

Athens University of Economics and Business
Department of Informatics, MSc in Data Science

Data visualization and communication

Professors: Dimitris Karlis, Nikos Platis
Lab assistant: Konstantinos Bourazas



Pisa competition 2018

static plots with **R**

Master Student:

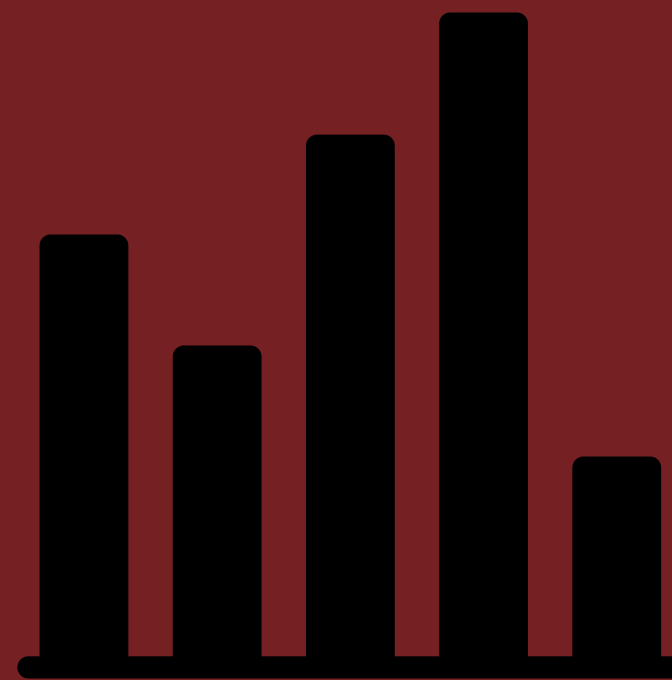
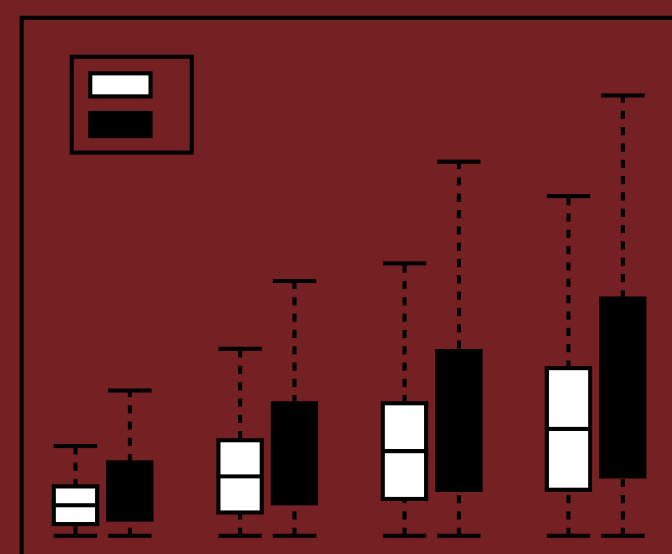
Evangelia Panourgia, e-panourgia  , evangelia-panourgia 
(f3352402, <https://github.com/e-panourgia/vizRTableau>) 



<https://www.oecd.org/en/data/datasets/pisa-2018-database.html>



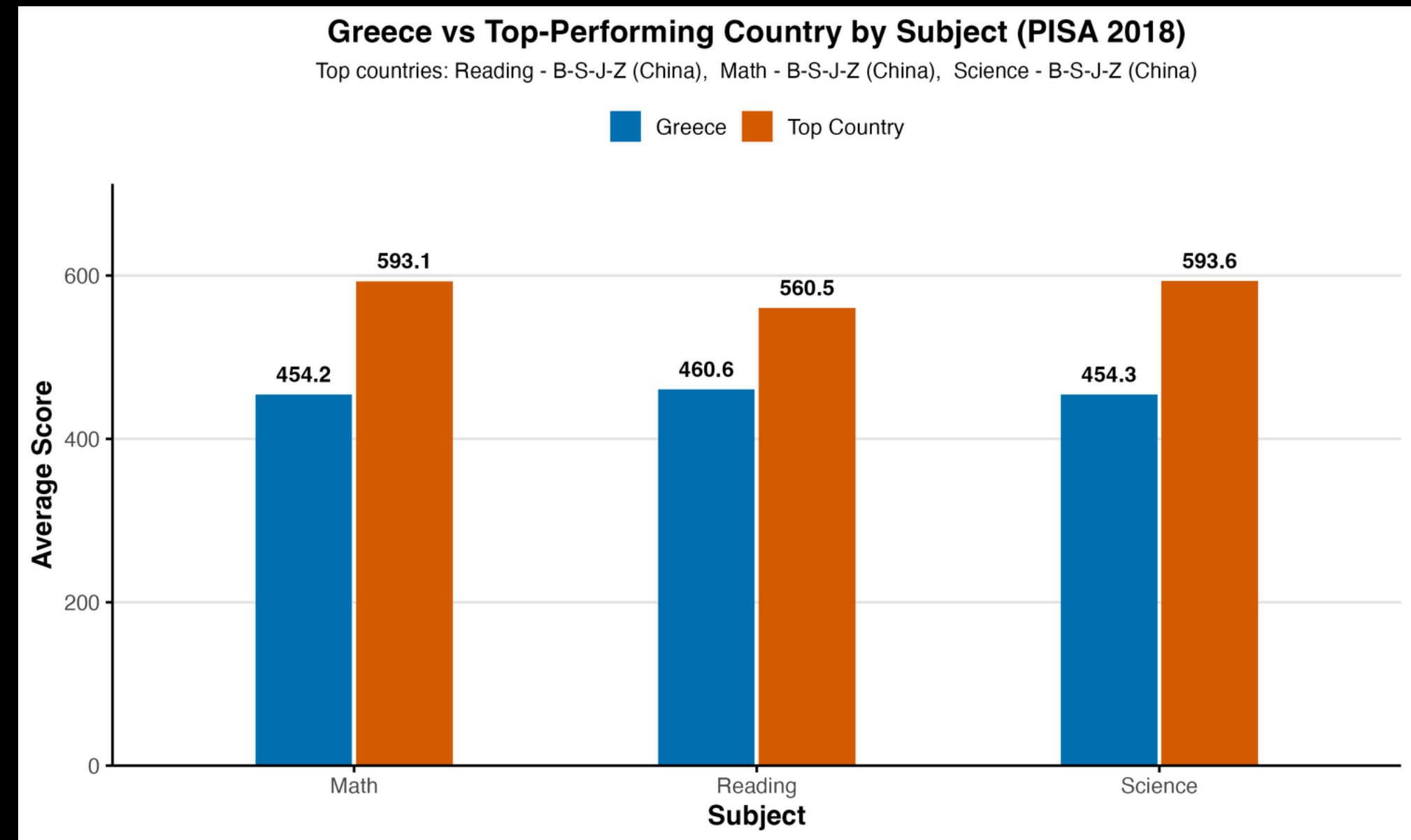
Static Visualisations



- Greece vs Top-Performing Country by Subject (PISA 2018)
- Number of Countries per Continent by OECD Membership (PISA 2018)
- Greece compared to Global and OCED Medians (PISA 2018)
- Greece and Higher-Scoring in Global Competence (PISA 2018)
- Greece's Global Rank by Subject and Overall (PISA 2018)
- Student Performance by Gender and Country Group (PISA 2018)
- Greece's Global Competence vs Academic Scores by Gender (PISA 2018)
- Gender Gap Scores by Country and Domain (PISA 2018)
- Score Change by Subject and Gender in Greece (2018 vs 2022)
- Score Change by Country, Gender, and Subject (2018 vs 2022)

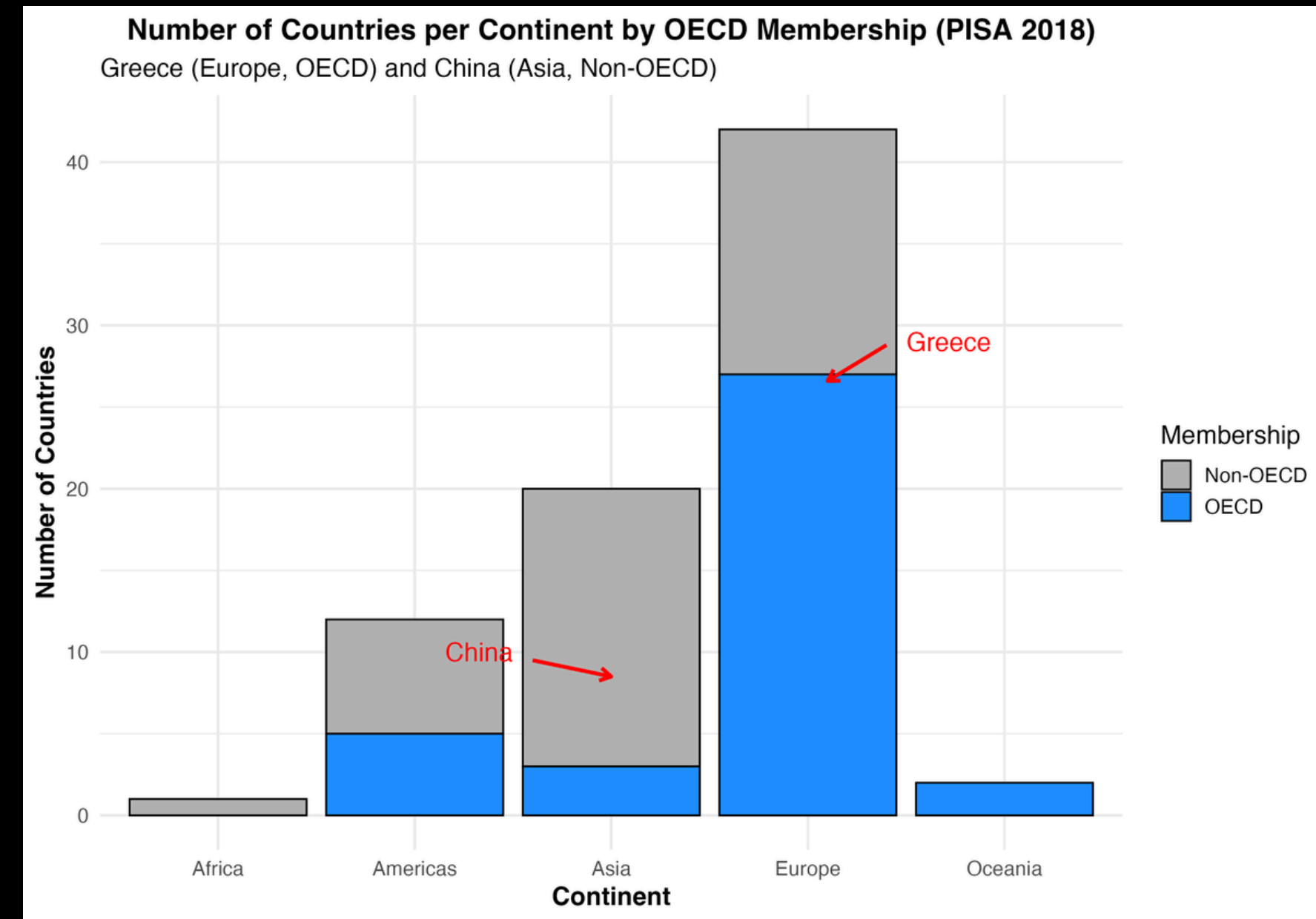
Greece vs Top-Performing Country by Subject (PISA 2018)

- This barplot illustrates the average performance of Greek students across all three PISA subjects: Math, Reading, and Science.
- It also shows the corresponding scores achieved by students from the top-performing country in each subject (in this case, China for all three).
- In every subject, Greek students scored significantly lower—by approximately 110 to 140 points—compared to the top performers.

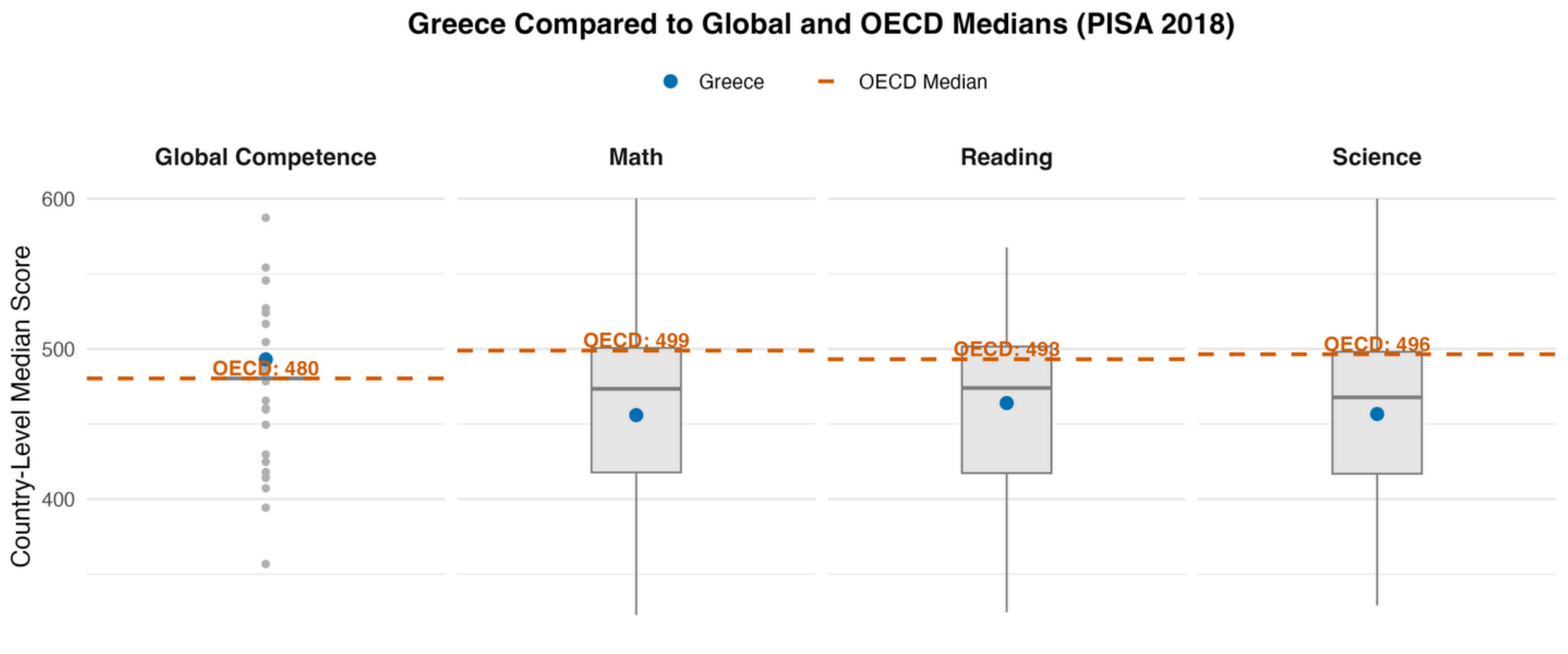


Number of Countries per Continent by OECD Membership (PISA 2018)

- This chart shows the number of PISA 2018 countries by continent and OECD membership.
- OECD countries (blue) are commonly used for performance comparisons. → They provide a consistent, high-income benchmark for evaluating education systems.
- Greece, shown in blue under Europe, is an OECD member and thus compared to similar economies.
- China, represented by B-S-J-Z, is a high-performing but non-OECD country in Asia.
- OECD countries will serve as an extra baseline in the next slide's comparisons.



Greece compared to Global and OCED Medians (PISA 2018)



Note: Why no box for Global Competence?

- Over half the countries have the exact same median score (480), so the interquartile range is zero. As a result, the boxplot collapses and isn't shown.

Count	Unique values	Q1=Q3	IQR
80	29	480	0

- This plot compares Greece's median performance to both the OECD median and the distribution of global country medians across four domains: Global Competence, Math, Reading, and Science.
- The OECD median (dashed orange line) serves as a benchmark among developed economies, while the boxplots represent the global spread of country-level medians.
- In Math, Reading, and Science, Greece's performance is below the OECD median and falls within the lower half of the global distribution, indicating it lags behind many peer countries.
- In contrast, for Global Competence, Greece performs right at or slightly above the OECD median, positioning itself comparatively better in this domain than in core academic subjects.
- This pattern highlights a relative strength for Greece in students' awareness of global issues, despite overall challenges in foundational academic skills.

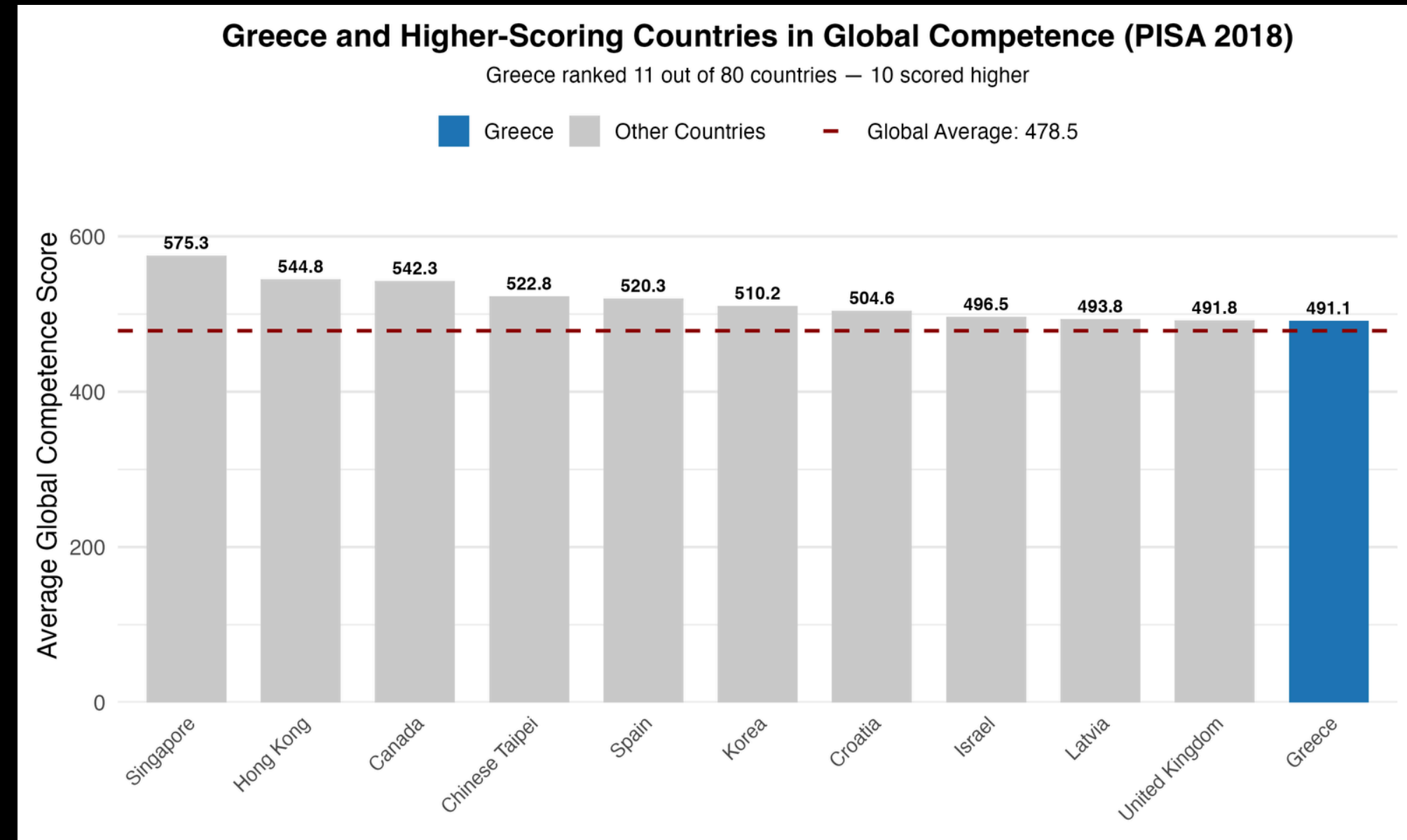
Greece and Higher-Scoring in Global Competence (PISA 2018)

- After seeing Greece slightly outperform the OECD and global medians in Global Competence, this slide zooms in to show how Greece ranks among the top countries globally.

- Greece ranked 11th out of 80 countries in Global Competence, outperforming the global average (491.1 vs 478.5).

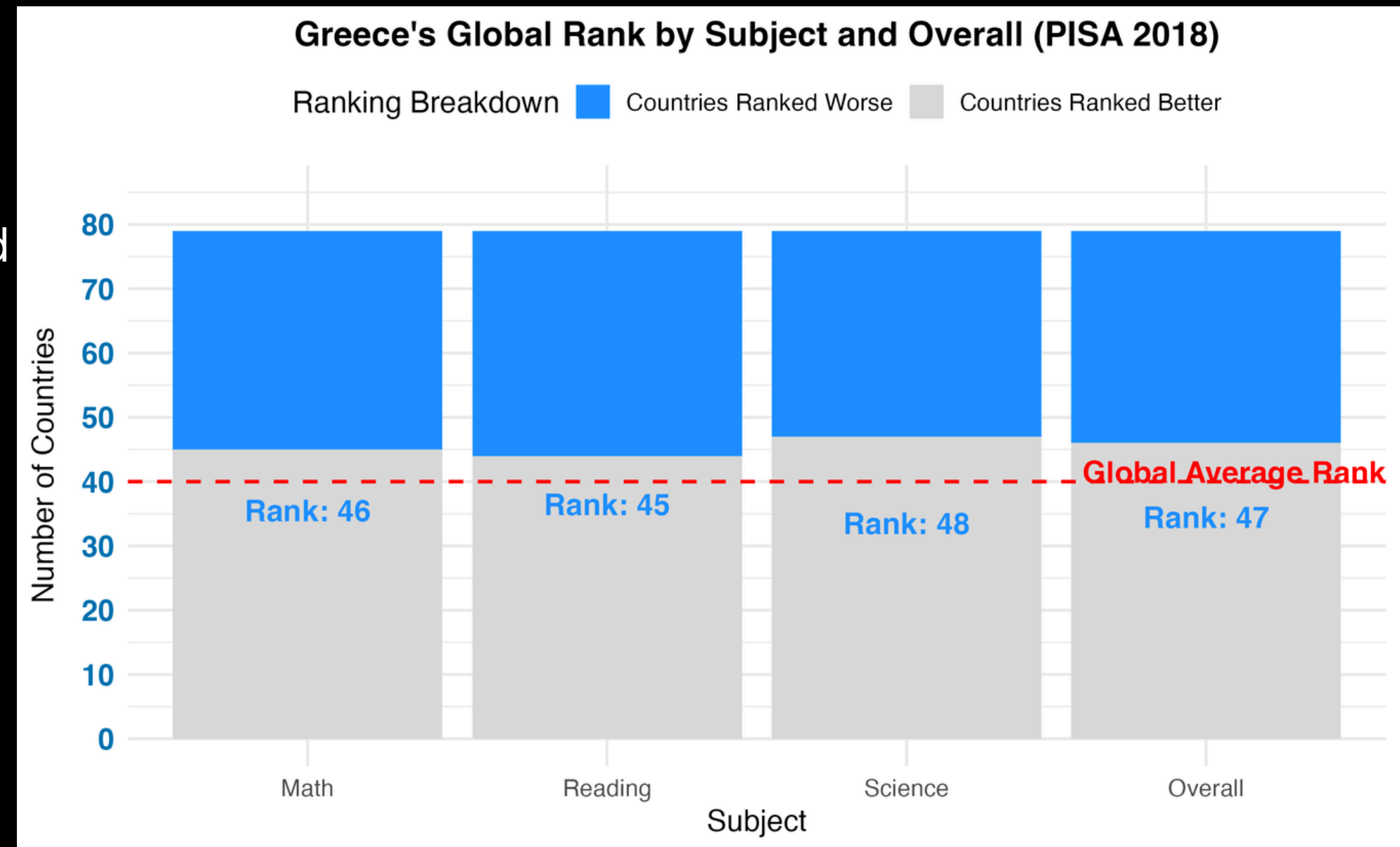
- Only 10 countries scored higher than Greece, including top performers like Singapore, Hong Kong, and Canada.

- This result highlights Greece's relative strength in students' awareness of global issues, despite weaker performance in core academic subjects.



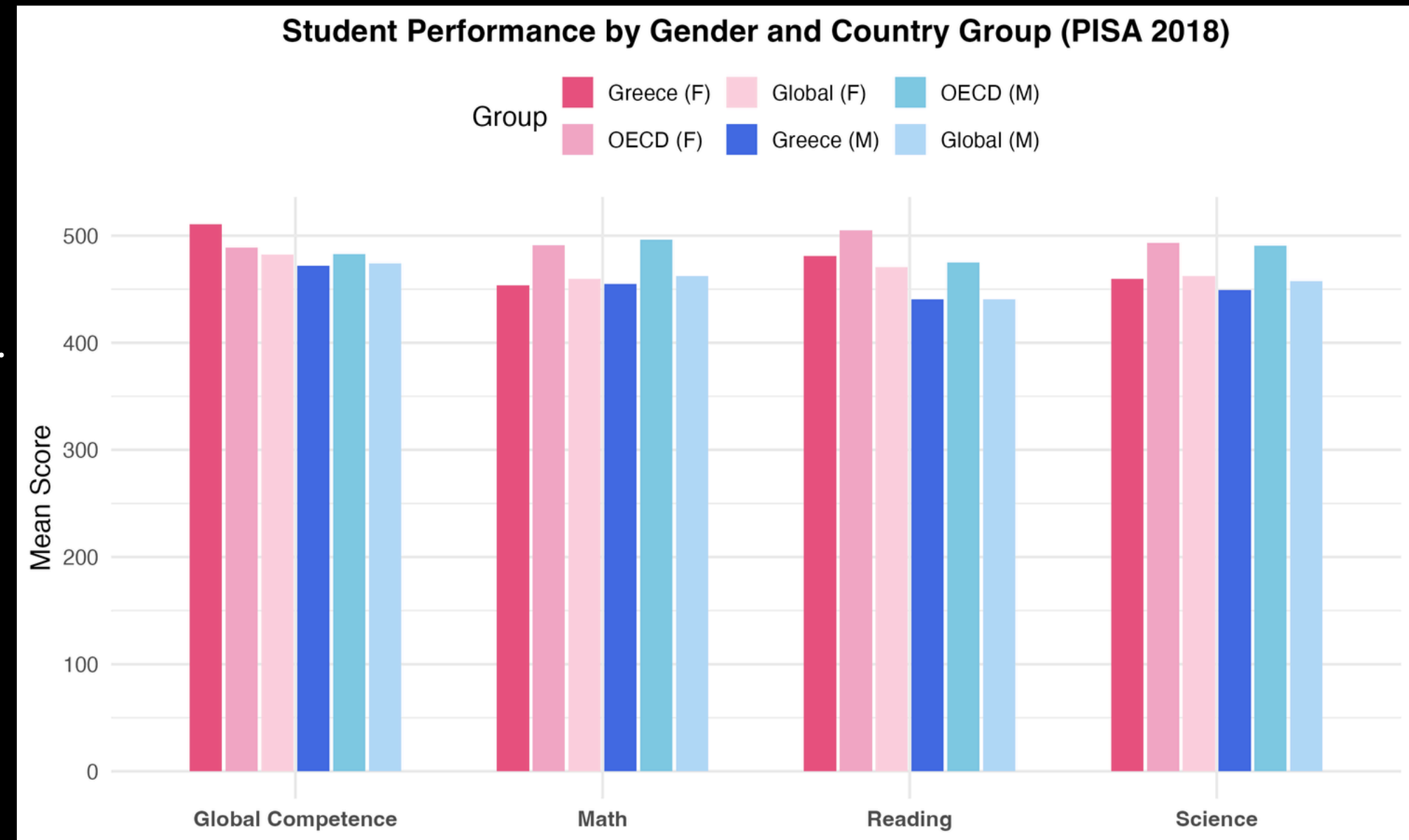
Greece's Global Rank by Subject and Overall (PISA 2018)

- This plot shows Greece's global ranking out of 80 countries in Math, Reading, Science, and Overall performance (average of the three). A lower rank means better performance.
- The red dashed line marks the global average rank (40). Bars extending above it indicate that Greece ranked worse than average in that subject.
 - **Greece ranked:**
 - 46th in Math
 - 45th in Reading
 - 48th in Science
 - 47th Overall
- In all subjects, Greece ranked below the global average, highlighting challenges in academic performance compared to other participating countries.
- This slide complements the separate result in Global Competence, where Greece ranked 11th — much higher than in core academic subjects.

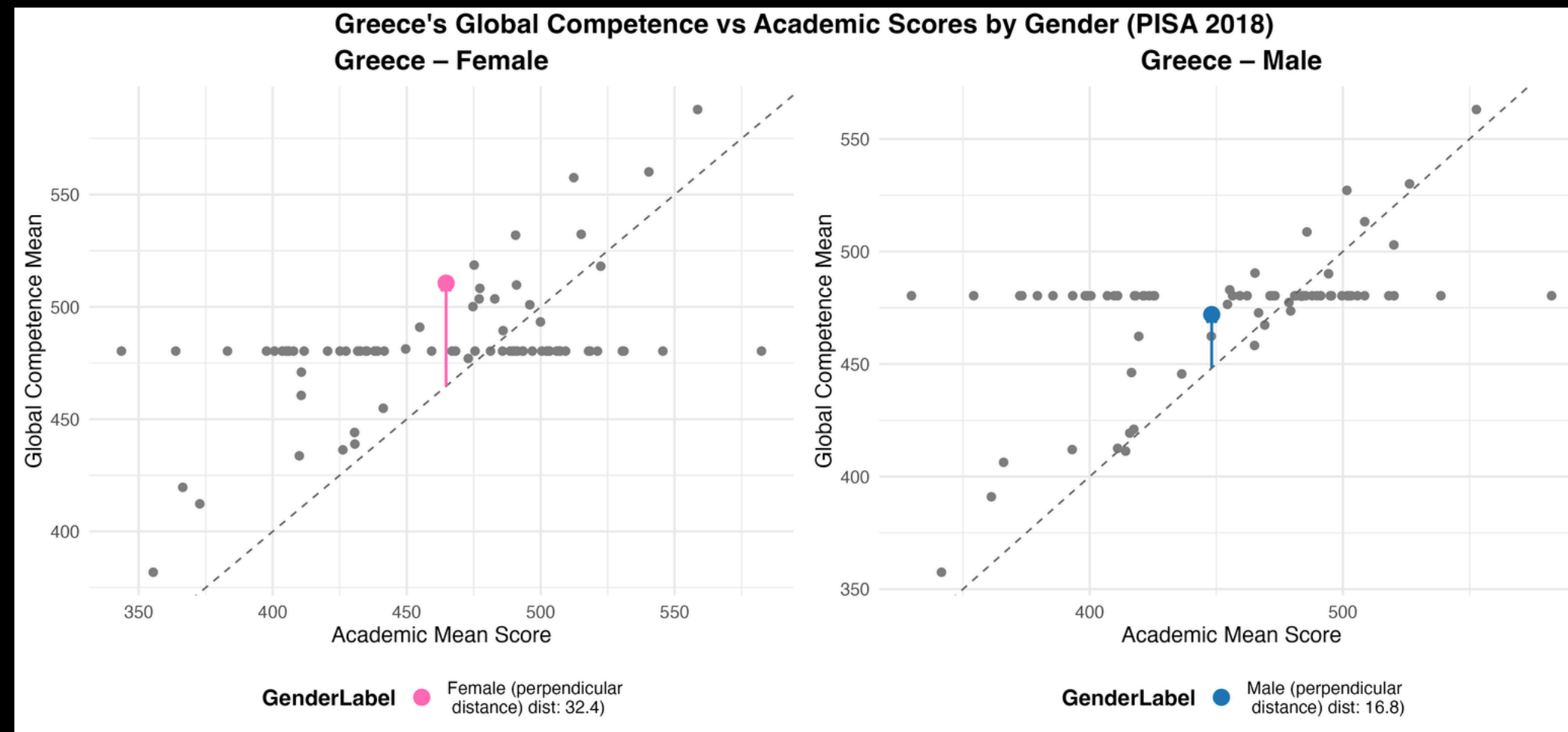


Student Performance by Gender and Country Group (PISA 2018)

- Delving into the dimension of gender, this plot compares PISA 2018 scores by gender across Greece, OECD, and global averages in global competence and in three subjects.
- Greece scores highest in Global Competence compared to global and OECD averages, especially for girls.
- Whereas, Math and Science scores are below OECD and global averages for boys.
- **Within Greece:**
 - Greek girls outperform Greek boys in Reading, Global Competence, and Science.
 - In Math, Greek boys slightly outperform Greek girls.
- **Compared to Global and OECD:**
 - Greek boys score lower than boys in both the OECD and Global groups across all domains.
 - Greek girls perform similar to or slightly below OECD girls in most areas, but are much higher than Greek boys in Global Competence and Reading.



Greece's Global Competence vs Academic Scores by Gender (PISA 2018)

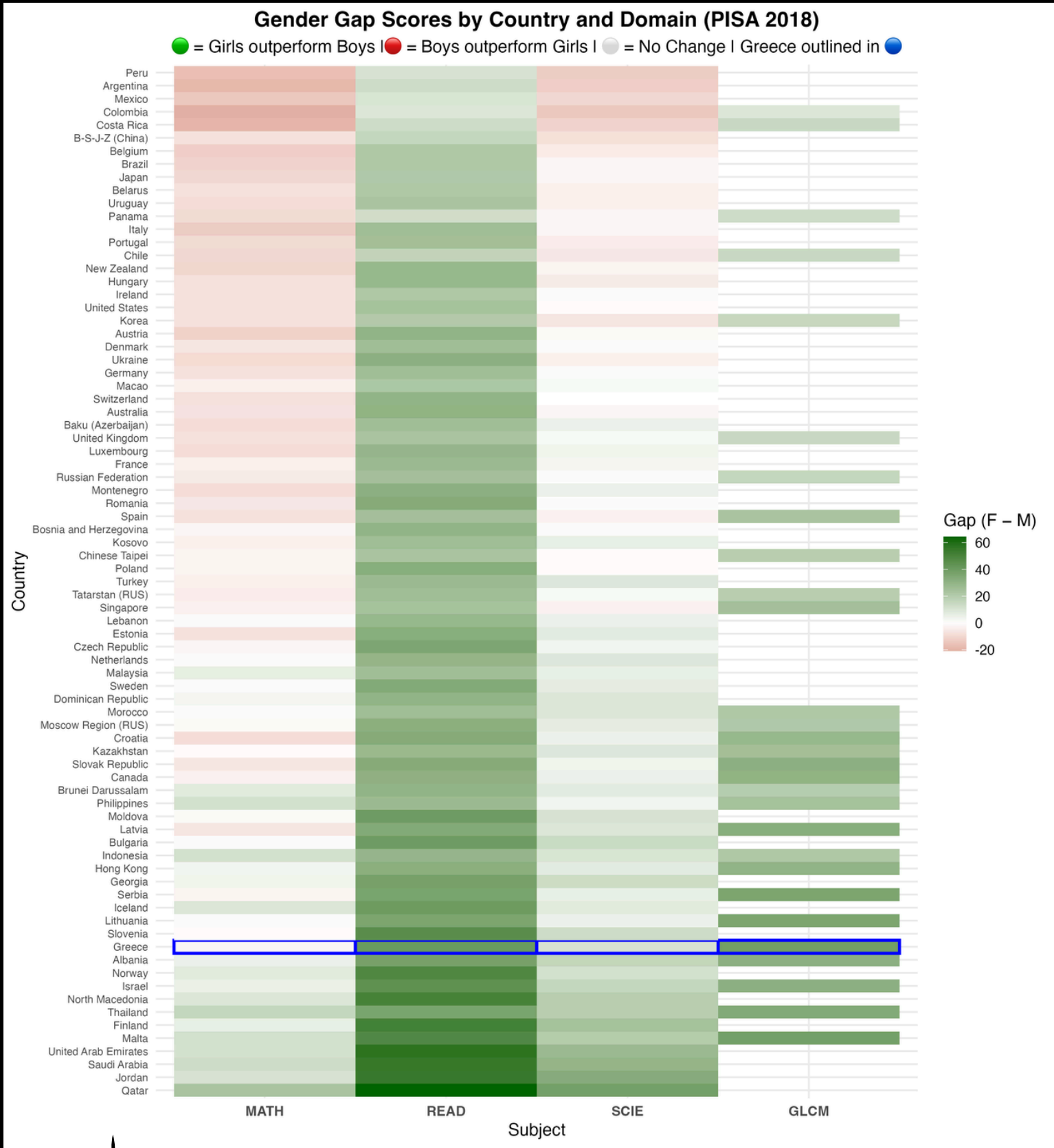


- The plots show Global Competence vs Academic Mean Scores for Greek females (left —pink dot) and males (right — blue dot), each compared to global peers. The dashed line represents a typical linear relationship — countries above it score higher in Global Competence than expected based on academic results.
- Greek females are significantly above the line, showing exceptional Global Competence relative to their academic performance.
- Greek males are slightly above the line, indicating a modest Global Competence advantage.
- This pattern suggests that Greece's strength in Global Competence is gender-driven, led primarily by female students.
- The relationship between Global Competence and Academic Scores is typically linear (as shown by the dashed line), but Greece—especially its female students—deviates positively, scoring much higher in Global Competence than expected based on academic performance.

Gender Gap in PISA 2018 Scores by Country and Domain

- Building on Greece’s gender-driven strength in Global Competence, we now compare gender gaps across countries and subjects to place Greece’s pattern in a broader international context.
- The plot shows gender gaps (girls – boys) in PISA 2018 scores across countries and domains, with Greece highlighted (blue).
- **Trends for Greece:**
 - Global Competence and reading shows the largest gap in Greece, with girls clearly outperforming boys.
 - Science has a moderate gap, still favoring girls but less extreme.
 - Math shows a small or no gap, with boys slightly ahead or near equal.
- **General Trends:**
 - Reading & GLCM: Most countries show girls clearly outperforming boys.
 - Science: Moderate gap, generally favoring girls.
 - Math: Small or no gap, often with boys slightly ahead.

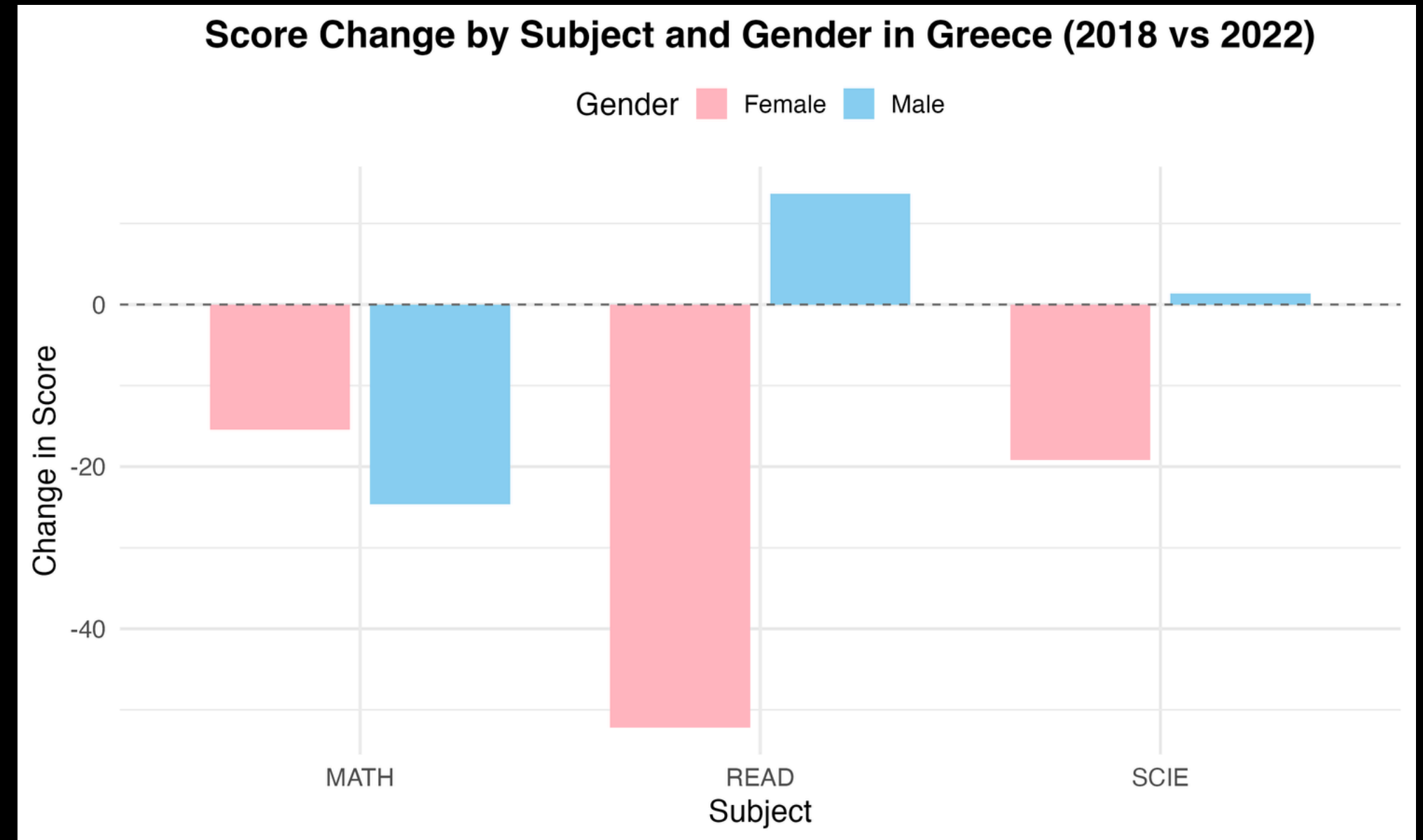
Note: not all countries have GLCM



Tech tip: Heatmaps work well for comparing many countries across domains.

Score Change by Subject and Gender in Greece (2018 vs 2022)

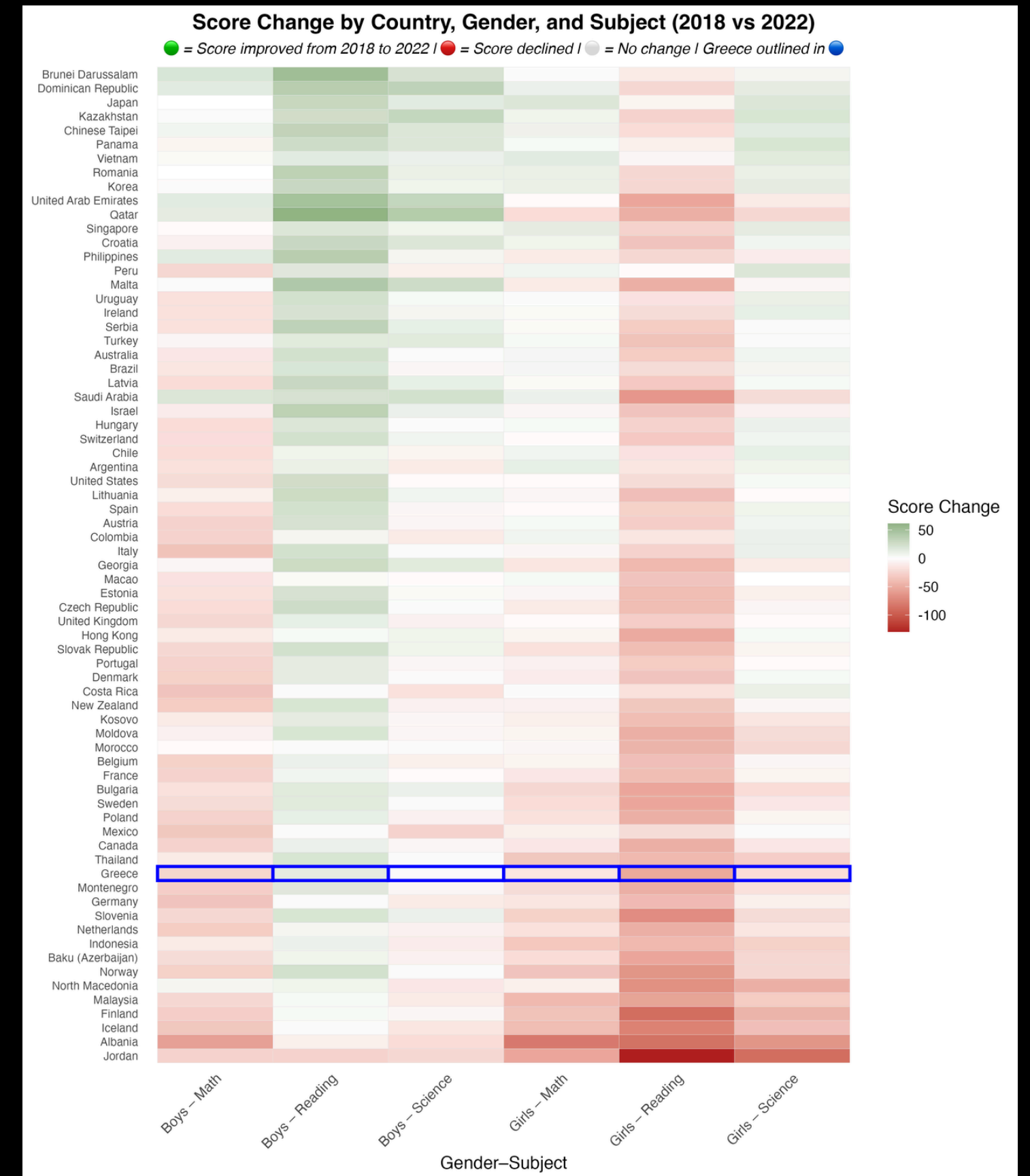
- The plot shows score changes (2018,2022) in **Greece** for males and females across Math, Reading, and Science.
 - Since 2022 is the most recently published year, we chose to compare it with 2018 data.
- Reading scores dropped sharply for girls, while boys improved, reversing the gender gap trend in this subject.
- In Math, both genders declined, but boys' scores fell more than girls'.
- Science remained relatively stable, with minor changes for both boys and girls.
- So, Reading shows the strongest gender shift in Greece (2018 vs 2022), with girls' scores dropping sharply and boys' scores rising — a key trend worth deeper analysis.



Note: for 2022 not published field for GLCM

Score Change by Country, Gender, and Subject (2018 vs 2022)

- This heatmap compares student performance in 2018 vs. 2022 across countries, broken down by gender and subject (Math, Reading, Science). Each tile shows how scores have changed over time for a specific gender–subject group. Colors represent the direction and size of the change—green for improvement, red for decline, white for no change—with Greece outlined in blue to highlight its position relative to global trends.
- Zooming in from the previous slide, we focus on **Girls – Reading**, the category with some of the most pronounced score declines. The heatmap reveals that sharp drops occurred across the majority of countries—including Greece—highlighting a broader global trend rather than an isolated national issue.
- Whereas in Greece, boys' Reading scores improved slightly, narrowing the gender gap.
- Math & Science (Both Genders): Mixed trends across countries—some show declines, others improvements, but changes are generally smaller than in Reading.



Summary

GREECE POSITION

- Greece underperforms in Math, Reading, and Science, scoring 110–140 points lower than top-performing countries.
- It ranks below both global and OECD medians in academic subjects. Specifically, Greece ranked 46th in Math, 45th in Reading, 48th in Science, and 47th overall (out of 80).
- In contrast, Greece performs above the global and OECD averages in Global Competence.
- It holds a strong **11th place** (out of 80) in Global Competence, versus ~35th in academic rankings. 🏆
- So, Greece stands out for its comparative strength in Global Competence (global issues) despite academic weaknesses.

GENDER GAP

- In Greece, girls outperform boys in Science—and especially in Reading and Global Competence. The gender gap is most pronounced in Reading and Global Competence, moderate in Science, and minimal or even reversed in Math.
- Greek females show exceptionally high Global Competence scores relative to academic scores.
- General Trends Globally:
 - Reading & GLCM: Most countries show girls clearly outperforming boys.
 - Science: Moderate gap, generally favoring girls.
 - Math: Small or no gap, often with boys slightly ahead.
- From 2018 to 2022, girls' Reading scores declined sharply in Greece, while boys' scores improved slightly—narrowing the gender gap.
- A similar pattern is observed globally:
 - Girls' Reading scores declined in most countries, often more steeply than boys'.
 - Boys' Reading scores were more stable, or in some cases slightly improved.

If you find this project helpful, please consider starring it on GitHub ★

<https://github.com/e-panourgia/vizRTableau>, authored by e-panourgia 

Data Acknowledgments:  OECD

(a) <https://www.oecd.org/en/data/datasets/pisa-2018-database.html>, (b) <https://www.oecd.org/en/data/datasets/pisa-2022-database.html>

Thank you for your time! 😊