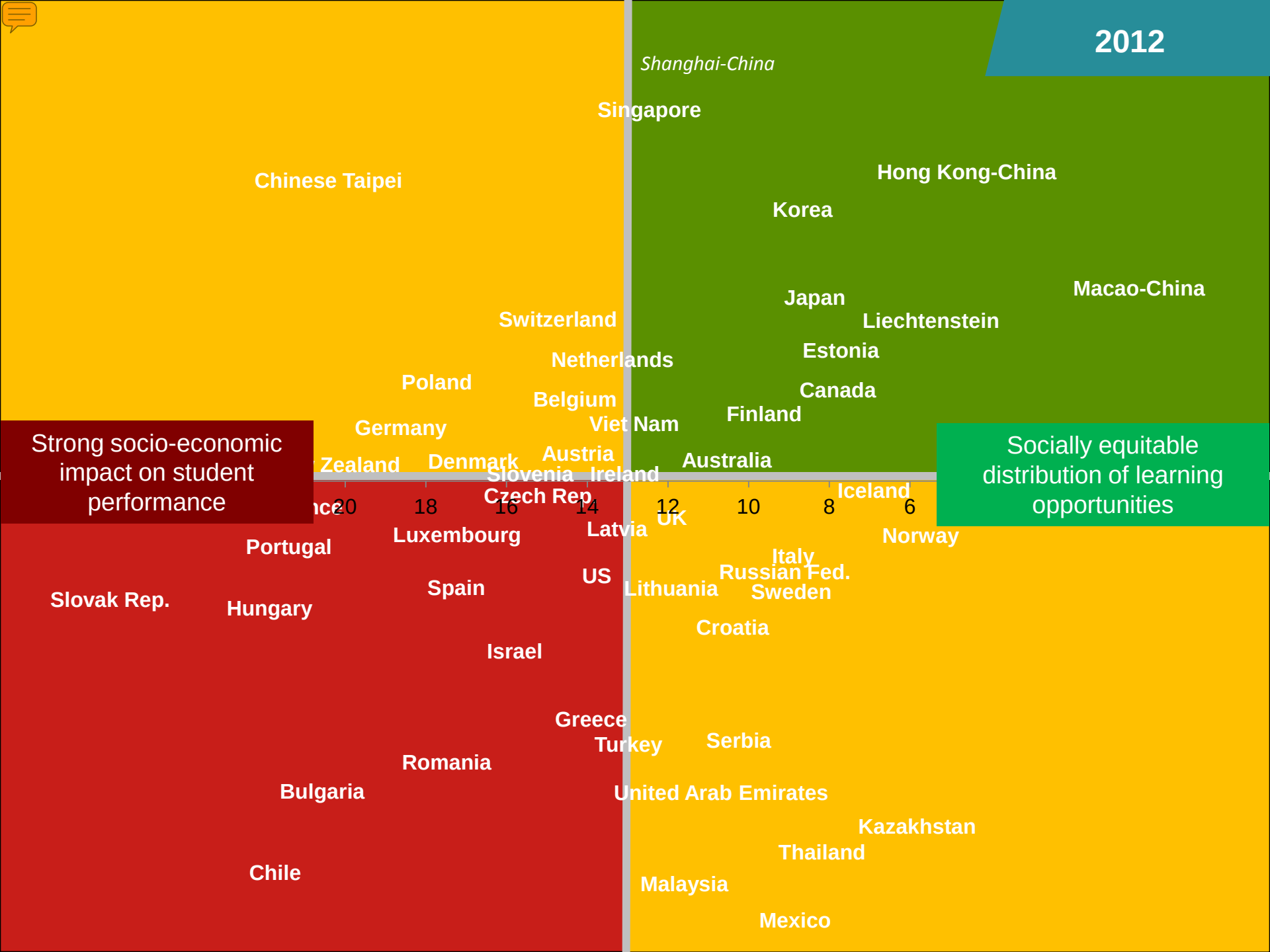
Malaysia
Mexico
Low mathematics performance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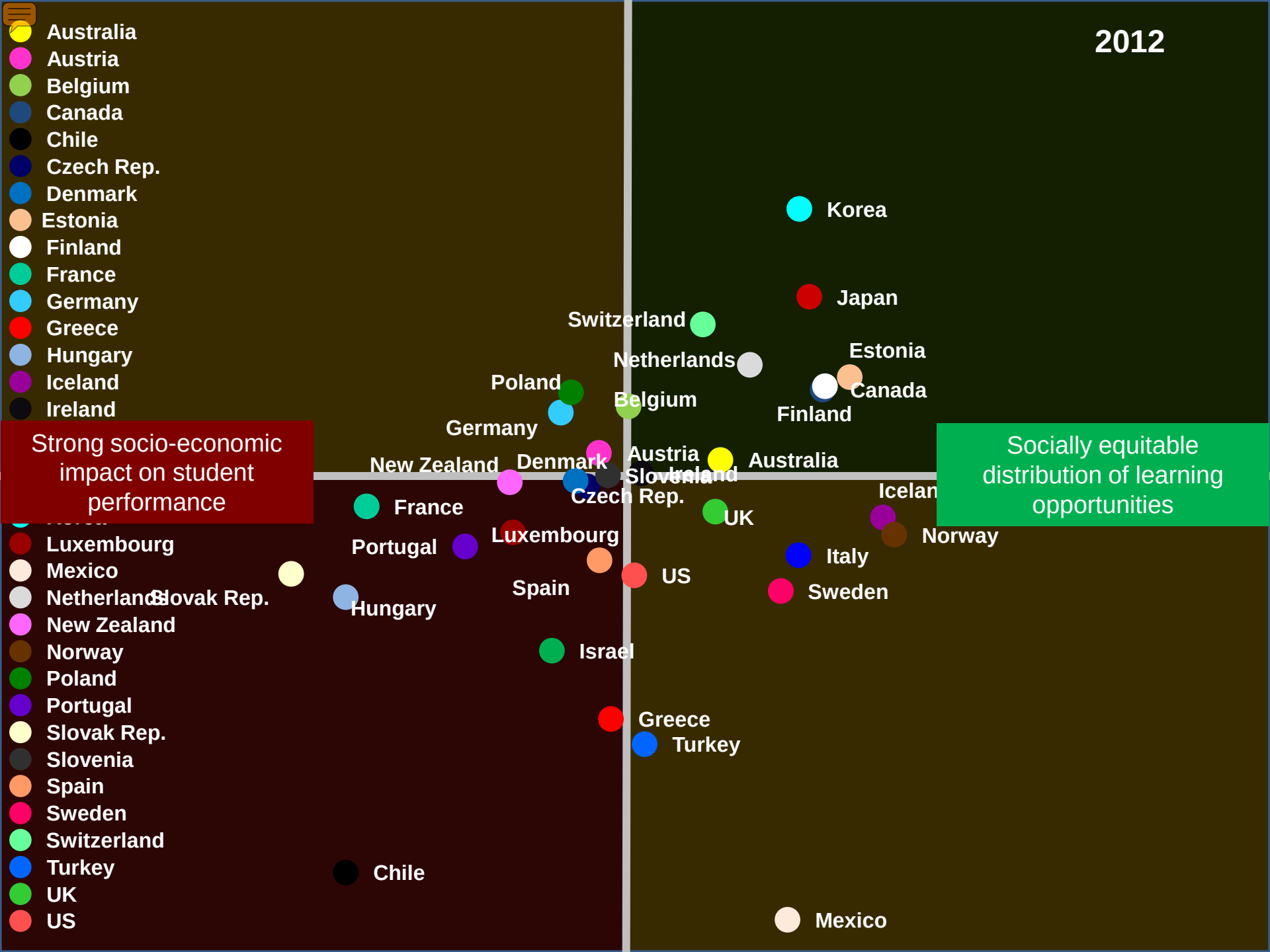
Strong socio-economic impact on student performance
Socially equitable distribution of learning opportunities


2012
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Strong socio-economic impact on student performance
Luxembourg
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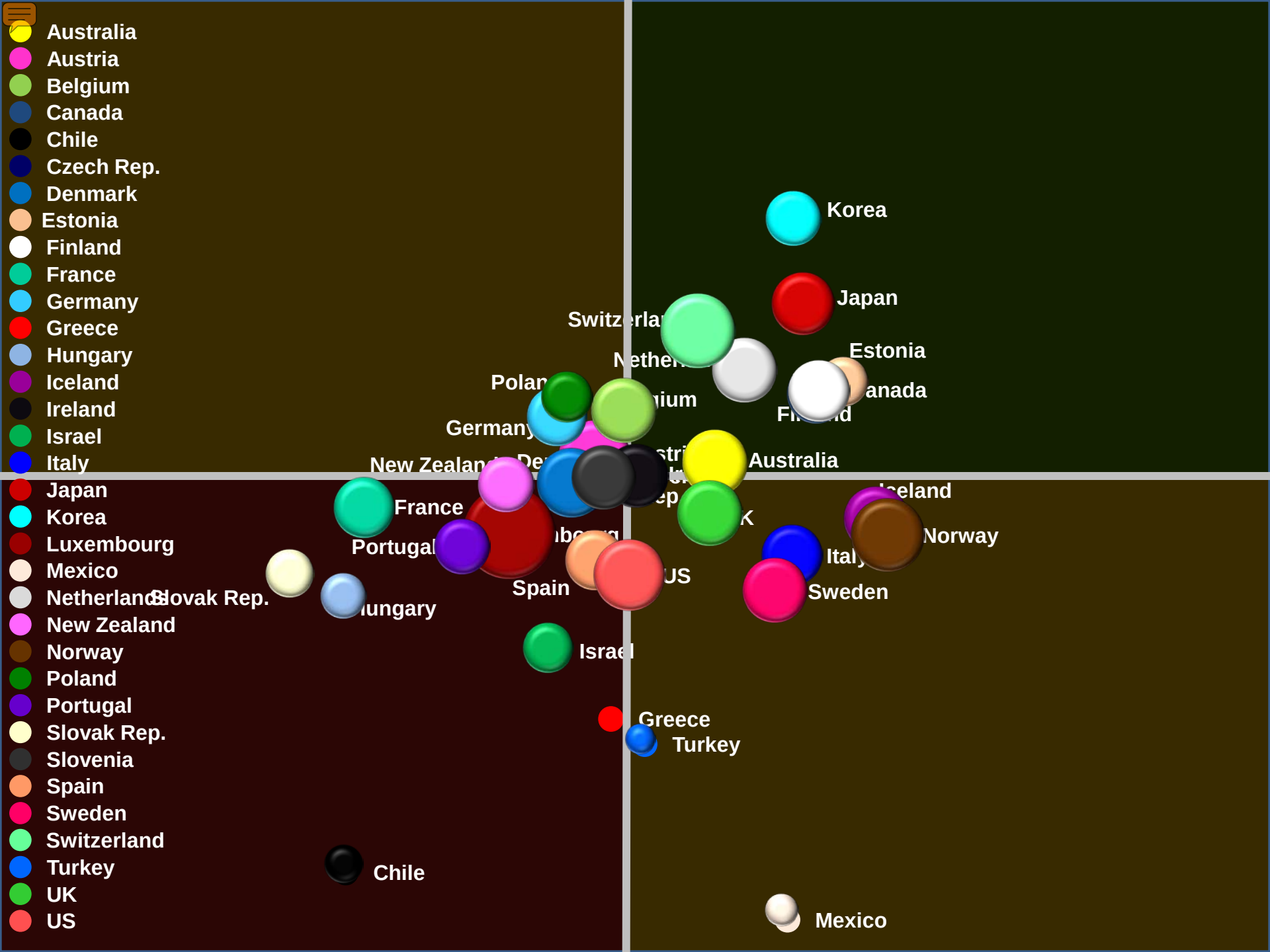
Socially equitable distribution of learning opportunities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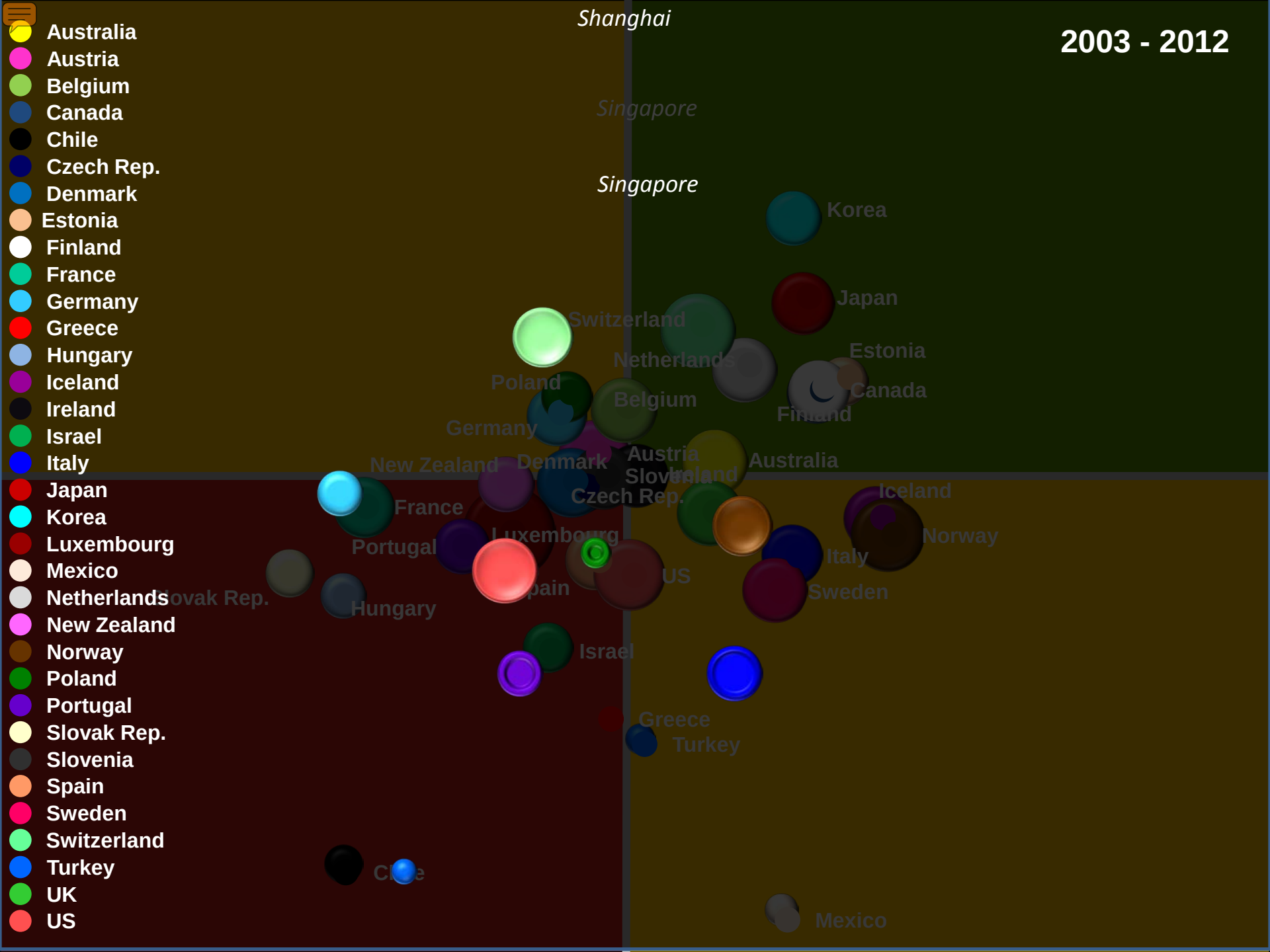
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2003 - 2012
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Mexico
Germany, Turkey and Mexico saw significant improvements in both math performance and equity between 2003 and 2012


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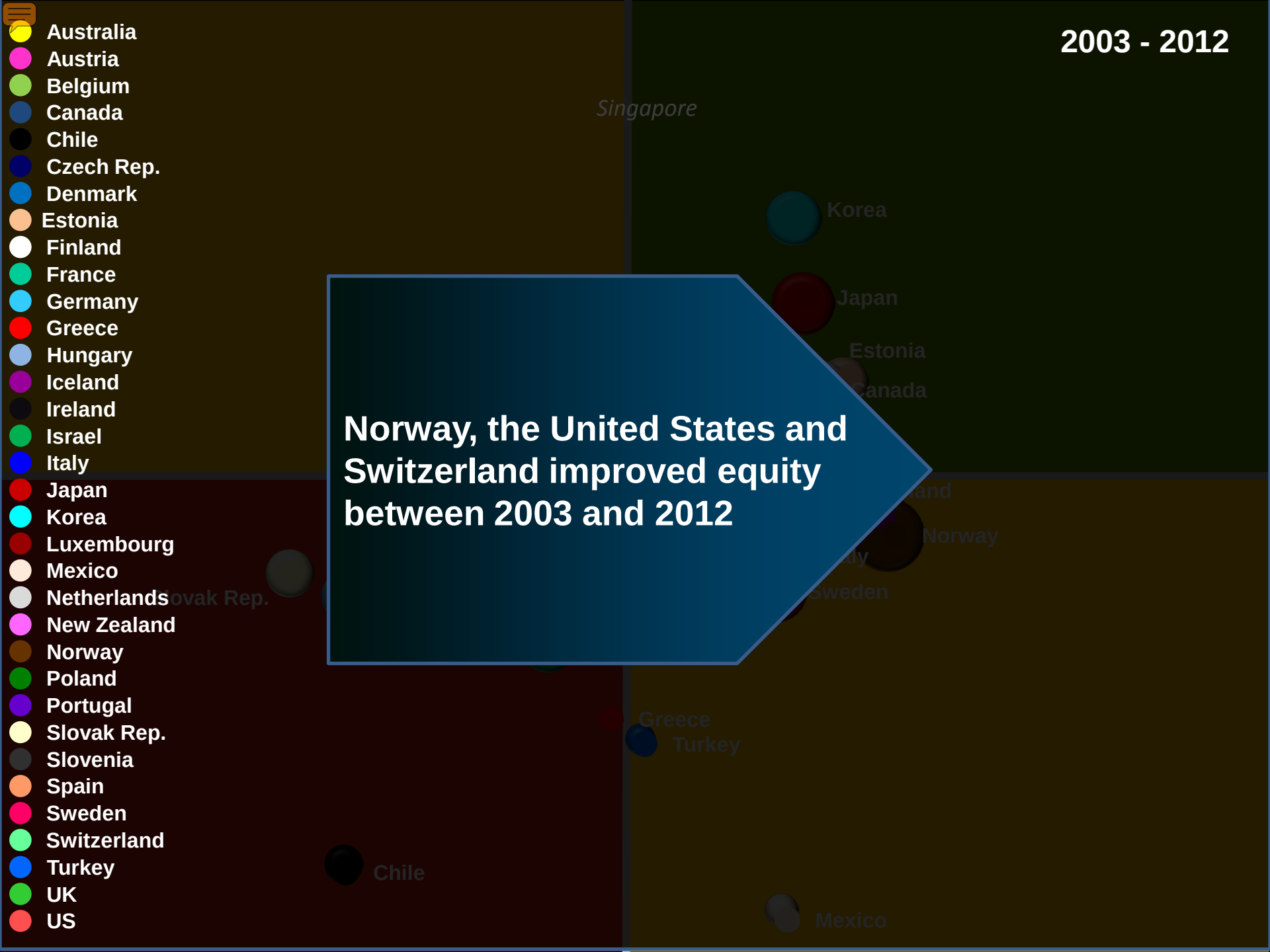
Mexico
Brazil, Italy, Macao-China, Poland, Portugal, Russian Federation, Thailand and Tunisia saw significant improvements in math performance between 2003 and 2012
(adding countries with more recent trends results in 25 countries with improvements in math)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Switzerland
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2003 - 2012
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Estonia
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Norway
Sweden
Greece
Turkey
Chile
Mexico
Norway, the United States and Switzerland improved equity between 2003 and 2012

Of the 65 countries…
…45 improved at least in one subject

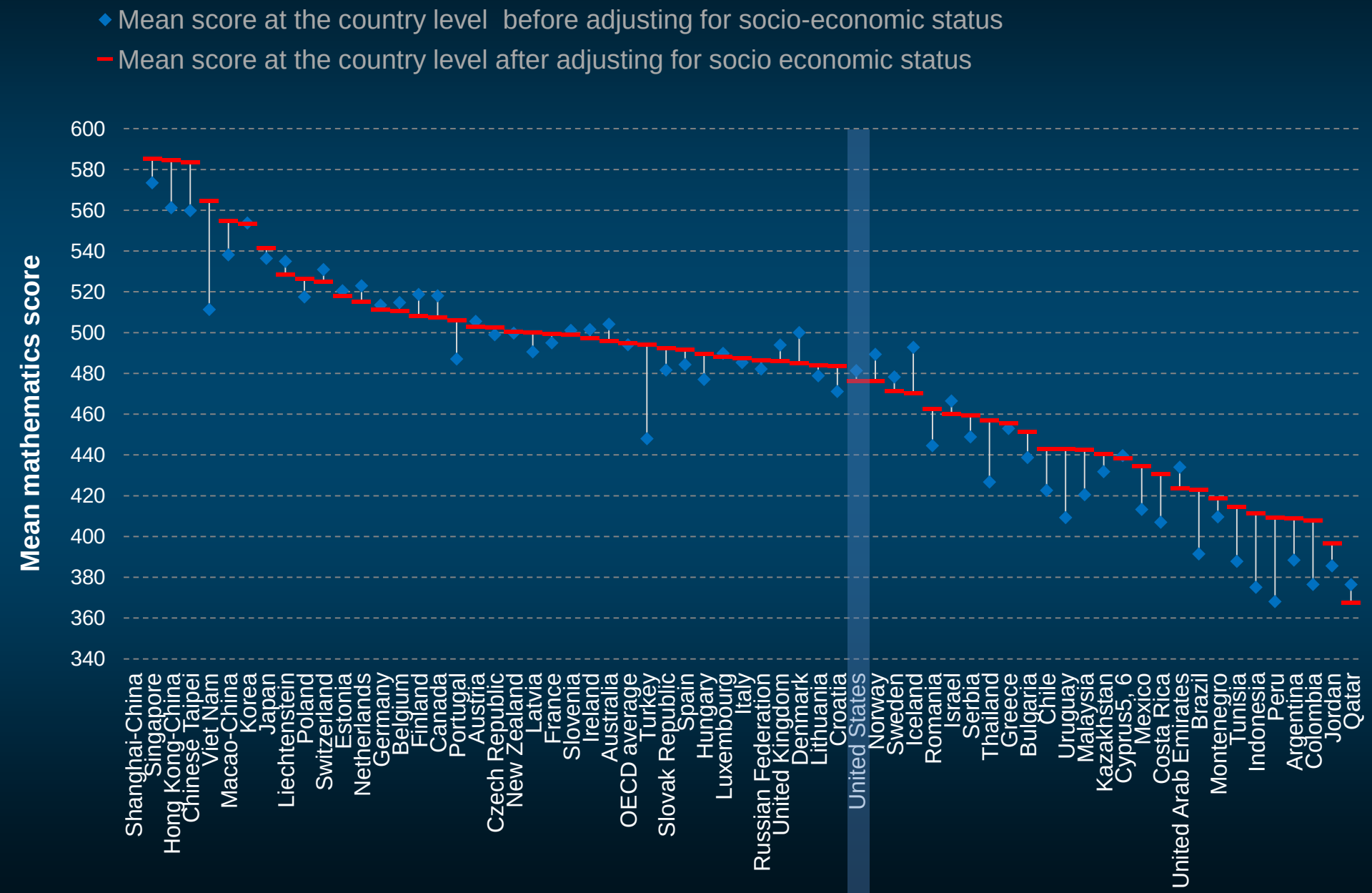
Performance of countries in a level playing field

How the world would look if students around the world were living in similar social and economic conditions

Mathematics performance in a level playing field

Mean mathematics performance after accounting for socio-economic status

Fig II.3.3

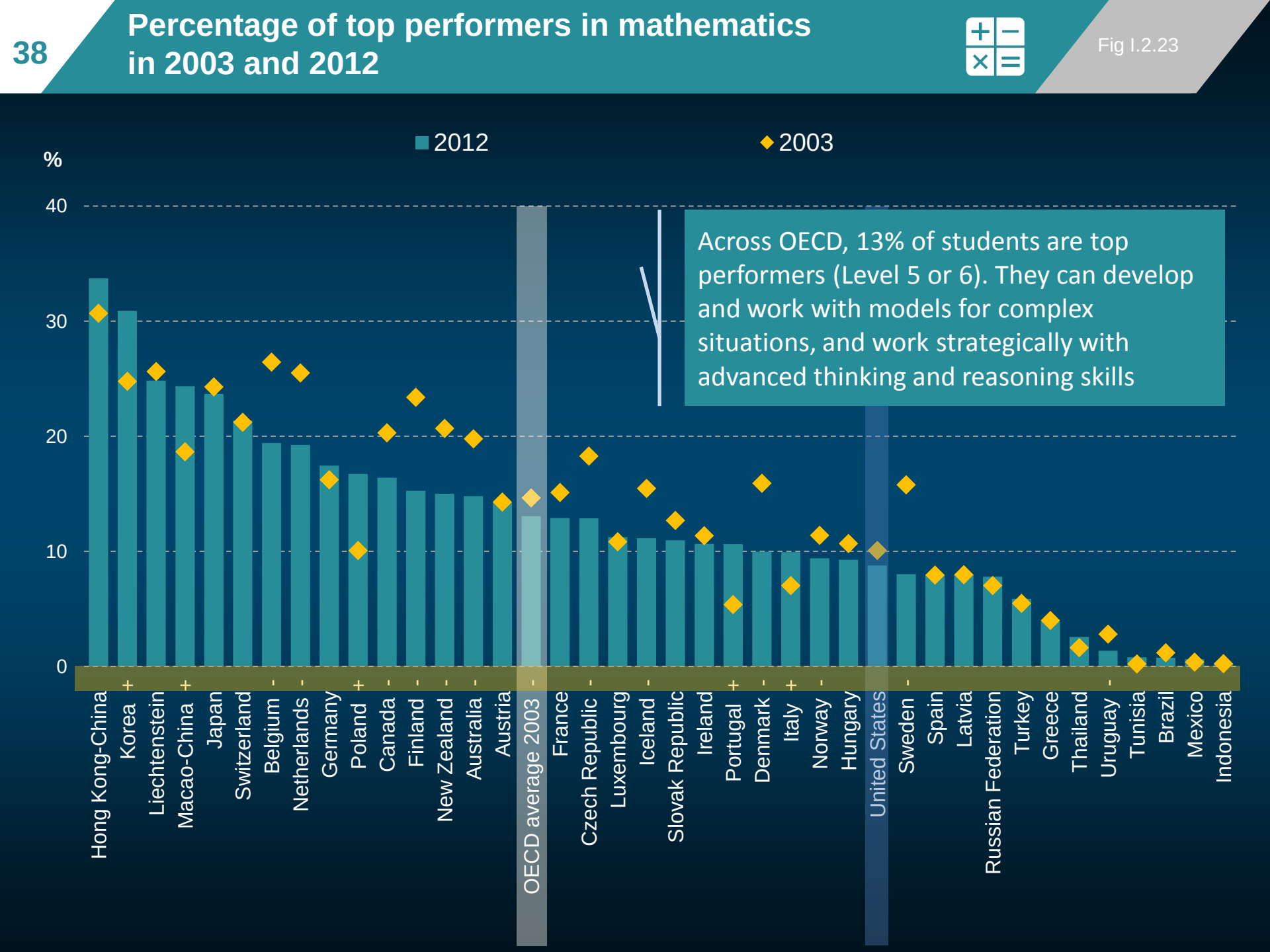


It is not just about poor kids in poor neighbourhoods…

…but about many kids in many neighbourhoods

Percentage of top performers in mathematics in 2003 and 2012

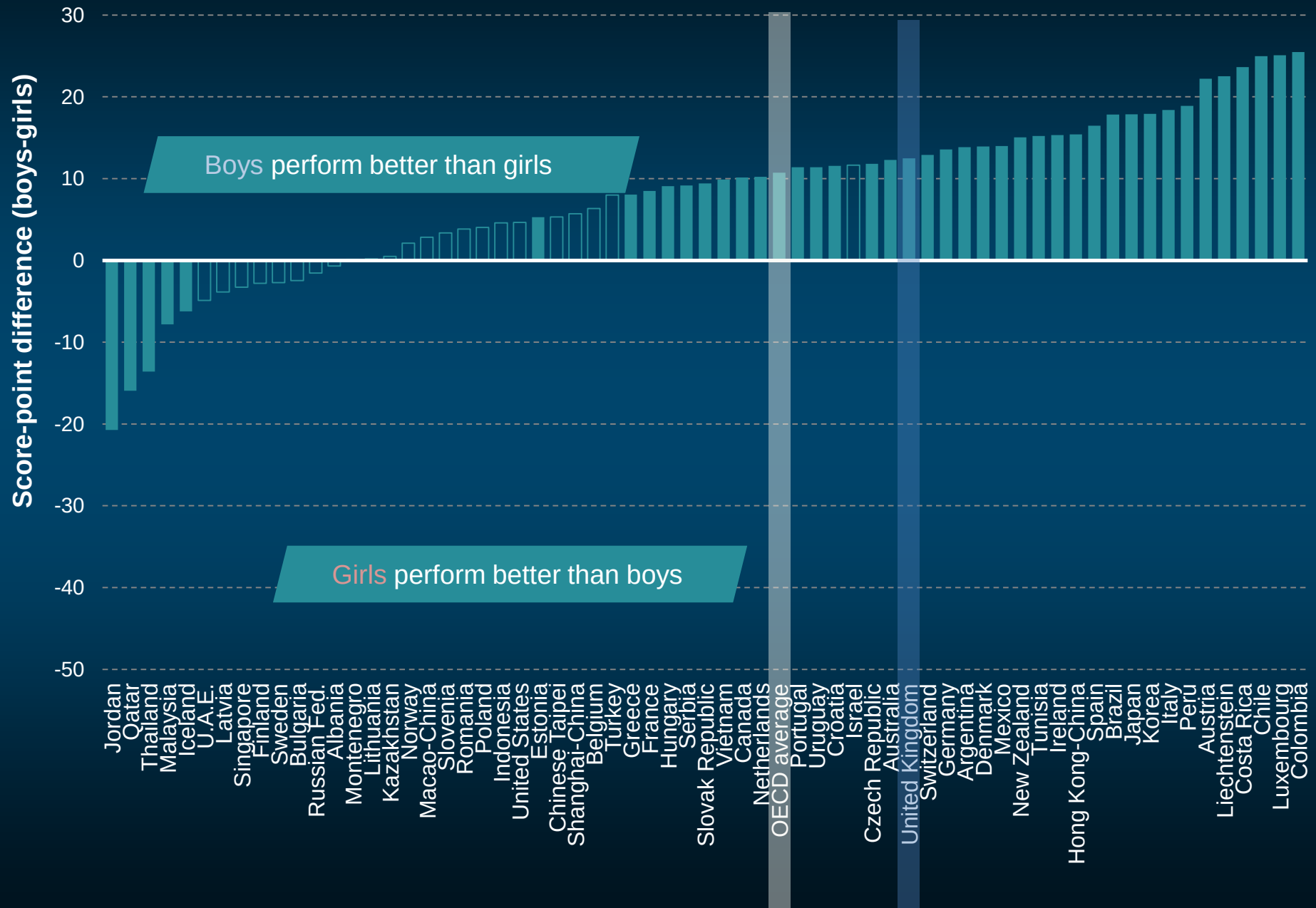
Fig I.2.23



Gender differences remain

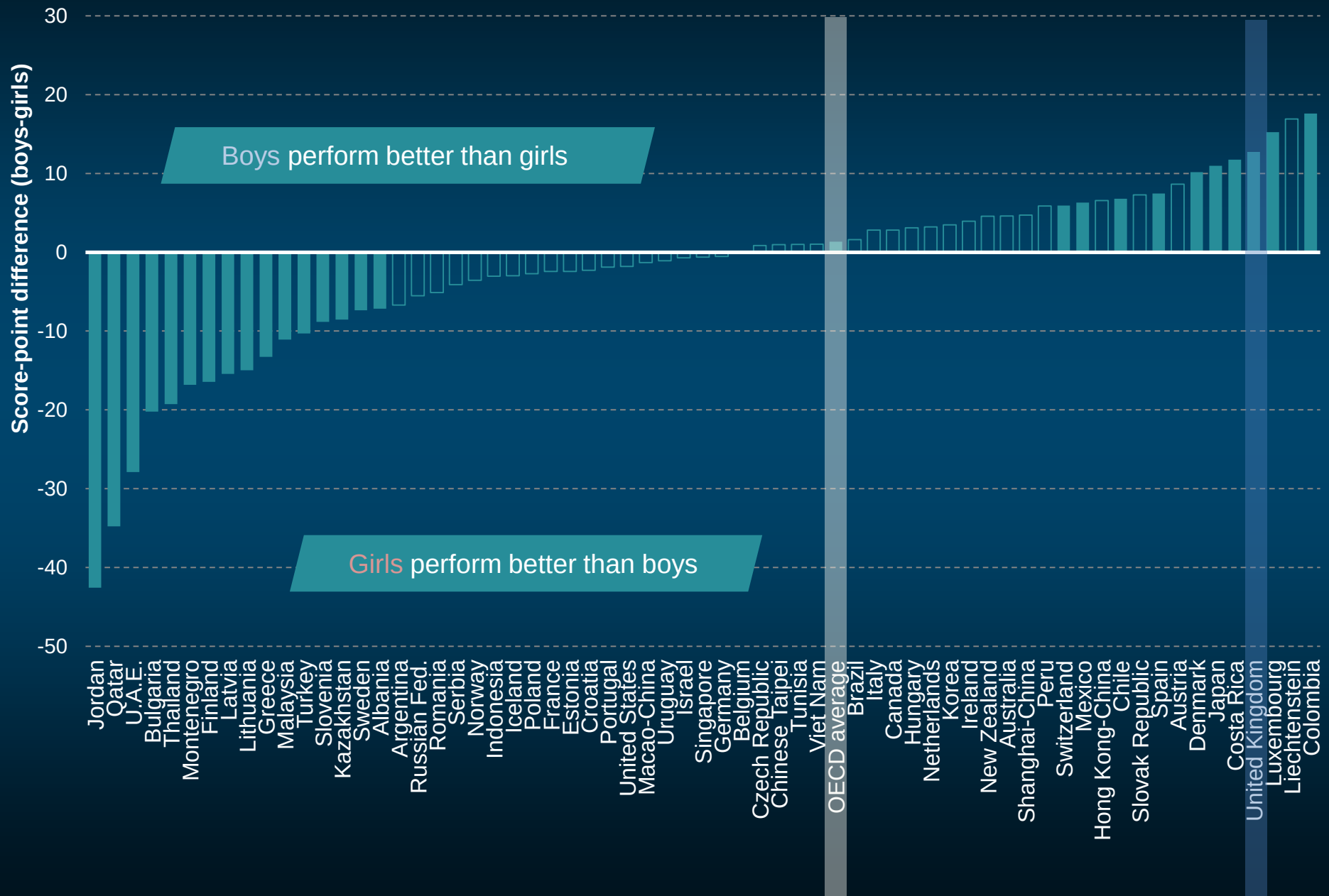
Gender differences in mathematics performance

Fig I.2.25



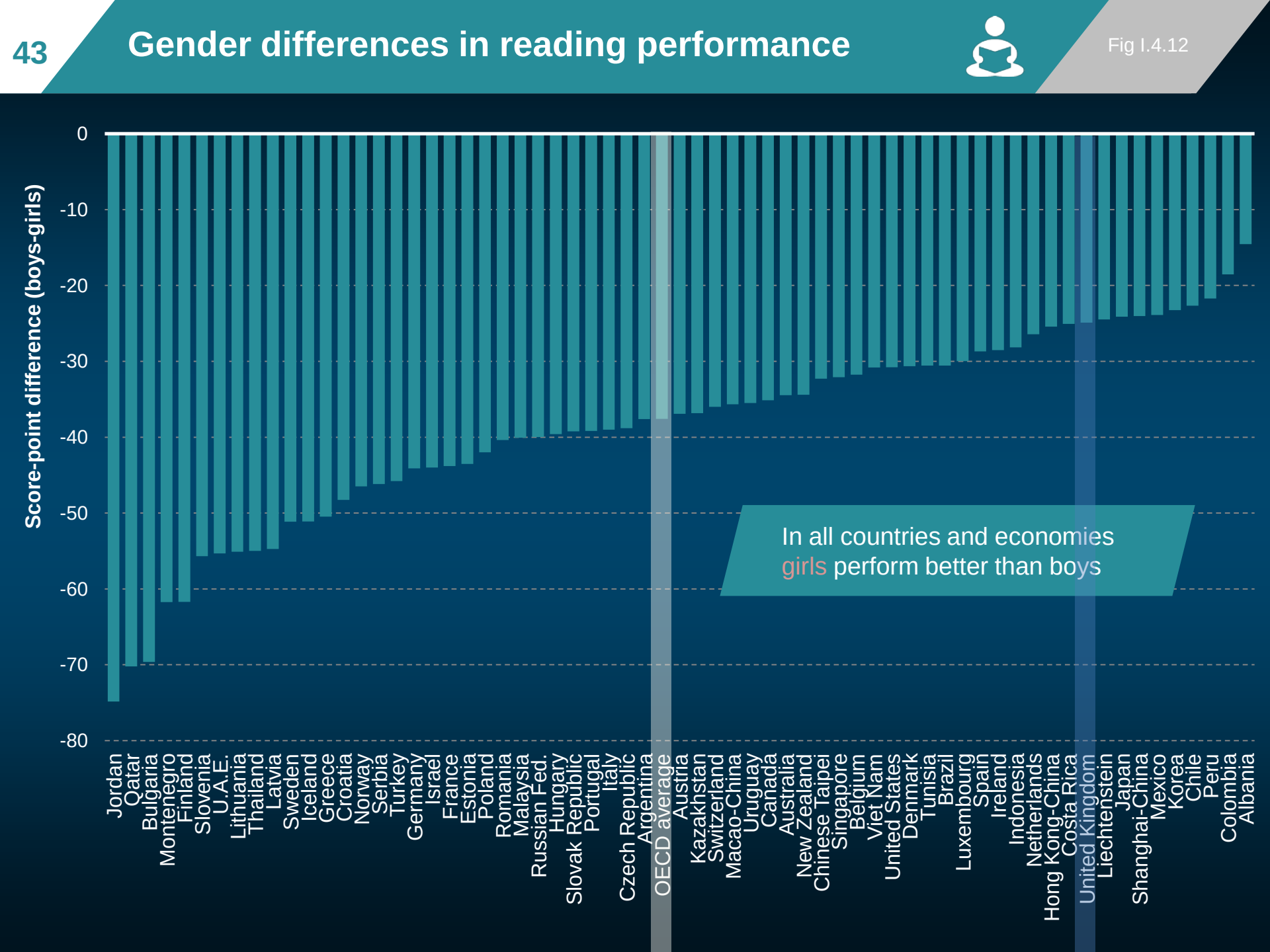
Gender differences in science performance

Fig I.5.12



Gender differences in reading performance

Fig I.4.12

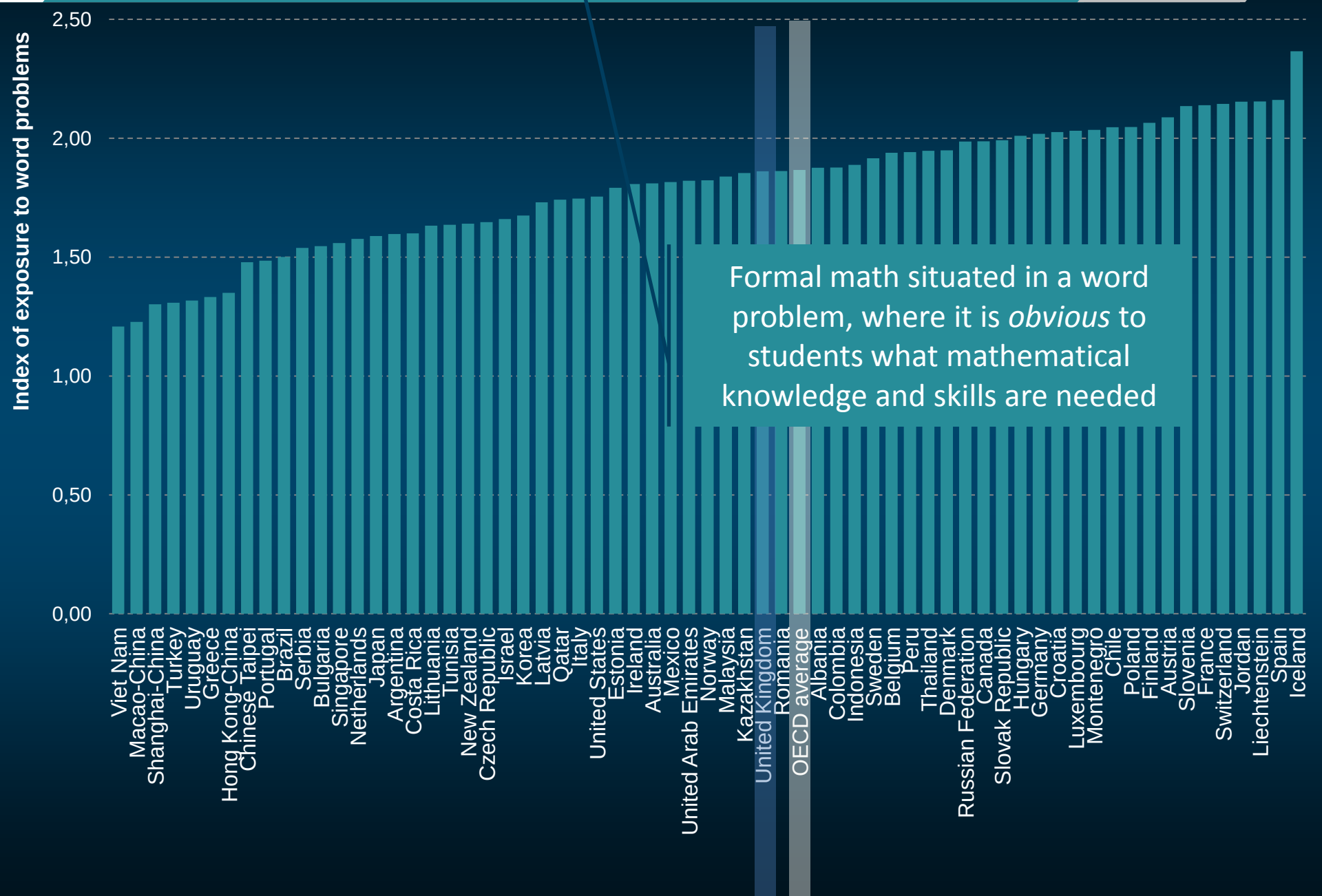


Math teaching ≠ math teaching

PISA = reason mathematically and understand, formulate, employ and interpret mathematical concepts, facts and procedures

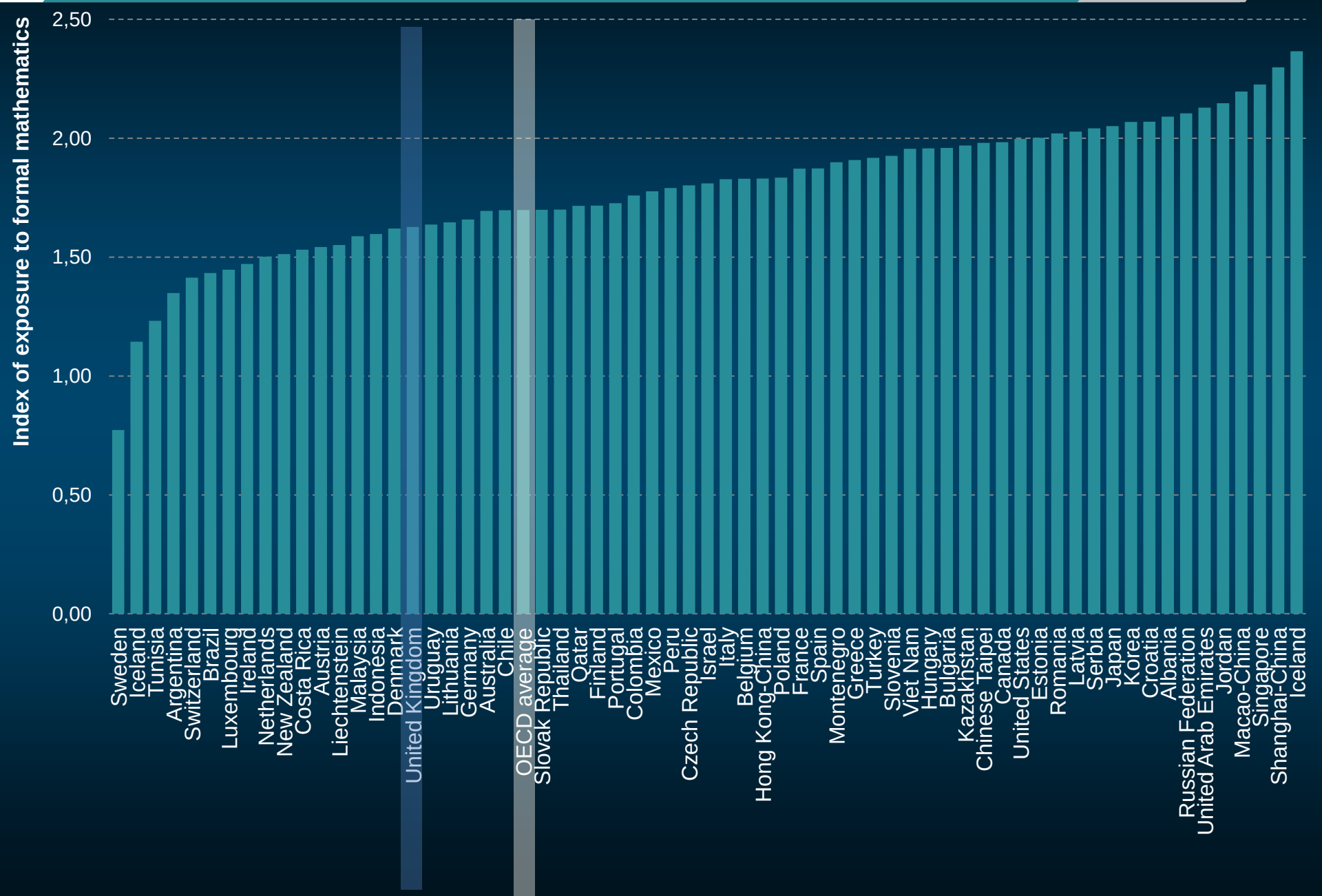
Students' exposure to word problems

Fig I.3.1a



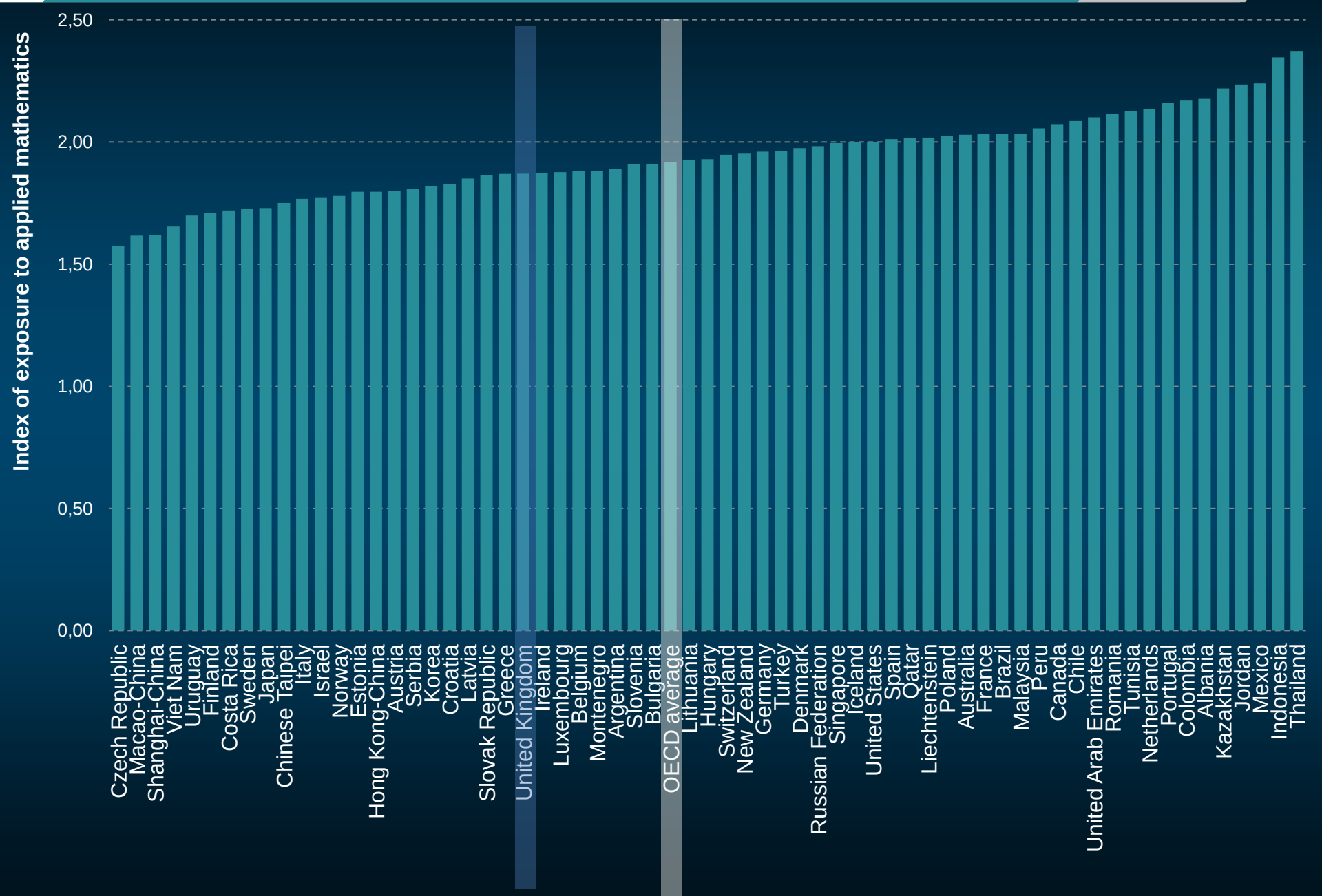
Students' exposure to formal mathematics

Fig I.3.1b



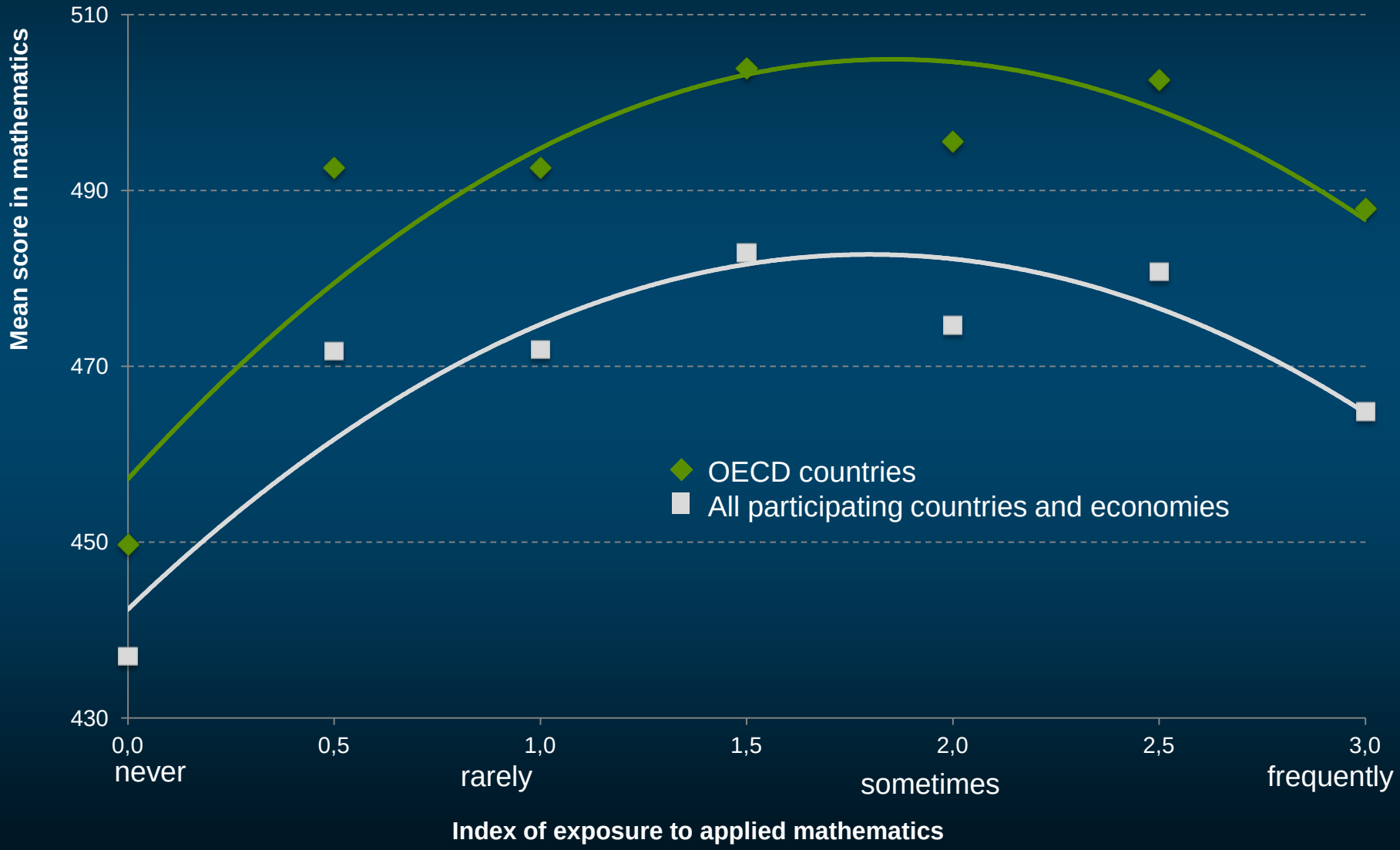
Students' exposure to applied mathematics

Fig I.3.1c



Relationship between mathematics performance and students' exposure to applied mathematics

Fig I.3.2

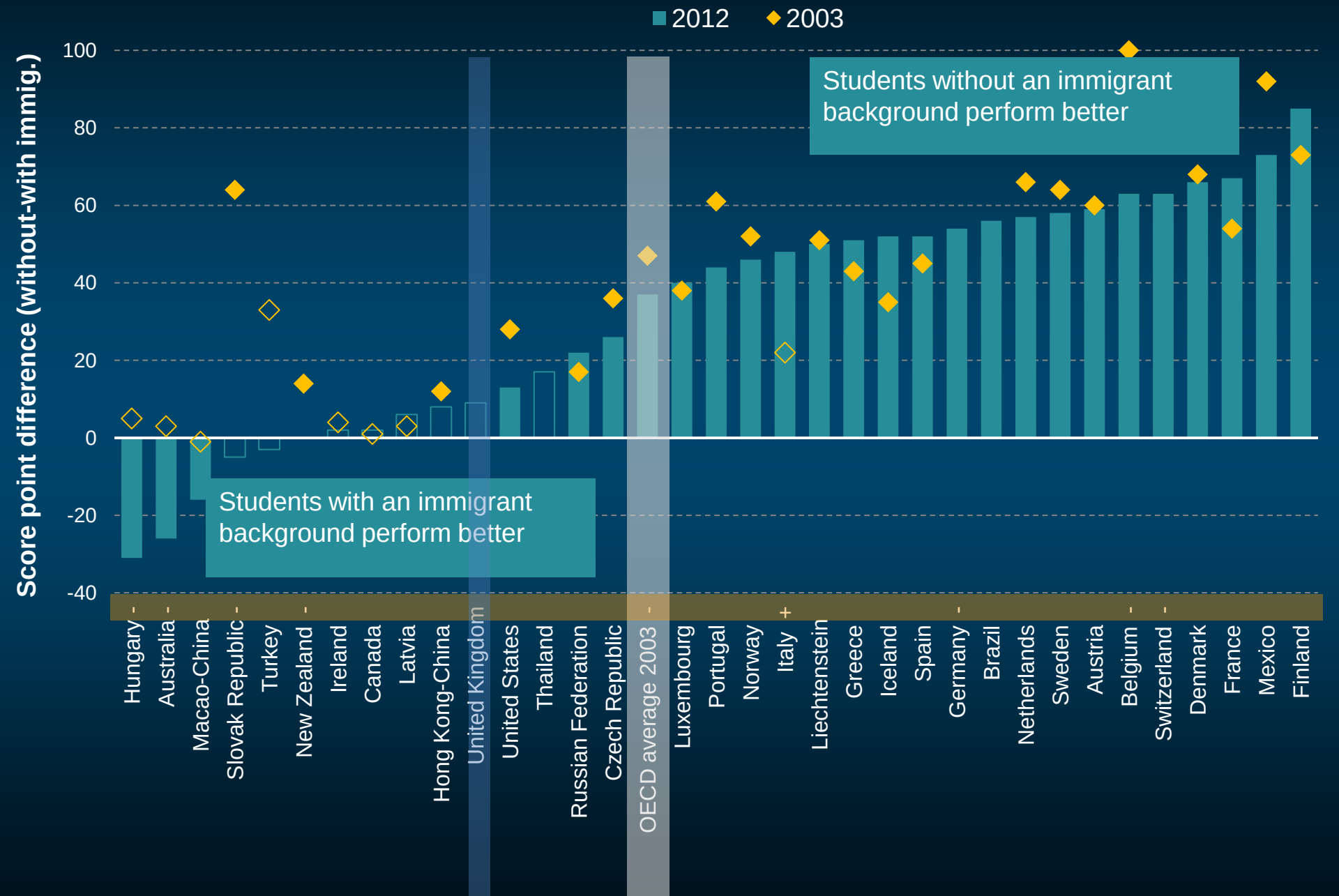


The share of **immigrant students** in OECD countries increased from 9% in 2003 to 12% in 2012…

…while the performance disadvantage of immigrant students shrank by 11 score points during the same period (after accounting for socio-economic factors)

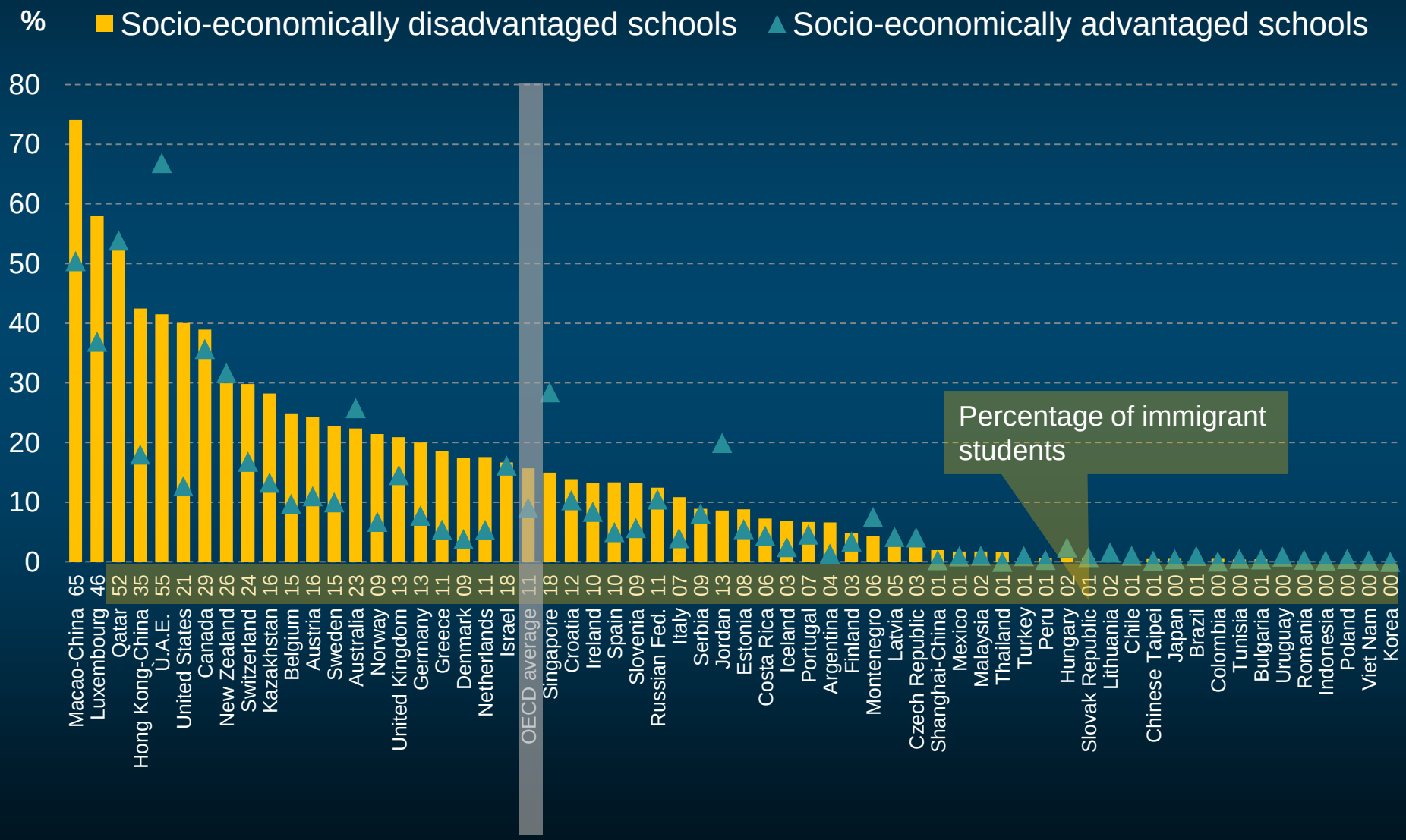
Change between 2003 and 2012 in immigrant students' mathematics performance – **before** accounting for students' socio-economic status

Fig II.3.5



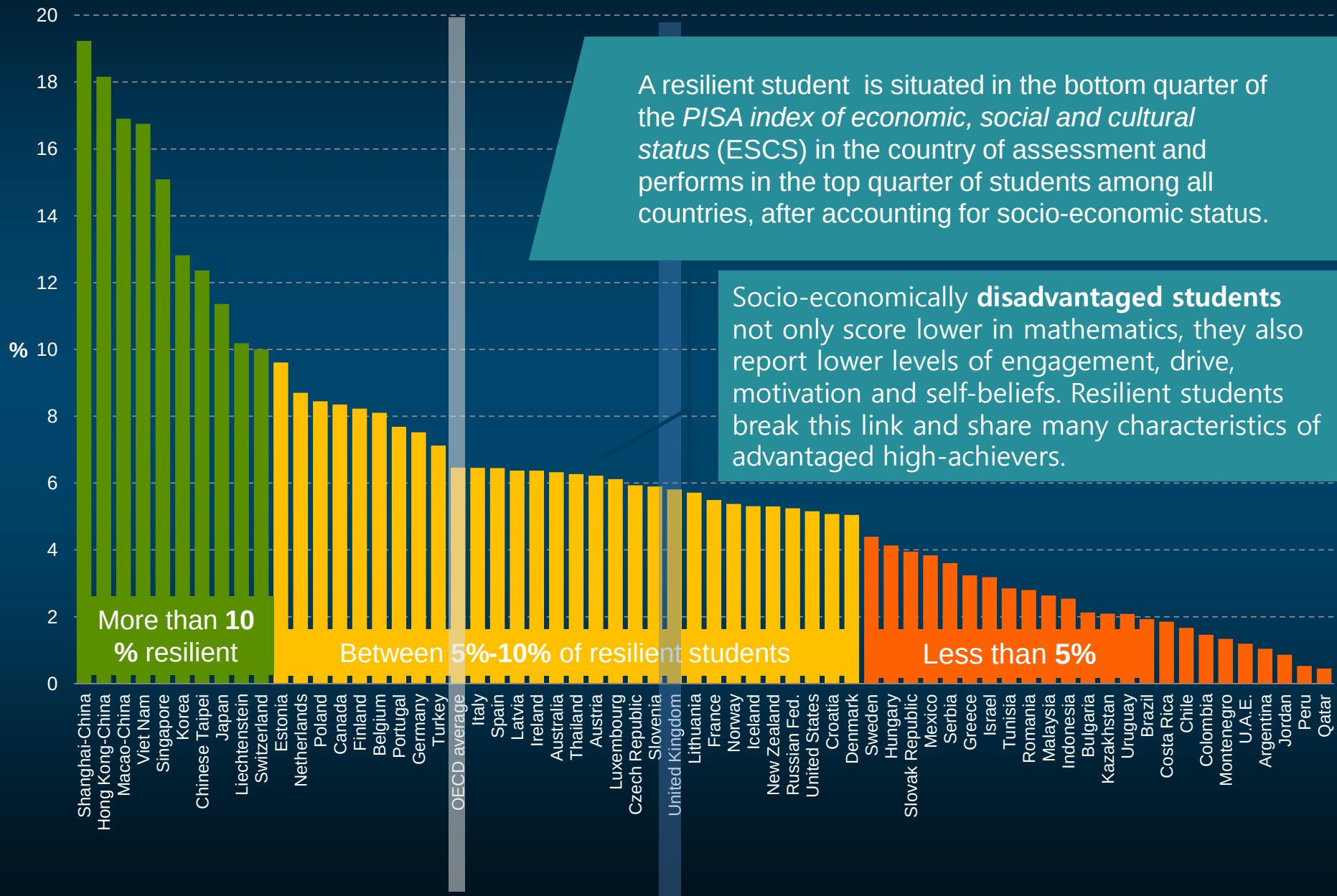
Proportion of immigrant students in socio-economically disadvantaged, average and advantaged schools

Fig II.3.9



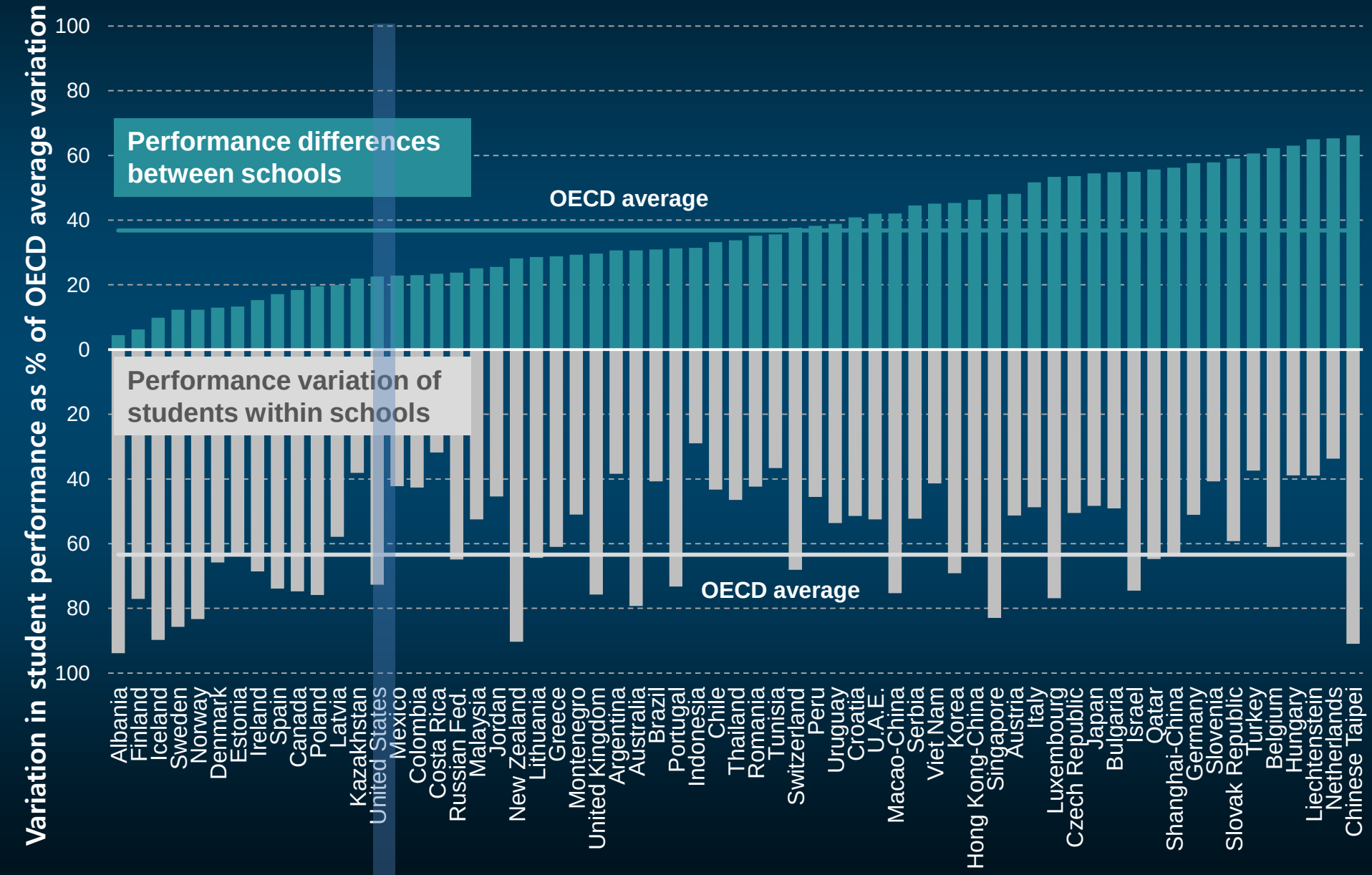
Percentage of resilient students

Fig II.2.4



Variability in student mathematics performance between and within schools

Fig II.2.7

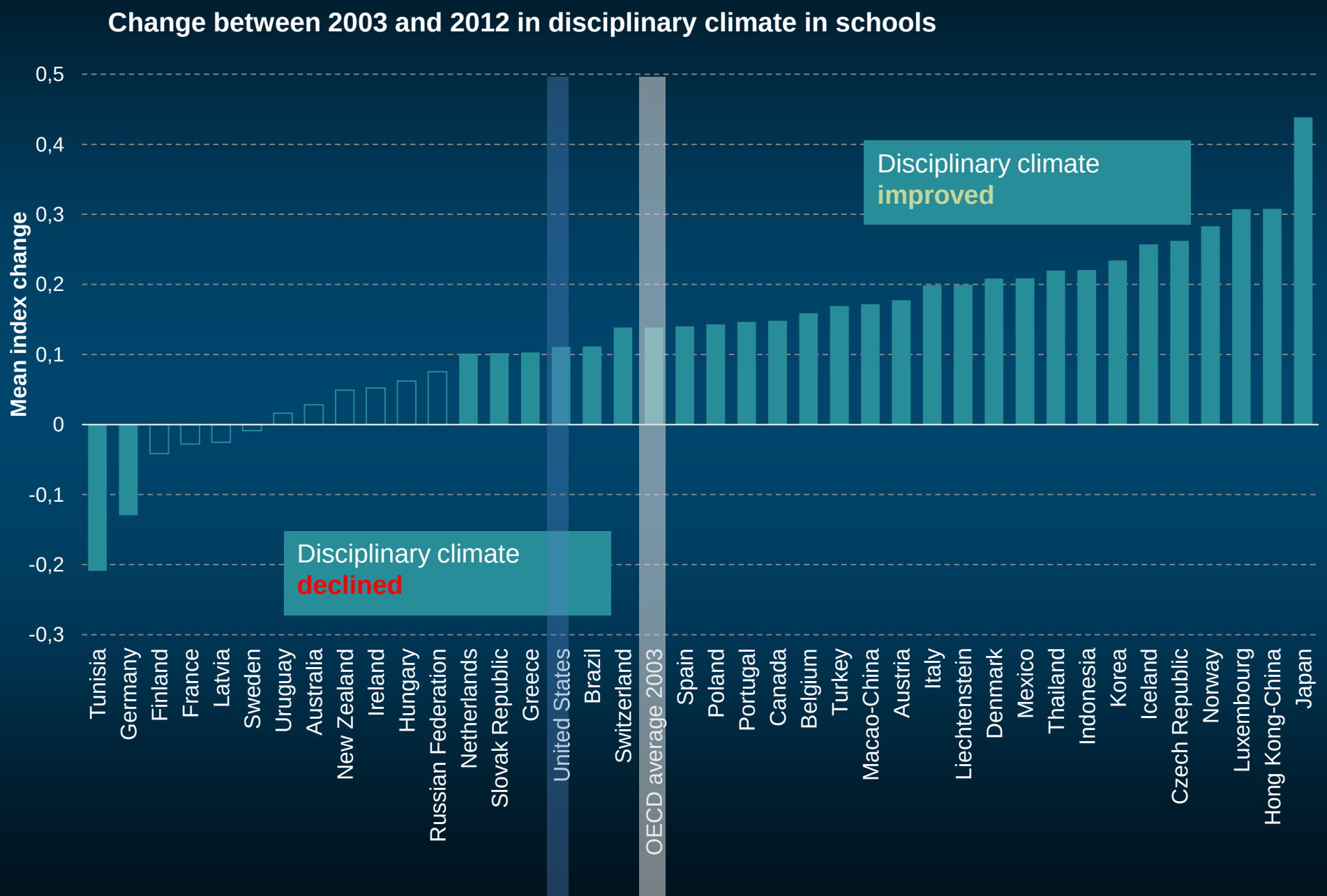


Disciplinary climate improved

Teacher-student relations improved between 2003 and 2012 in all but one country; and disciplinary climate also improved during the period, on average across OECD countries and in 27 individual countries

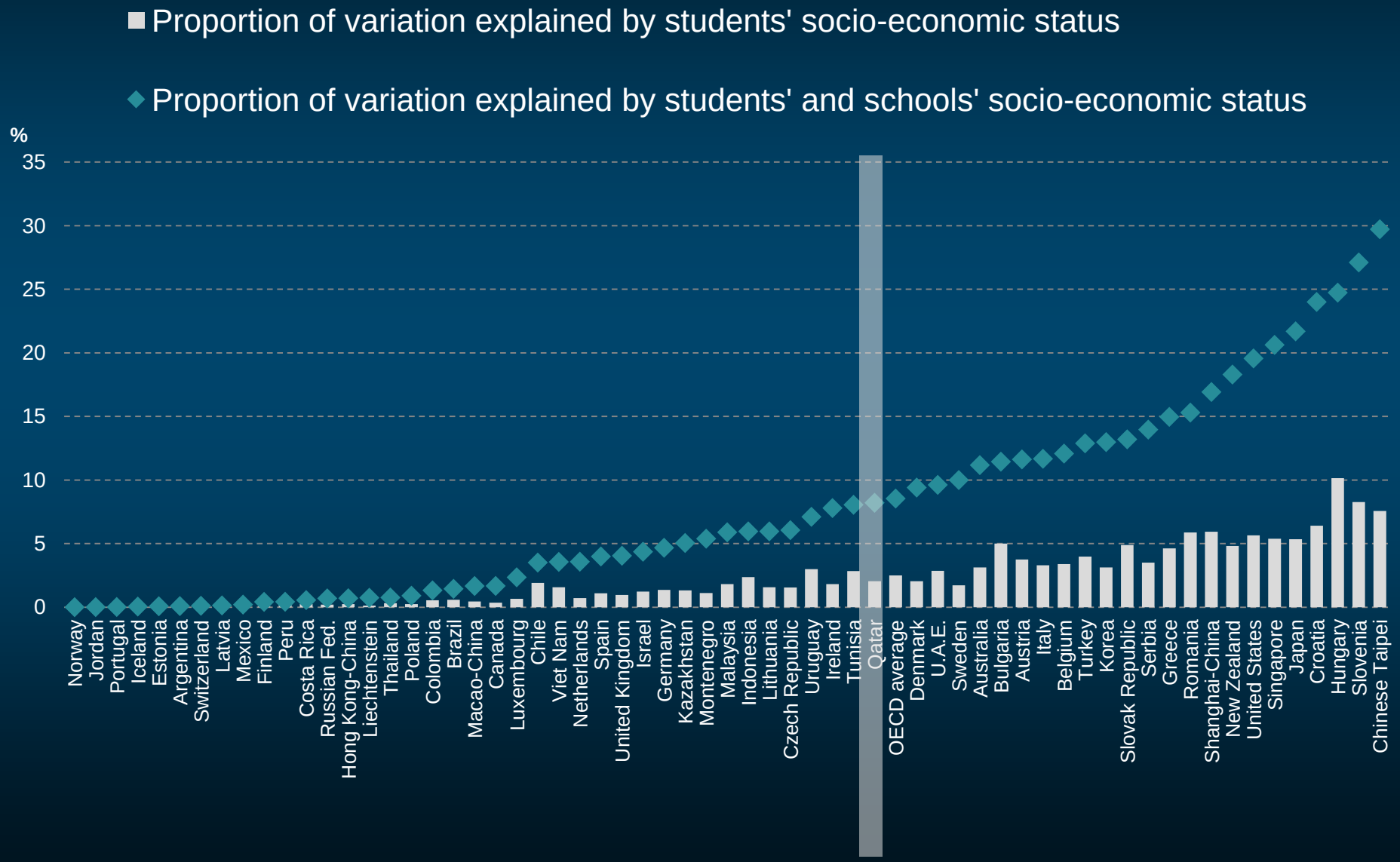
In most countries and economies, the disciplinary climate in schools improved between 2003 and 2012

Fig IV.5.13



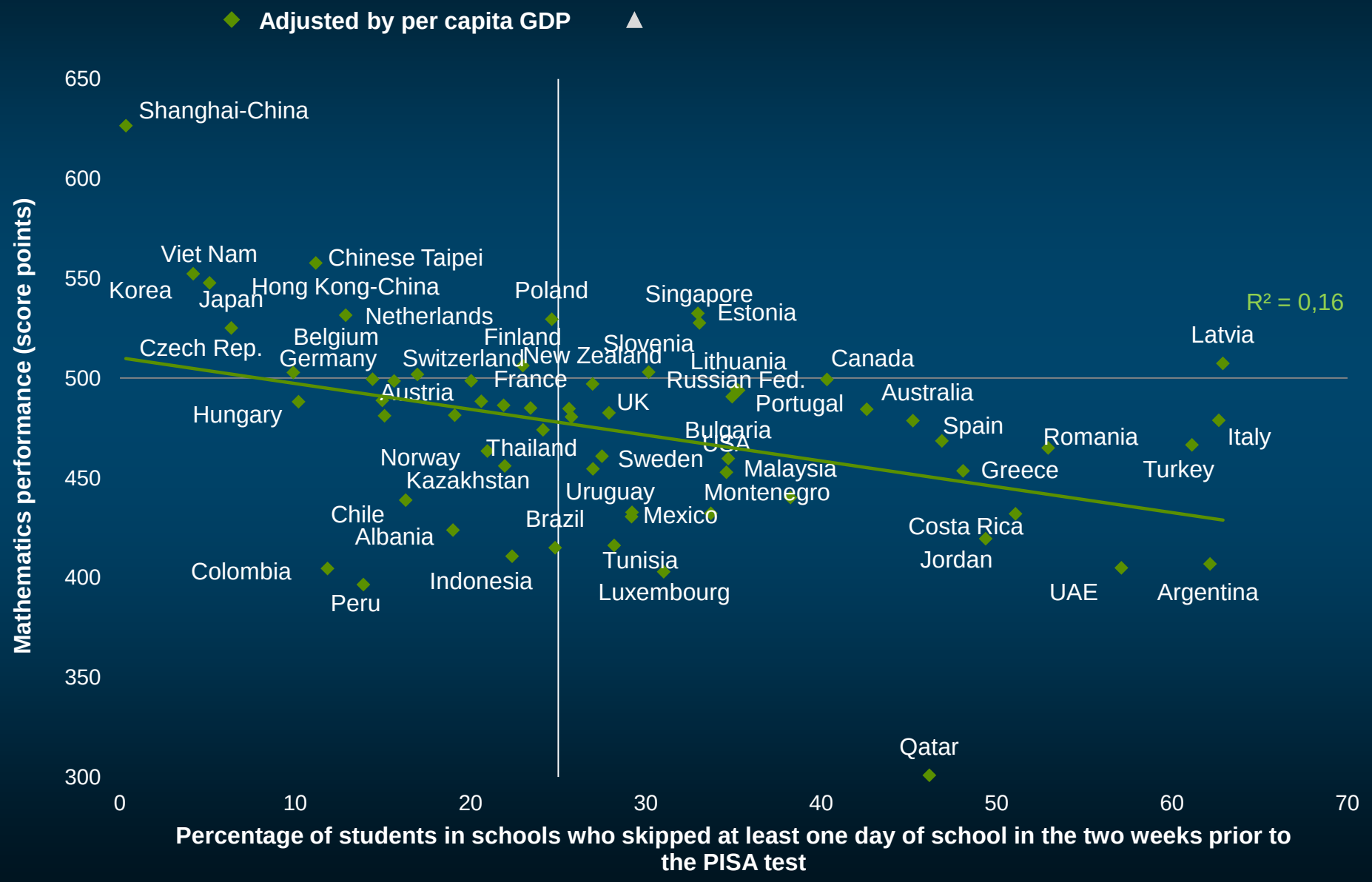
Differences in disciplinary climate explained by students' and schools' socio-economic profile

Fig II.4.9



Countries with large proportions of truants perform worse in mathematics

Fig IV.1.22

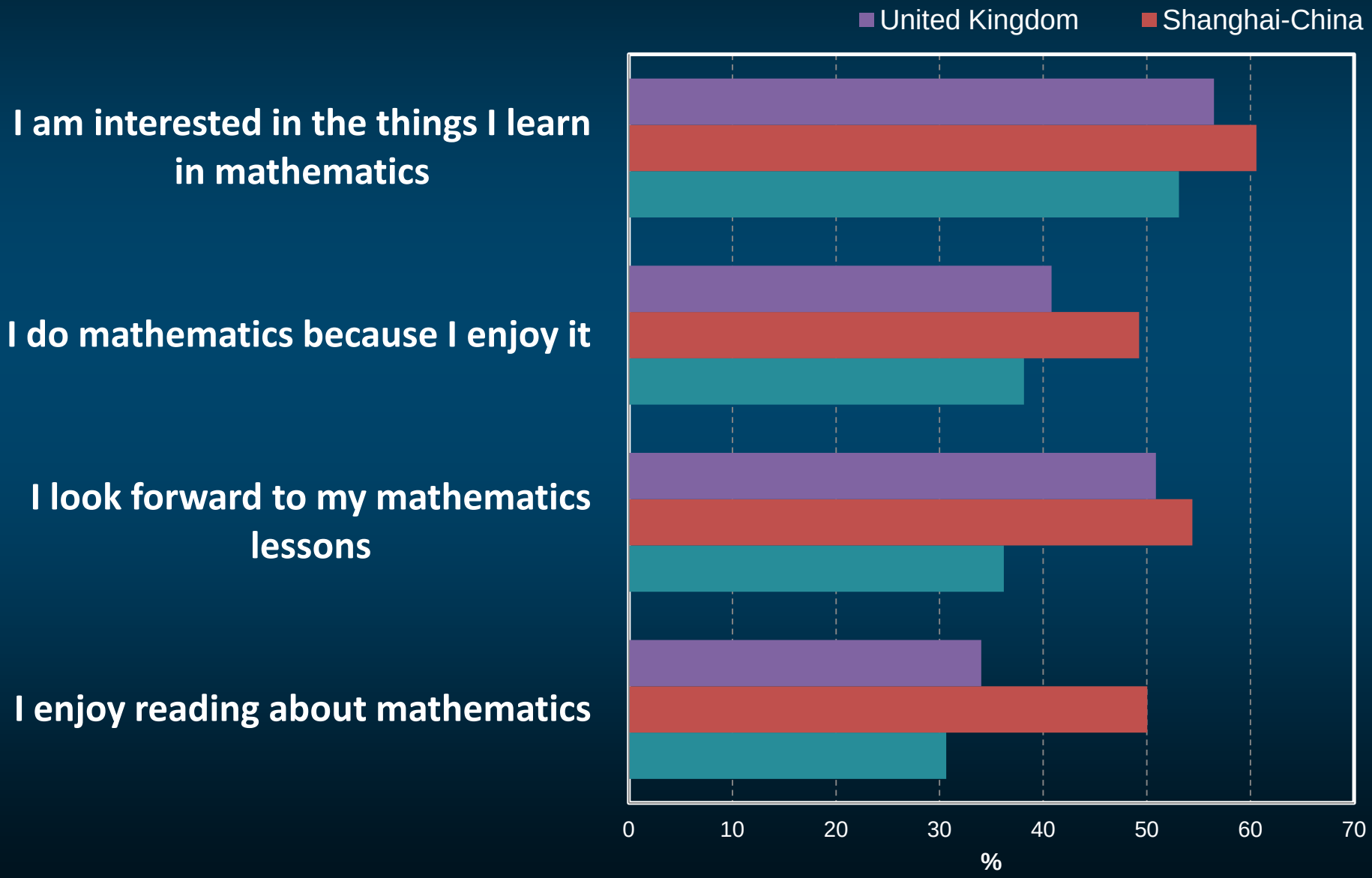


Social and emotional dimensions matter too

Motivation to learn mathematics

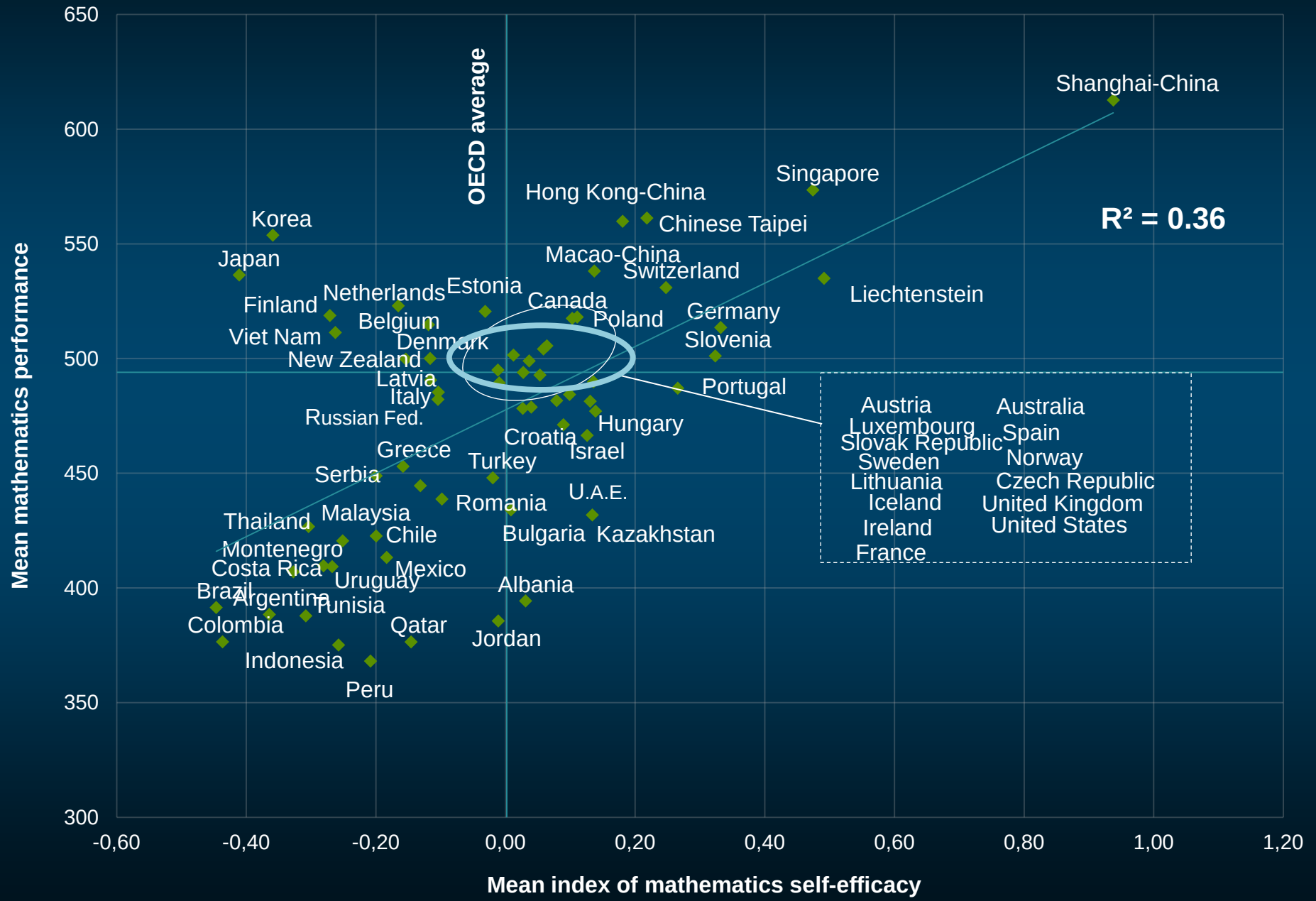
Fig III.3.9

Percentage of students who reported "agree" or "strongly agree" with the following statements:



Countries where students have stronger beliefs in their abilities perform better in mathematics

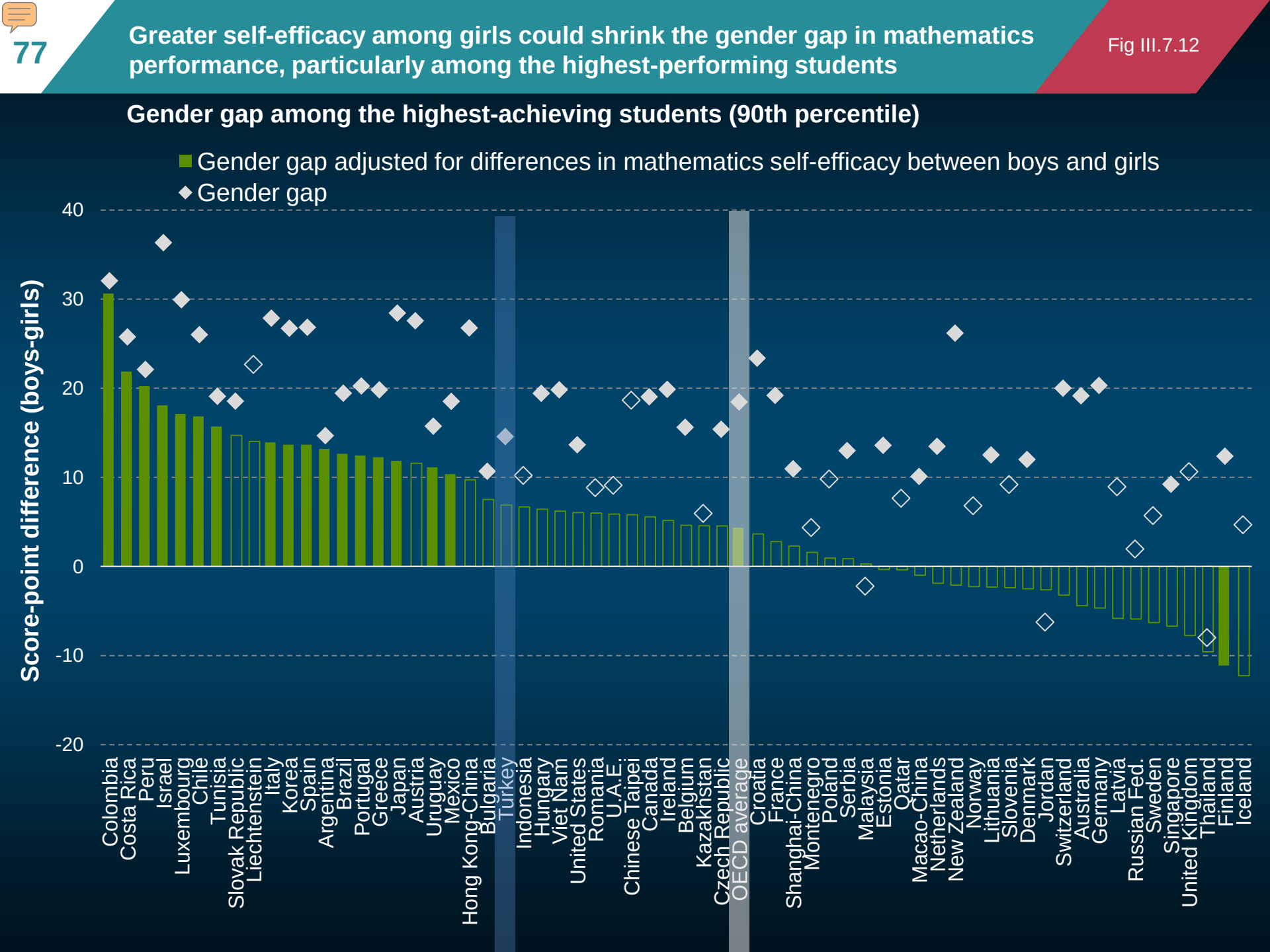
Fig III.4.5



Greater self-efficacy among girls could shrink the gender gap in mathematics performance, particularly among the highest-performing students

Fig III.7.12

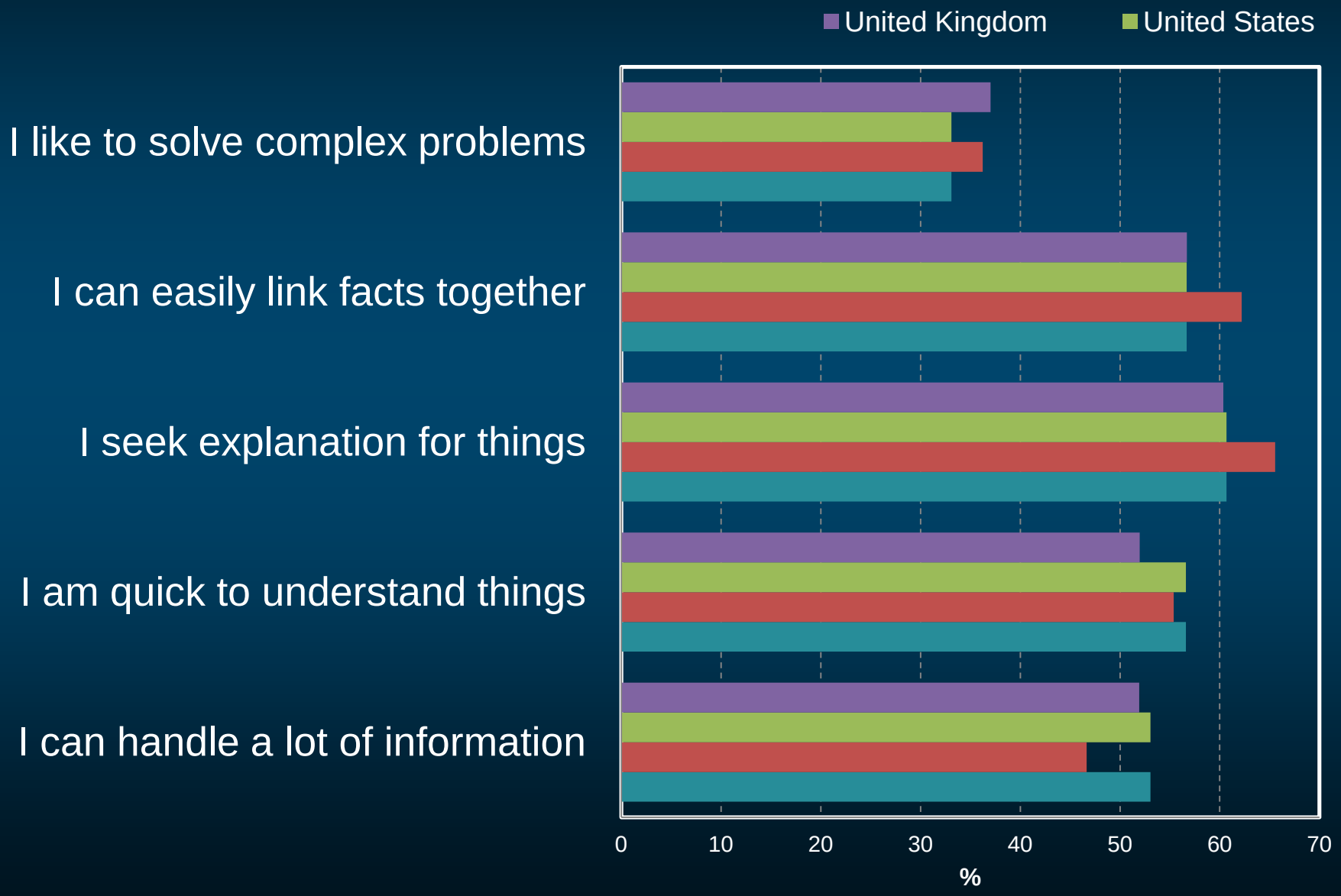
Gender gap among the highest-achieving students (90th percentile)



Openness to problem solving

Fig III.3.4

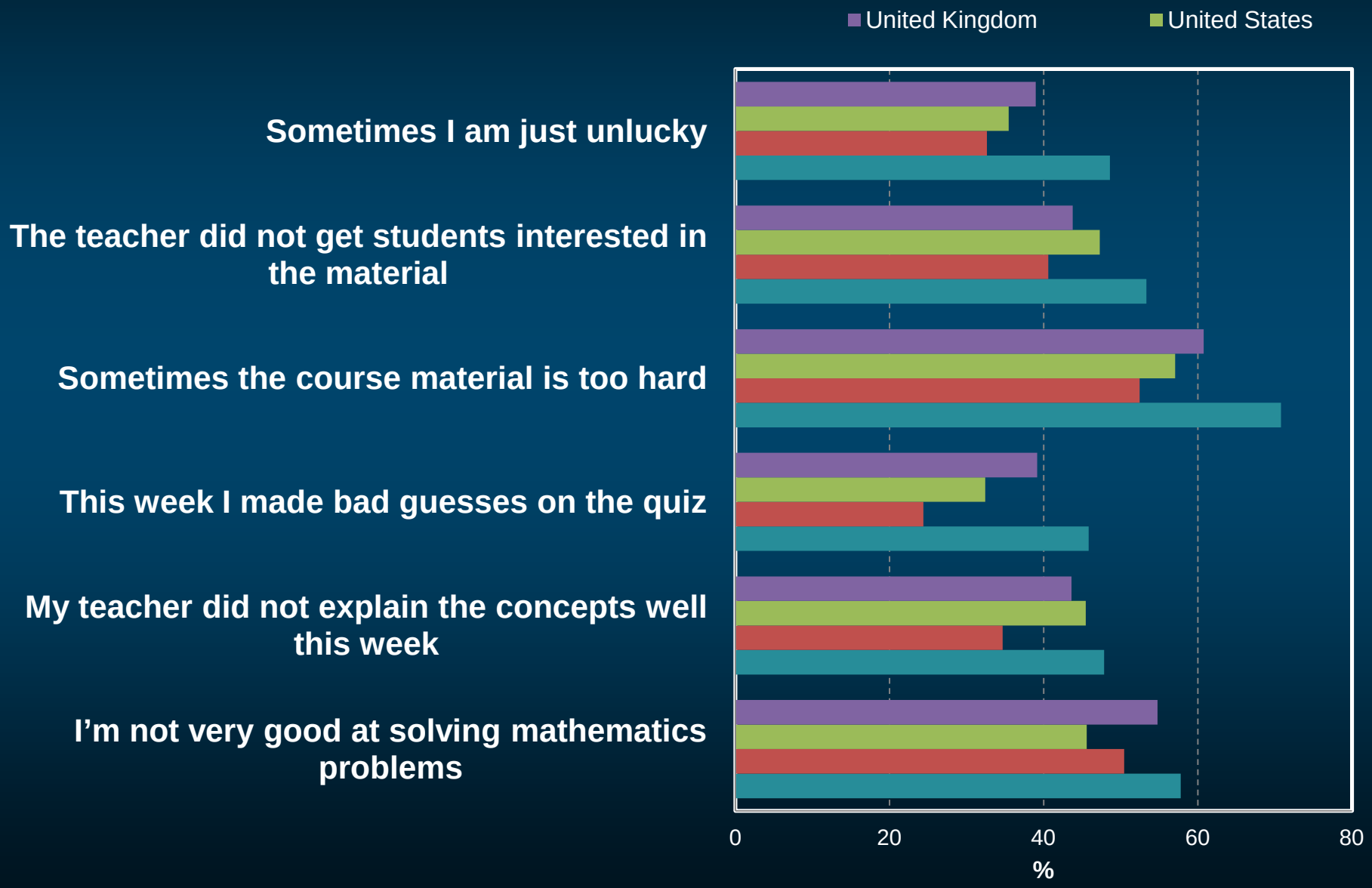
Percentage of students who reported "agree" or "strongly agree" with the following statements:



Perceived self-responsibility for failure in mathematics

Fig III.3.6

Percentage of students who reported "agree" or "strongly agree" with the following statements:

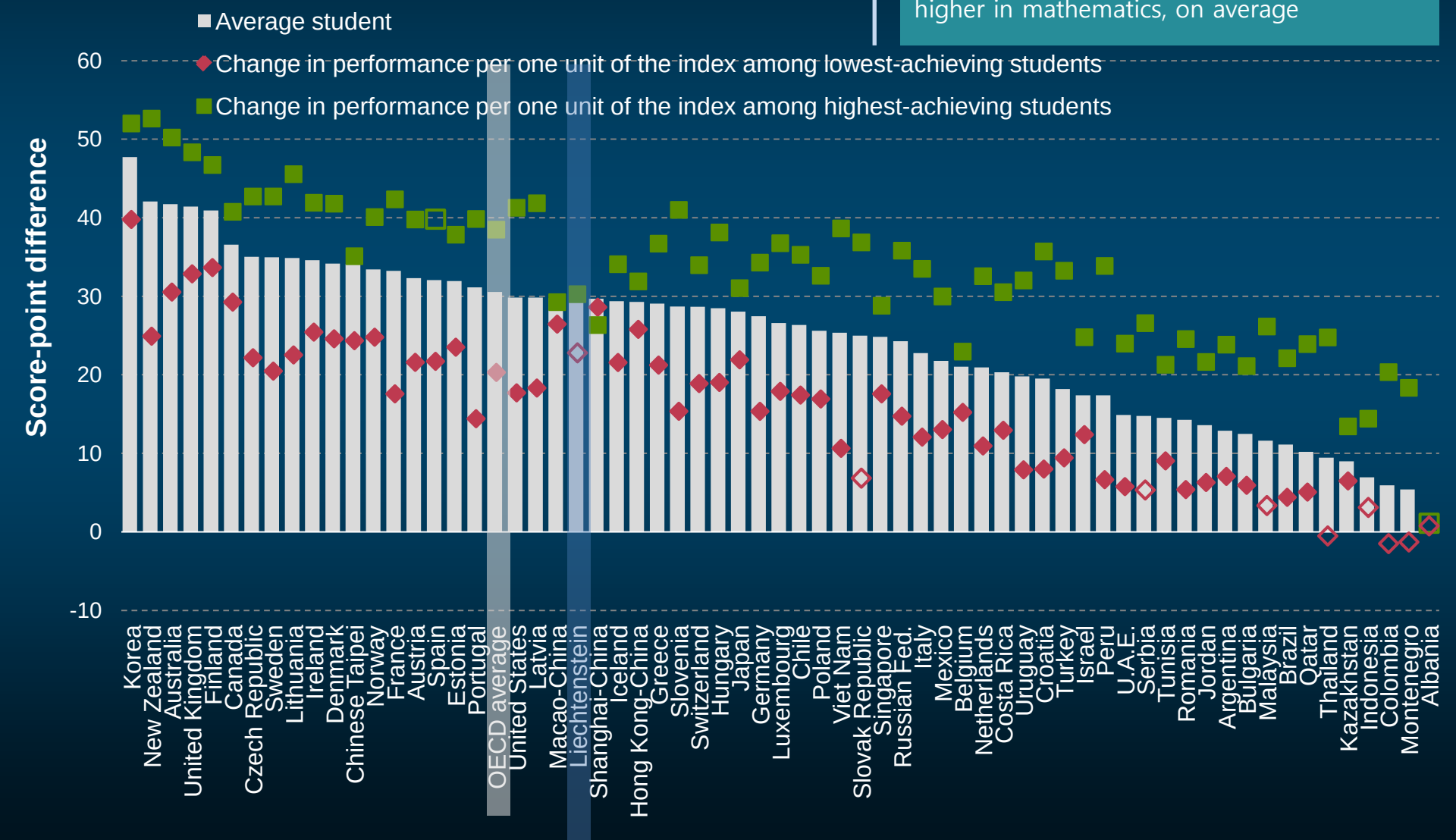


Students open to problem solving perform better

Fig III.3.5

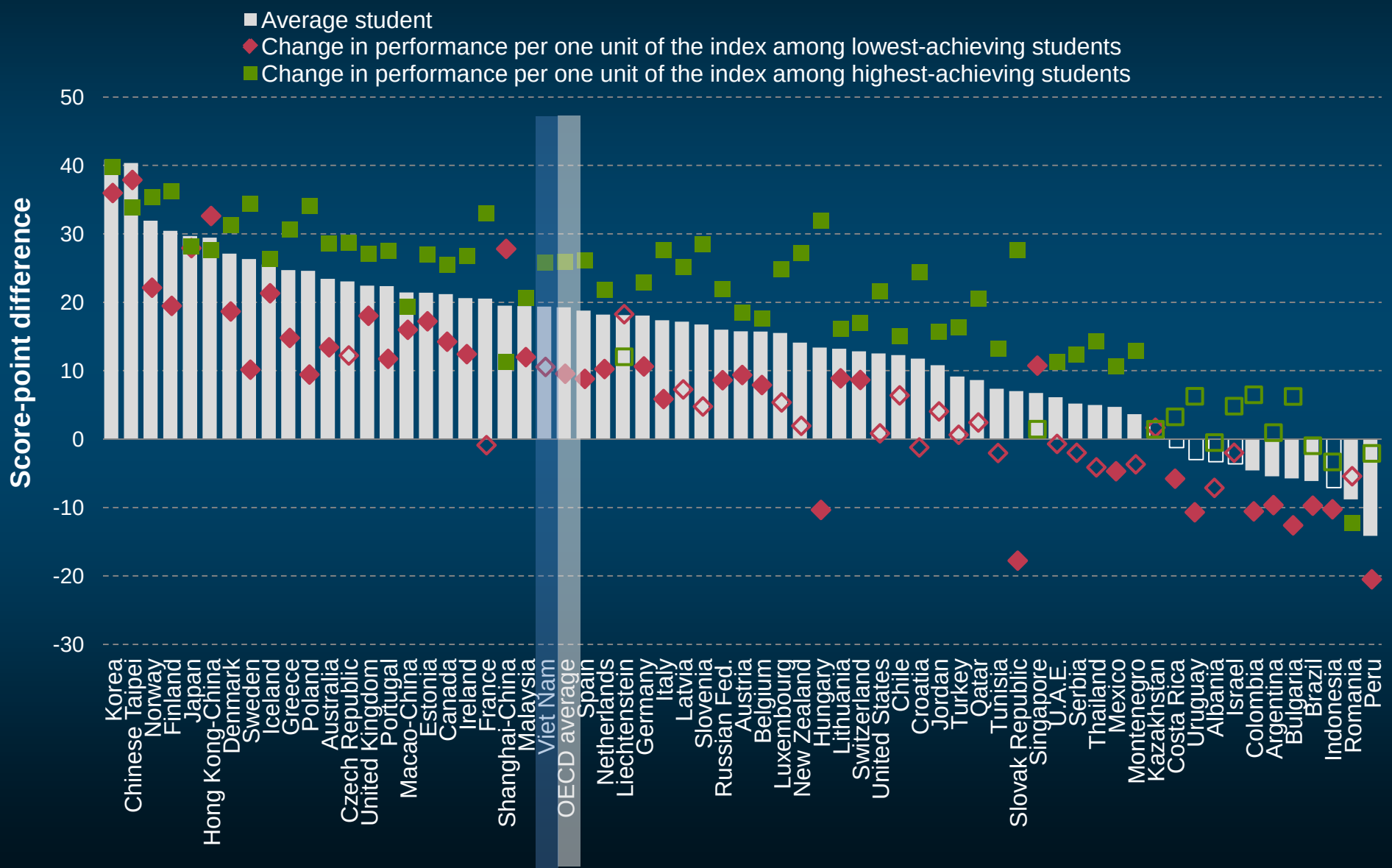
Score-point difference in mathematics associated with one unit of the index of students' openness to problem solving

Students who feel that they can handle a lot of information, seek explanations for things, can easily link facts together, and like to solve complex problems – score 30 points higher in mathematics, on average



Students who enjoy learning mathematics perform better

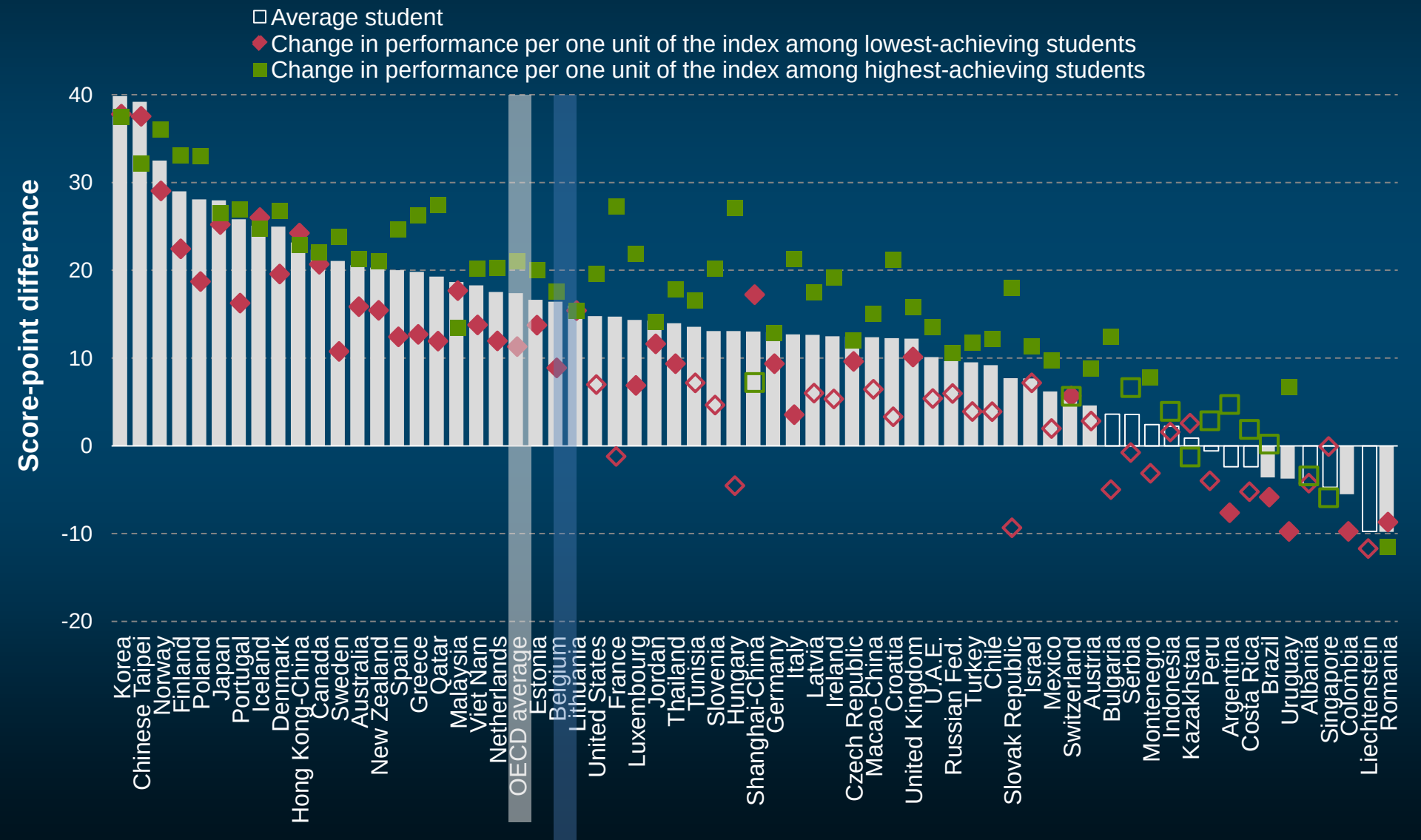
Score-point difference in mathematics associated with one unit of the index of intrinsic motivation to learn mathematics



Students who believe that learning mathematics is useful perform better

Fig III.3.17

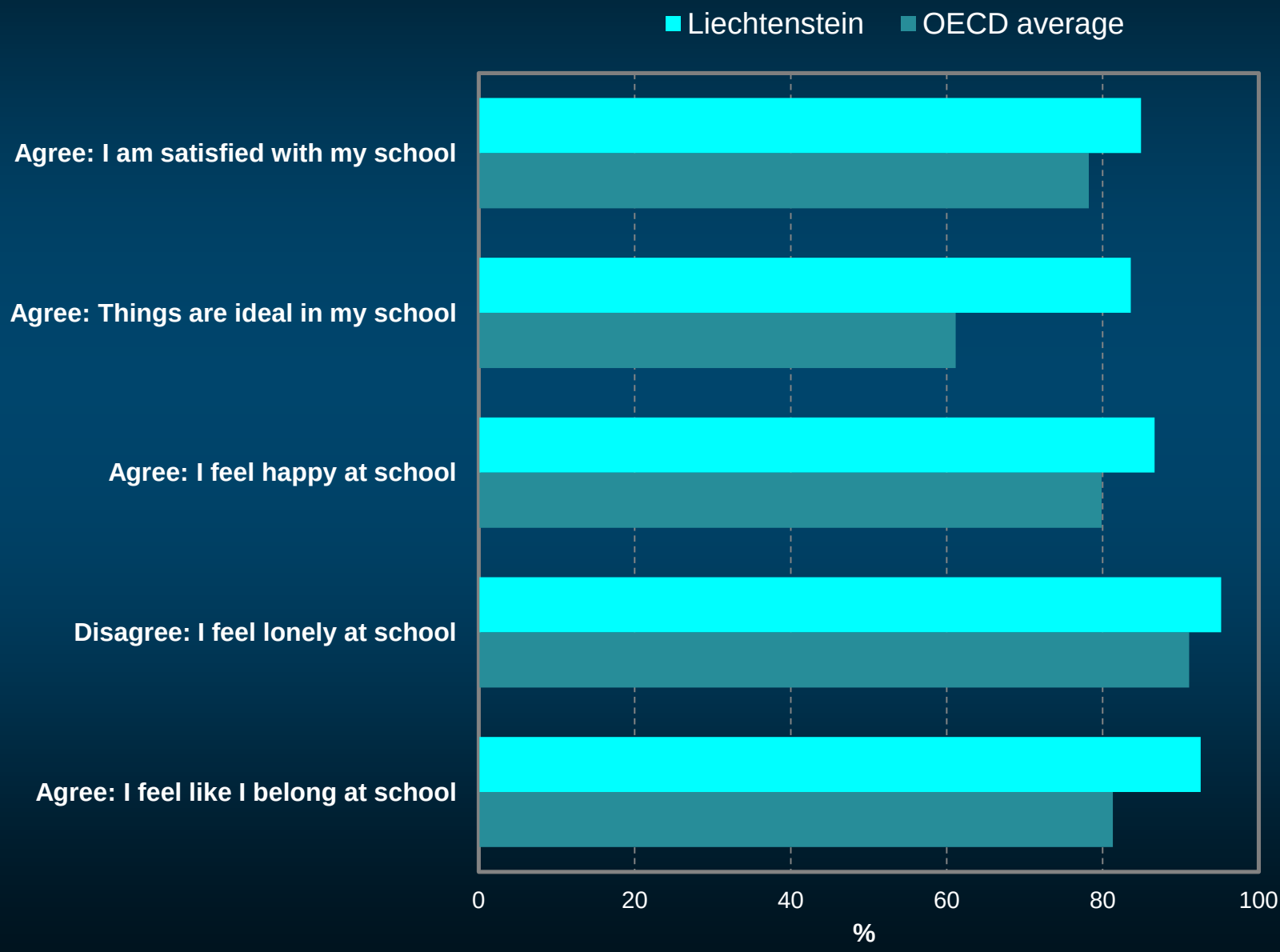
Score-point difference in mathematics associated with one unit of the index of instrumental motivation to learn mathematics



Students' sense of belonging

Fig III.2.12

Percentage of students who agree/disagree with the following statements:



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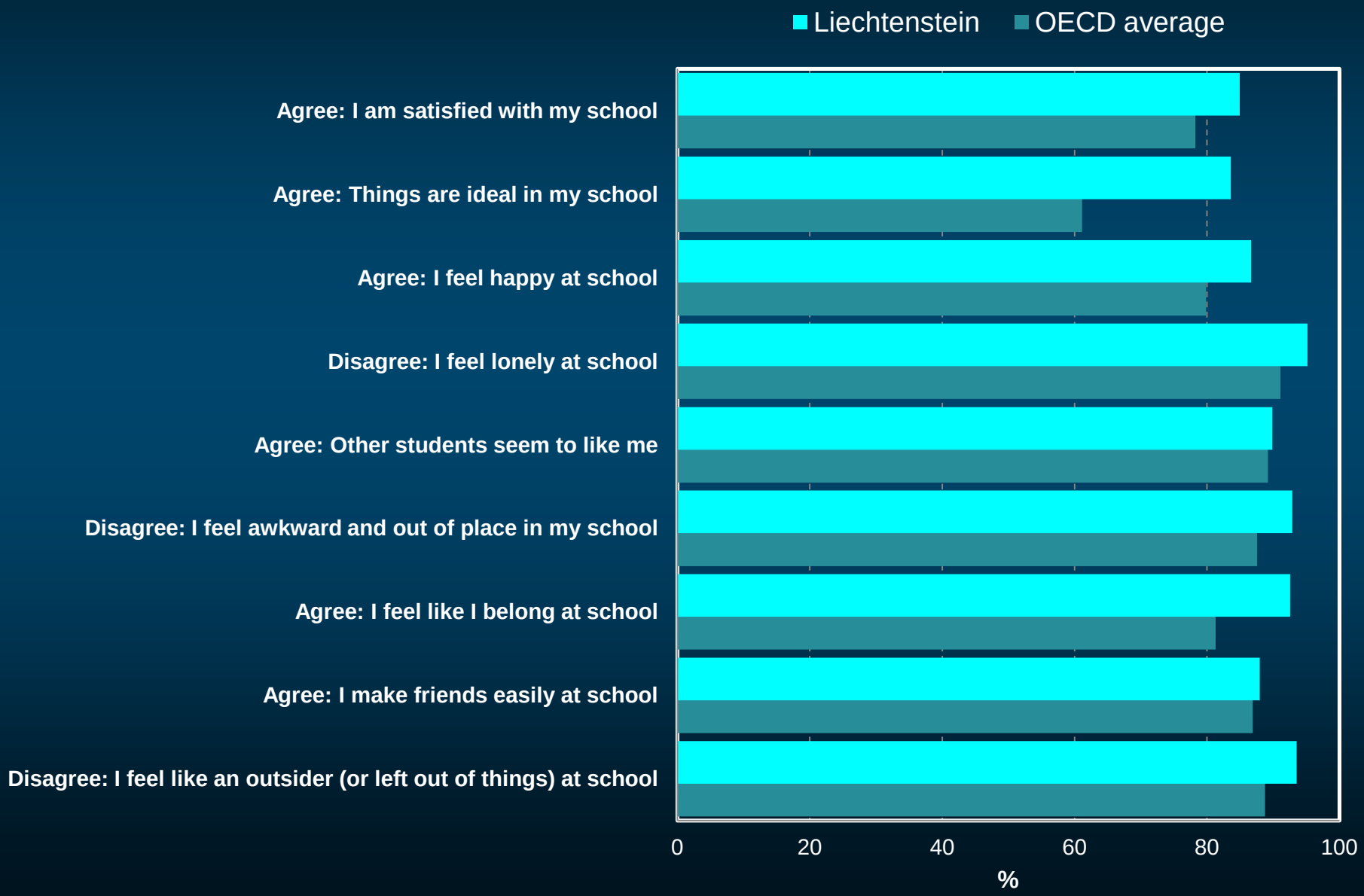
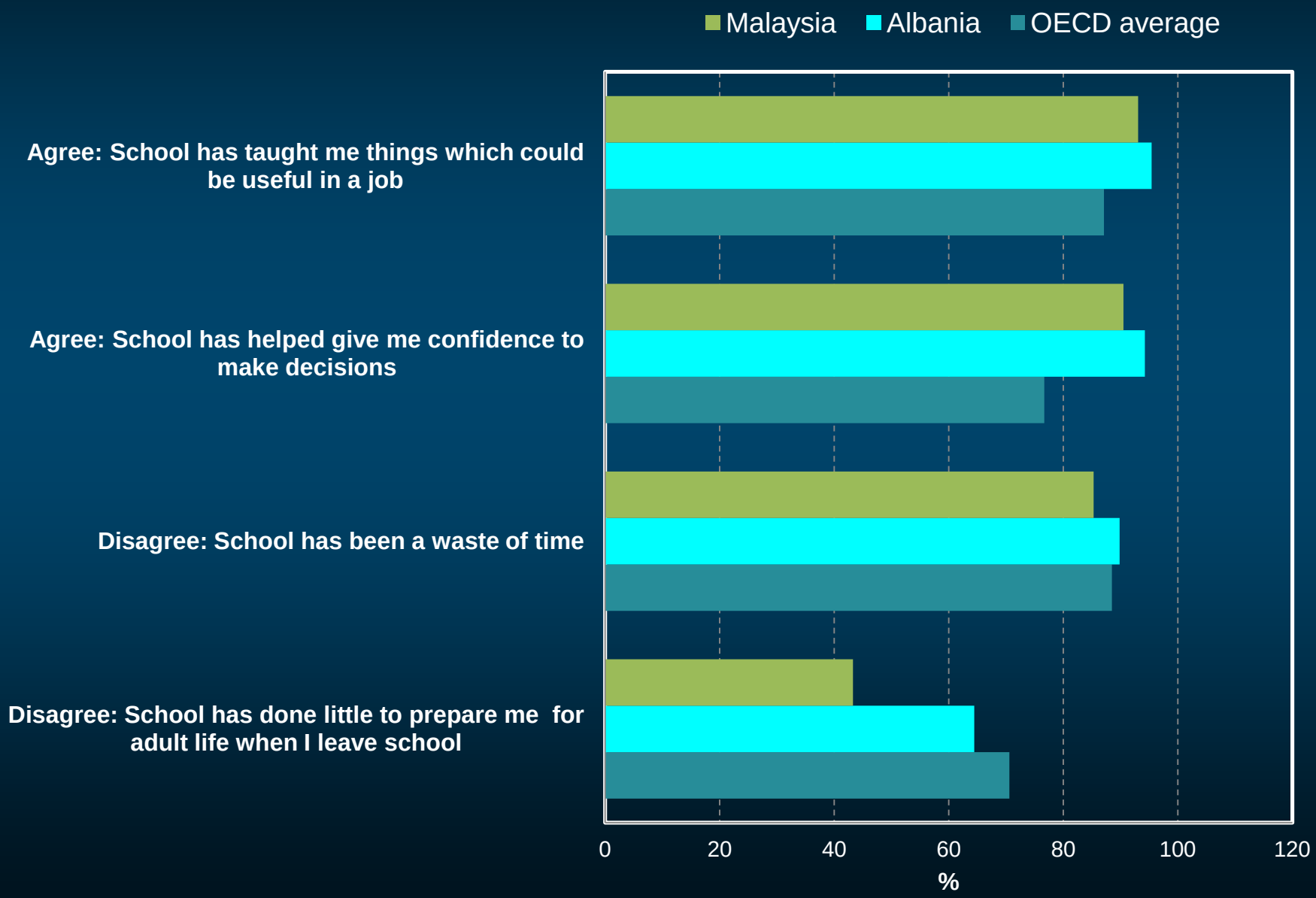


Students' attitudes towards school: Learning outcomes

Fig III.2.15

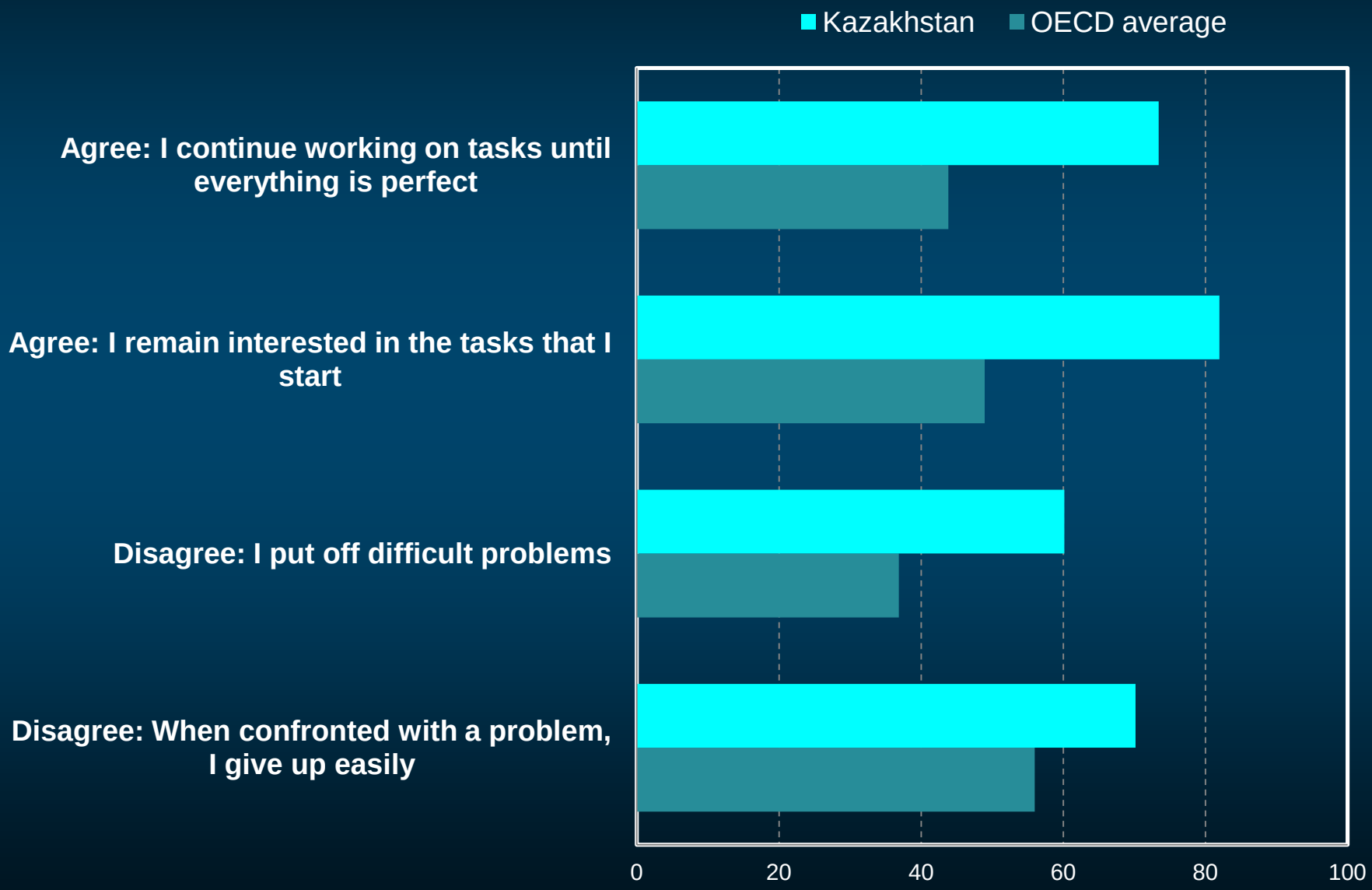
Percentage of students who agree/disagree with the following statements:



Students and perseverance

Fig III.3.2

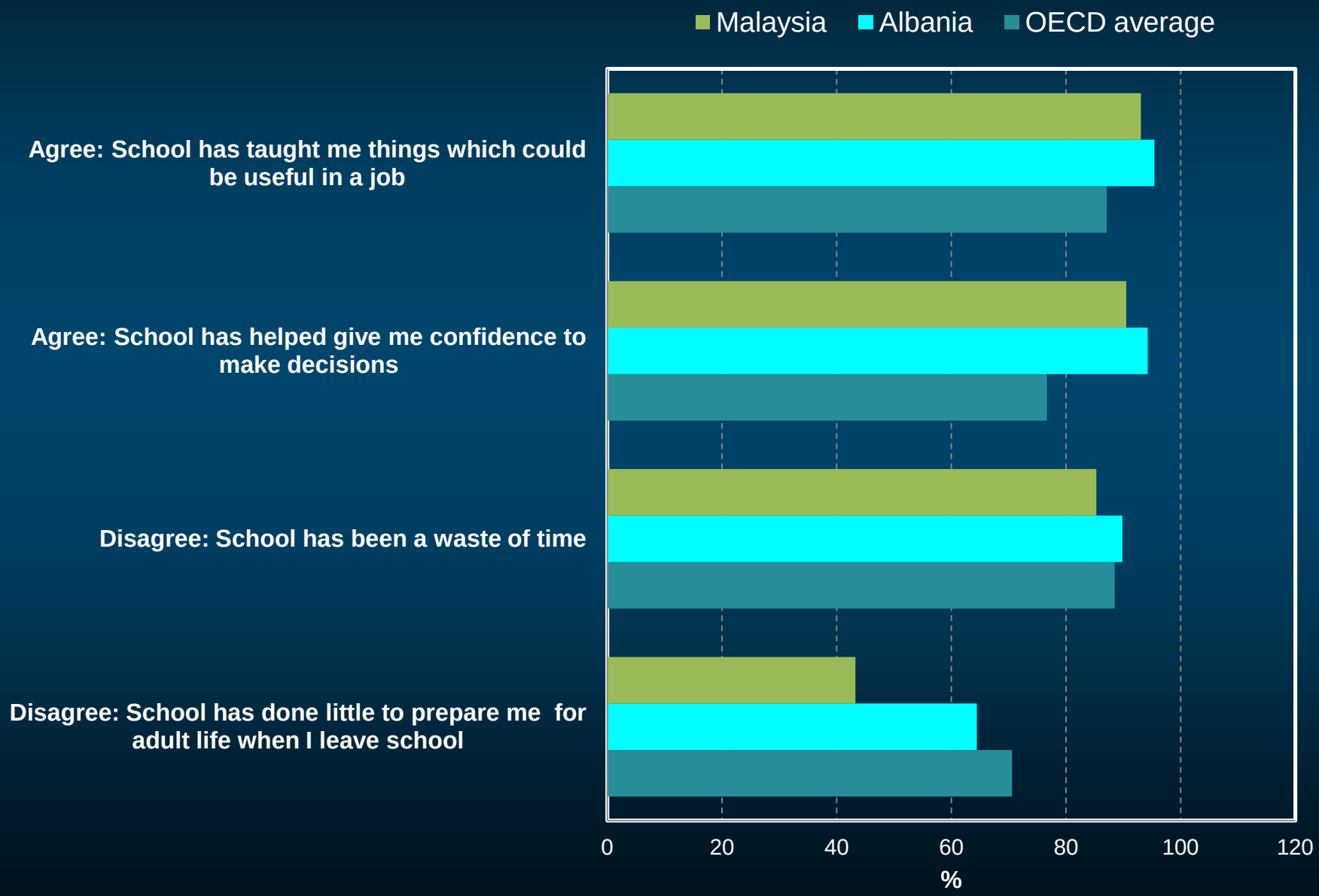
Percentage of students who reported that the following statements describe someone "very much like me" or "mostly like me" (*) or "not much like me" or "not at all like me" (**)



Students' attitudes towards school: Learning outcomes

Fig III.2.15

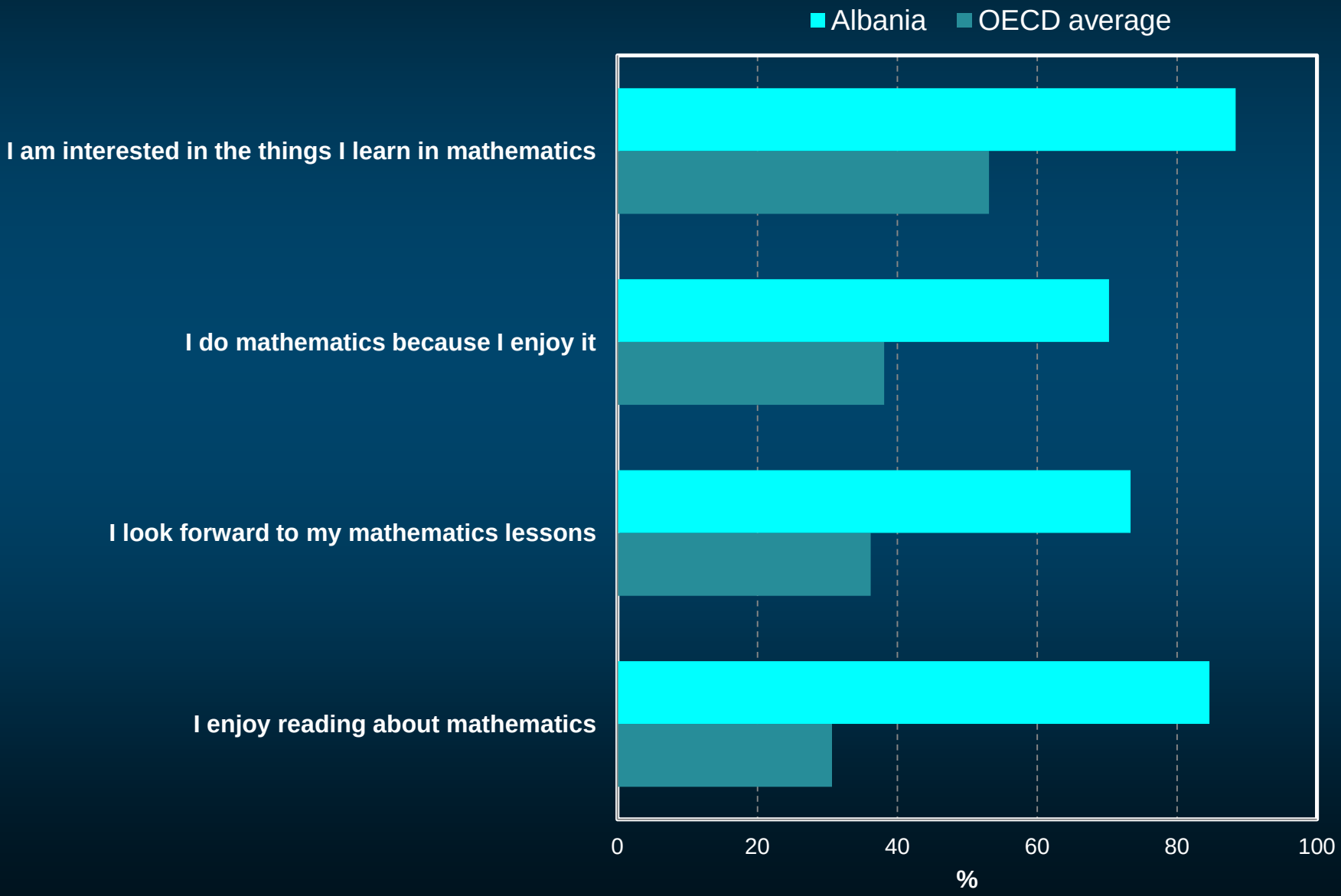
Percentage of students who agree/disagree with the following statements:



Students' intrinsic motivation to learn mathematics

Fig III.3.9

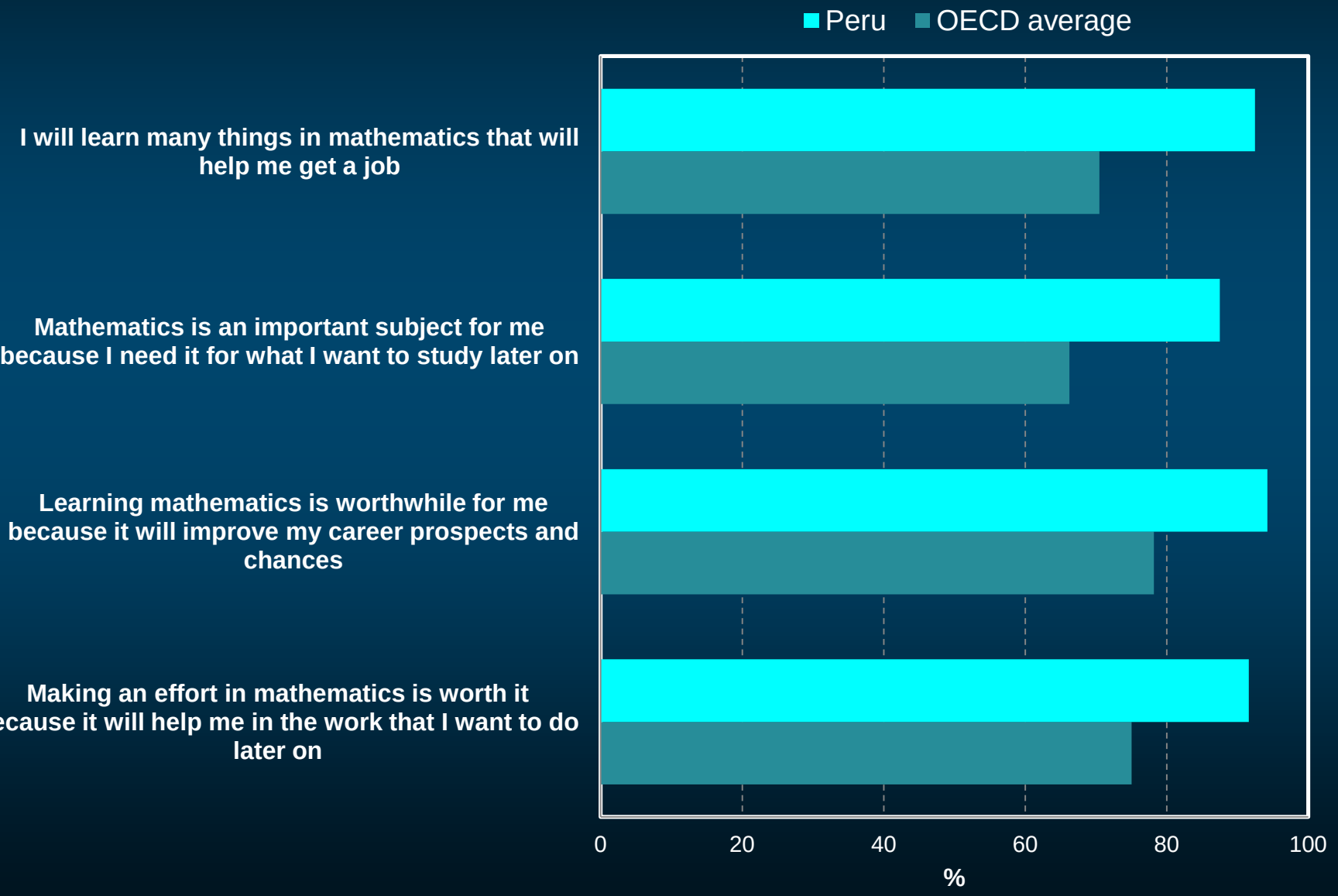
Percentage of students who reported "agree" or "strongly agree" with the following statements:



Students' instrumental motivation to learn mathematics

Fig III.3.14

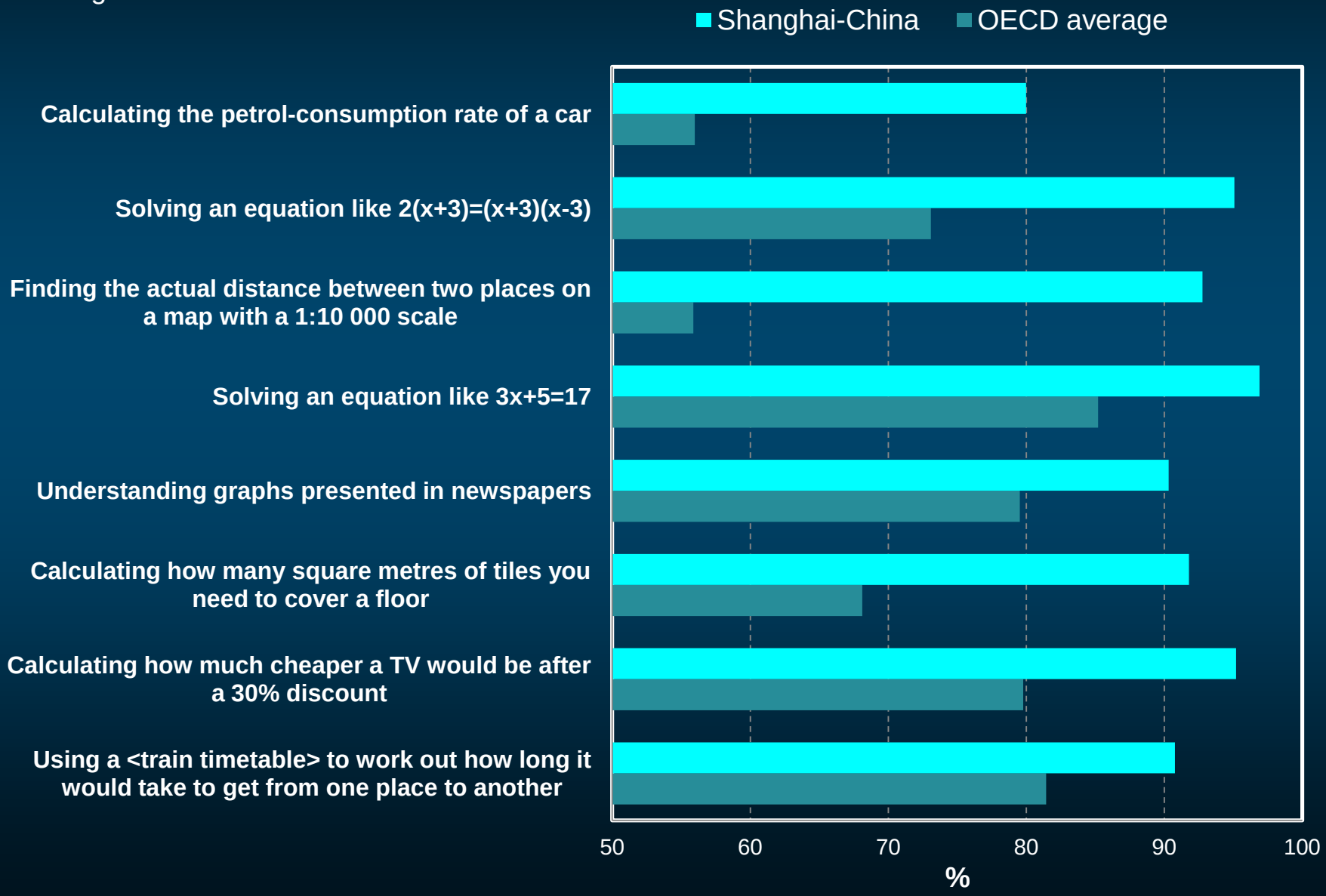
Percentage of students who reported "agree" or "strongly agree" with the following statements:



Students' mathematics self-efficacy

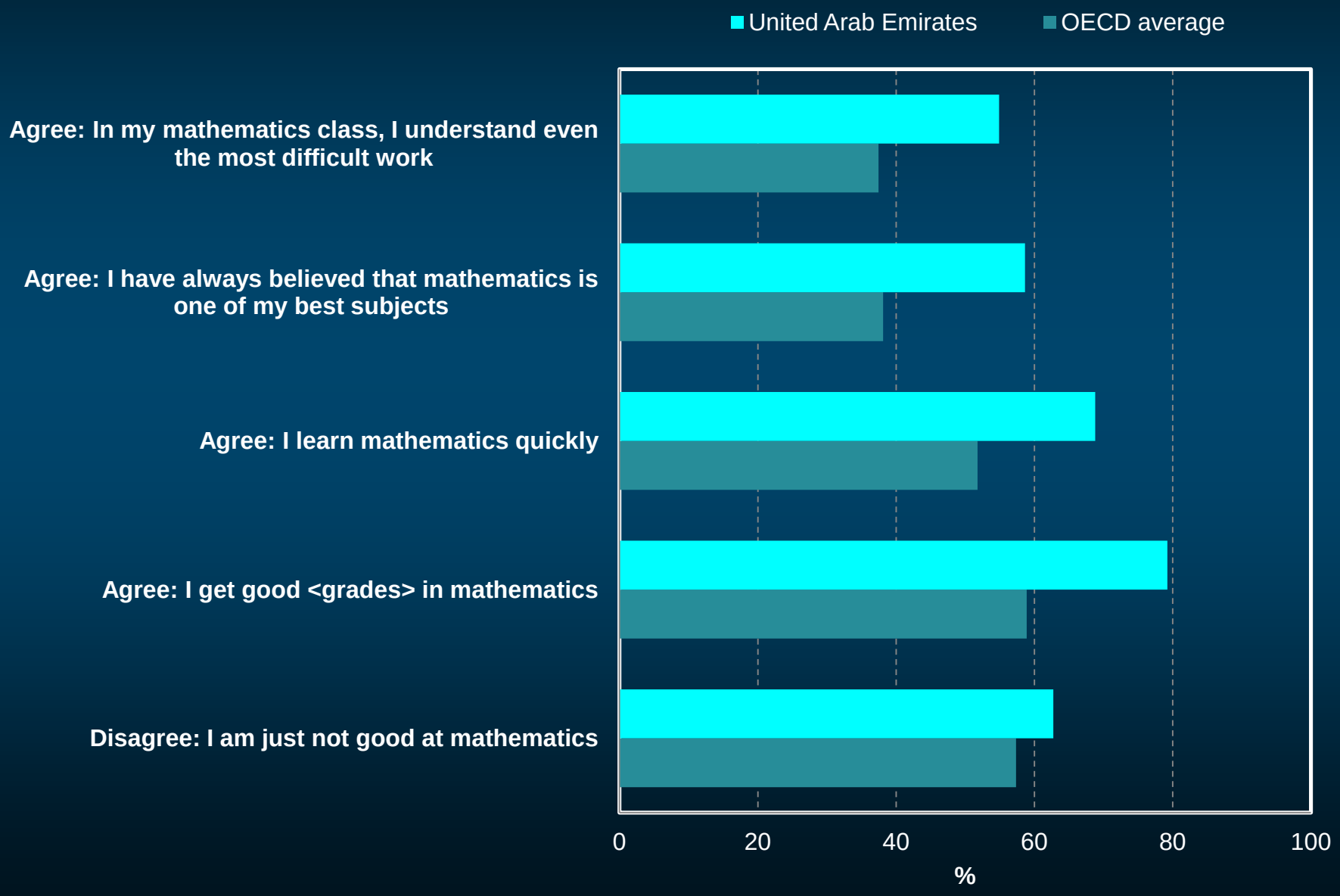
Fig III.4.2

Percentage of students who feel very confident or confident about having to do the following tasks in mathematics:



Students' mathematics self-concept

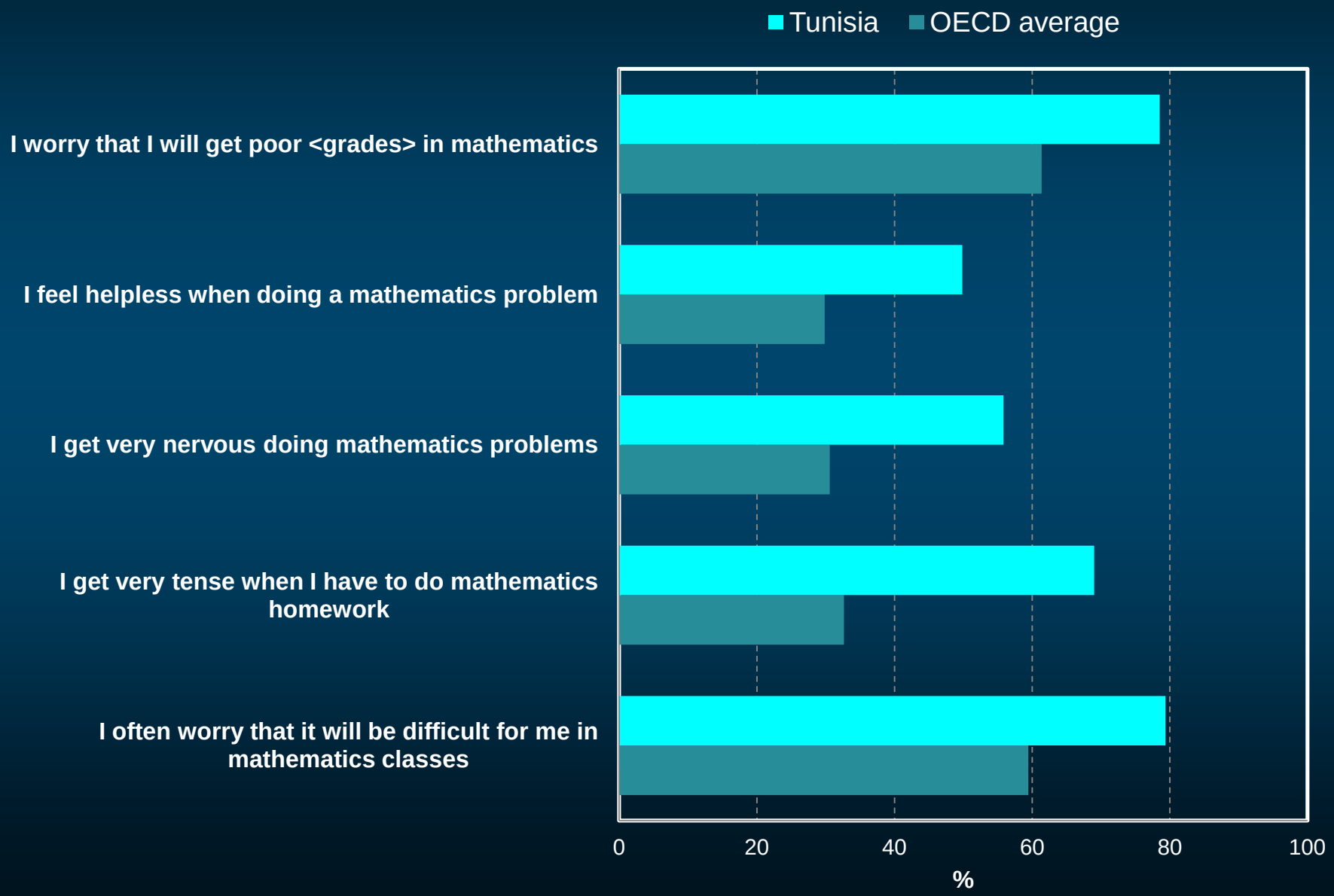
Percentage of students who agree*/disagree** with the following statements:



Students' mathematics anxiety

Fig III.4.10

Percentage of students who reported "agree" or "strongly agree" with the following statements:



Students' participation in mathematics-related activities

Fig III.4.16

Percentage of students who reported "agree" or "strongly agree" with the following statements:

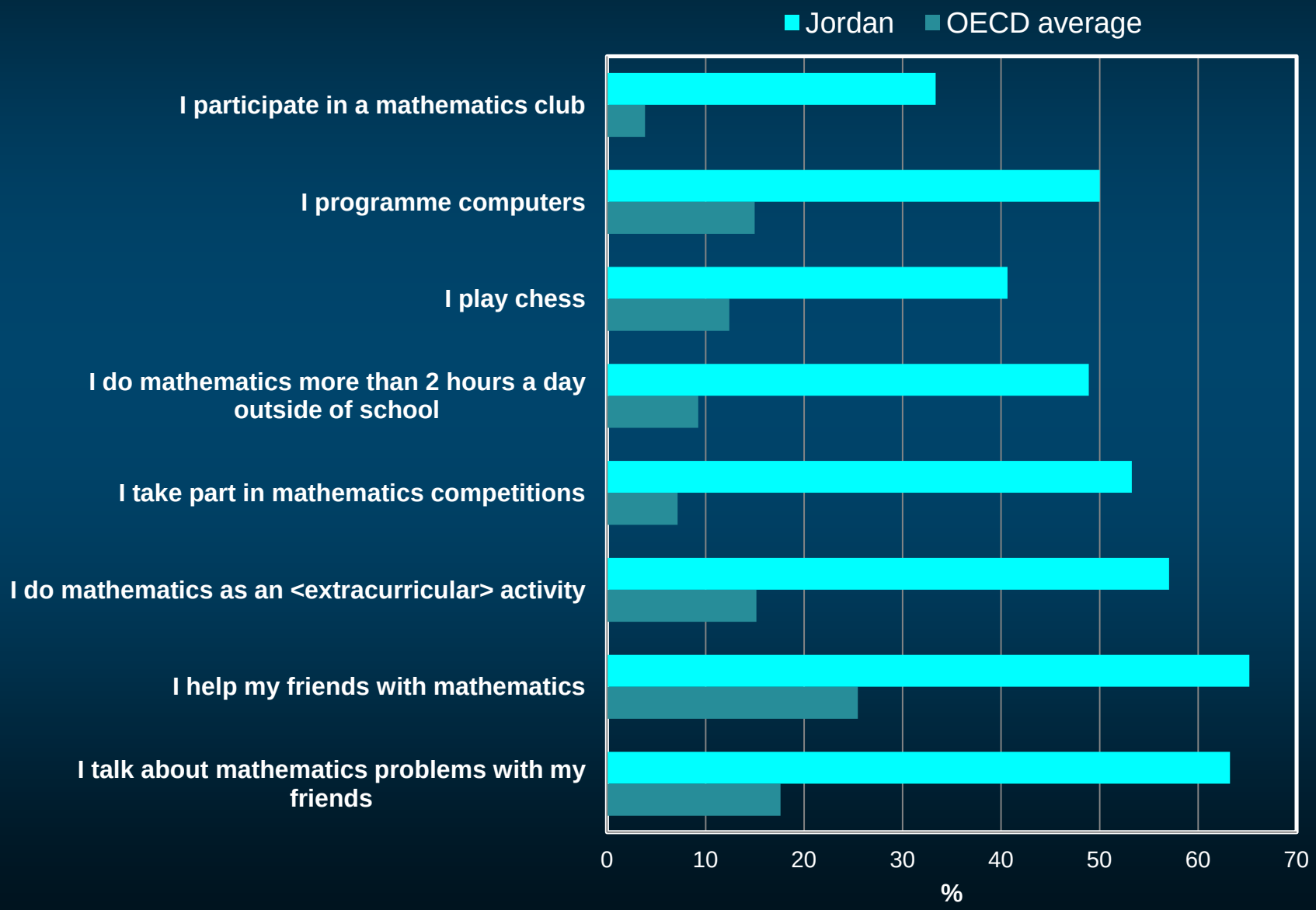
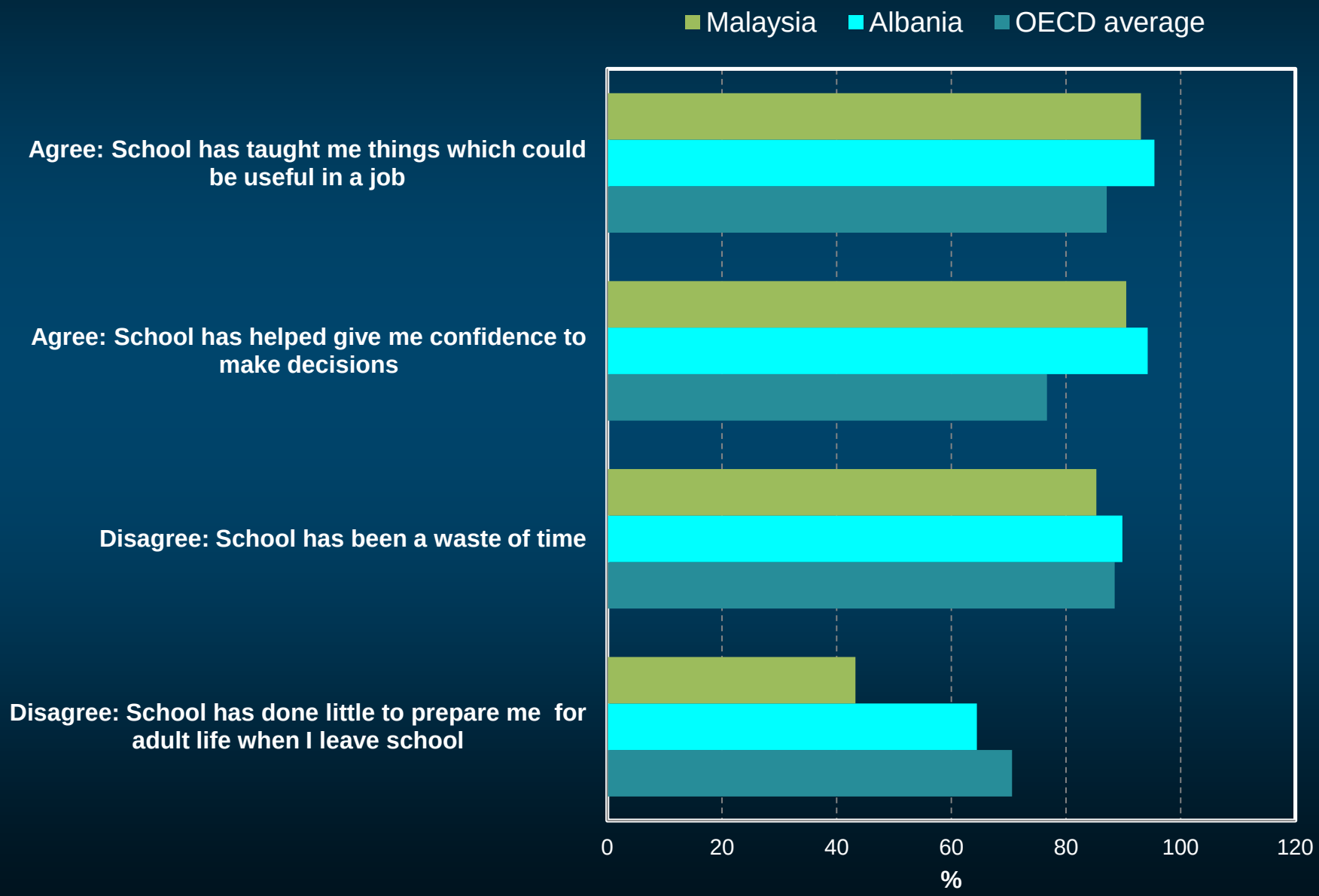


Fig III.2.15


Malaysia
Albania
OECD average
Agree: School has taught me things which could be useful in a job
Agree: School has helped give me confidence to make decisions
Disagree: School has been a waste of time
Disagree: School has done little to prepare me for adult life when I leave school
0
20
40
60
80
100
120
%

Also worth noting

- 85% of advantaged students but only 78% of disadvantaged students say feel they belong at school
- More than one in three students in OECD countries say they had arrived late for school in the two weeks prior to the PISA test; and more than one in four students reported that they had skipped a class or a day of school during this period
- Better **teacher-student relations** are strongly associated with greater student engagement at school
- Even **when girls perform as well as boys in mathematics**, they tend to report less perseverance, less openness to problem solving, less motivation to learn mathematics, less self-belief in their ability to learn mathematics and more anxiety about mathematics than boys, on average; they are also more likely than boys to attribute failure in mathematics to themselves .

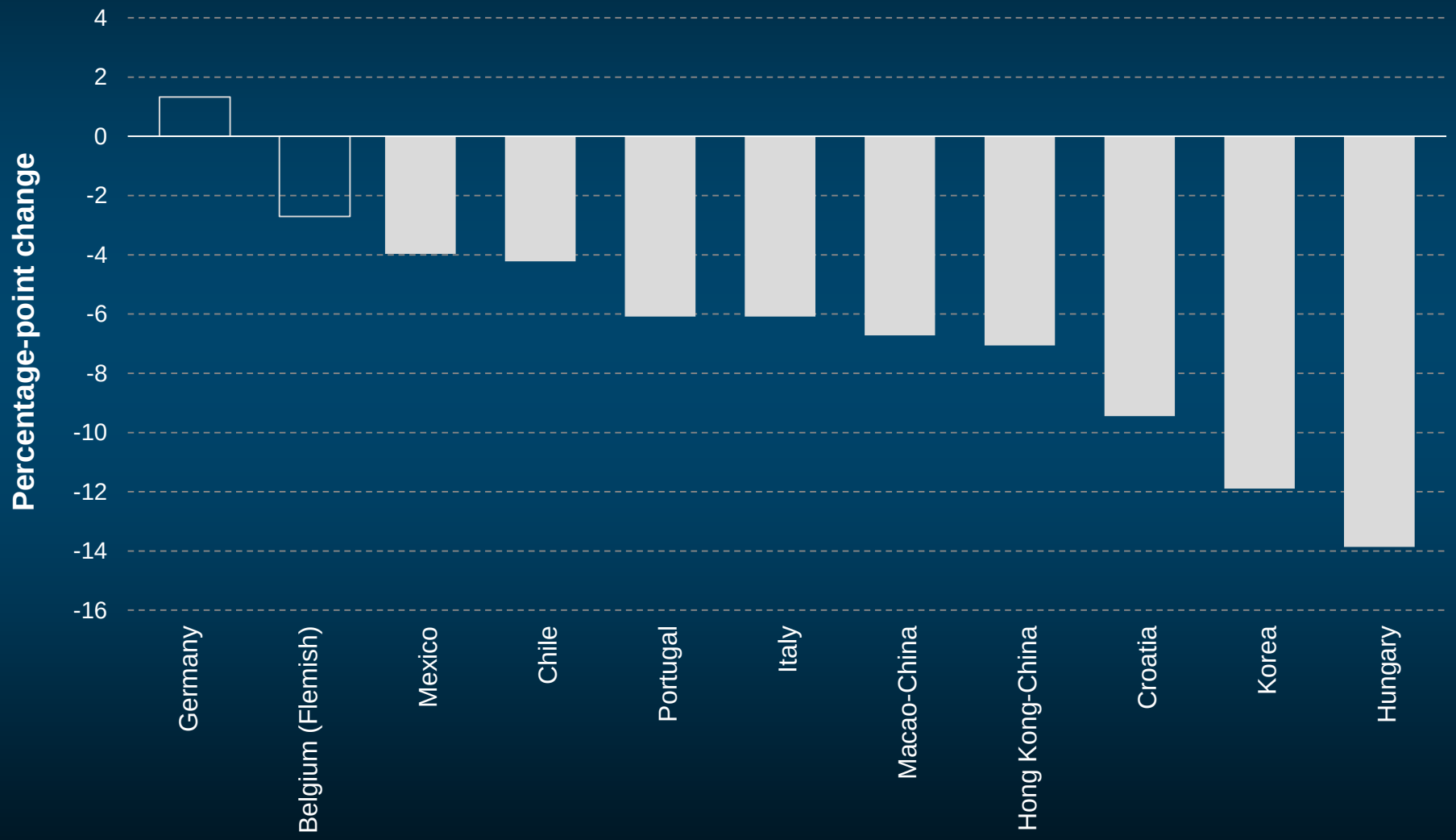
The parent factor

Students whose **parents have high educational expectations for them** tend to report more perseverance, greater intrinsic motivation to learn mathematics, and more confidence in their own ability to solve mathematics problems than students of similar background and academic performance, whose parents hold less ambitious expectations for them.

Parents' expectations for their child have a strong influence on students' behaviour towards school

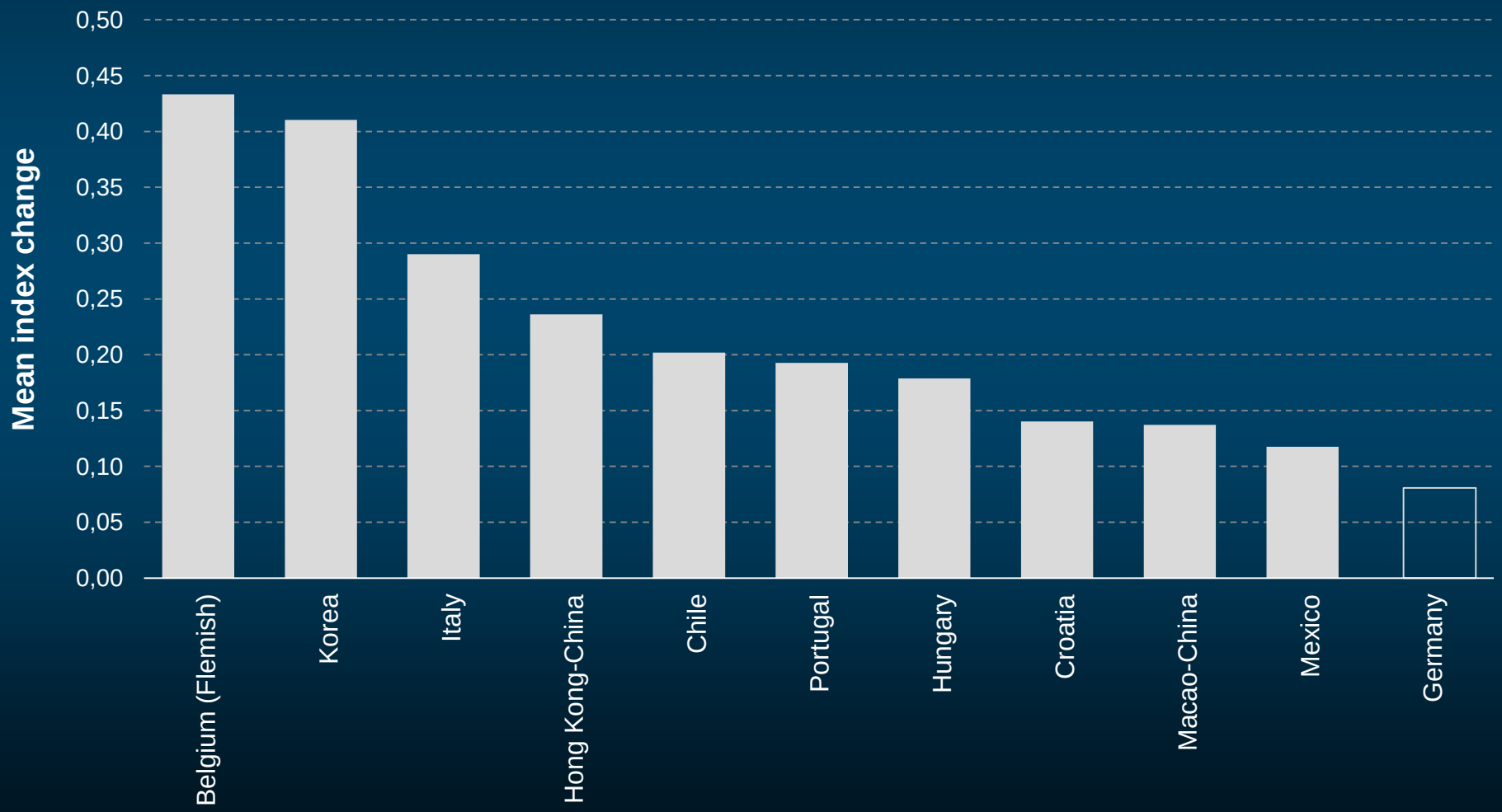
Fig III.6.11

Percentage-point change in arriving late for school that is associated with parents expecting the child to complete a university degree



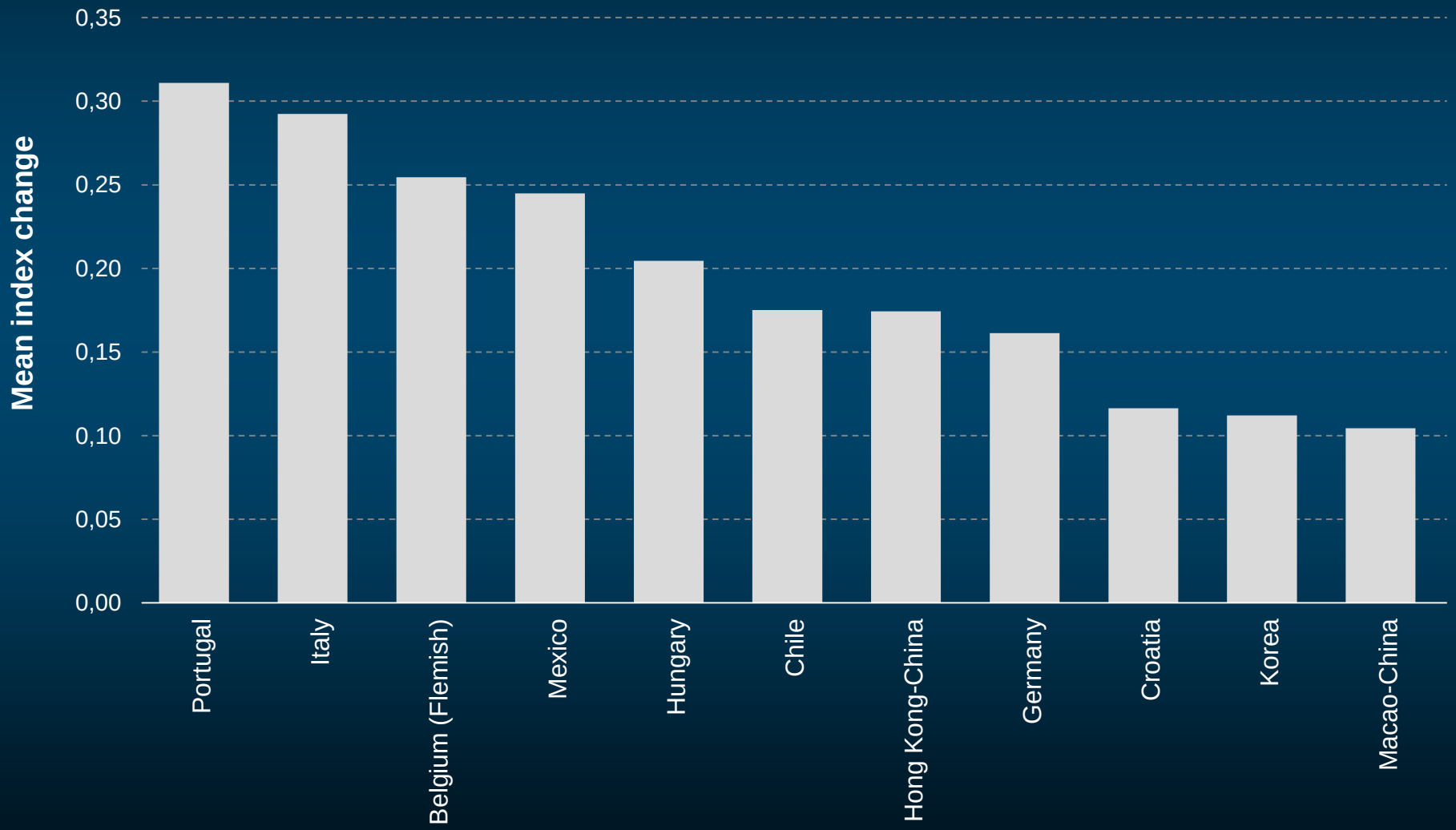
Parents' high expectations can nurture students' enjoyment in learning mathematics

Change in the index of intrinsic motivation to learn mathematics that is associated with parents expecting the child to complete a university degree



Parents' high expectations can foster perseverance in their child

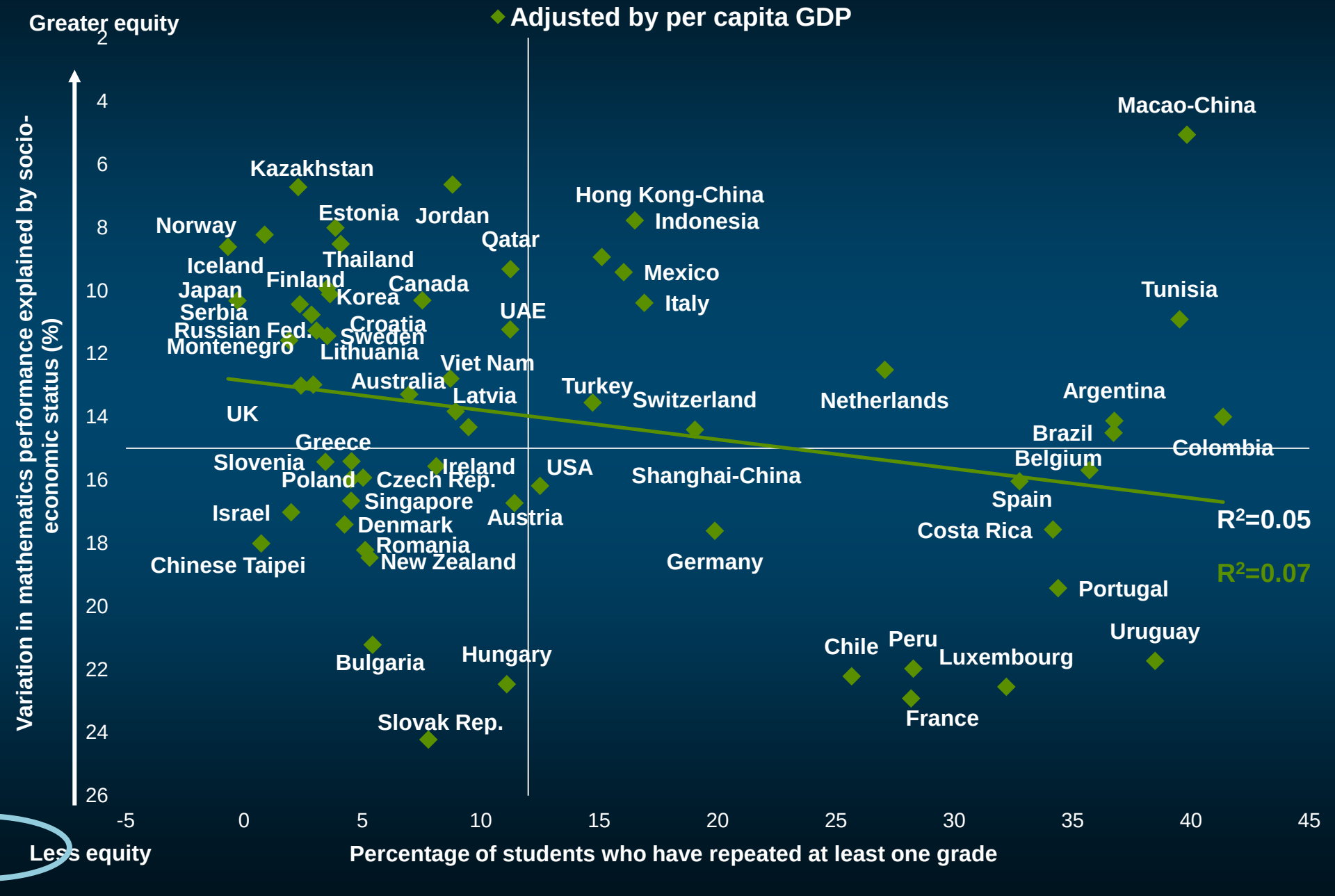
Change in the index of perseverance that is associated with parents expecting the child to complete a university degree



Schools make a difference

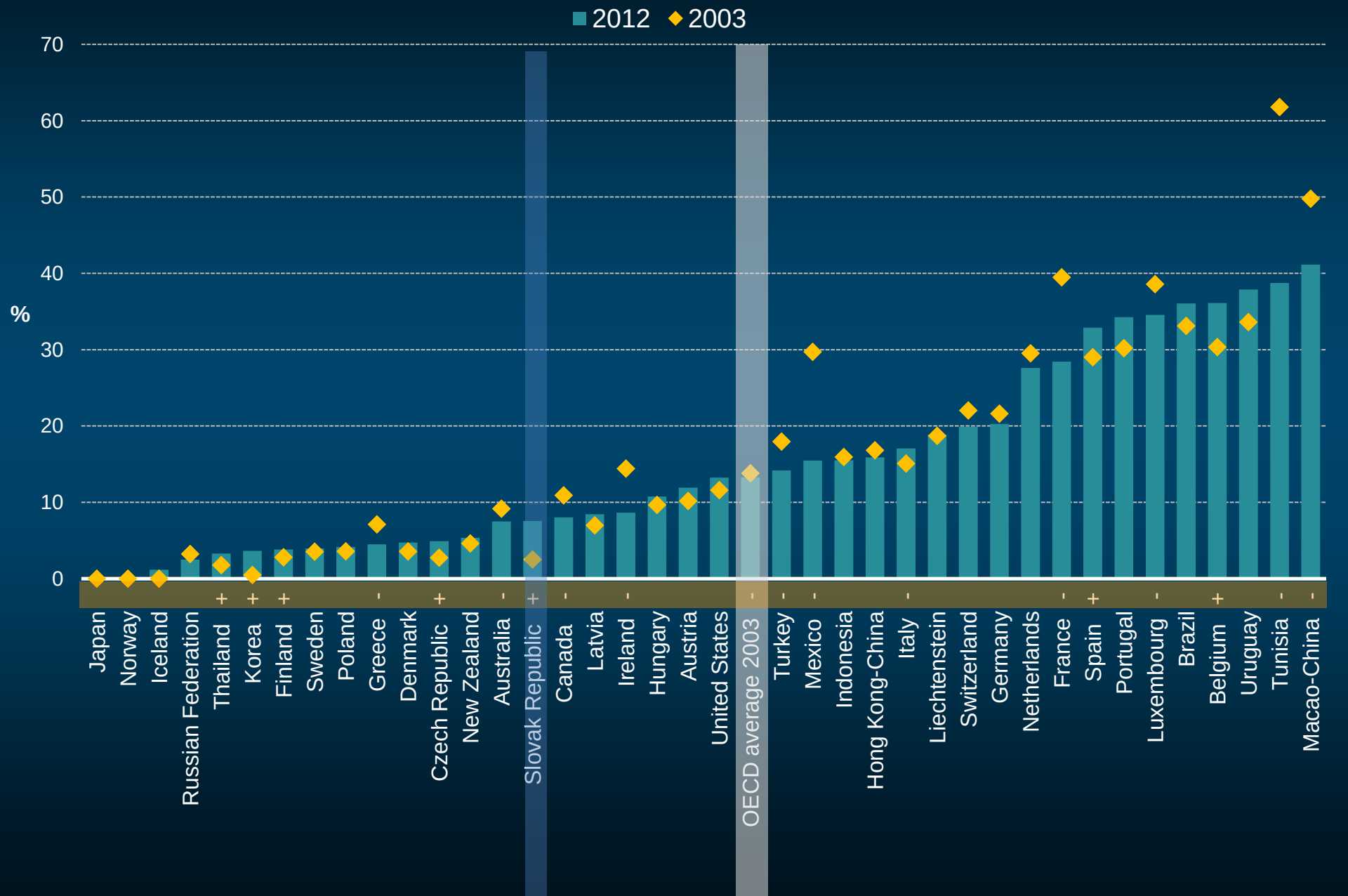
Grade repetition is negatively related to equity

Fig IV.1.4



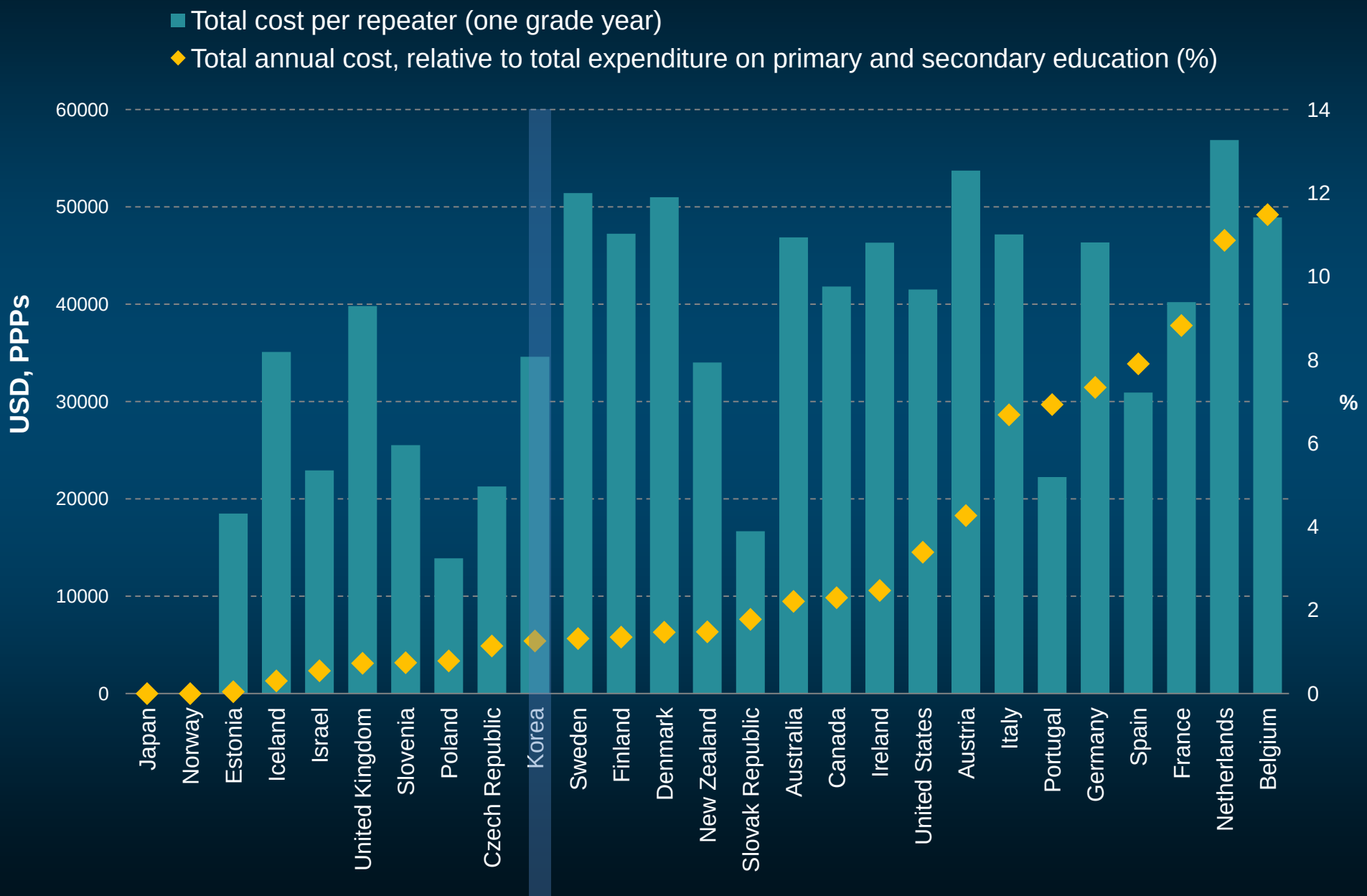
Percentage of repeaters in 2003 and 2012

Tab IV.2.18



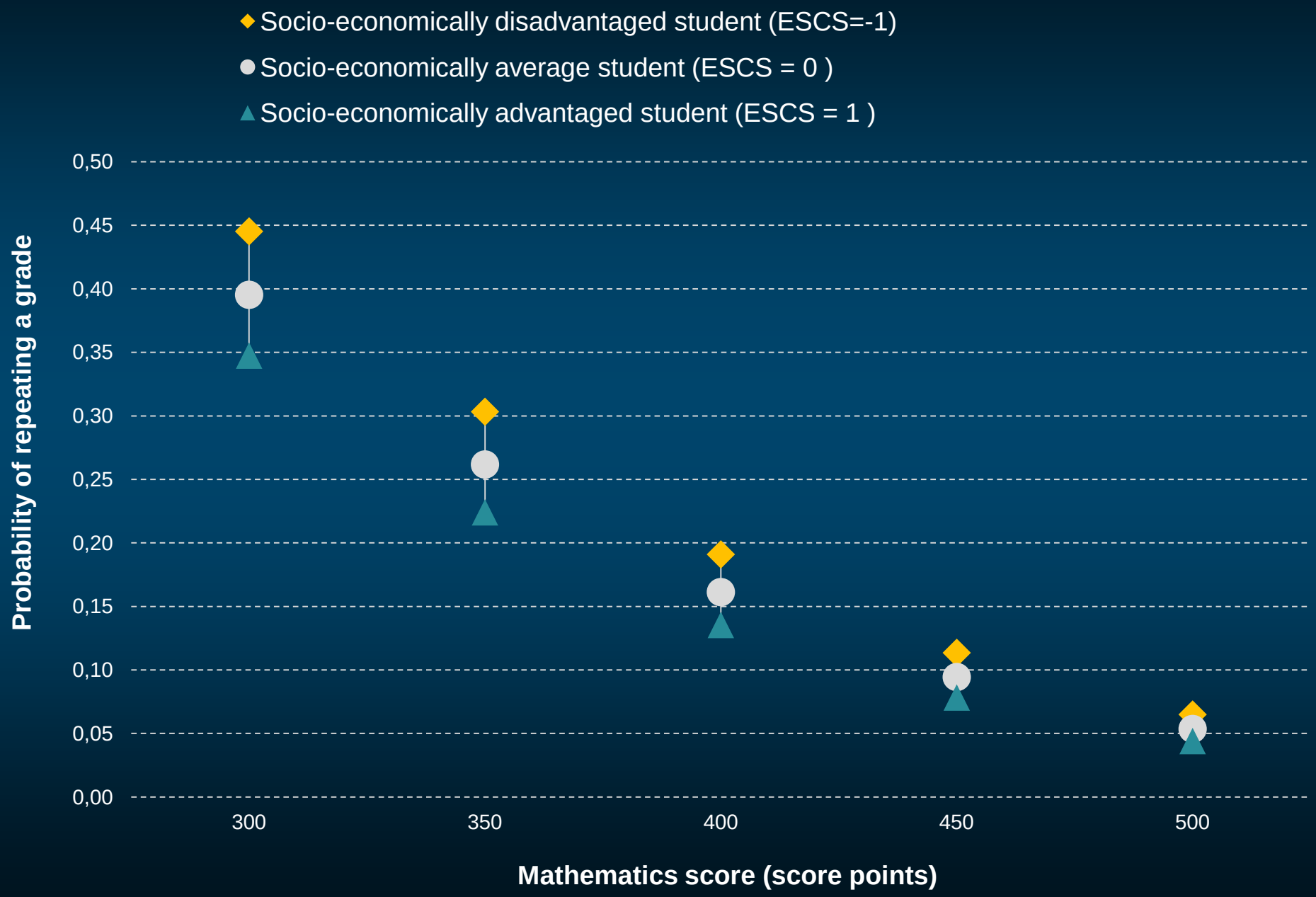
Grade repetition is an expensive policy

Fig IV.1.5



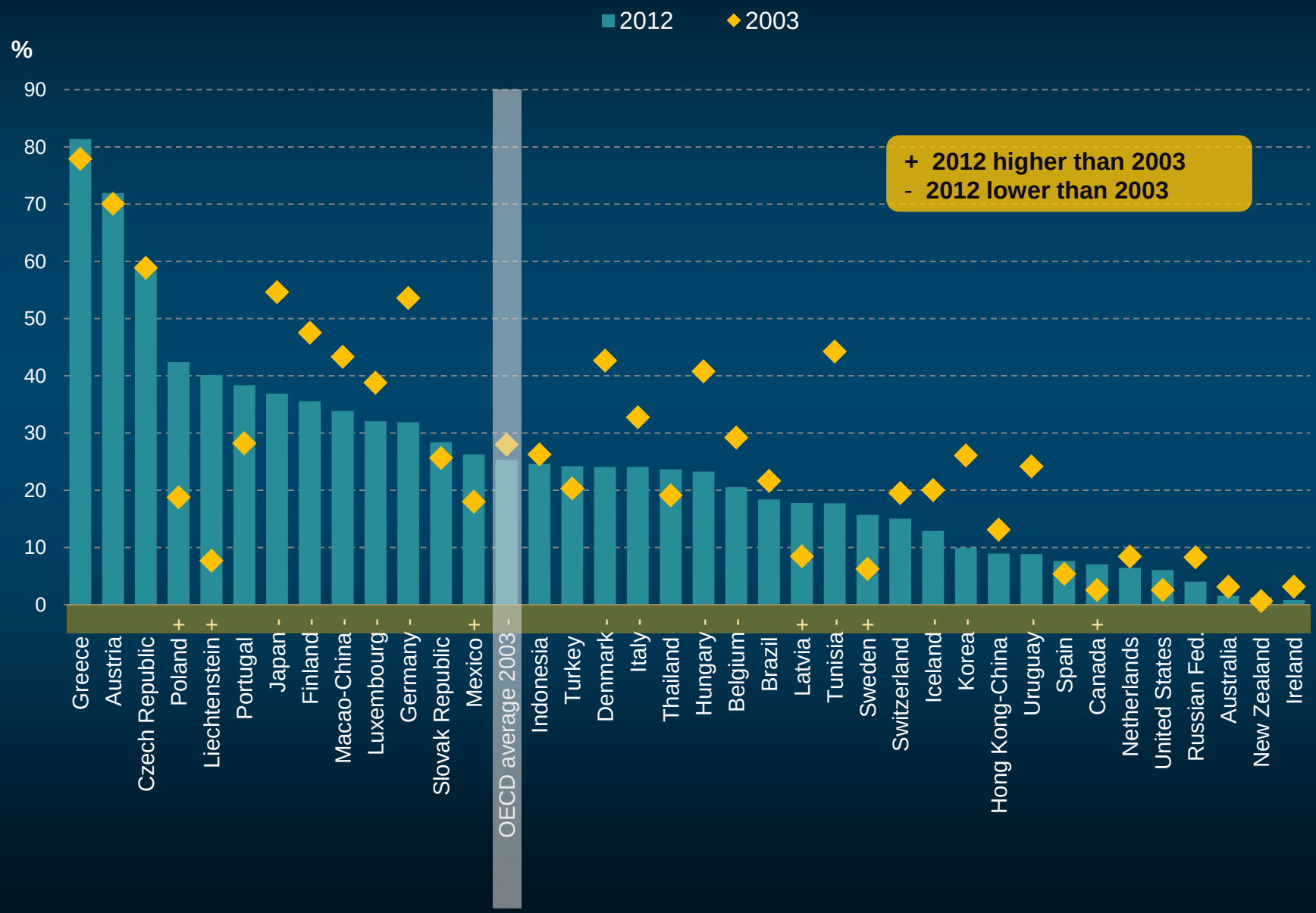
In most countries, disadvantaged students are more likely to have repeated a grade than advantaged students

Fig IV.2.3



Change between 2003 and 2012 in ability grouping

Fig IV.2.11



Also worth noting

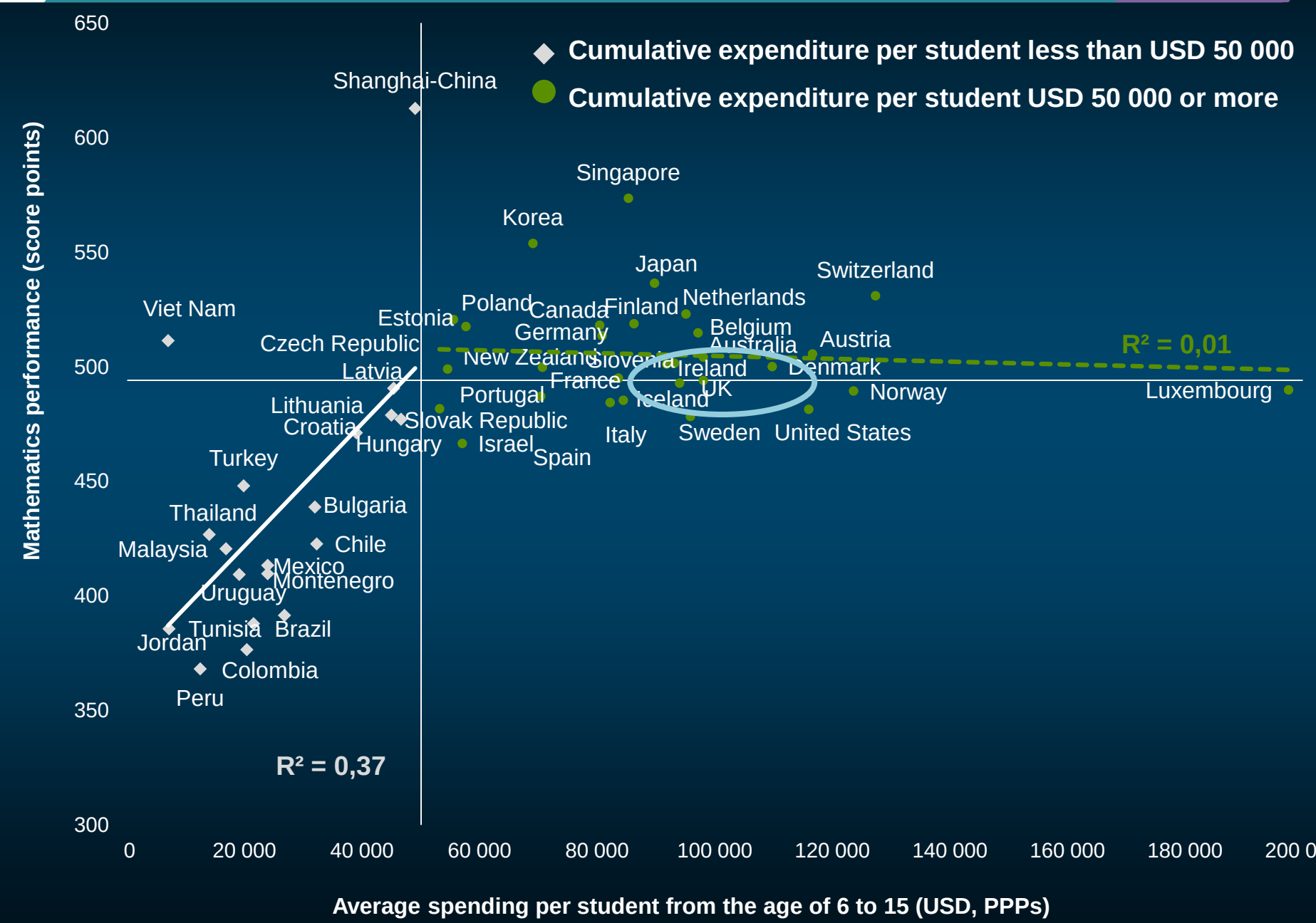
- **Stratification** in school systems (e.g. grade repetition and selecting students at a young age for different "tracks" or types of schools) is negatively related to equity; and students in highly stratified systems tend to be less motivated than those in less-stratified systems

Money makes a difference…

…but only up to a point

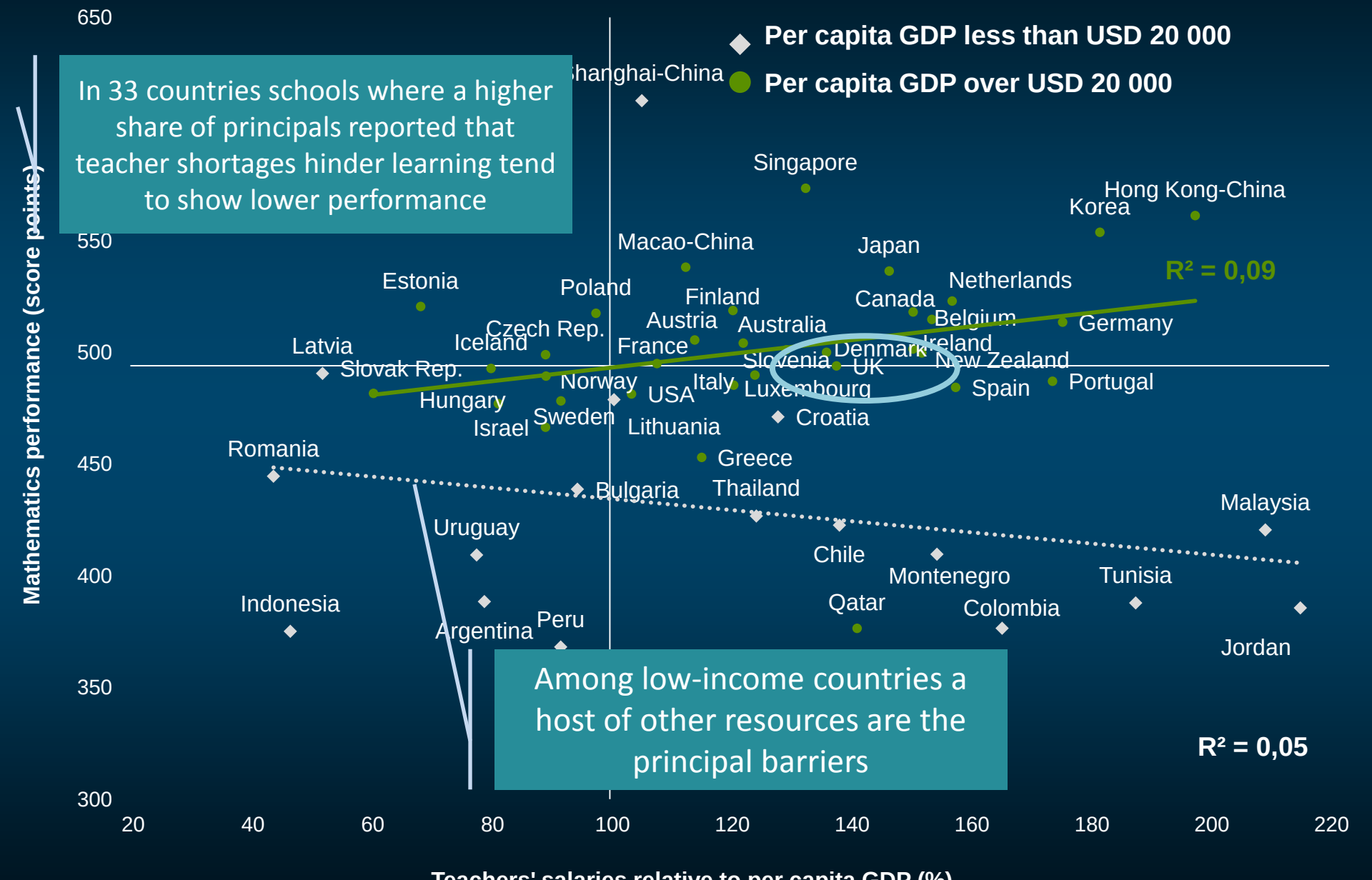
Spending per student from the age of 6 to 15 and mathematics performance in PISA 2012

Fig IV.1.8



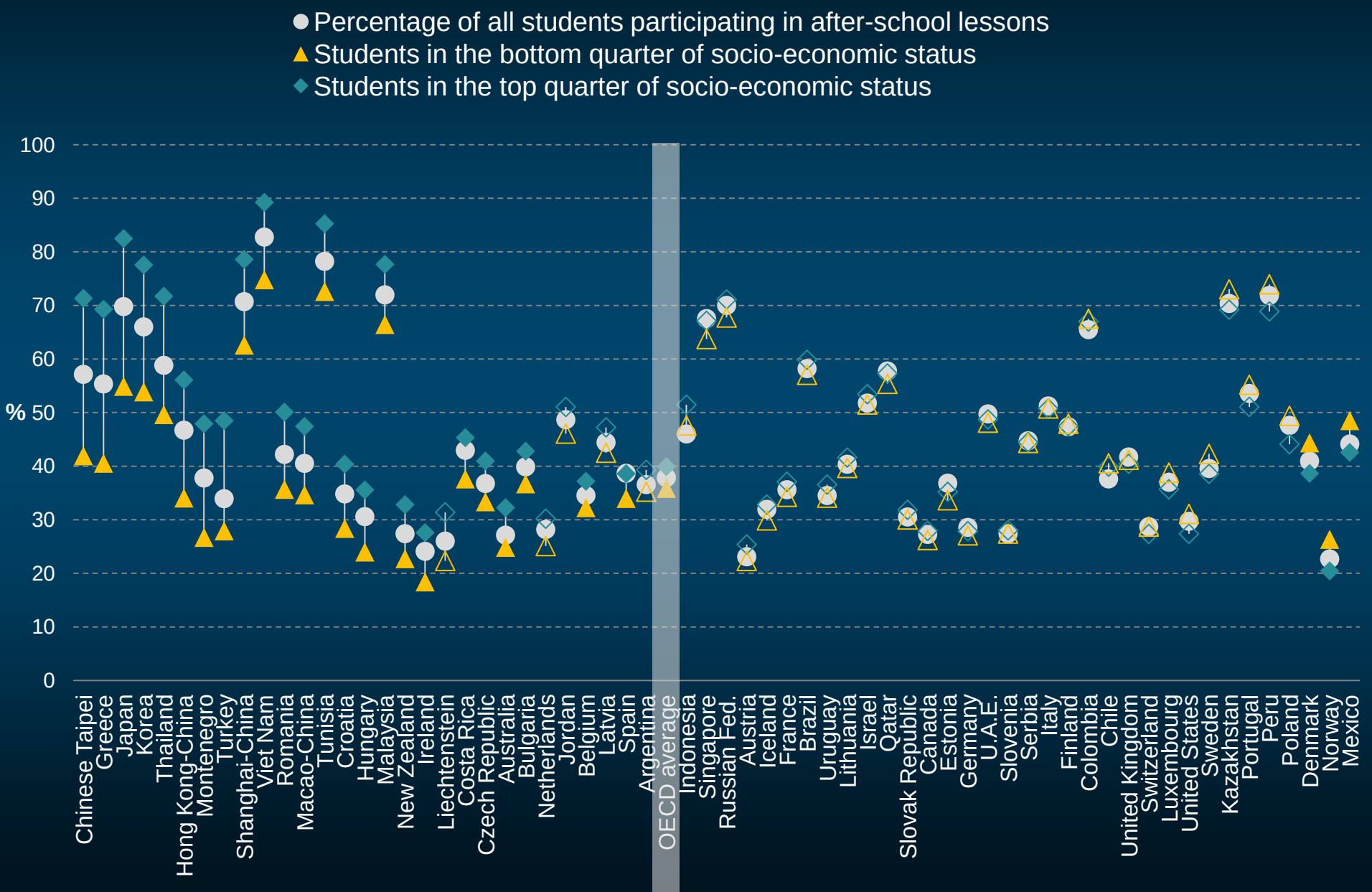
Among high-income countries high-performers pay teachers more

Fig IV.1.10



In many countries, more advantaged than disadvantaged students attend after-school lessons

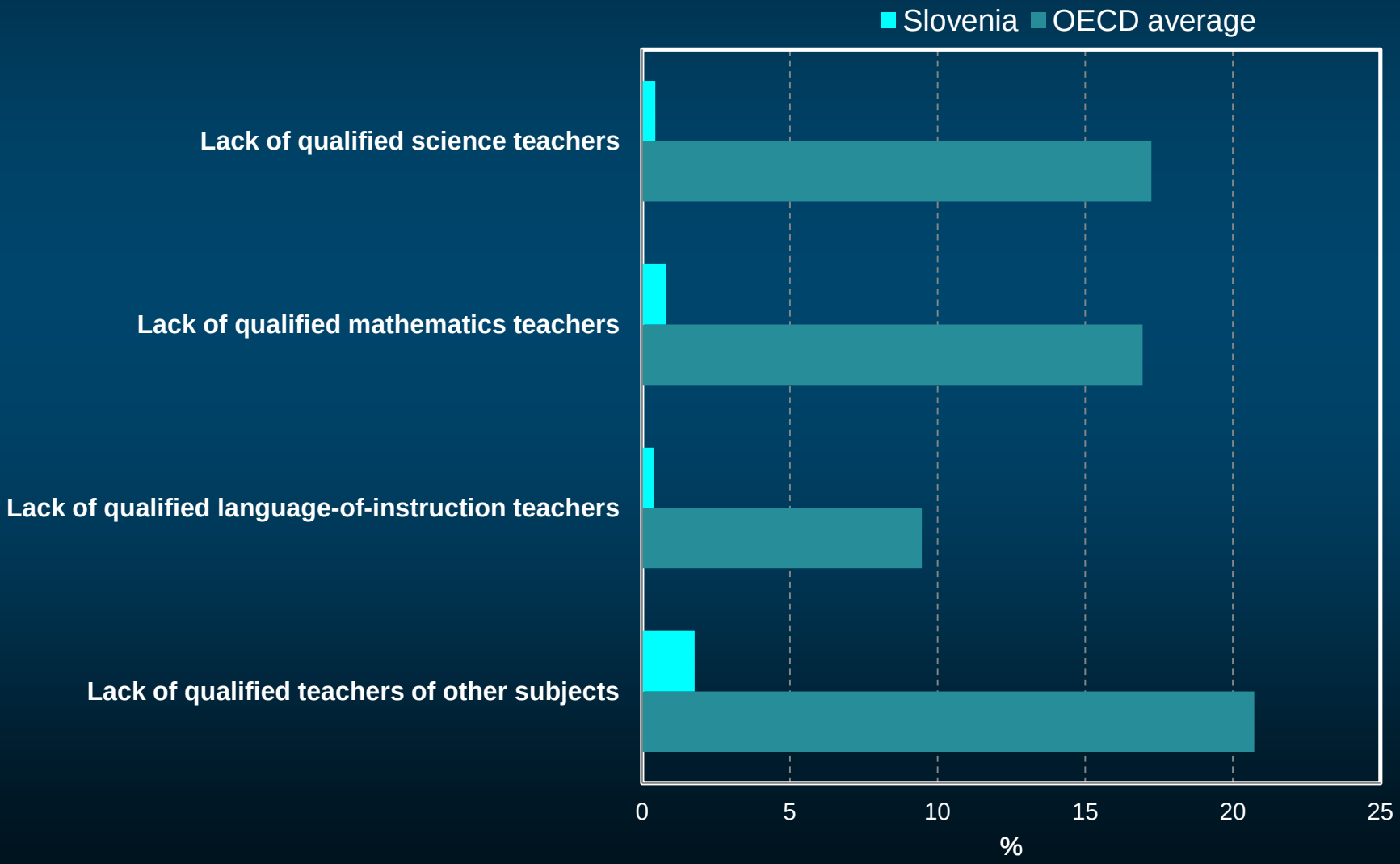
Fig IV.3.11



Teacher shortage

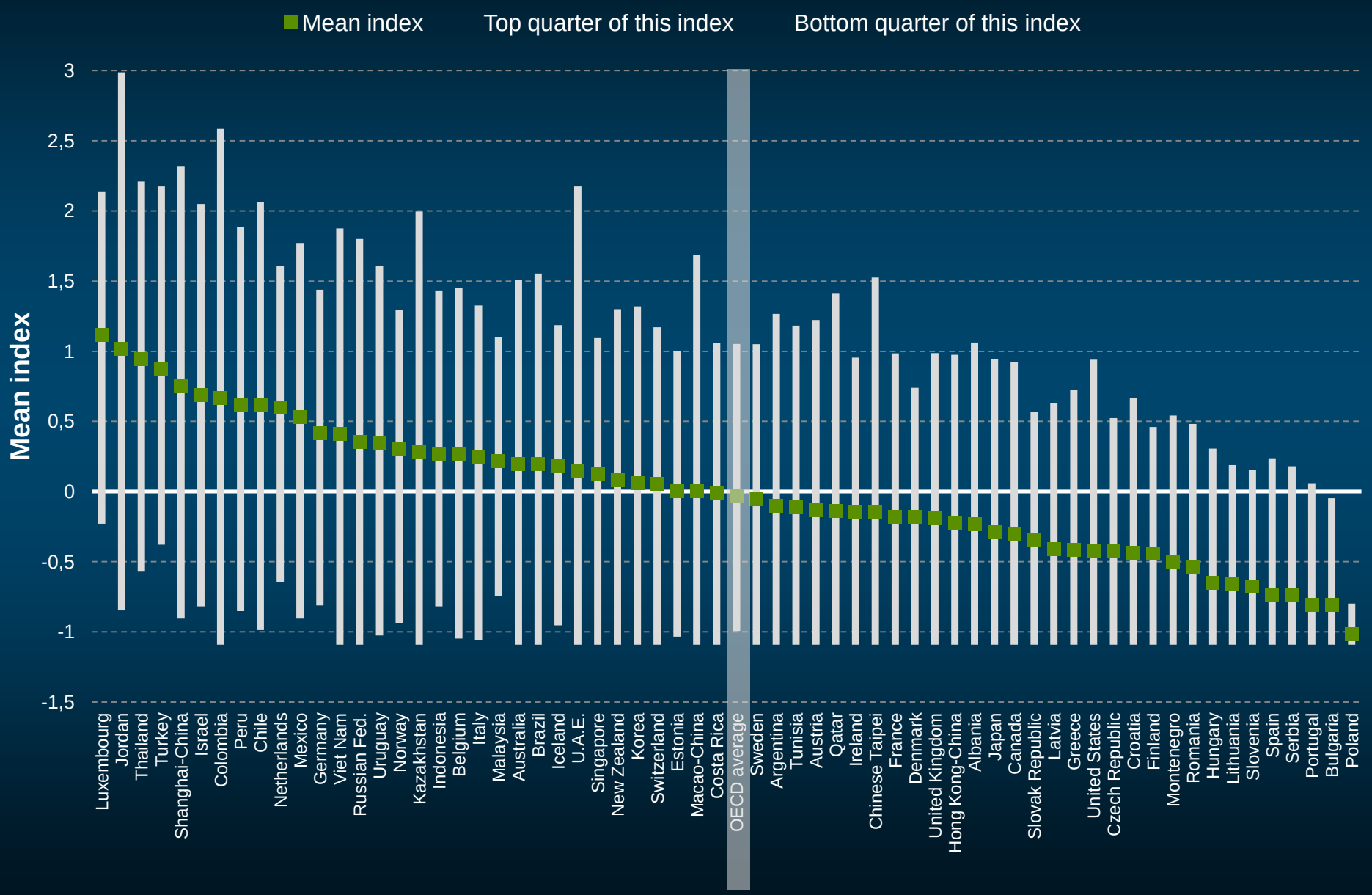
Fig IV.3.5

Percentage of students in schools whose principals reported that the following phenomena hindered student learning "to some extent" or "a lot":



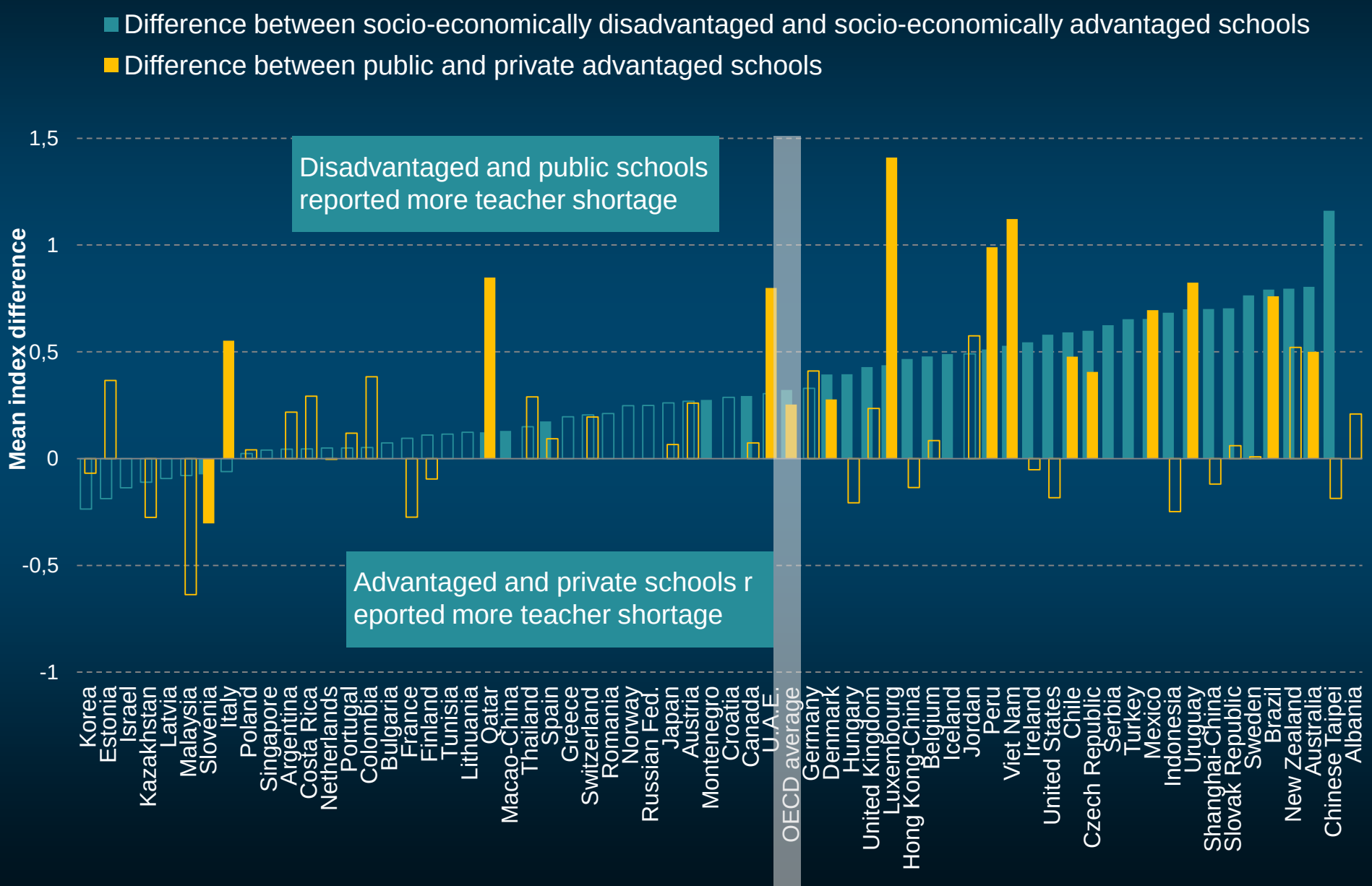
Teacher shortage

Fig IV.3.5



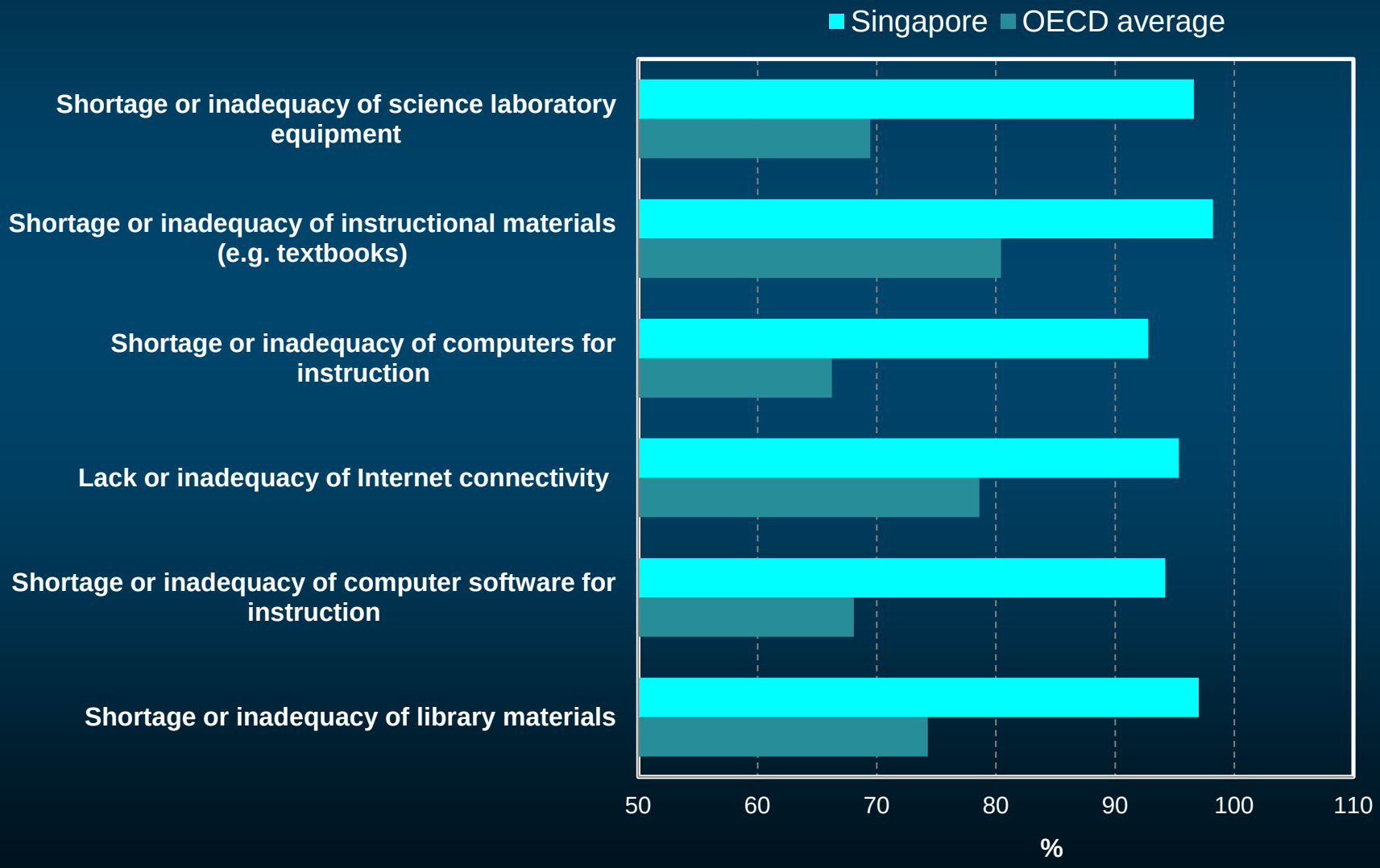
Teacher shortage is more of concern in disadvantaged schools also in public schools, in most countries

Fig IV.3.5



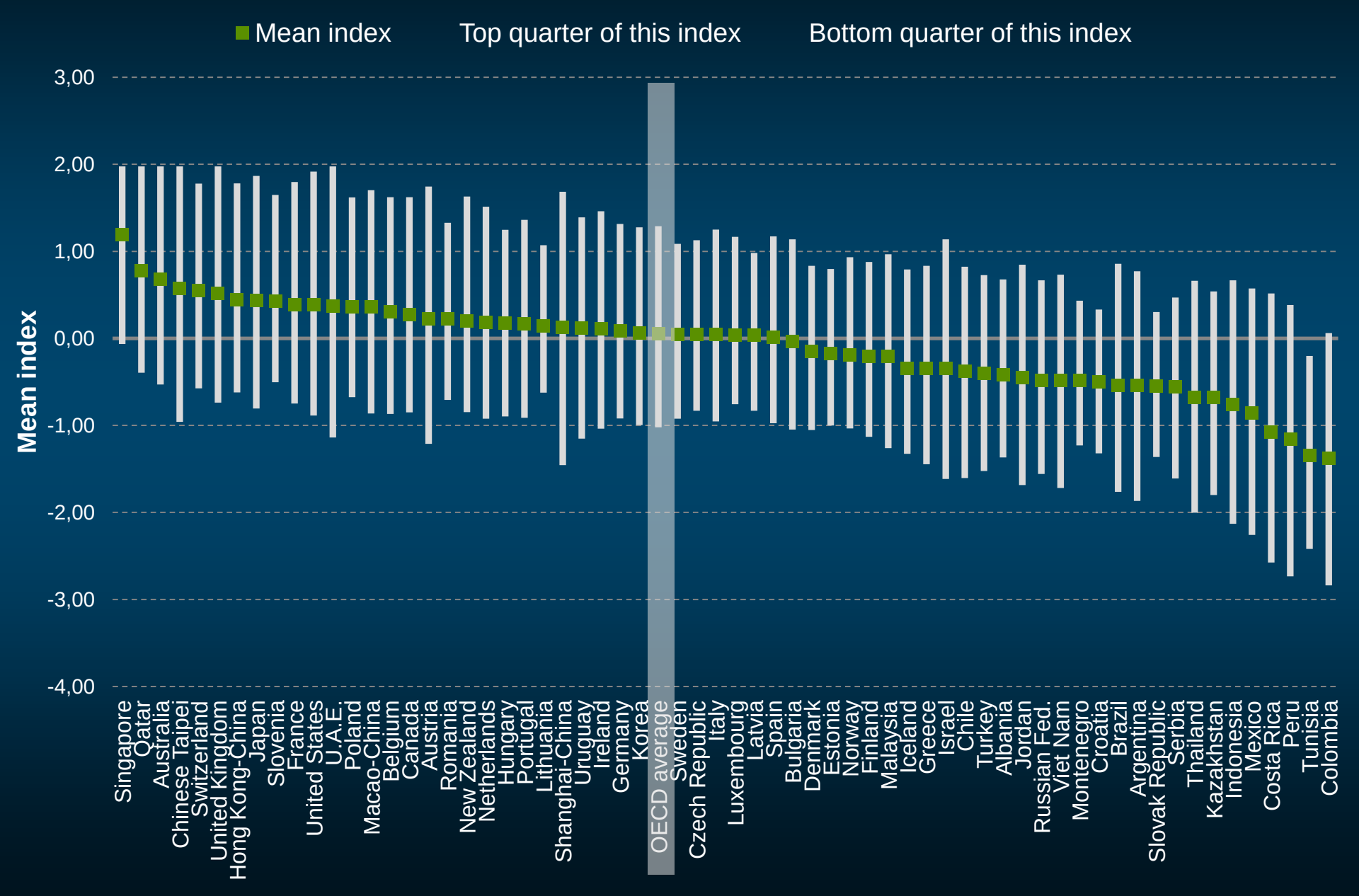
Adequacy of educational resources

Percentage of students in schools whose principals reported that the following phenomena hindered student learning "not at all" or "very little“:



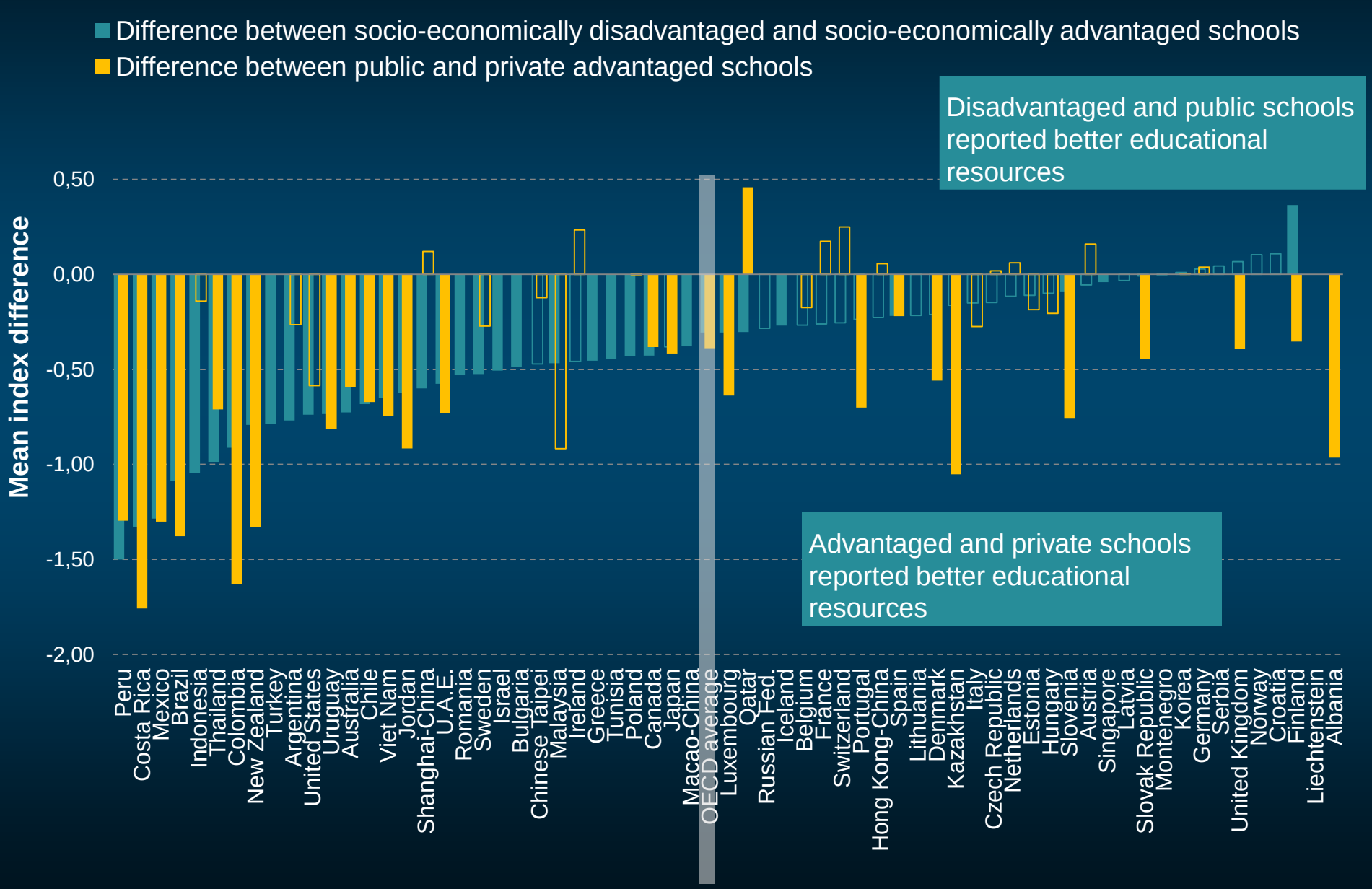
Adequacy of educational resources

Fig IV.3.8



Educational resources are more problematic in disadvantaged schools, also in public schools in most countries

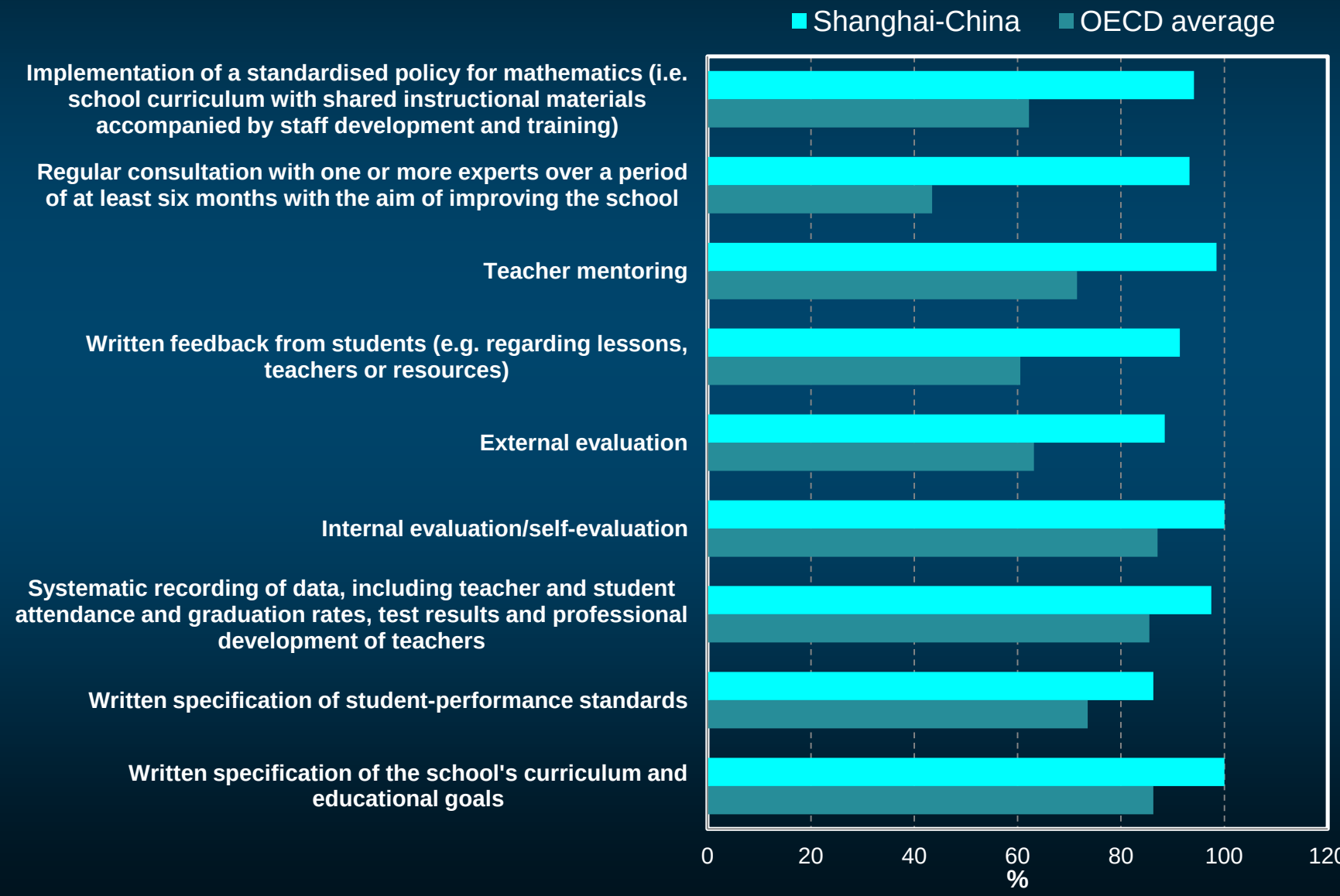
Fig IV.3.8



Quality assurance and school improvement

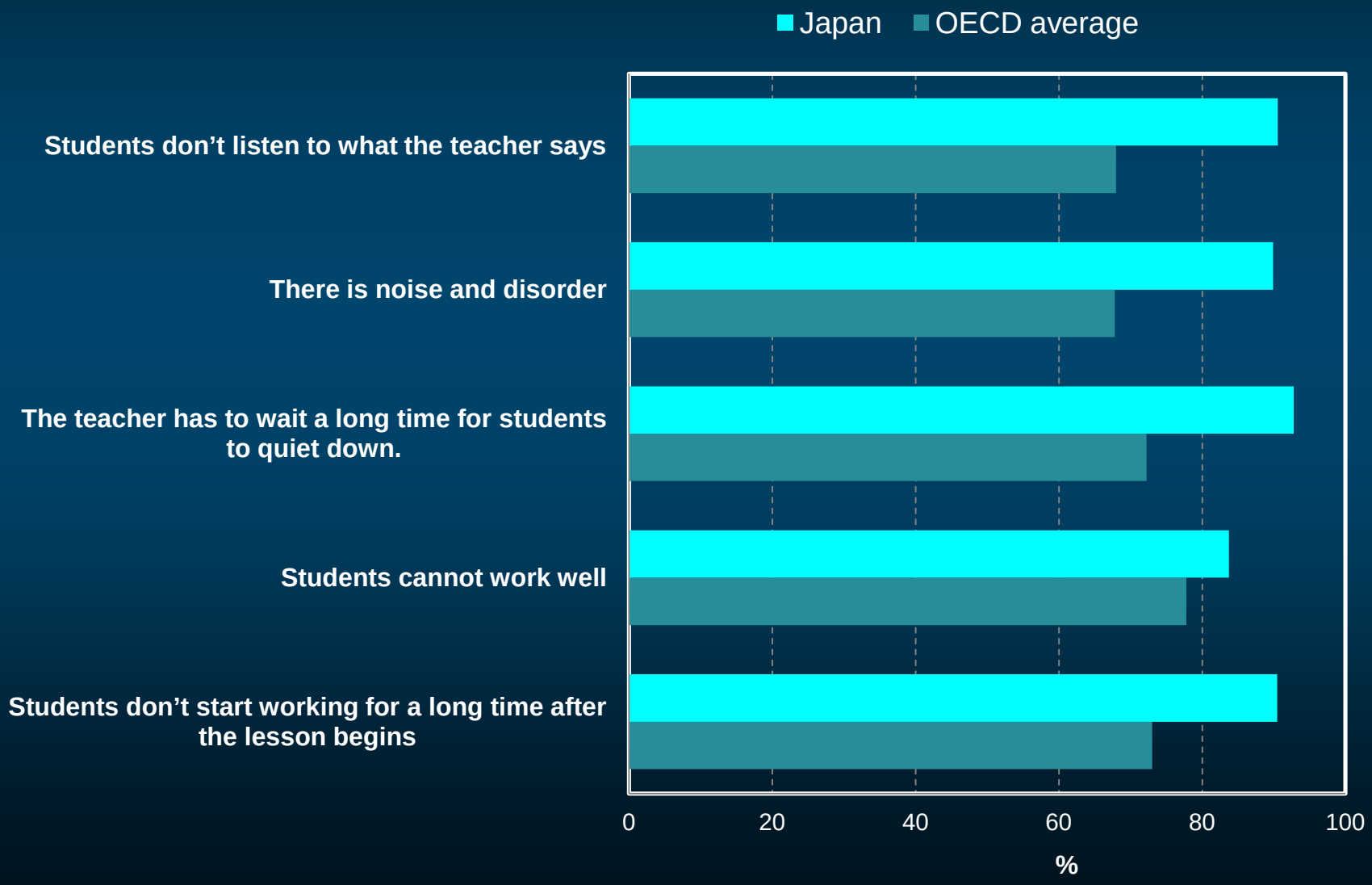
Fig IV.4.14

Percentage of students in schools whose principal reported that their schools have the following for quality assurance and improvement:



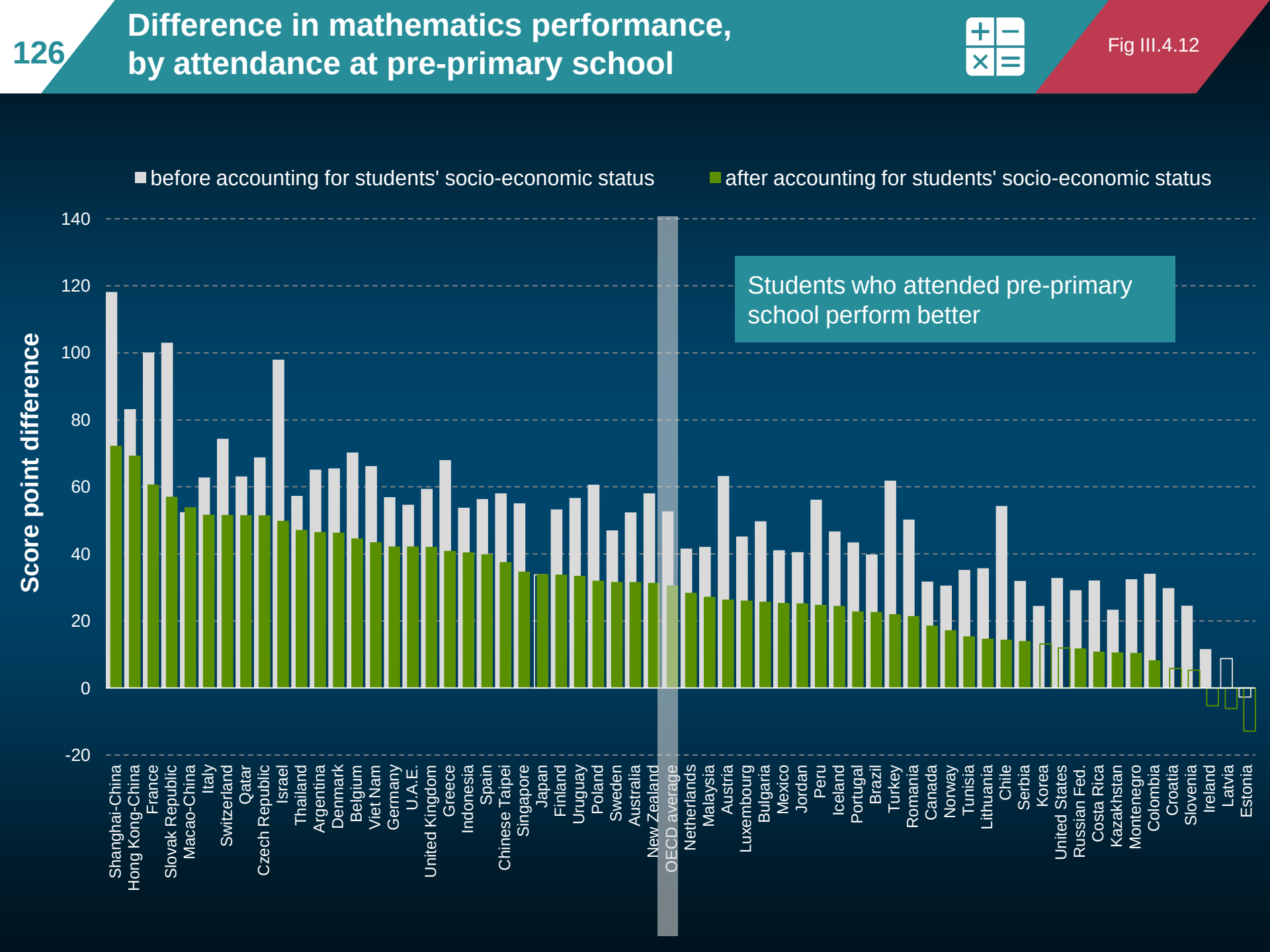
Students' views of how conducive classrooms are to learning

Percentage of students who reported that the following phenomena occur "never or hardly ever" or "in some lessons":



Difference in mathematics performance, by attendance at pre-primary school

Fig III.4.12



Also worth noting

- Educational resources relate to student performance
  - 33% of the variation in math performance is explained by differences in principal's responses to questions about the adequacy of science laboratory equipment, instructional material, ICT and libraries (GDP adjusted)
- Adequacy of physical infrastructure unrelated to performance
- *Within* countries, class time relates positively to performance
  - Holds also after accounting for socio-economic and demographic factors, but does *not* hold when pooling data across countries (learning outcomes are the product of quantity and quality)
  - The proportion of students in schools with after-school mathematics lessons is unrelated to system performance
  - Homework relates positively to school performance

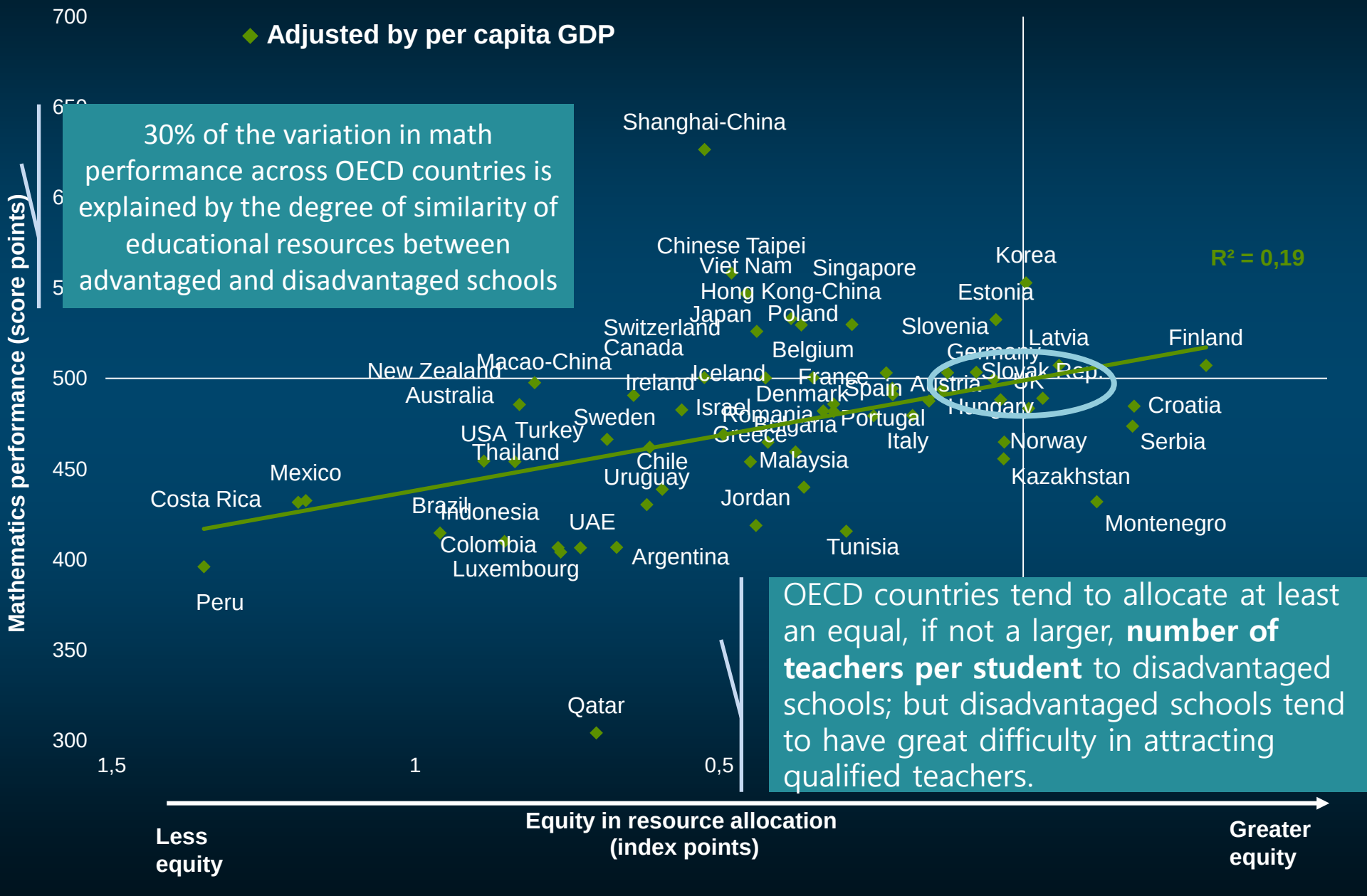
Also worth noting

- Most countries and economies with comparable data between 2003 and 2012 have moved towards **better-staffed and better-equipped schools**
- Students in 2012 were more likely than their counterparts in 2003 to have attended at least one year of **pre-primary education**
  - yet many of the students who reported that they had not attended pre-primary school are disadvantaged

High performers spend resources where they are needed most

Countries with better performance in mathematics tend to allocate educational resources more equitably

Fig IV.1.11



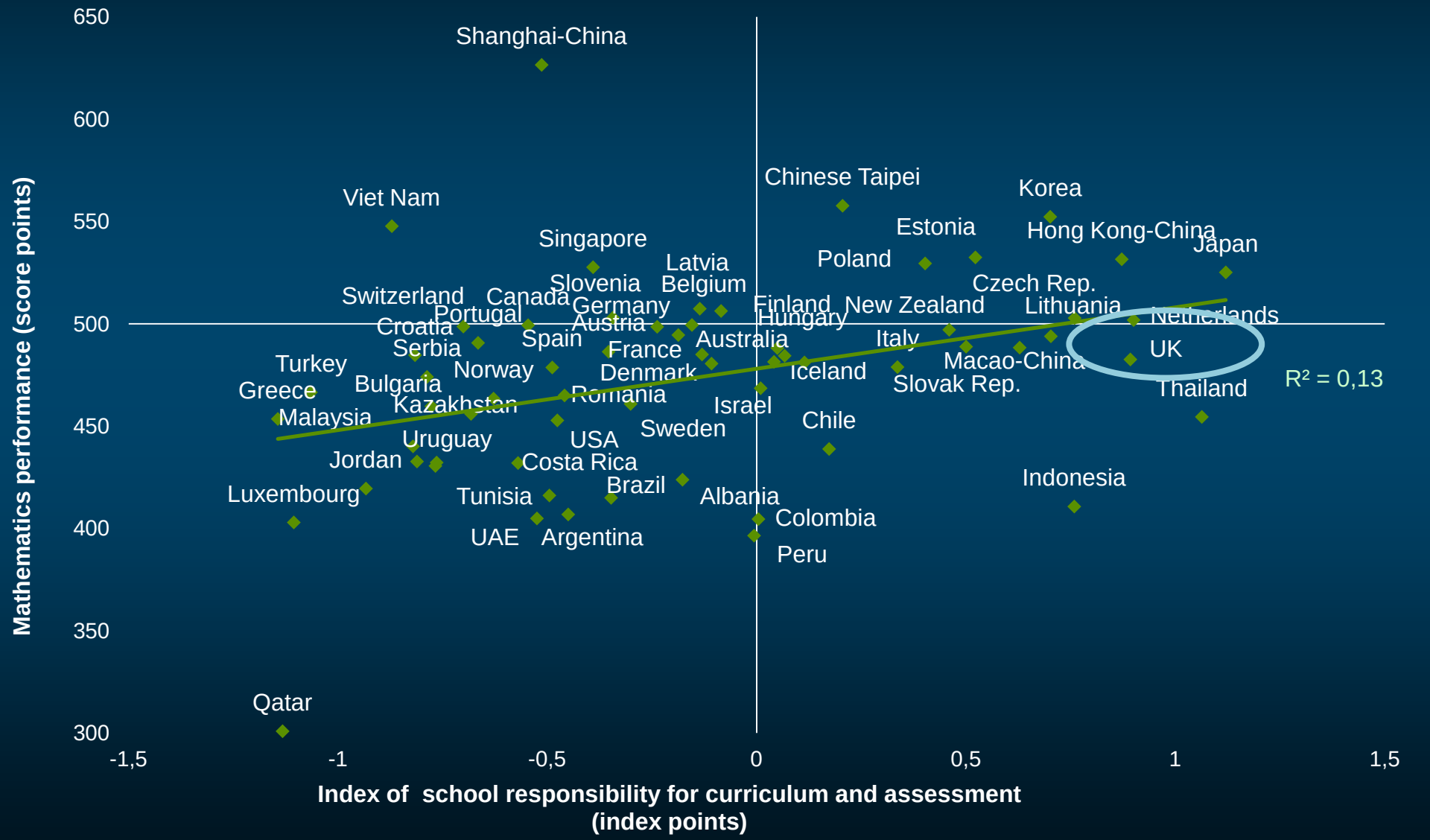
OECD countries tend to allocate at least an equal, if not a larger, **number of teachers per student** to disadvantaged schools; but disadvantaged schools tend to have great difficulty in attracting qualified teachers.

Governance matters

Schools with more **autonomy over curricula and assessments** tend to perform better than schools with less autonomy where they are part of school systems with more accountability arrangements and greater teacher-principal collaboration in school management

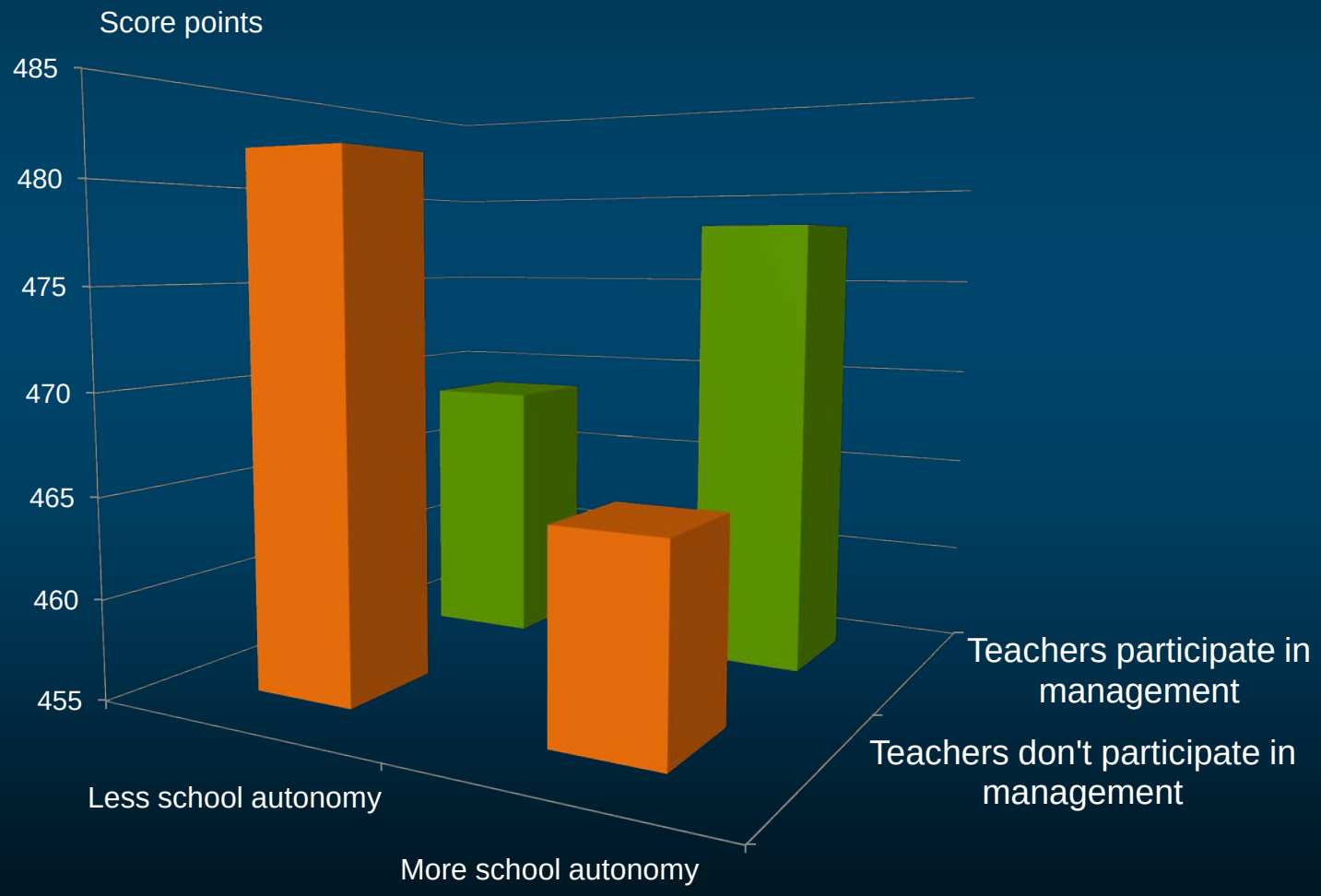
Countries that grant schools autonomy over curricula and assessments tend to perform better in mathematics

Fig IV.1.15



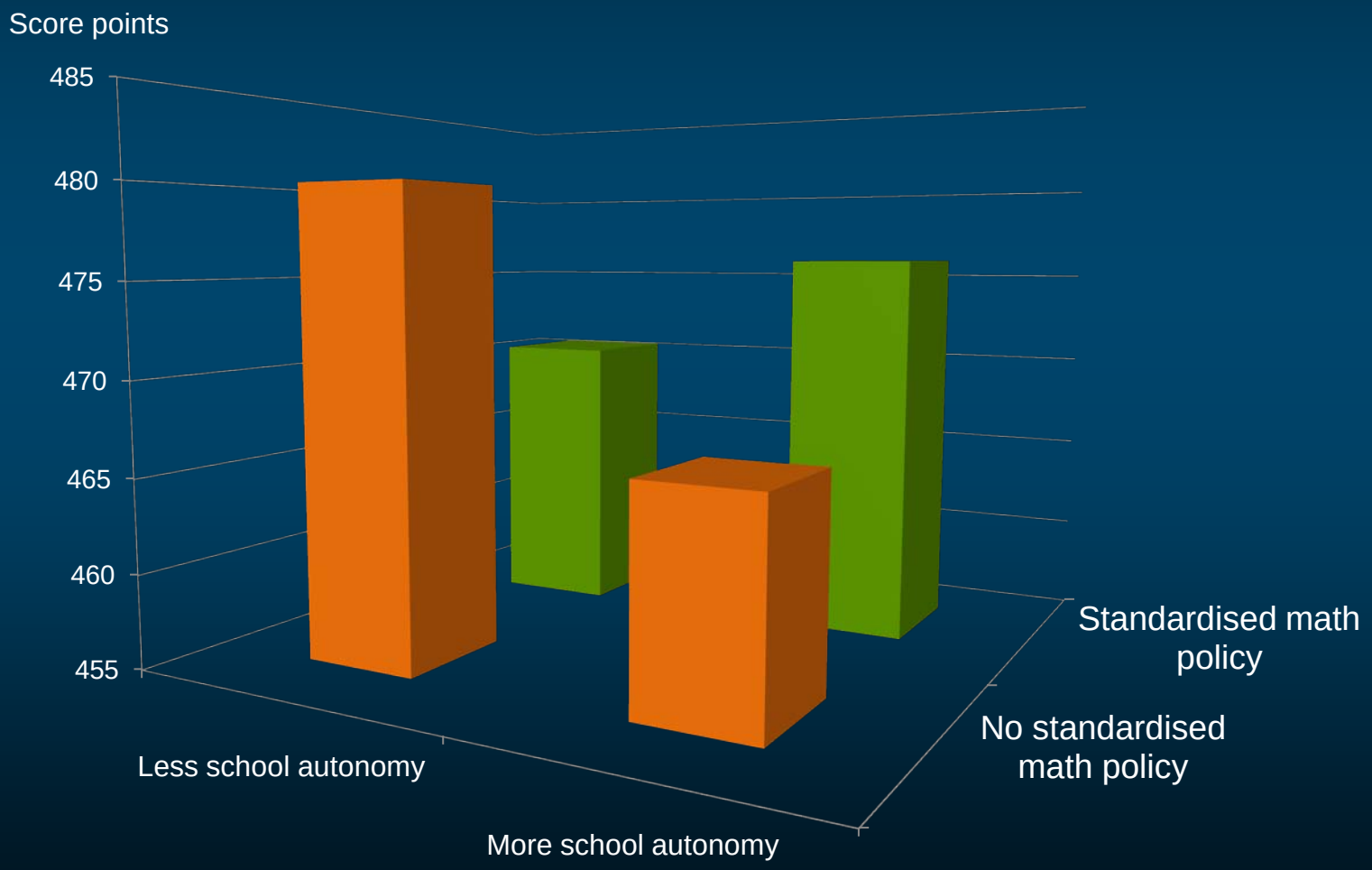
Schools with more autonomy perform better than schools with less autonomy in systems with more collaboration

School autonomy for resource allocation x System's level of teachers participating in school management
Across all participating countries and economies



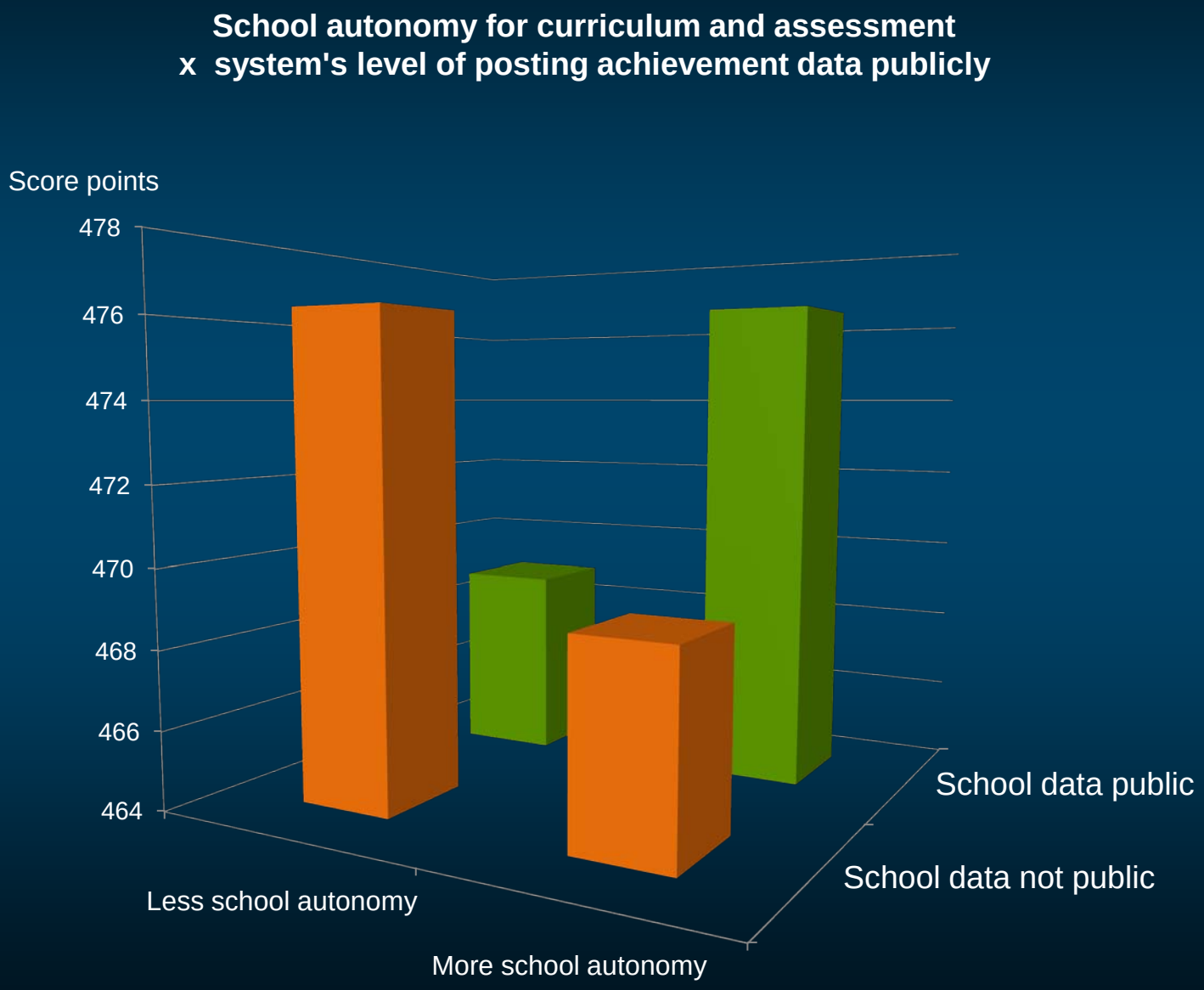
Schools with more autonomy perform better than schools with less autonomy in systems with standardised math policies

School autonomy for curriculum and assessment
x system's extent of implementing a standardised math policy (e.g. curriculum and instructional materials)



Schools with more autonomy perform better than schools with less autonomy in systems with more accountability arrangements

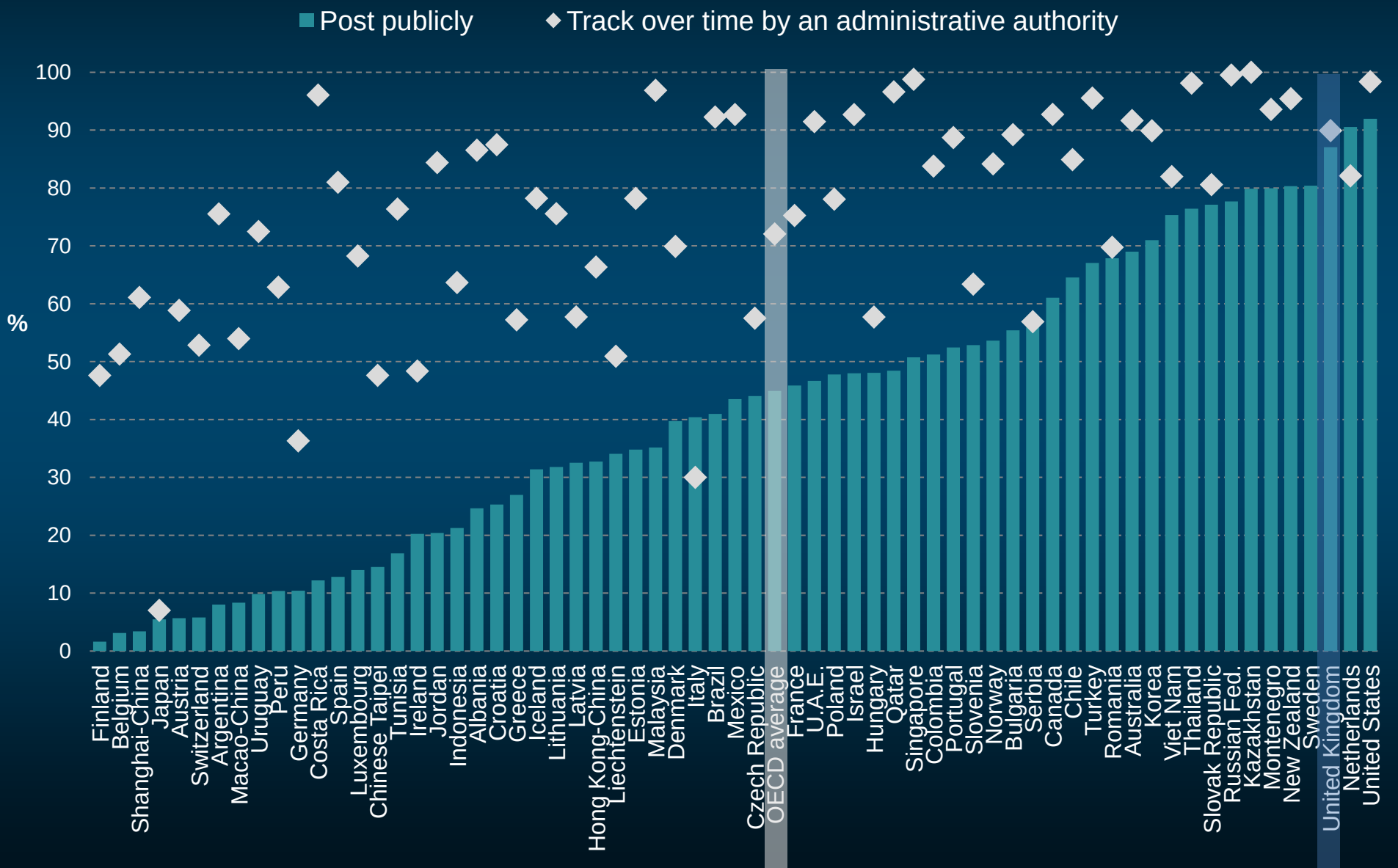
Fig IV.1.16



Use of achievement data for accountability

Fig IV.4.13

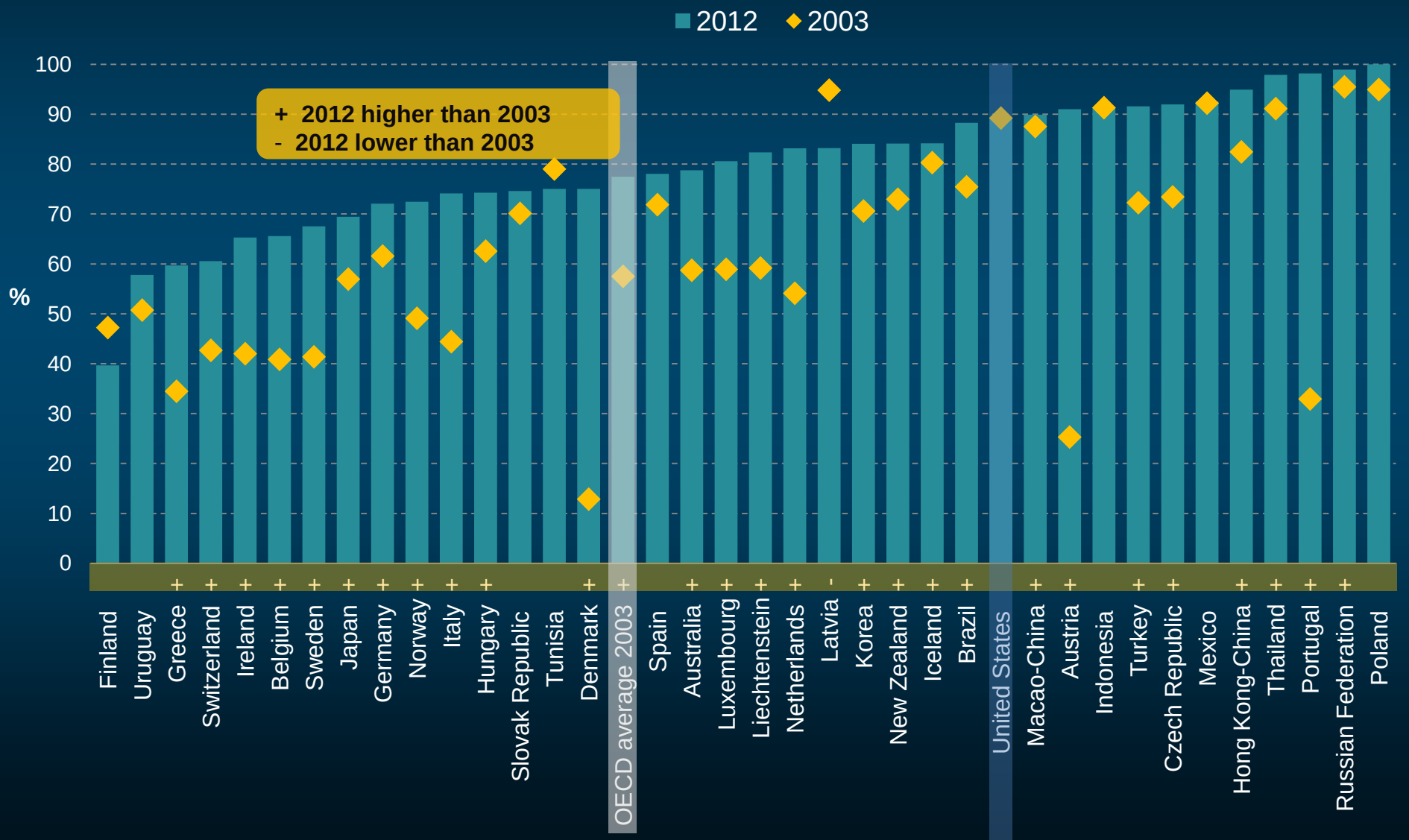
Percentage of students in schools that use achievement data in the following ways:



Change between 2003 and 2012 in using student assessment data to monitor teachers

Fig IV.4.19

Percentage of students in schools that use assessment data to monitor teachers:



The issue is not how many charter schools a country has…

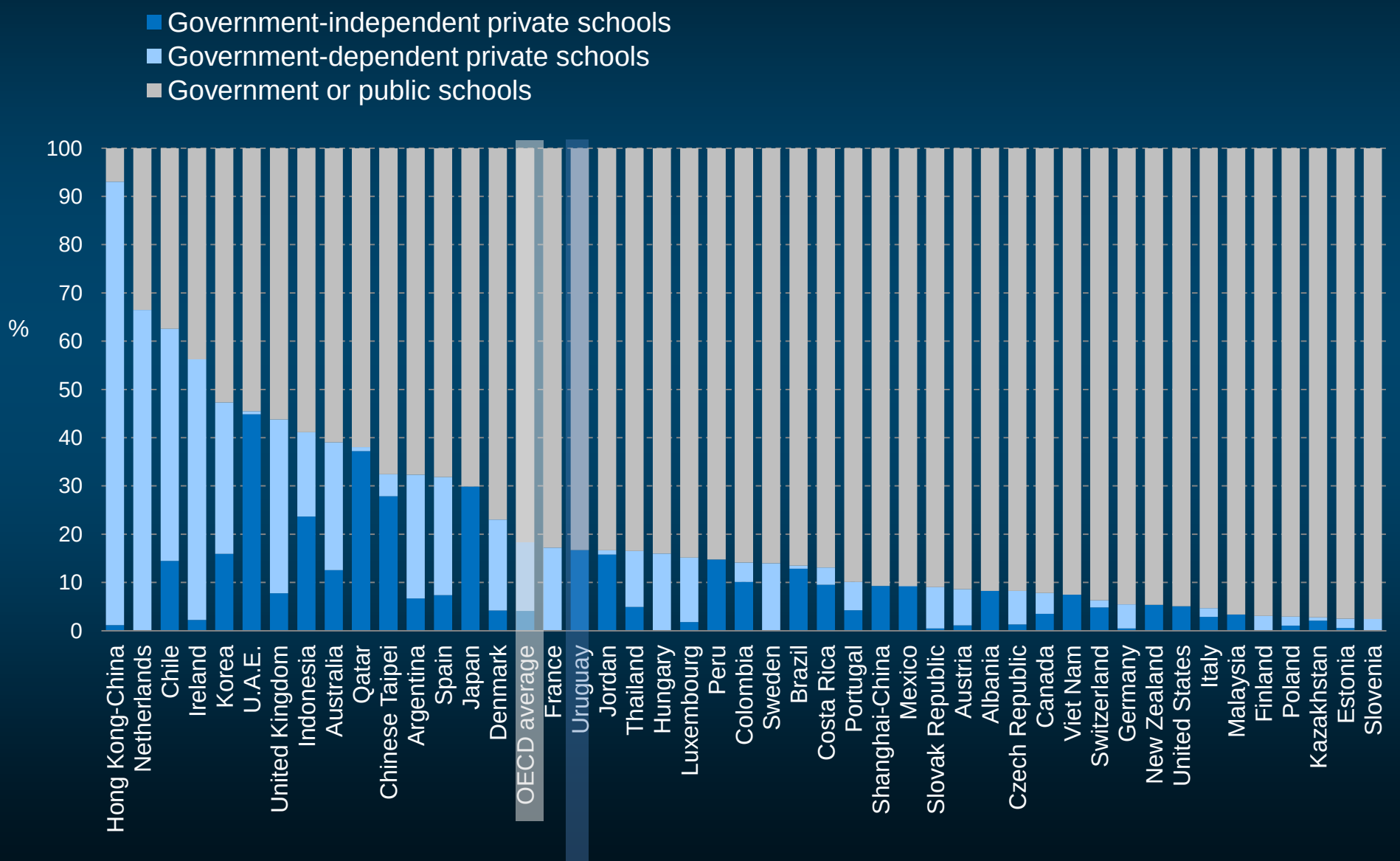
…but how countries enable every school
to assume charter type autonomy

What type of school do most students attend?

Fig IV.1.22

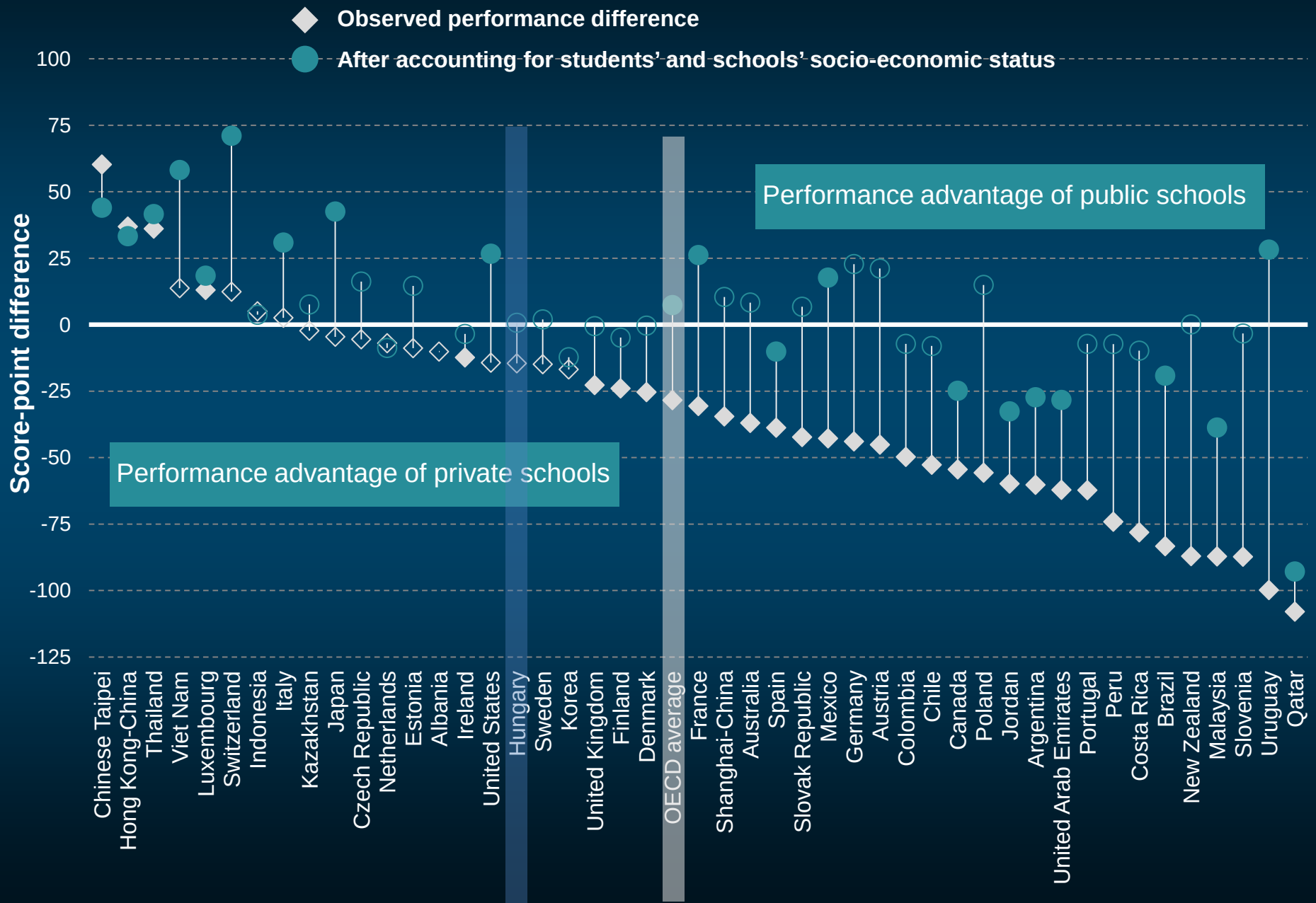
Fig IV.1.22

Percentage of students attending



Differences in mathematics performance between private and public schools shrink considerably after accounting for socio-economic status

Fig IV.1.19

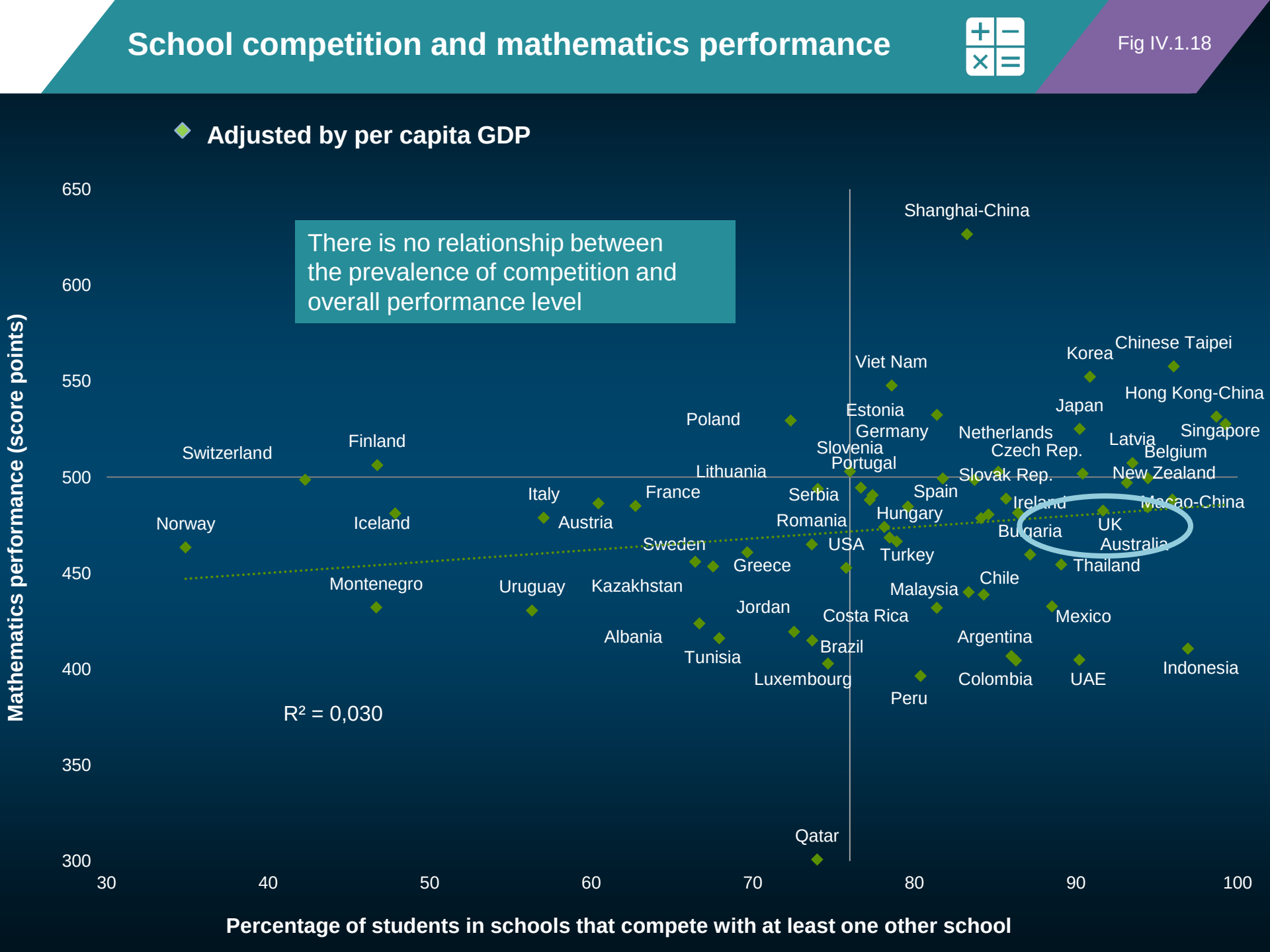


How the theory of school choice squares with the reality in families

If offered a **choice of schools** for their child, parents consider criteria as "a safe school environment" and "a school's good reputation" more important than "high academic achievement of students in the school".

School competition and mathematics performance

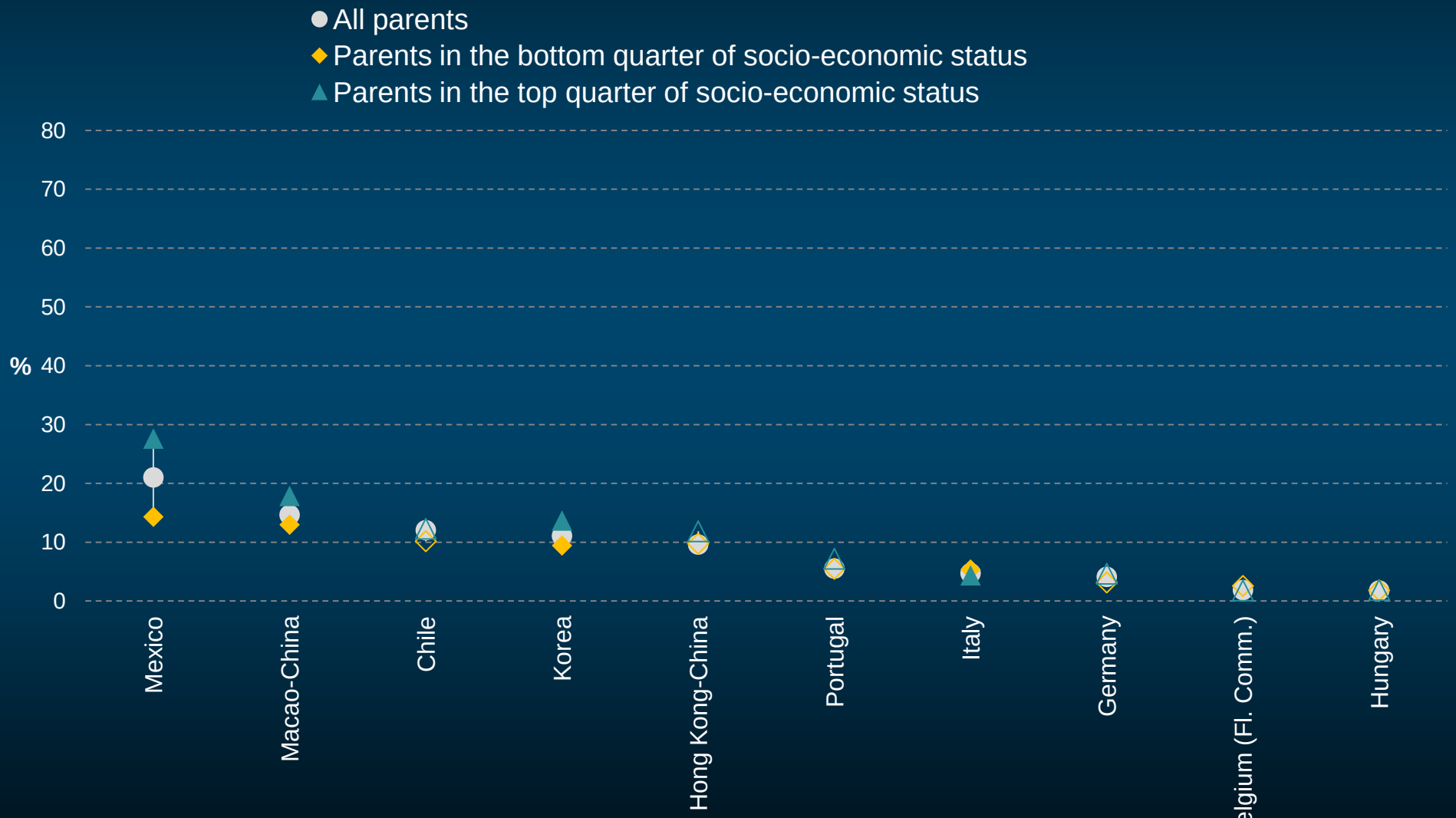
Fig IV.1.18



A school's particular approach to teaching is not a determining factor when parents choose a school for their child

Fig IV.4.5

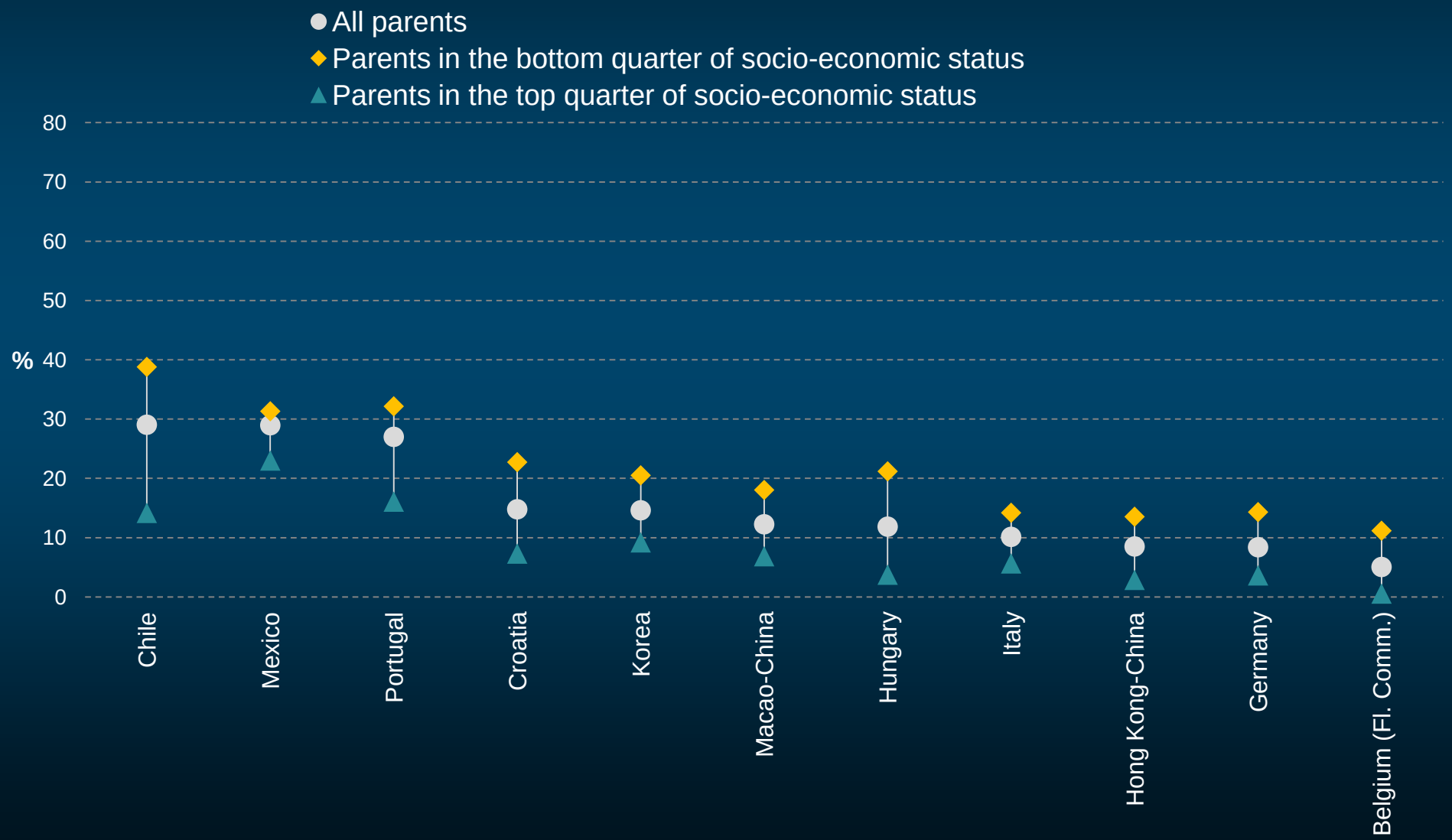
Percentage of parents who reported that a particular approach to pedagogy is a very important criterion when choosing a school for their child



Expenses associated with schooling are a concern among disadvantaged families

Fig IV.4.5

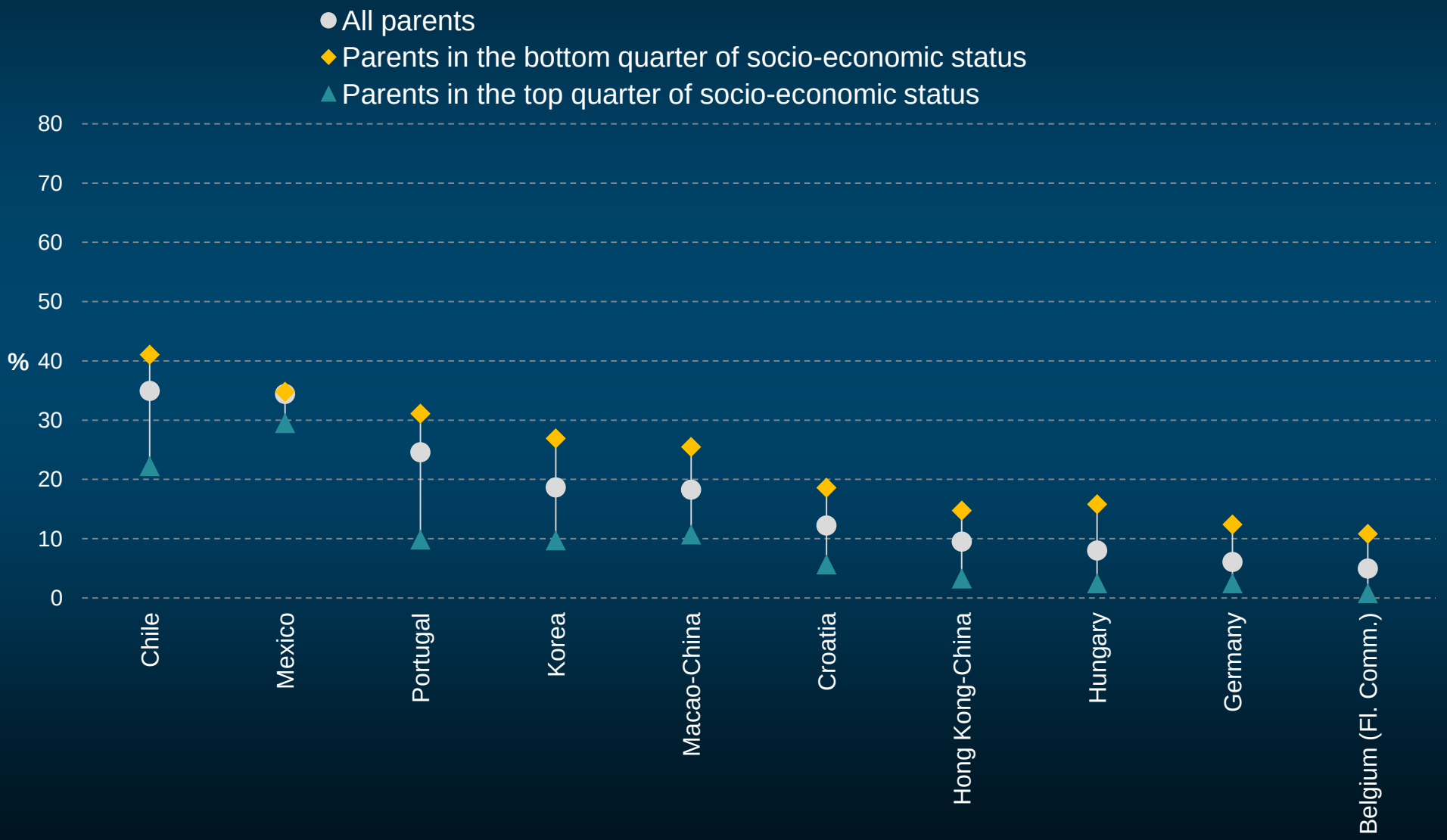
Percentage of parents who reported that expenses such as tuition, books, and room and board, are very important criteria when choosing a school for their child



Financial aid for school is a greater concern among disadvantaged parents

Fig IV.4.5

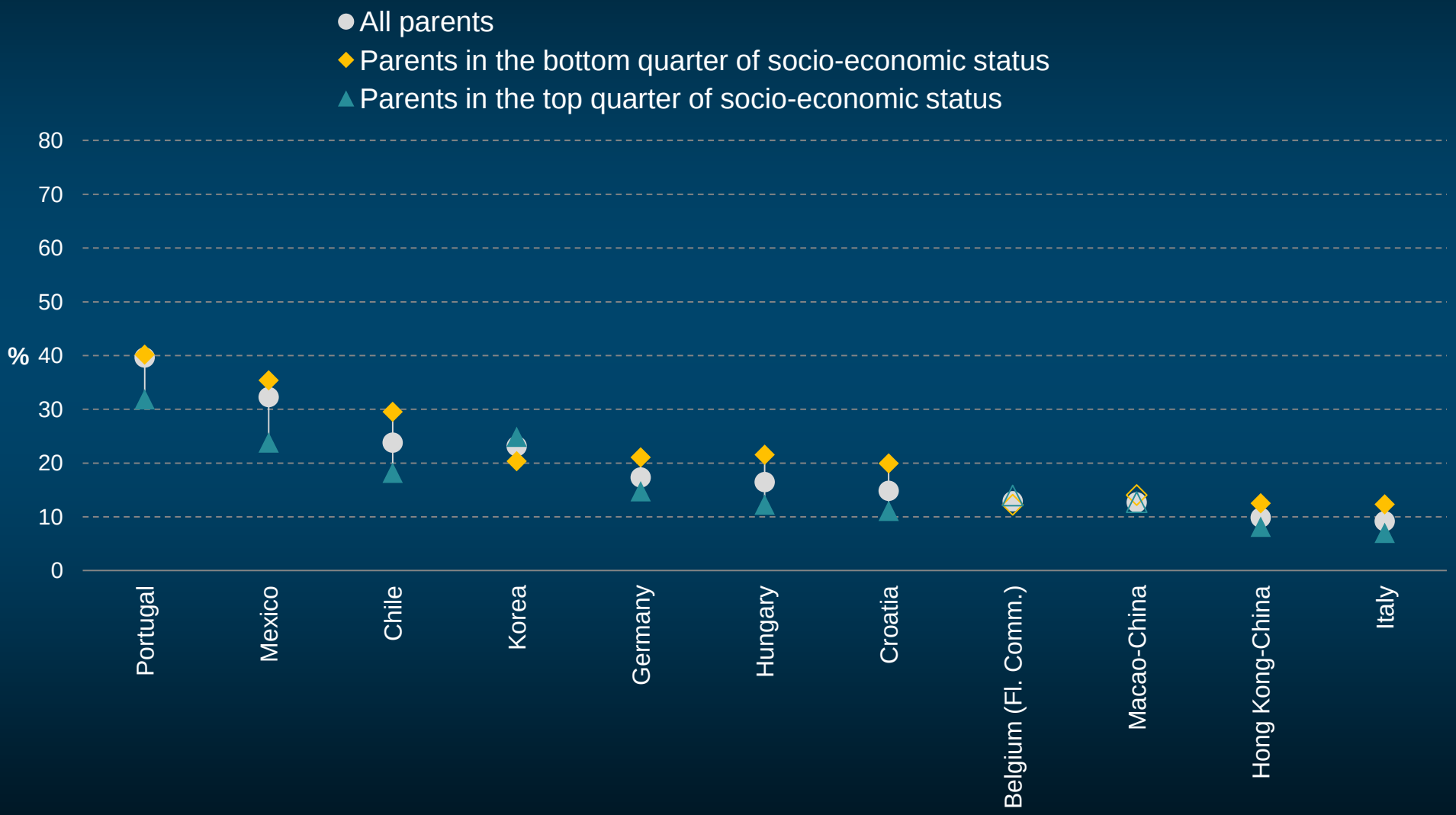
Percentage of parents who reported that the availability of financial aid, such as a school loan, scholarship or grant, is a very important criterion when choosing a school for their child



For disadvantaged families, physical access to school is a significant concern

Fig IV.4.5

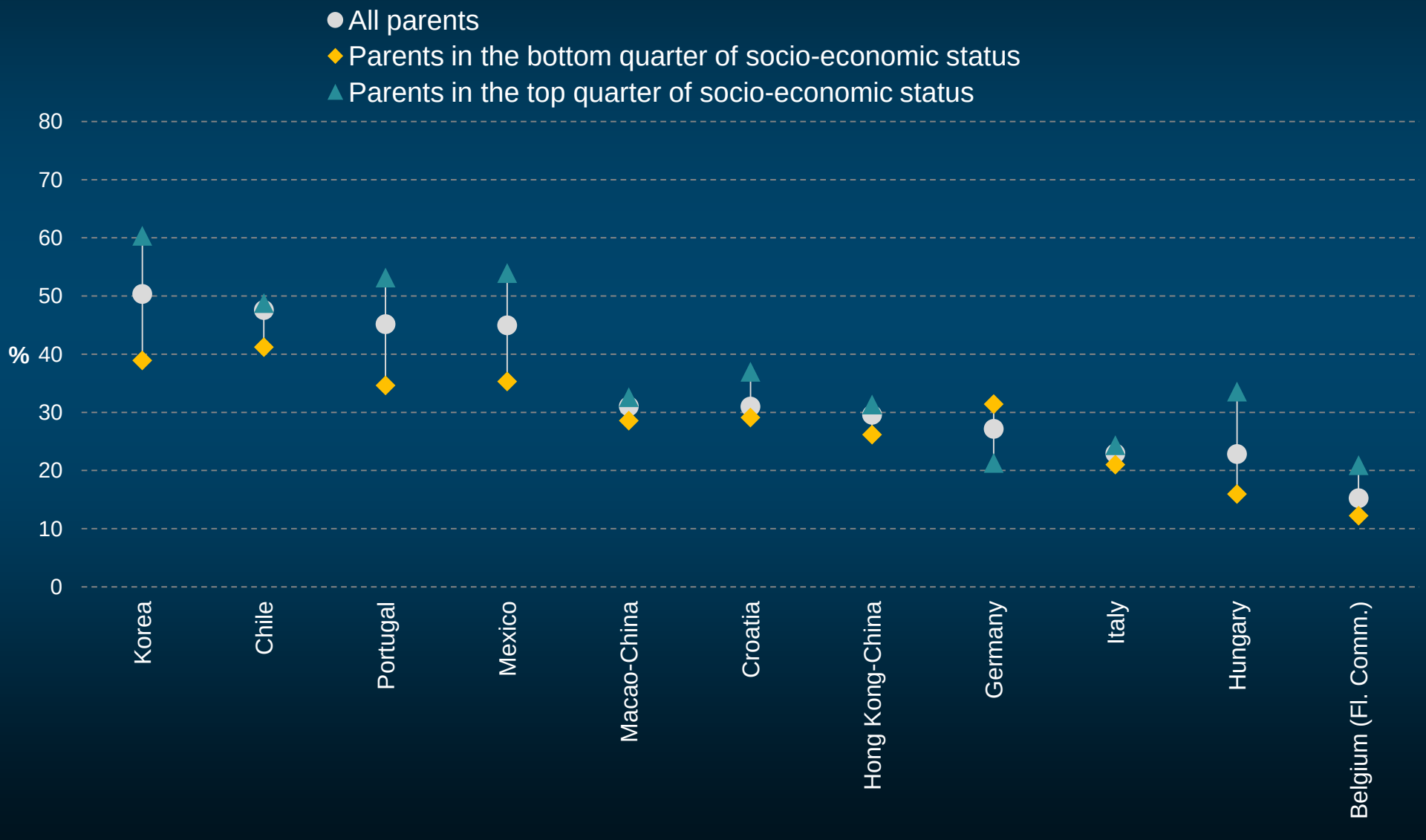
Percentage of parents who reported that the school's distance from home is a very important criterion when choosing a school for their child



Advantaged families tend to seek out schools whose students are high achievers

Fig IV.4.5

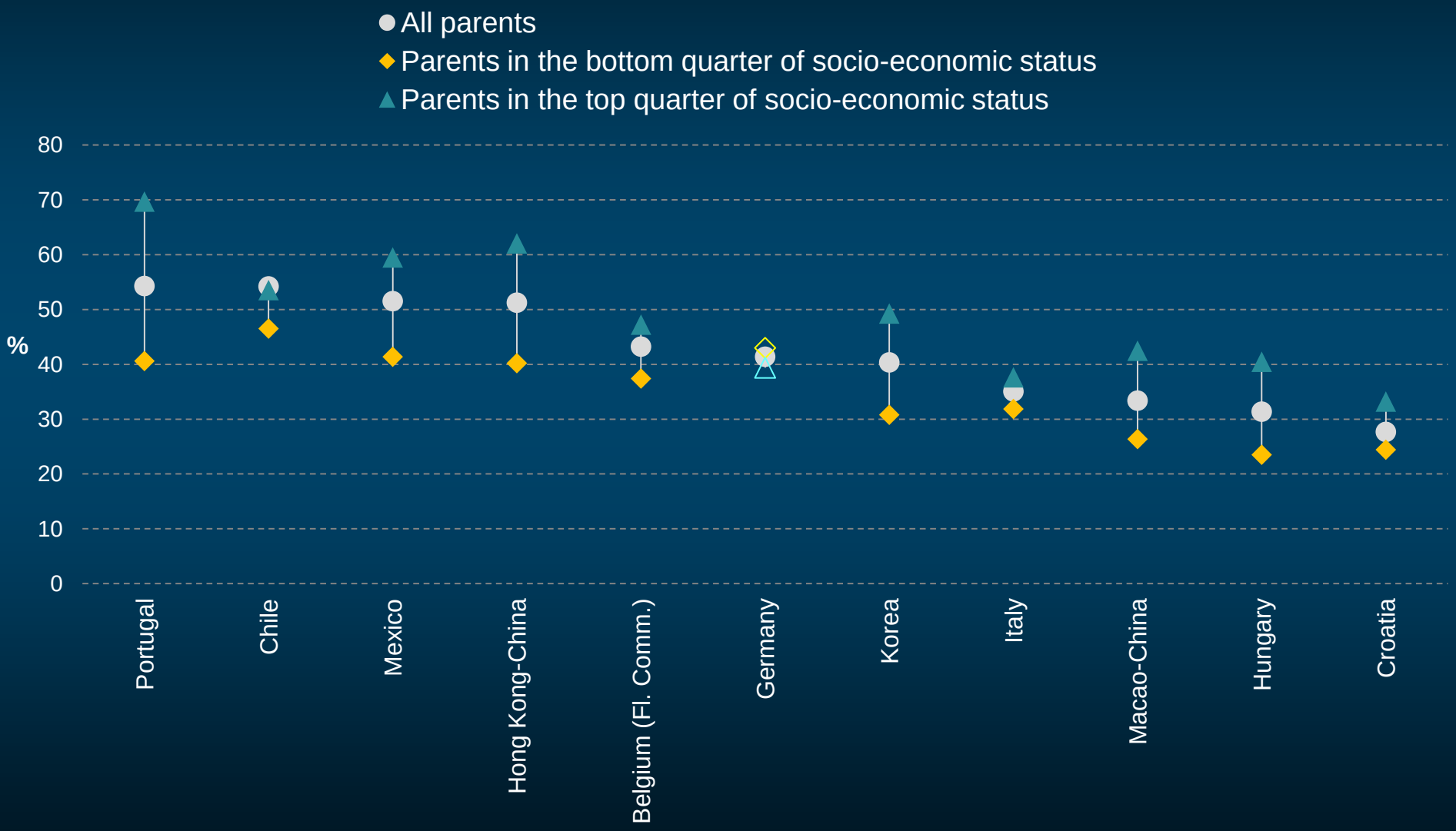
Percentage of parents who reported that students' high academic achievement is a very important criterion in choosing a school for their child



A school's reputation is a very important consideration among advantaged families

Fig IV.4.5

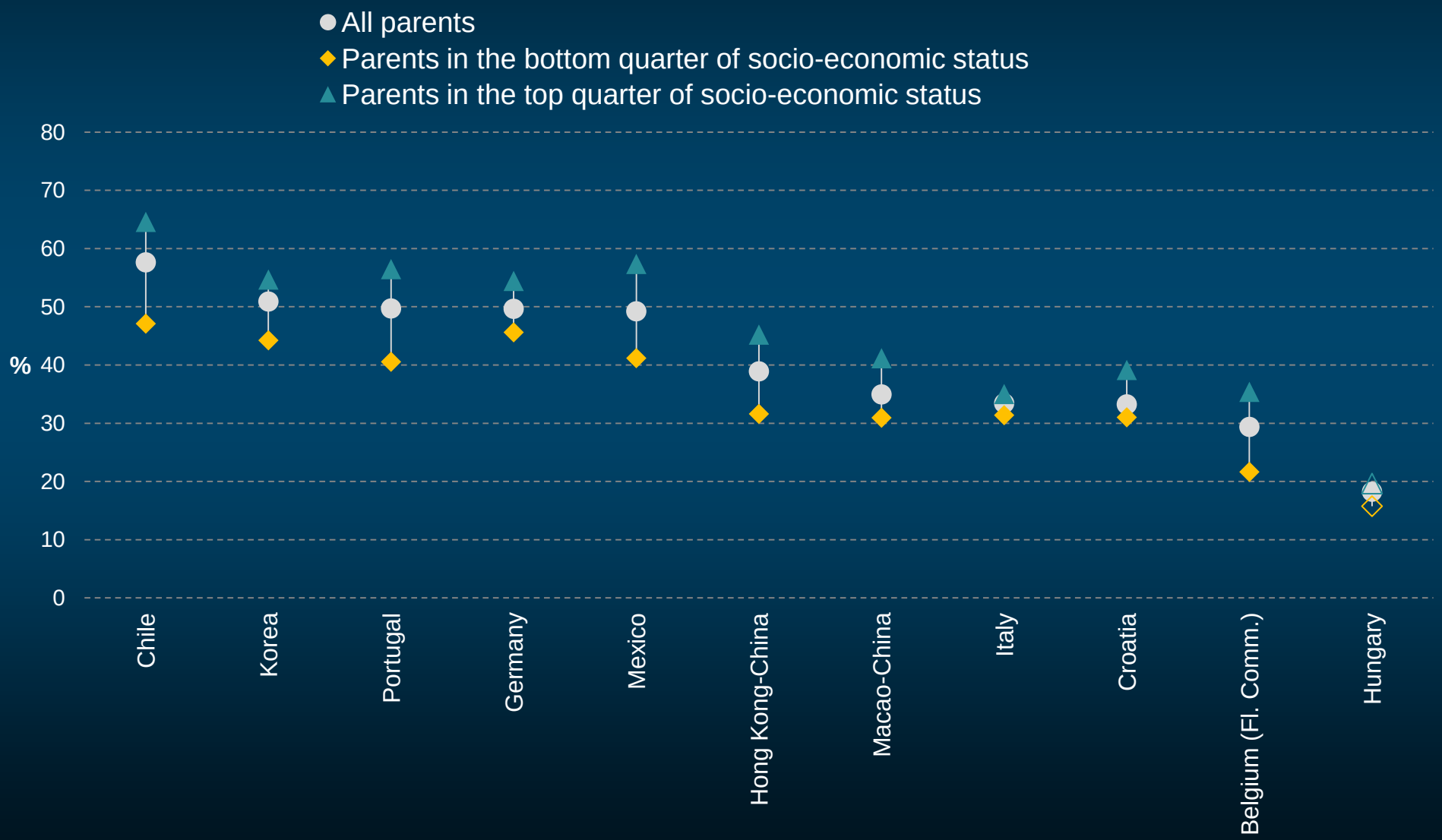
Percentage of parents who reported that a school's good reputation is a very important criterion when choosing a school for their child



Advantaged parents tend to seek out schools with an active and pleasant climate

Fig IV.4.5

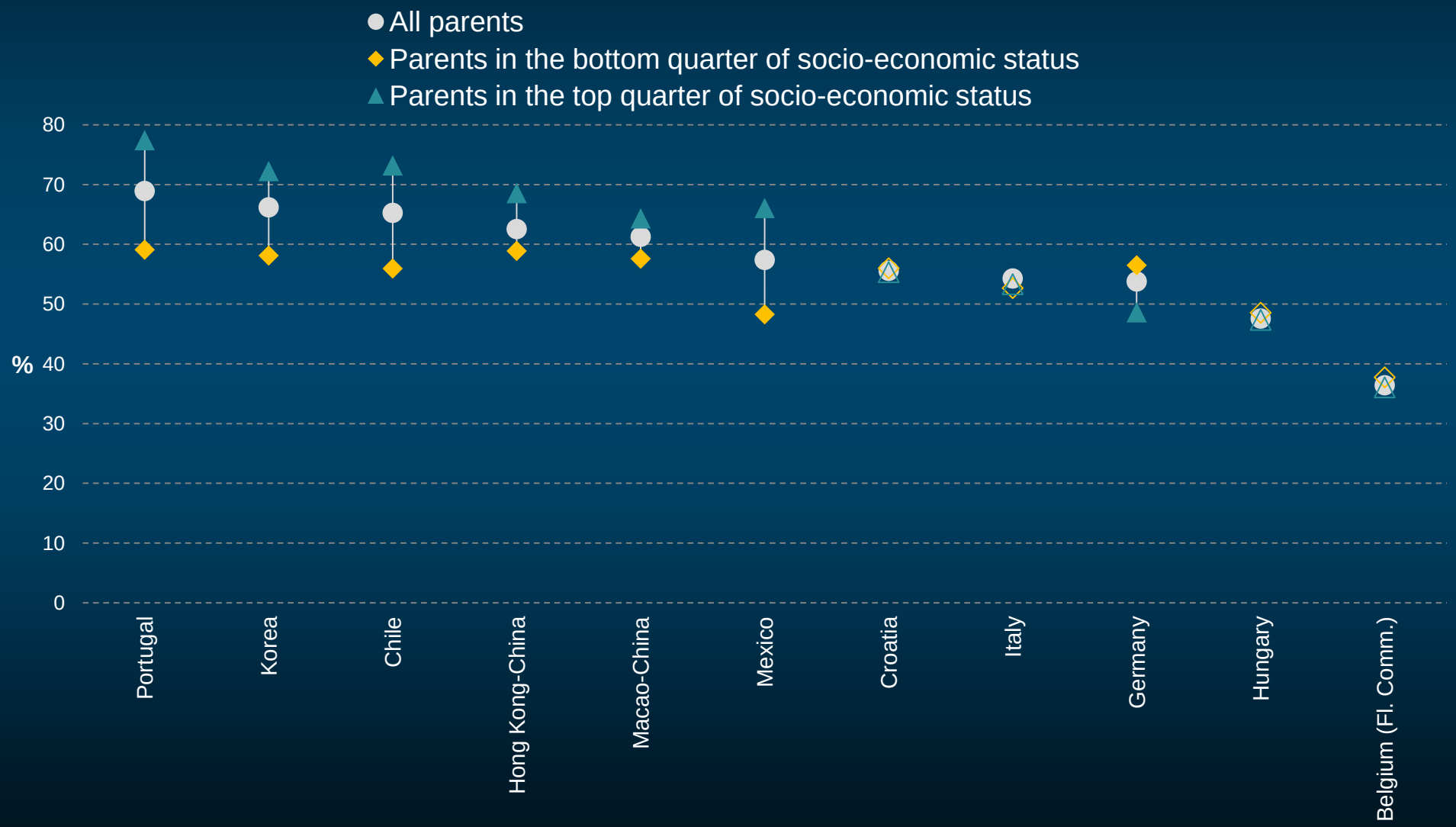
Percentage of parents who reported that an active and pleasant climate is a very important criterion when choosing a school for their child



Parents everywhere look for a safe school environment for their child

Fig IV.4.5

Percentage of parents who reported that a safe school environment is a very important criterion in choosing a school for their child



Revolving Door

Correct Answer: in the range from 103 to 105.

Accept answers calculated as 1/6th of the circumference (100π/3). Also accept an answer of 100 only if it is clear that this response resulted from using π =3.

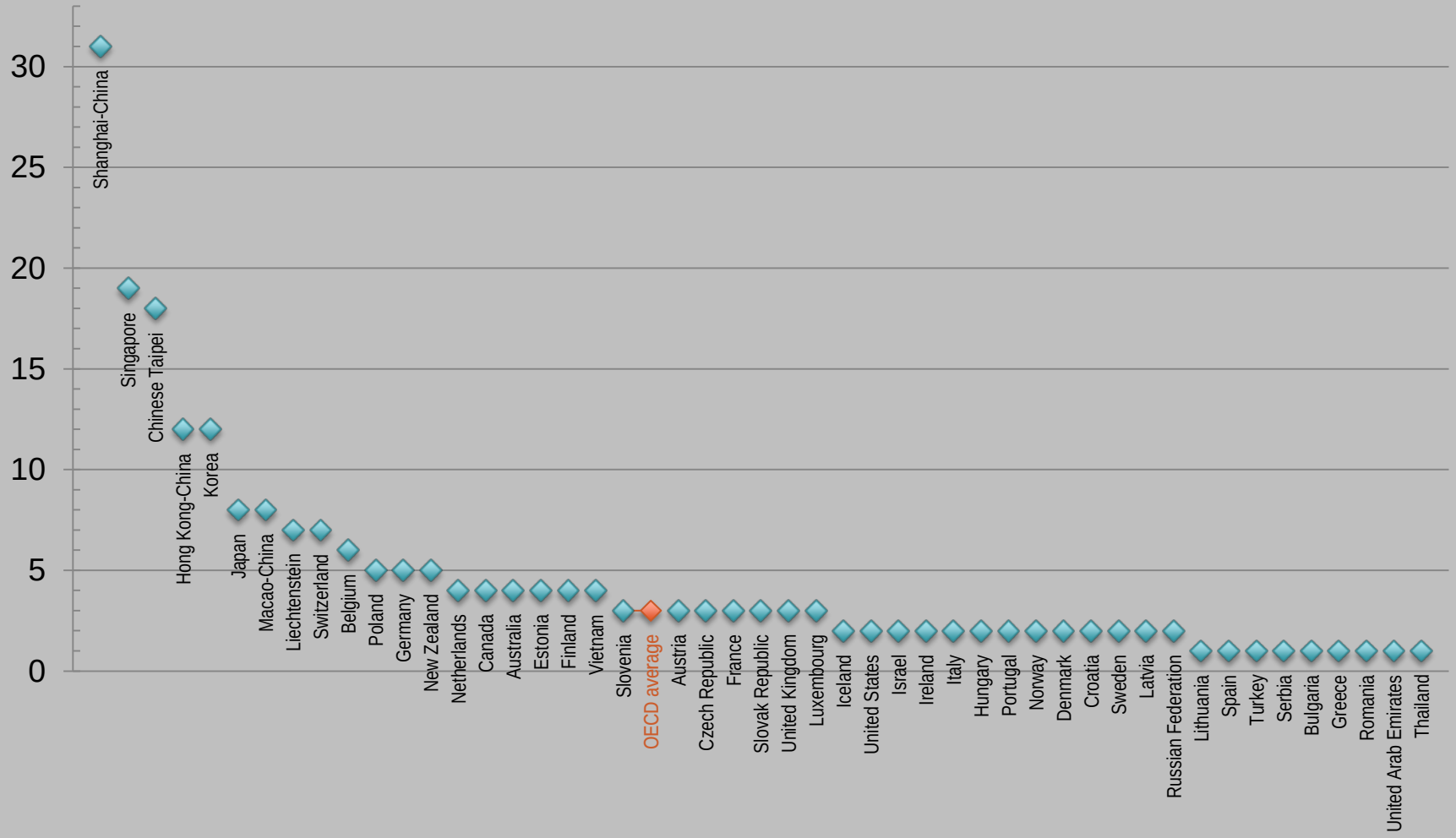
Note: Answer of 100 without supporting working could be obtained by a simple guess that it is the same as the radius (length of a single wing).

This item belongs to the *space and shape* category. Space and shape encompasses a wide range of phenomena that are encountered everywhere in our visual and physical world: patterns, properties of objects, positions and orientations, representations of objects, decoding and encoding of visual information, navigation and dynamic interaction with real shapes as well as with representations.

SCORING:	
Description:	Interpret a geometrical model of a real life situation to calculate the length of an arc
Mathematical content area:	Space and shape
Context:	Scientific
Process:	Formulate

PISA 2012 Sample Question **4**

Percent of 15-year-olds who scored Level 6 or Above



Find out more about PISA at www.pisa.oecd.org

- All national and international publications
- The complete micro-level database

Thank you !

Email: Andreas.Schleicher@OECD.org
Twitter: SchleicherEDU

and remember:

Without data, you are just another person with an opinion

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