

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

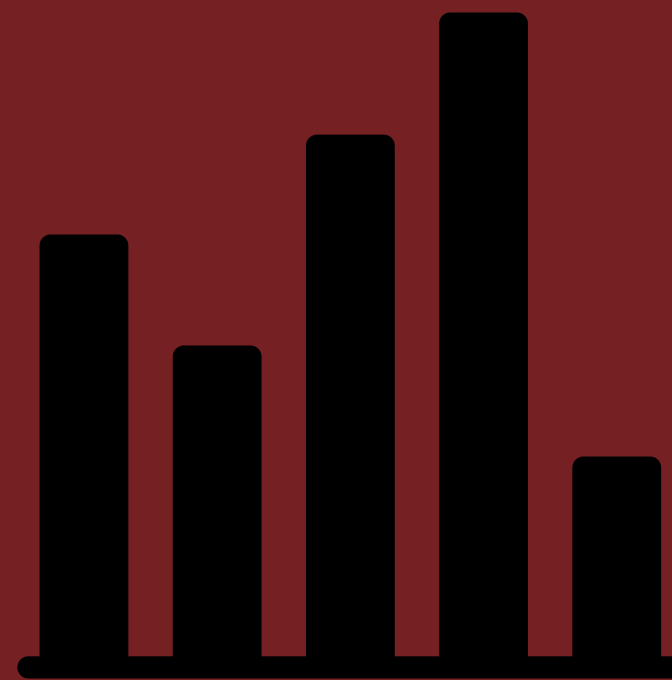
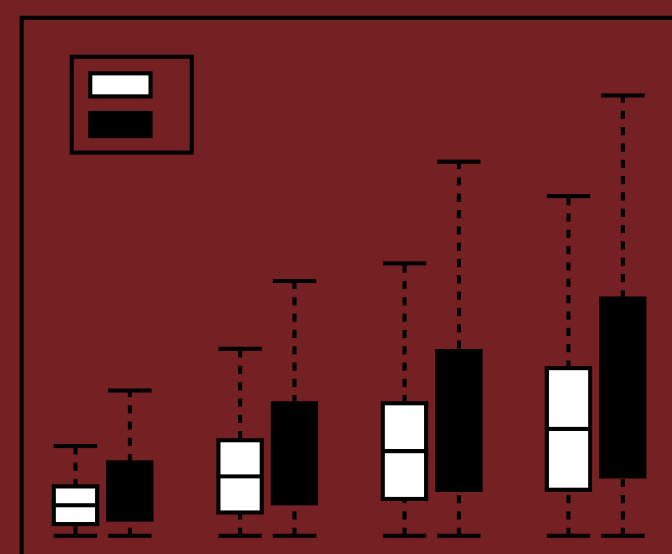
(f3352402, <https://github.com/e-panourgia/vizRTableau>) 



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



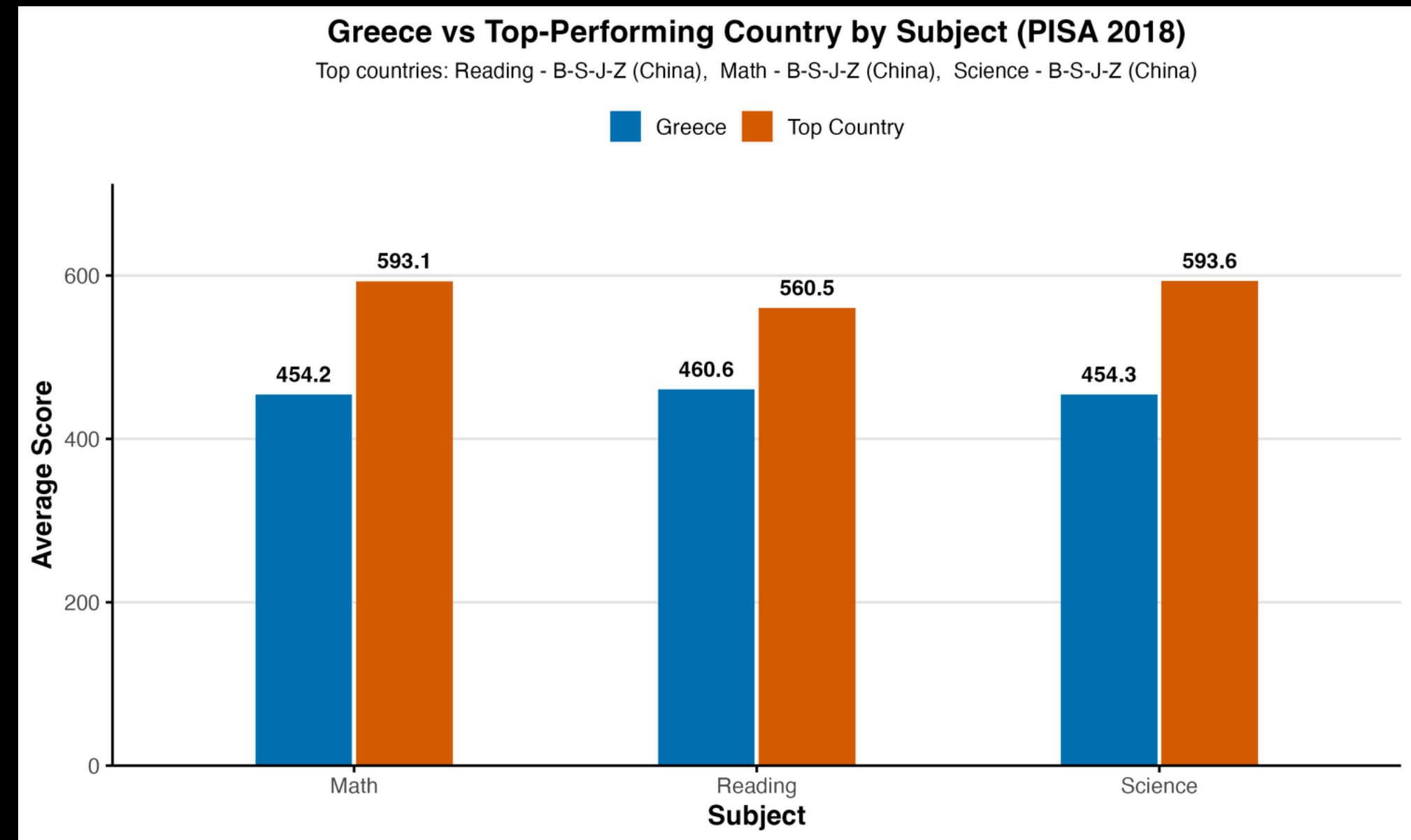
## Static Visualisations



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

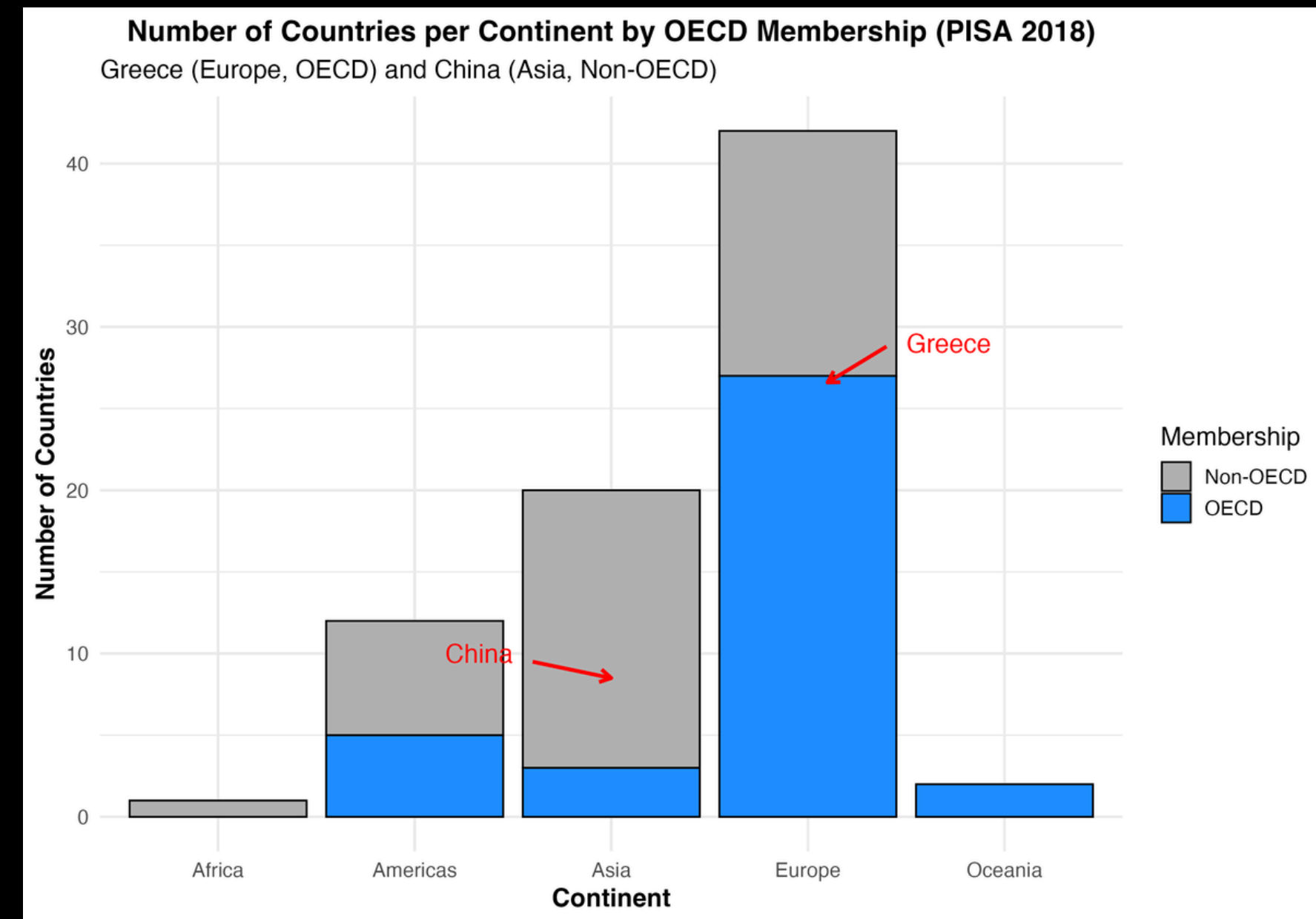
# Greece vs Top-Performing Country by Subject (PISA 2018)

- 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.

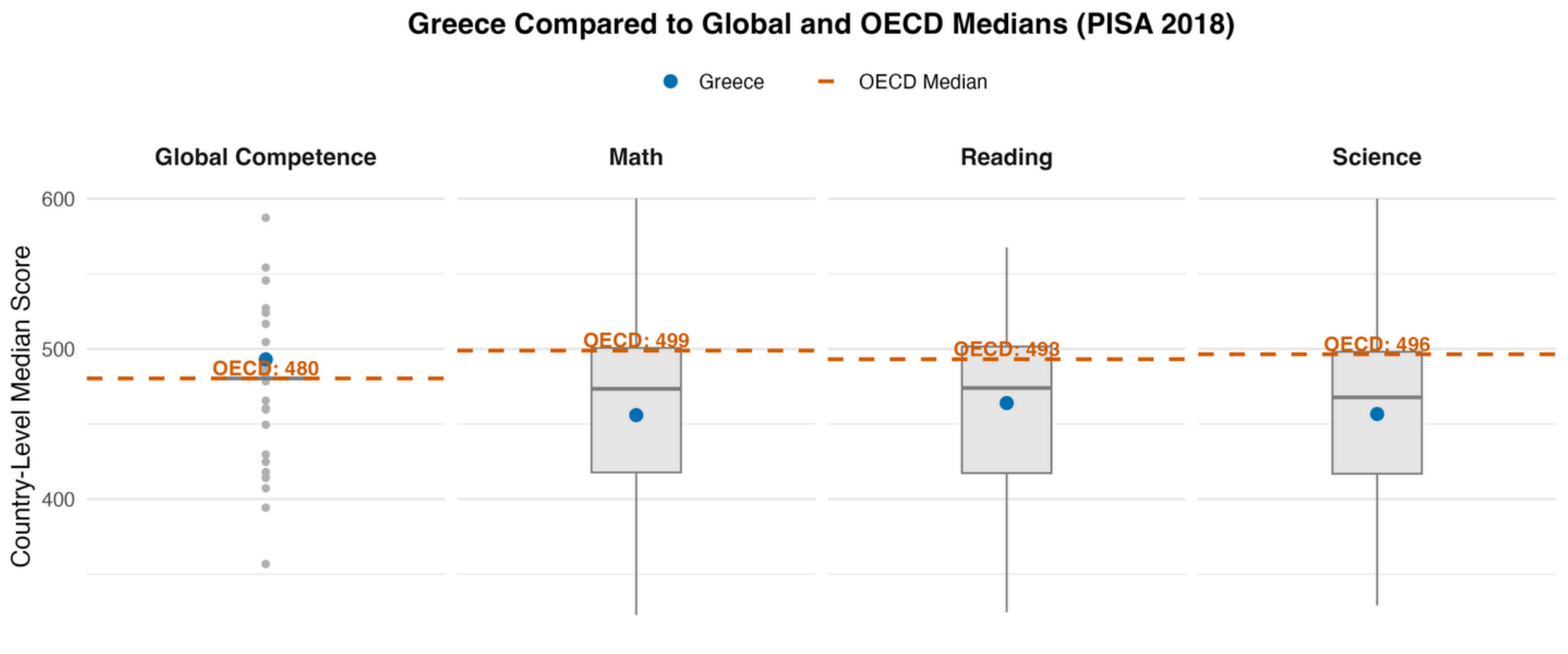


# Number of Countries per Continent by OECD Membership (PISA 2018)

- 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.



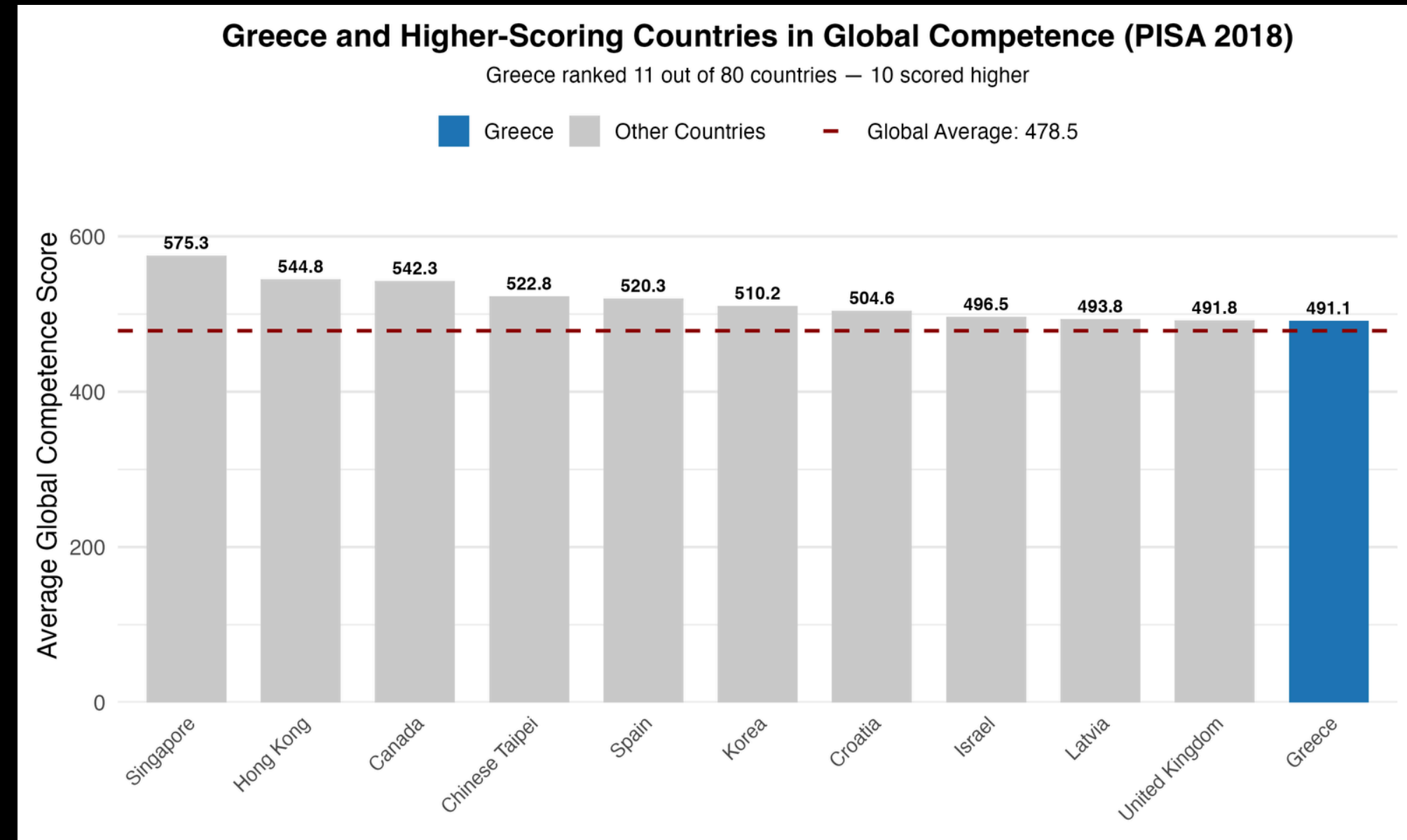
# Greece and Higher-Scoring in Global Competence (PISA 2018)

- 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).

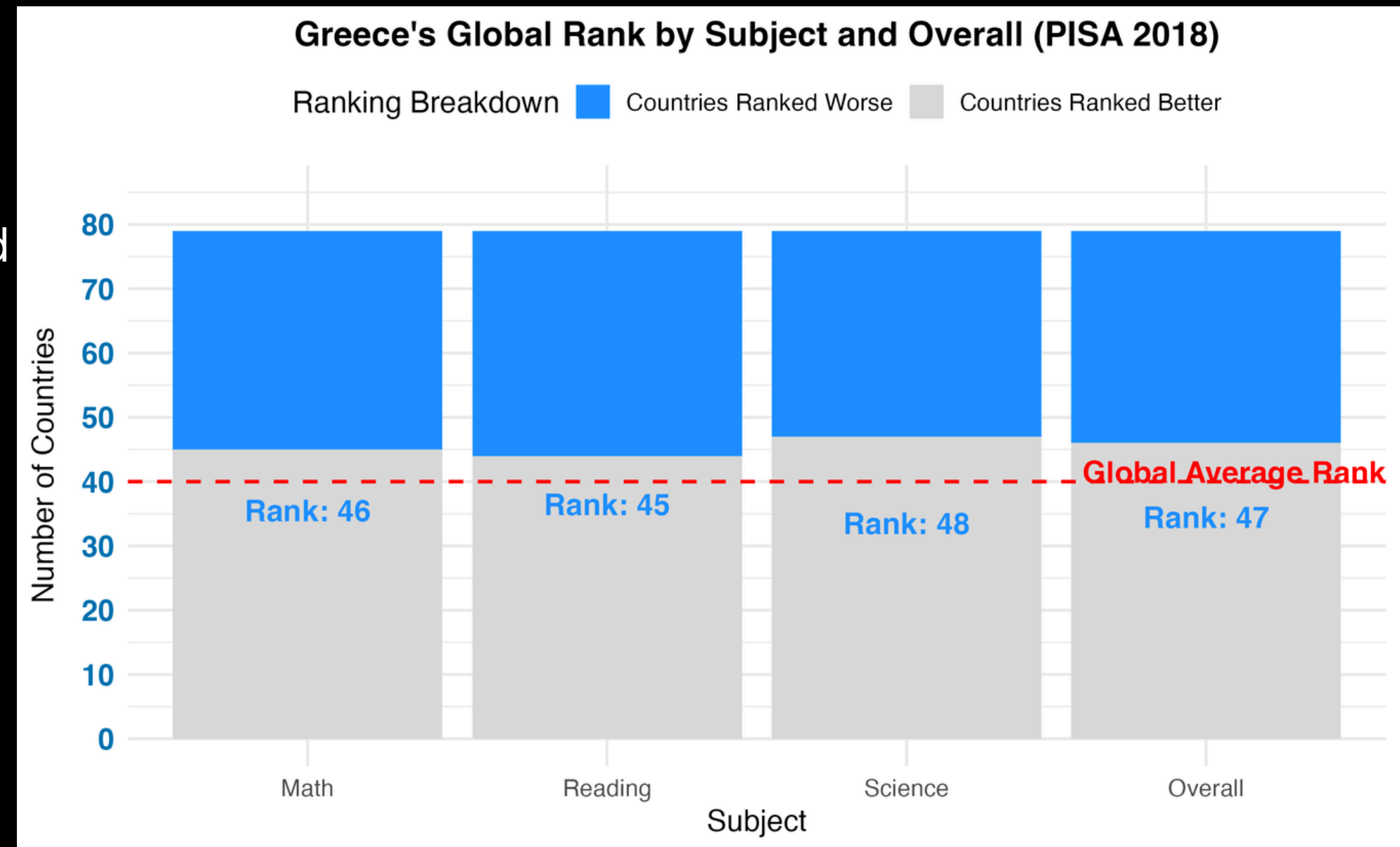
- Only 10 countries scored higher than Greece, including top performers like Singapore, Hong Kong, and Canada.

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



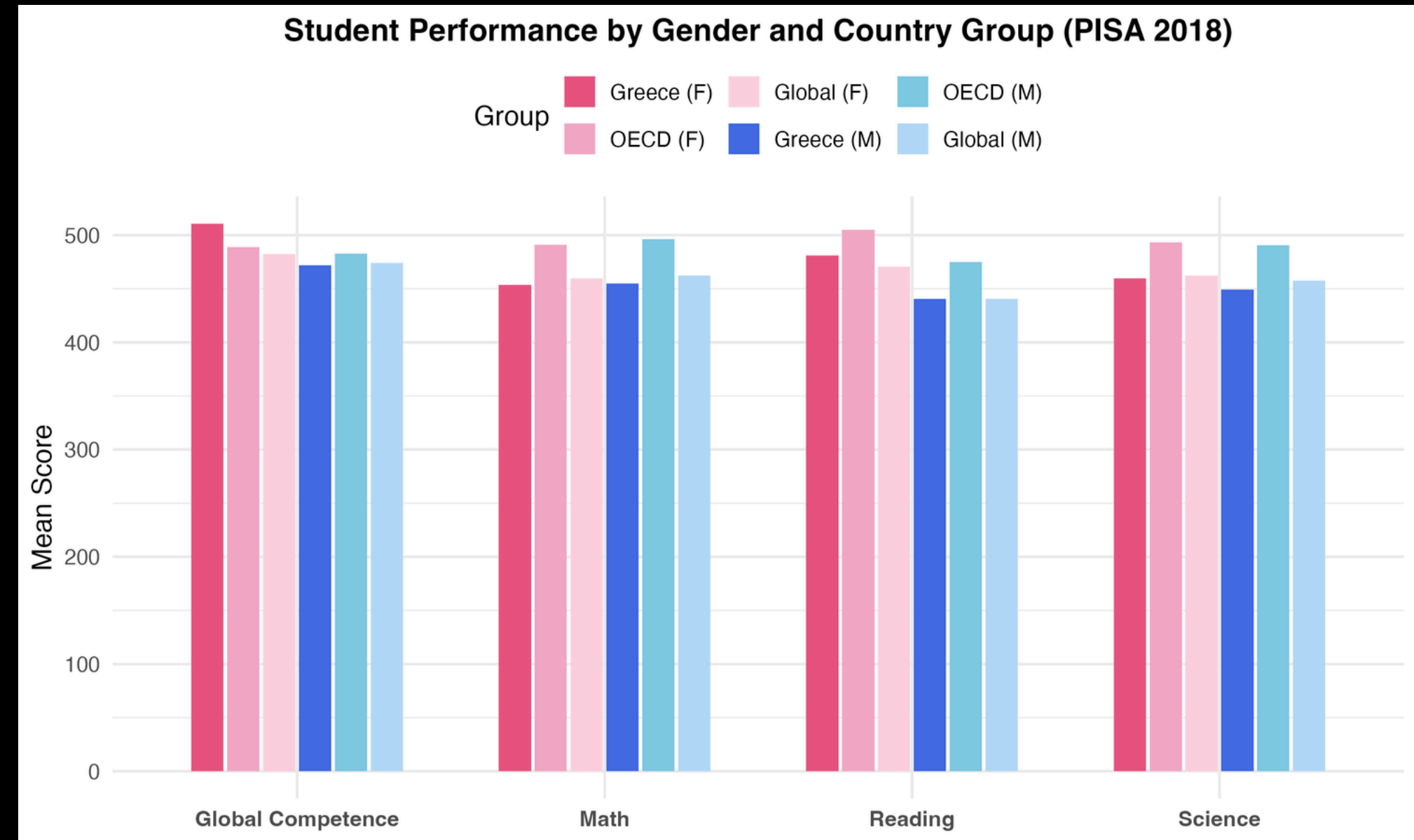
# Greece's Global Rank by Subject and Overall (PISA 2018)

- 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.



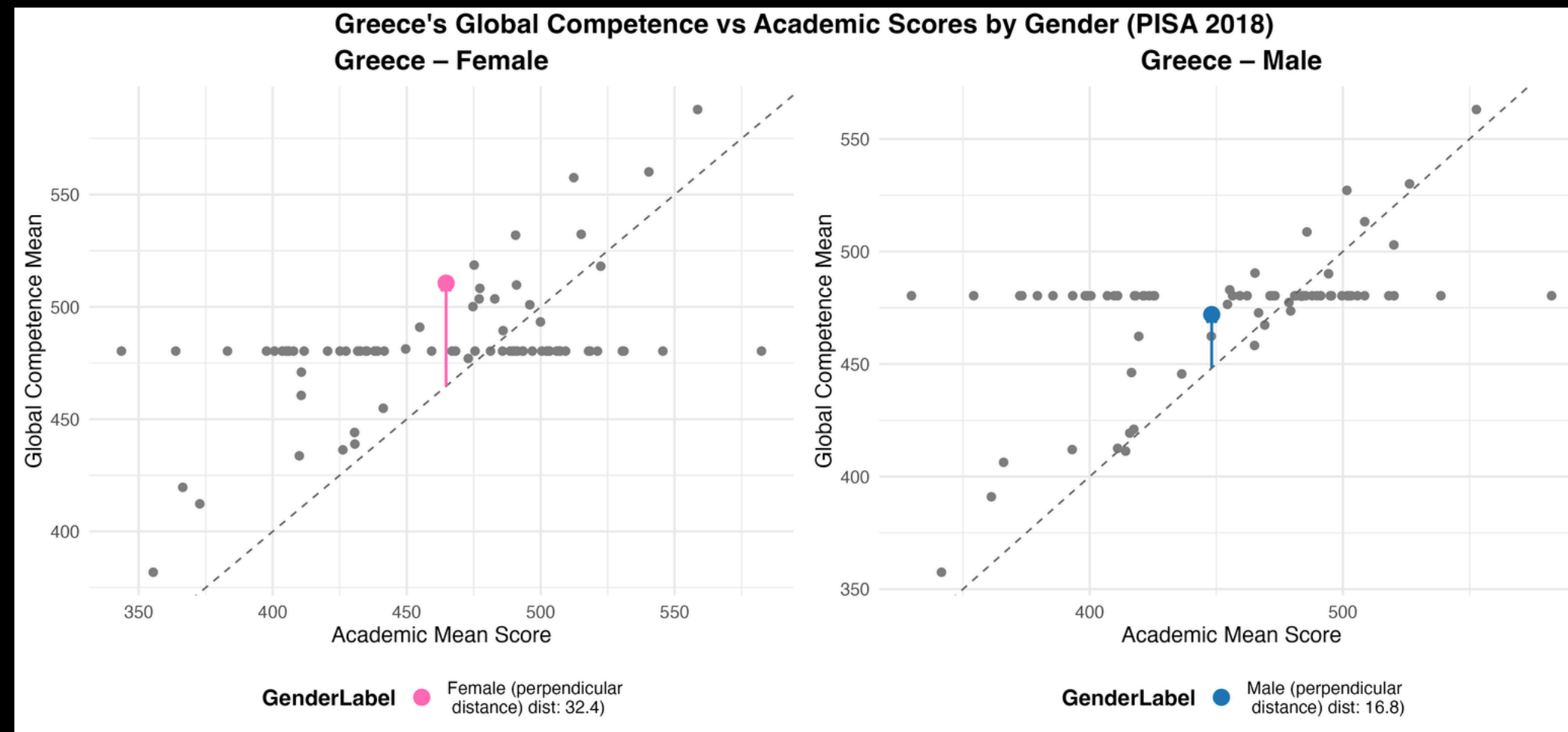
# Student Performance by Gender and Country Group (PISA 2018)

- 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.
- Girls in Greece outperform boys in all subjects, most notably in Reading and in global competence. So, Greece shows a strong gender gap in the aforementioned domains.





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

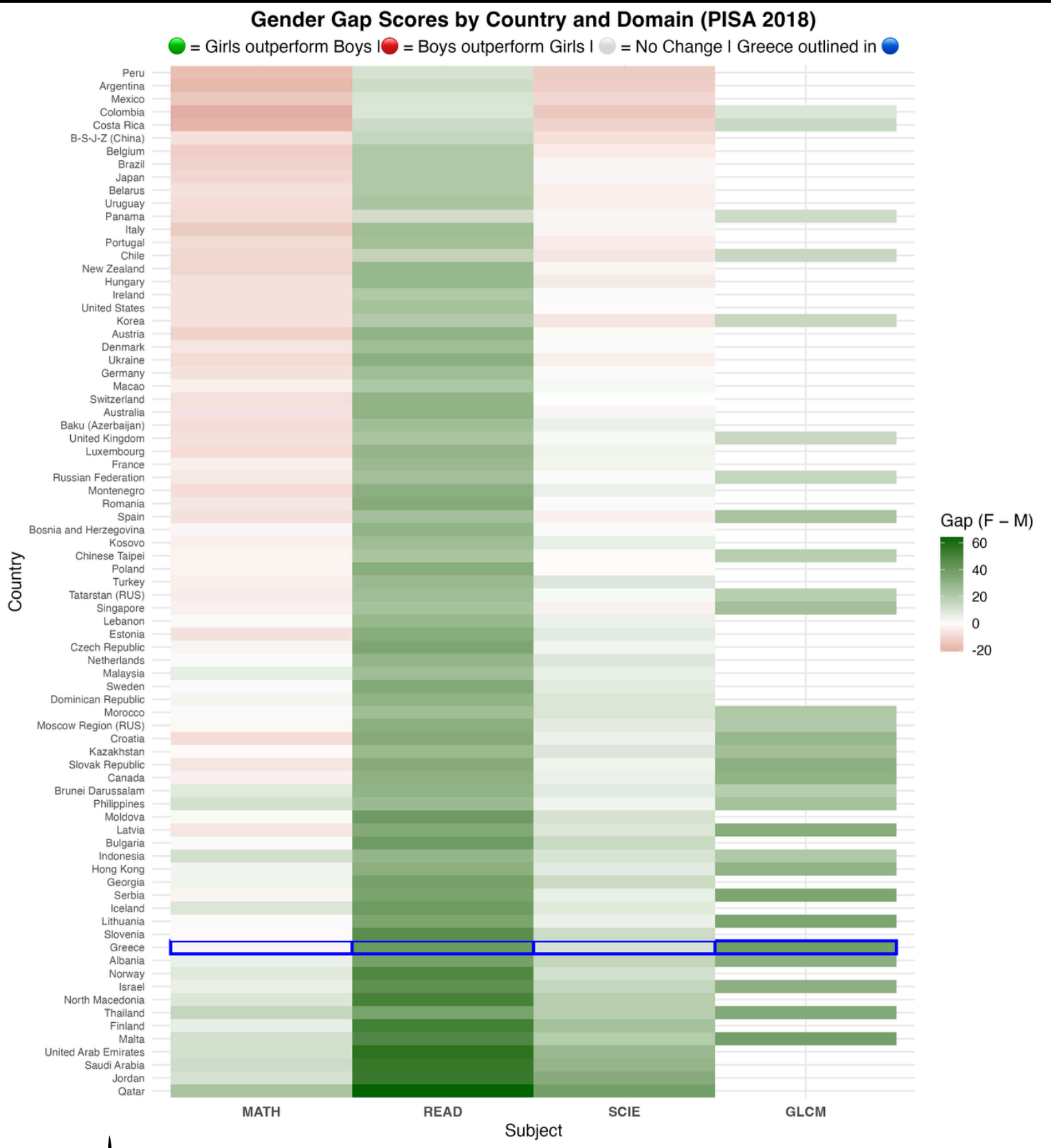


- The plots show Global Competence vs Academic Mean Scores for Greek females (left –pink dot) and males (right –blue dot), each compared to global peers. The dashed line represents a typical linear relationship – countries above it score higher in Global Competence than expected based on academic results.
- 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 Nonlinear, as shown by the dashed trend line, Greece—especially females—deviates positively from this pattern.

# 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*

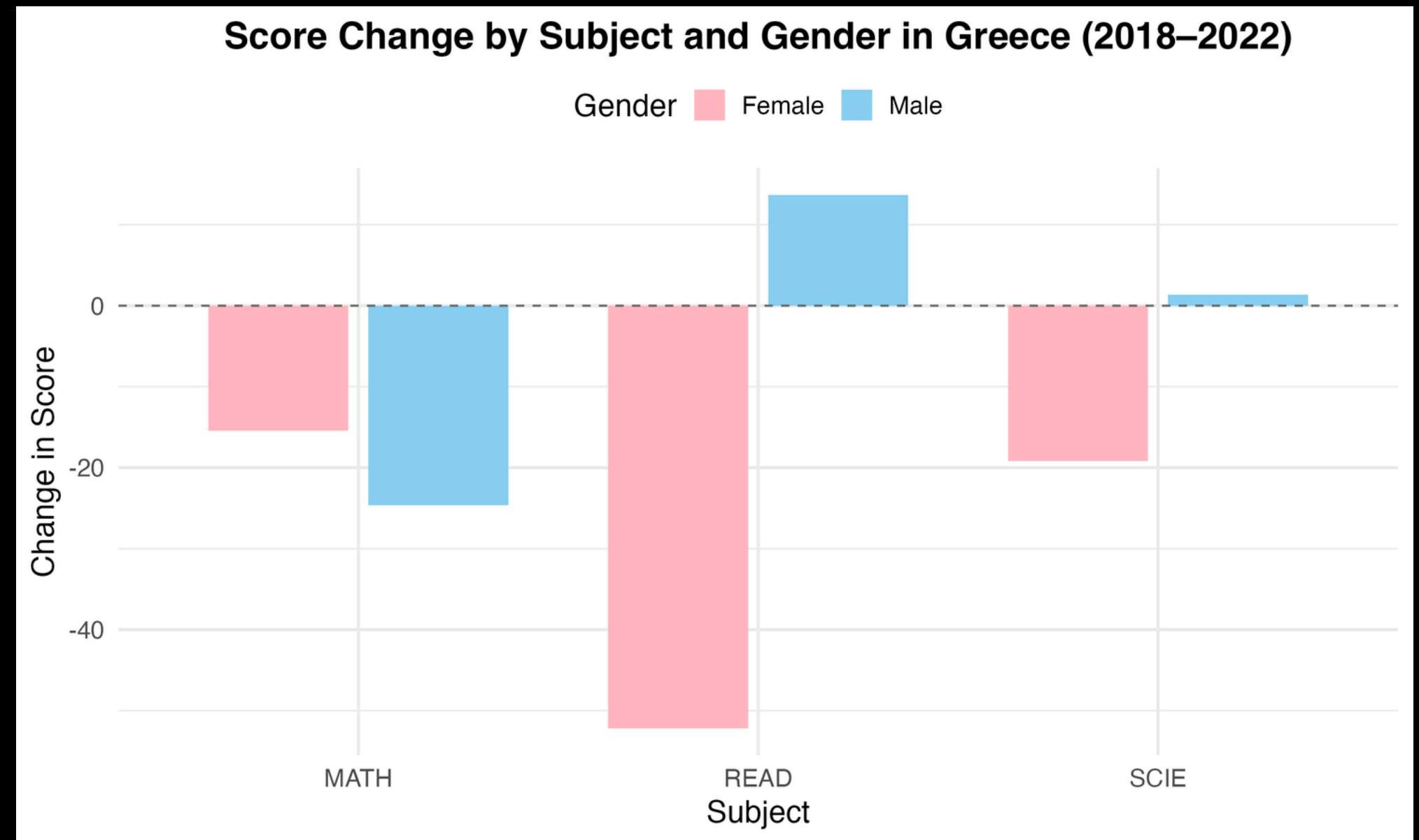


*Tech tip: Heatmaps work well for comparing many countries across domains.*



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

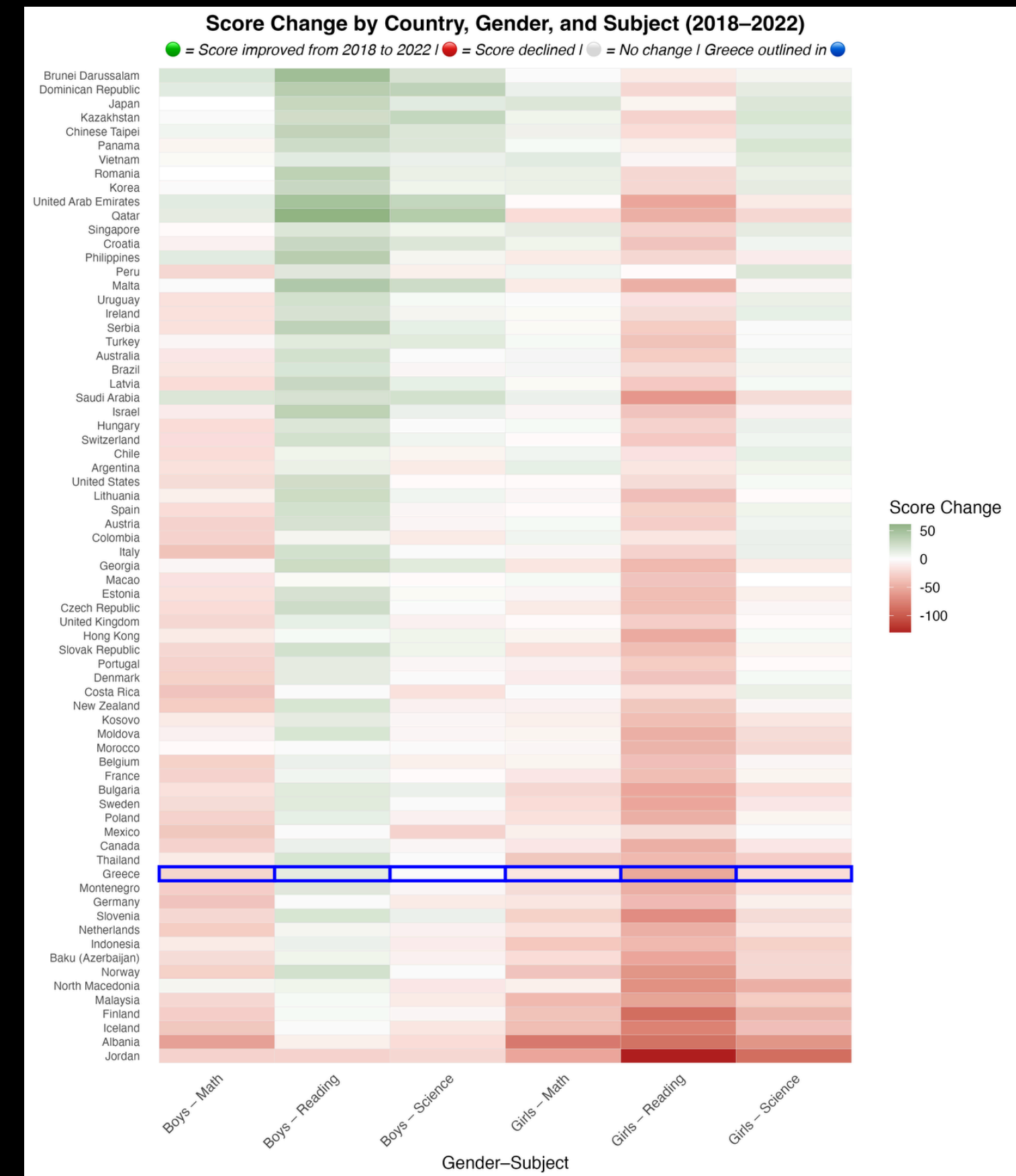
- The plot shows score changes (2018–2022) in Greece for males and females across Math, Reading, and Science.
- Reading scores dropped sharply for girls, while boys improved, reversing the gender gap trend in this subject.
- In Math, both genders declined, but boys' scores fell more than girls'.
- Science remained relatively stable, with minor changes for both boys and girls.
- So, Reading shows the strongest gender shift in Greece (2018–2022), 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 (2018–2022) by Country, Gender, and Subject

- The heatmap shows 2018–2022 score changes by country, gender, and subject, with Greece outlined (blue) for comparison across trends.
- Reading (Girls): Sharp declines in most countries, including Greece — showing a global drop.
- Reading (Boys): Scores stayed stable or rose — narrowing the gender gap, also seen in Greece.
- 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.
- 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 despite academic weaknesses.

## GENDER GAP

- Girls in Greece outperform boys in all subjects, especially in Reading and Global Competence.
- Greek females show exceptionally high Global Competence scores relative to academic scores.
- Gender gap is most pronounced in Reading and GLCM, moderate in Science, and minimal or reversed in Math.
- From 2018 to 2022, girls' Reading scores declined while boys' scores rose — narrowing the gap.
- These patterns are broadly reflected globally:
  - Reading & GLCM: girls lead in most countries
  - Science: moderate gap favoring girls
  - Math: small or no gap, sometimes boys slightly ahead

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

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

Data Acknowledgments: 

(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! 