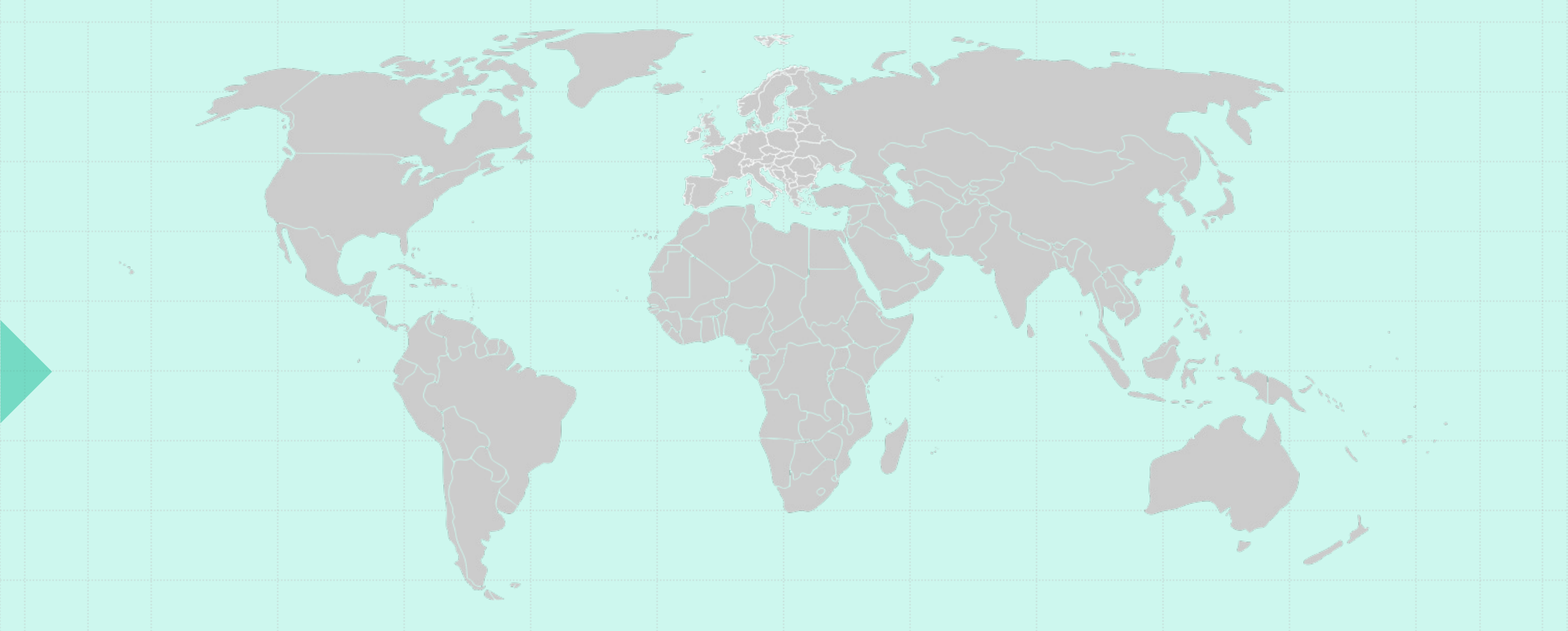


Is there a connection between poverty and literacy rate?

Alex Hagopian and Elisabeth Jacob



Part 1: The Variables

Analyzing the two individual variables (poverty rate and literacy rate)...

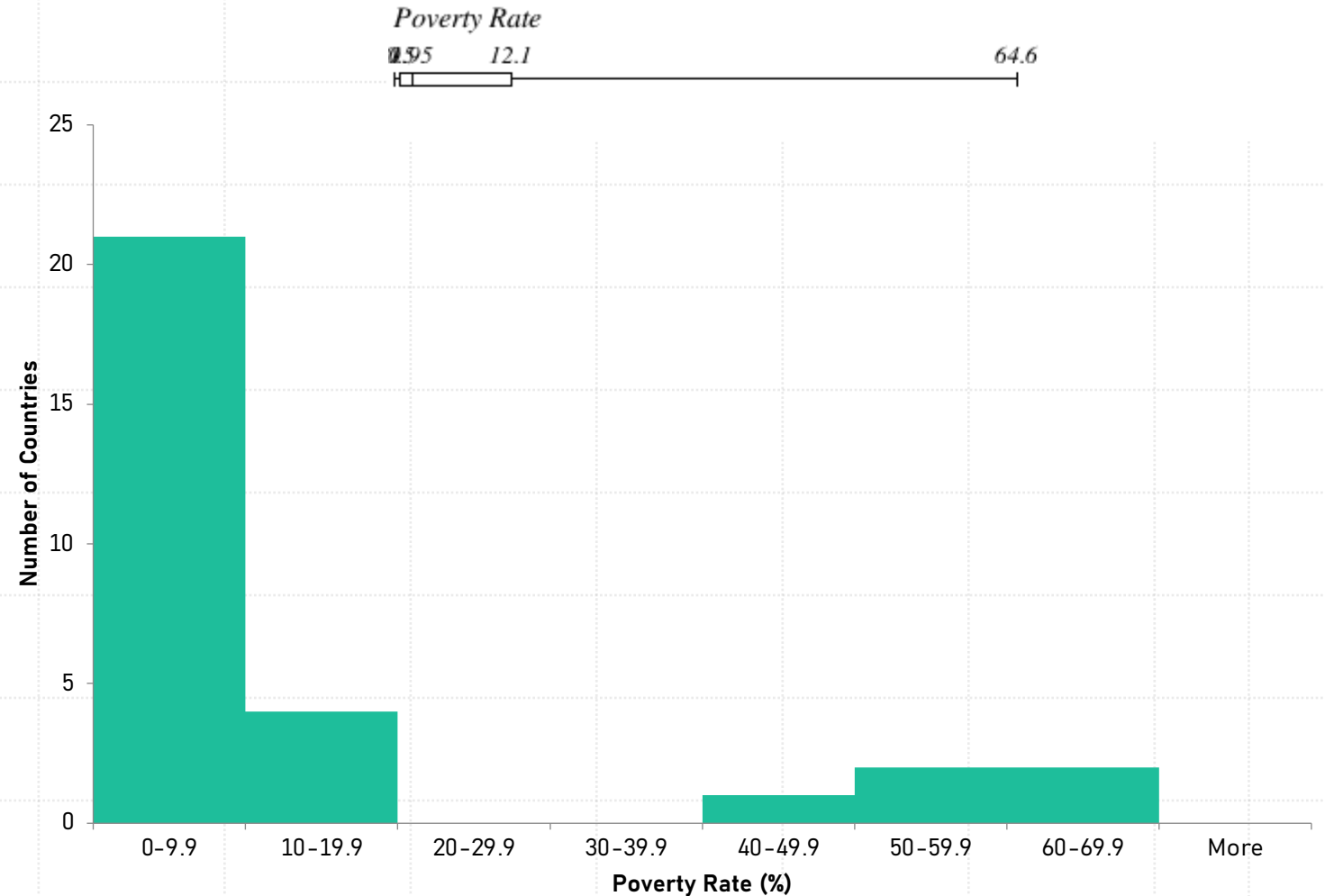
| Country | Poverty Rate (%) | Literacy Rate (%) |
|----------------------|------------------|-------------------|
| Albania | 1.5 | 97.2 |
| Angola | 52.9 | 66 |
| Brazil | 5.3 | 92 |
| Bulgaria | 1.4 | 98.4 |
| Burkina Faso | 63.1 | 34.6 |
| Benin | 53.2 | 32.9 |
| Chad | 64.6 | 22.3 |
| Chile | 1.7 | 96.9 |
| Costa Rica | 3.3 | 97.4 |
| Croatia | 0.7 | 99.1 |
| Dominican Republic | 4.3 | 93.8 |
| Hungary | 0.8 | 99.1 |
| Italy | 1.2 | 98.8 |
| India | 46.5 | 74.4 |
| Iran | 5.7 | 85.5 |
| Malaysia | 0.2 | 95 |
| Kazakhstan | 0.5 | 99.8 |
| Luxembourg | 0 | 100 |
| Moldova | 0.3 | 99.4 |
| Germany | 0.2 | 99 |
| Russia | 0.3 | 99.7 |
| Saudi Arabia | 12.7 | 97.6 |
| Serbia | 2.8 | 99.5 |
| Slovenia | 0 | 99.7 |
| Spain | 1.4 | 98.6 |
| Sri Lanka | 11.3 | 92.3 |
| Syria | 11.9 | 86.4 |
| Turkey | 2.2 | 96.7 |
| United Arab Emirates | 19.5 | 97.6 |
| United States | 0.5 | 86 |

Our Data

- 30 countries which ranged from highly developed, wealthy Western nations to poor countries with lower development.

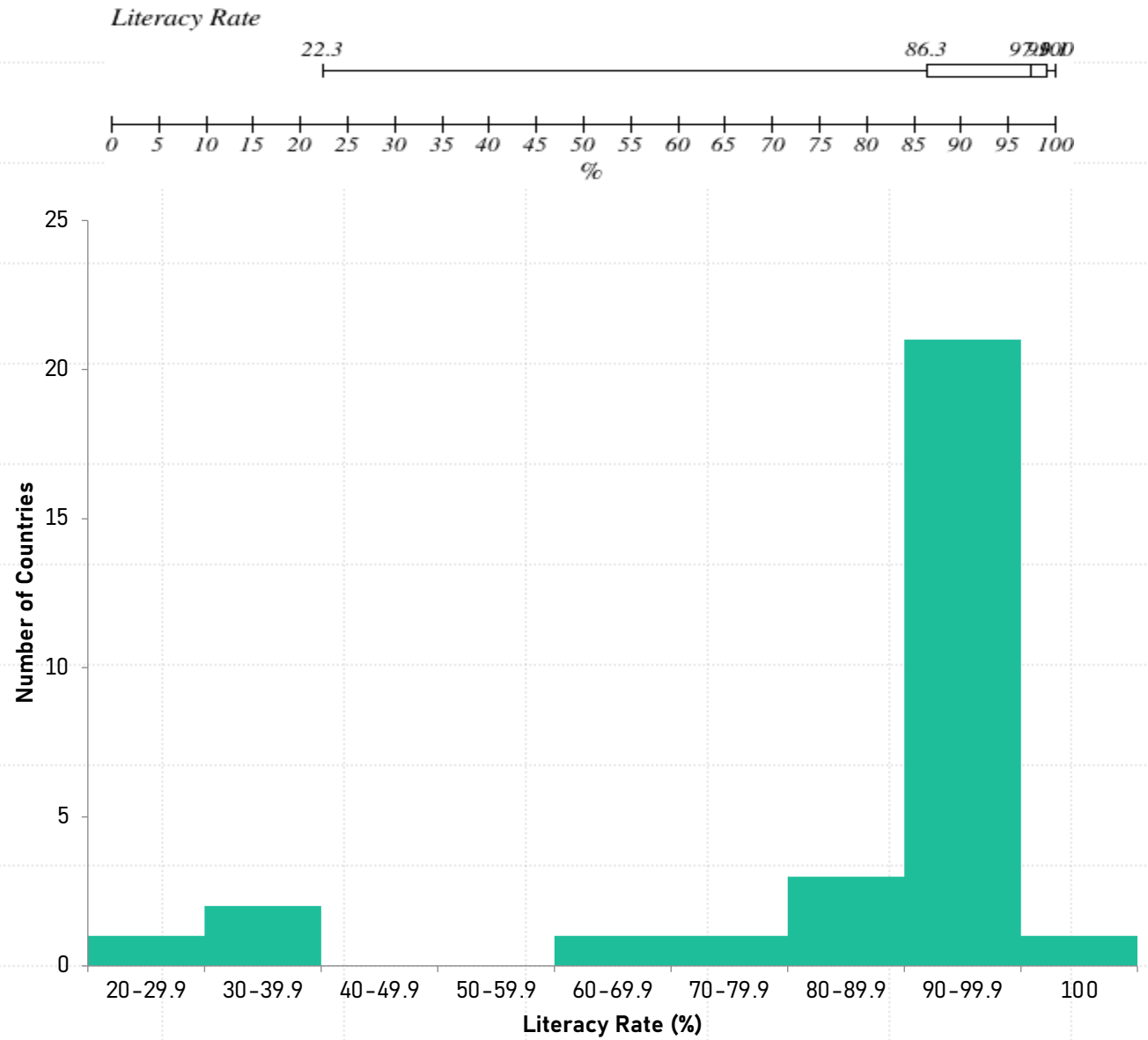
Poverty Rate

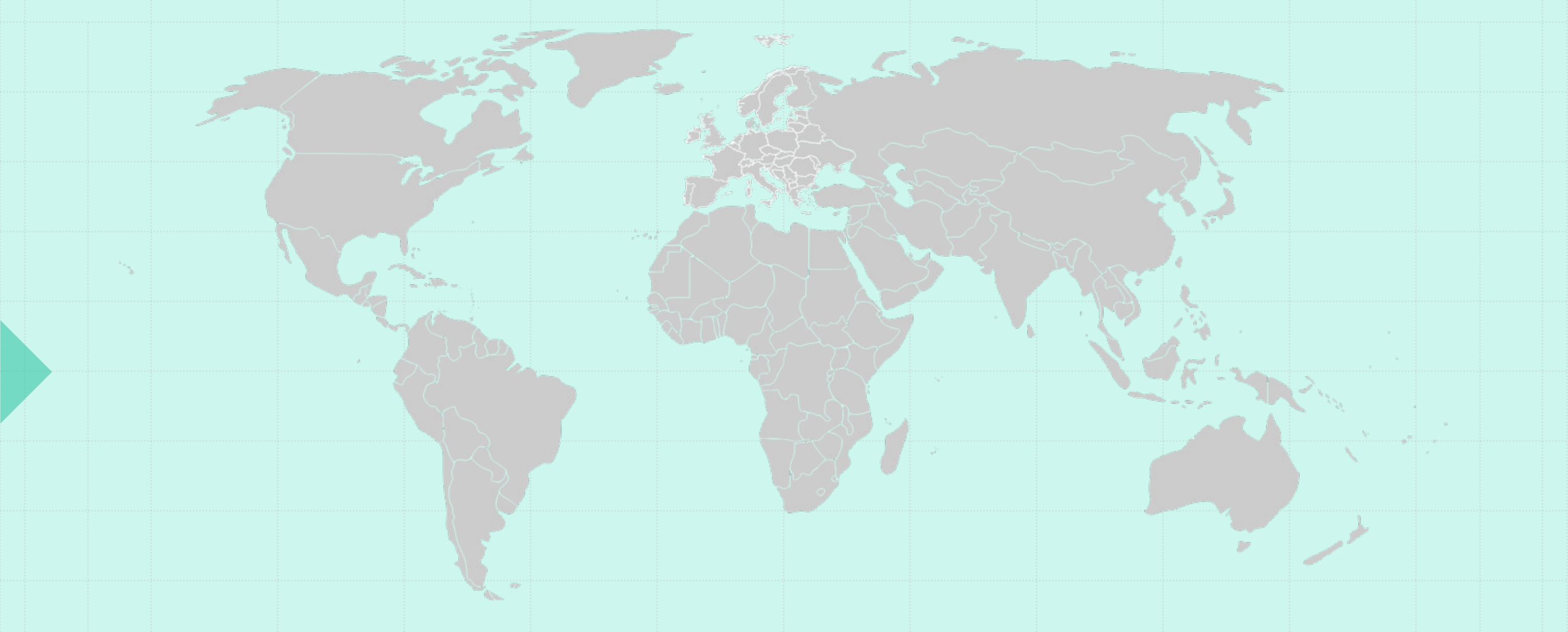
- Spread from 0–70%
- 21 countries have a poverty rate below 9.9%.
- Mean = 12.3%
- Standard deviation = 20.6%
- Unimodal, Right-skewed distribution
- Notable Individuals: India (46.5%), Angola (52.9), Benin (53.2%), Burkina Faso (63.1%), Chad (64.6)



Literacy Rate

- Spread from 20-100%
- 22 countries have a literacy rate below from 90-99.9%.
- Mean = 87.9%
- Standard deviation = 21.2%
- Unimodal, left-skewed distribution
- Outliers: Chad (22.2%), Benin (32.9%), and Burkina Faso (34.6%).
 - Underdeveloped, politically unstable





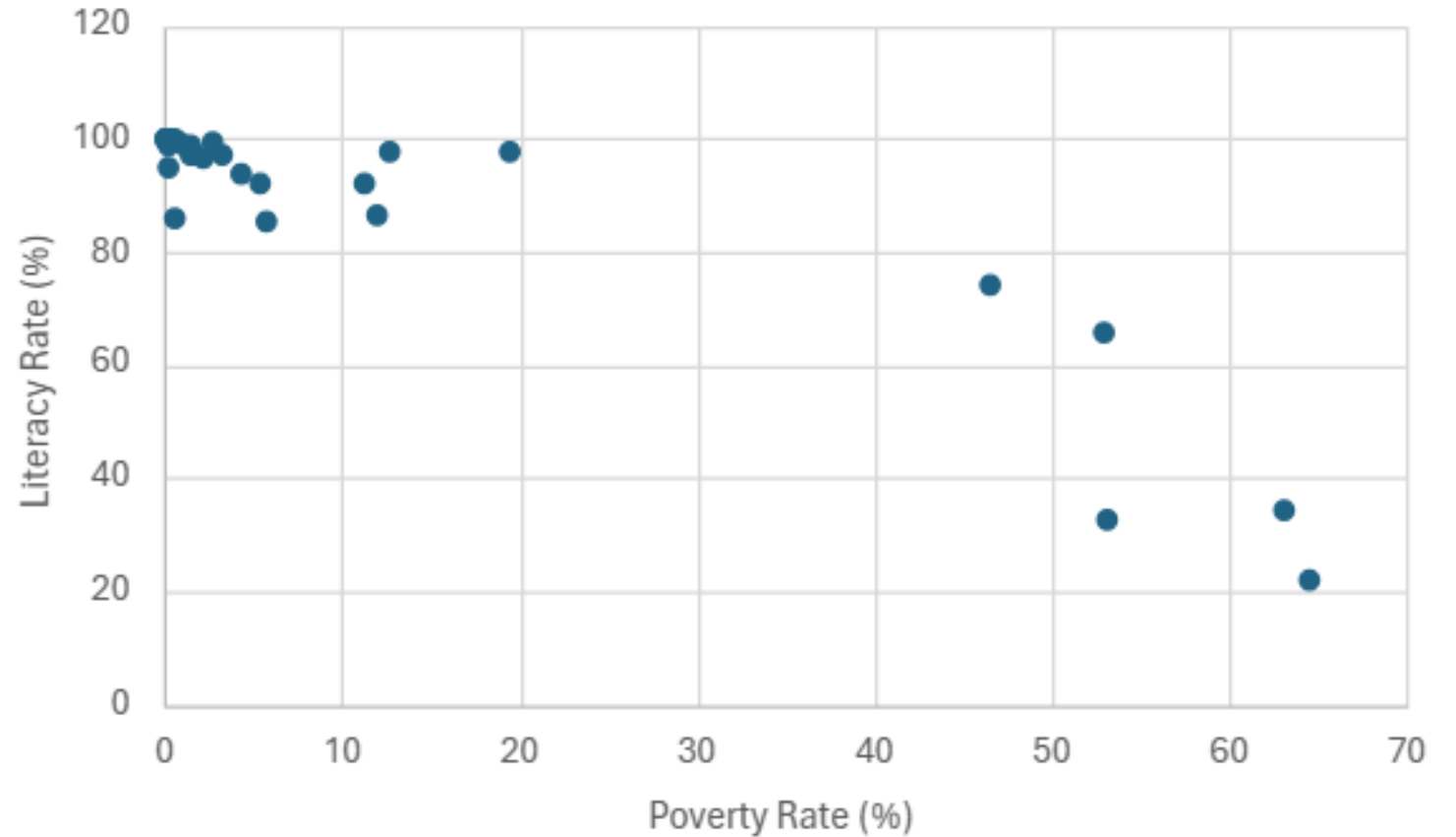
Part 2: Correlation

Analyzing the connection between poverty rate and literacy rate...

The Scatterplot

A scatterplot graph was created to represent the data and analyze the connection between the variables.

- In this scatterplot, each dot represents an individual country.
- The two variables being analyzed are **poverty rate** and **literacy rate**.
- Poverty rate is the explanatory variable and literacy rate is the response variable.

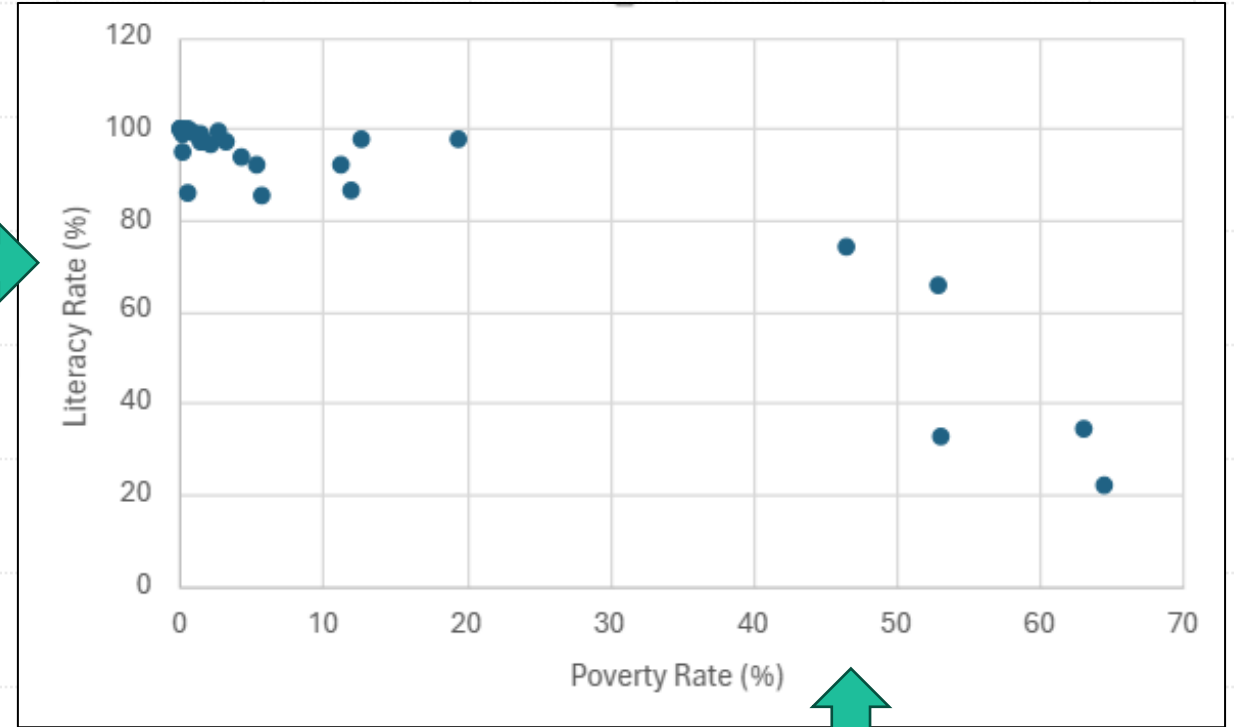


Explanatory Variable and Response Variable

Response variable:

- Located on y-axis.
- Can be explained by the explanatory variable.

In this scenario, **literacy rate percentage** is the response variable. The literacy rate of a country can be explained by its poverty rate.



Explanatory variable:

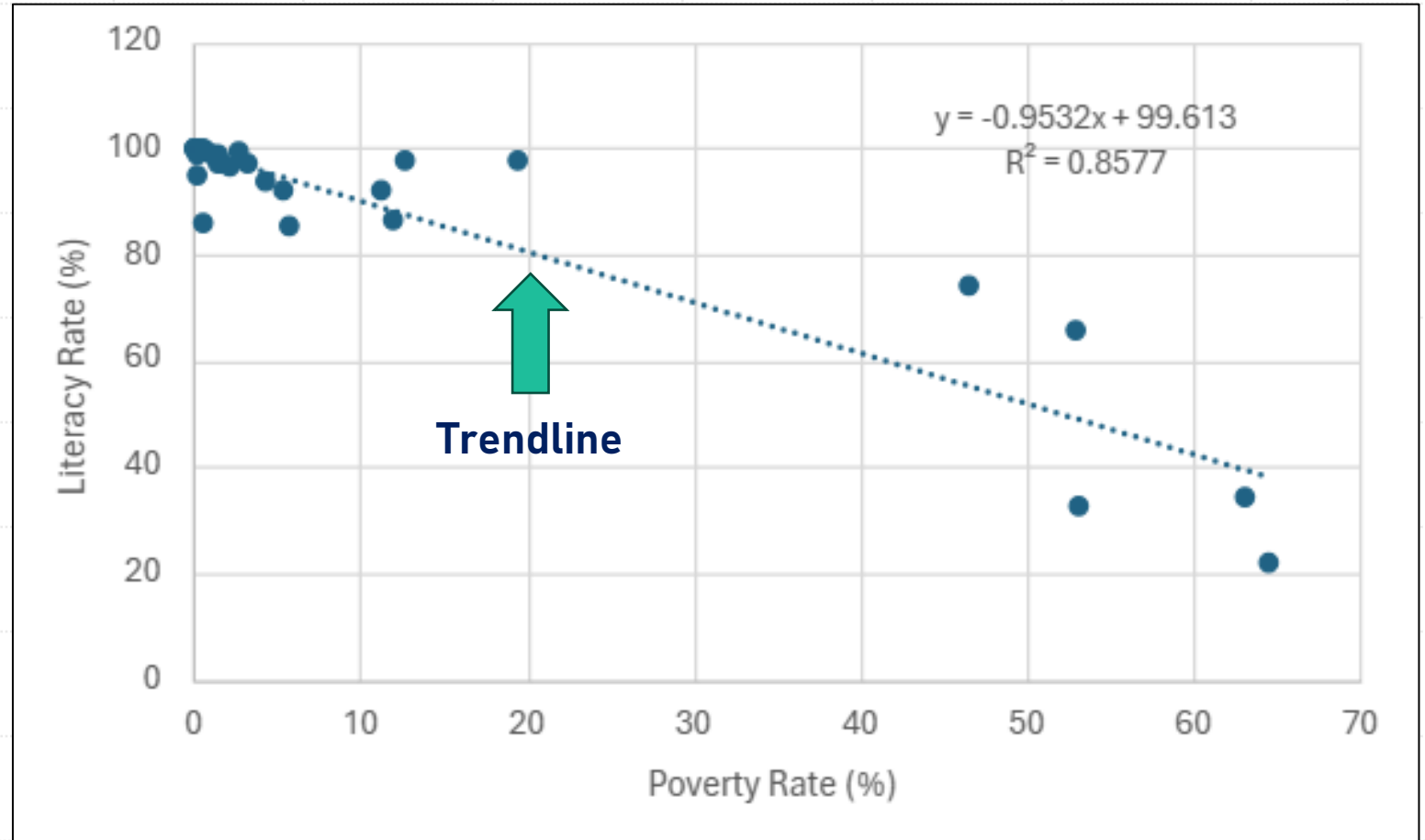
- Located on x-axis.
- Helps to explain the response variable.

In this scenario, **poverty rate percentage** is the explanatory variable. The poverty rate of a country helps to explain its literacy rate.

Trendline

Trendline:

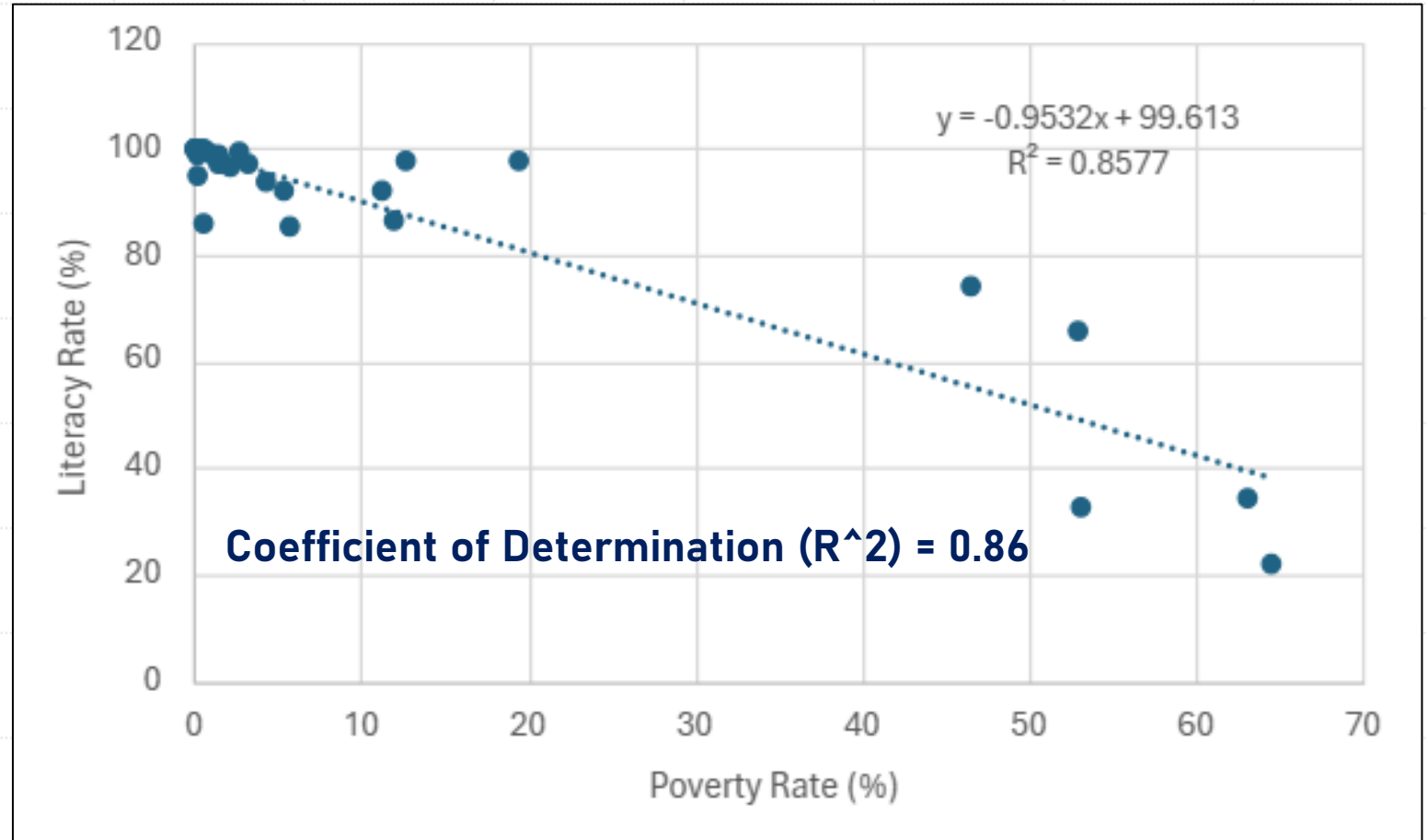
- A trendline is a linear representation of the general direction of the data.
- It is also known as the line of best fit.
- In this example, the trendline is **$y = -0.95x + 99.613$** .
- The negative sign in the trendline equation represents a negative relationship between poverty rate and literacy rate.
- A negative relationship means that as one variable increases (poverty rate), the other variable decreases (literacy rate) and vice versa.



Coefficient of Determination (R-Squared)

Coefficient of Determination:

- Measures the reliability of a trendline.
- Measures how reliable a statistical model is in predicting an outcome.
- Always between 0 and 1.
- In this example, the coefficient of determination is **0.86**.
- This means that 86% of variation in literacy rate (y-variable) can be explained by the linear regression on poverty rate (x-variable).



Correlation (R value) – Key Points

Key Points About Correlation:

- Correlation measures the relationship between two variables where $|r|$ is always between -1 and 1.
 - When r is close to 0, then correlation is weak.
 - When r is close 1 or -1, then correlation is strong.
 - When r is exactly 1, correlation is perfect. If r is exactly 0, then no correlation exists.
- Correlation can have a positive or negative sign:
 - A positive sign indicates positive correlation. Variables travel in the same direction.
 - A negative sign means negative correlation. Variables travel in the opposite direction.
- Correlation can be calculated by the taking the square root of the coefficient of determination (R-squared value).

$$r = \sqrt{r^2}$$

Correlation – Poverty Rate and Literacy Rate

Correlation Between Poverty Rate and Literacy Rate:

- The coefficient of determination is 0.86. To calculate correlation, take the square root of 0.86:

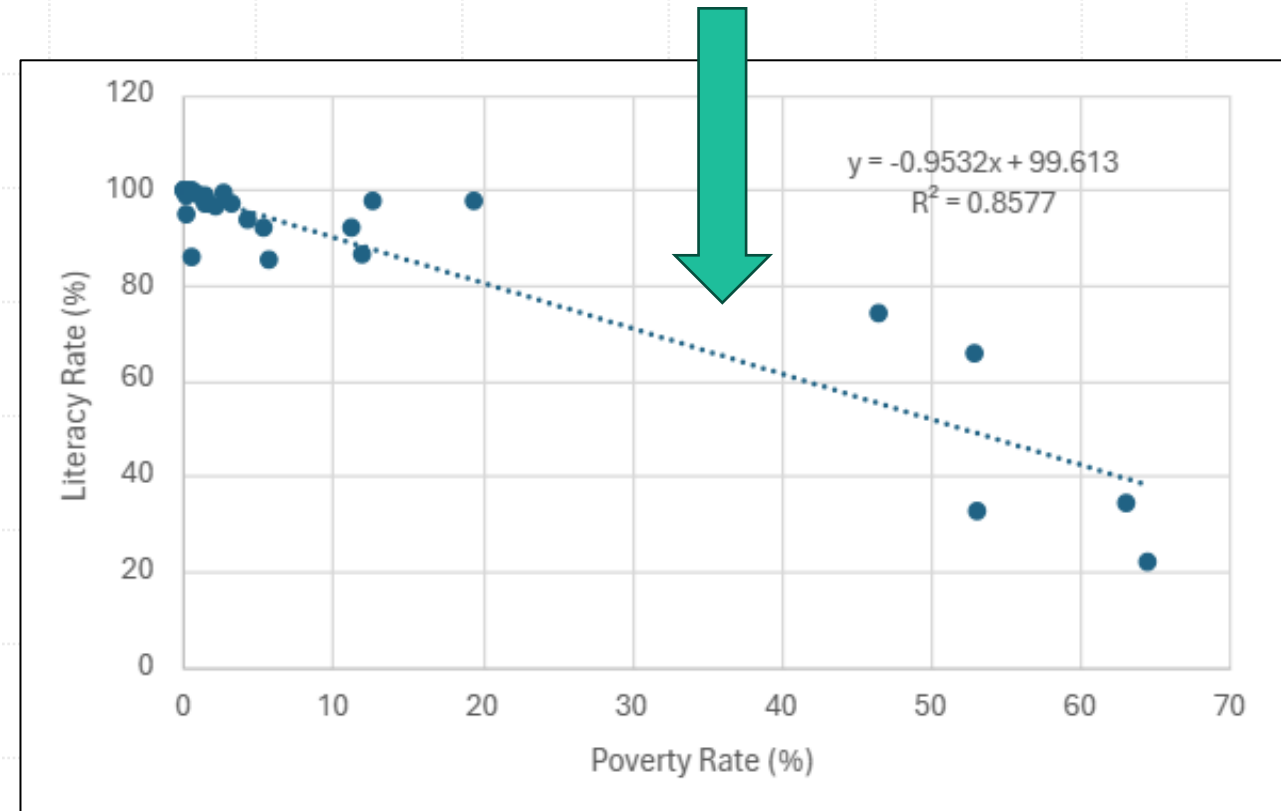
$$\sqrt{0.86} = 0.93$$

0.93 > 0.7, so correlation is strong

- The result is 0.93. Therefore, the correlation between poverty rate and literacy rate is 0.93. This correlation is **extremely strong**.
- Since the slope of the trendline is negative, this means the correlation is also **negative**. So, the correlation is **-0.93**.

In conclusion there is an **"extremely strong negative correlation"** between poverty rate and literacy rate.

Negative Trendline = Negative Correlation.



Predictions – Example of Interpolation



Predicting the literacy rate of the country of Canada based on its poverty rate...

- Poverty rate of Canada = 7.4% (Canada.ca, 2023).
- Predicted literacy rate = **92.583%**
 - *Literacy rate was predicted by plugging 7.4 into trendline equation... $0.95(7.4) + 99.613 = 92.583$*

Conclusion:

- *This prediction is **fairly reliable** because:*
 - Correlation is 0.93. In order to be fairly reliable, correlation must be greater than 0.7.
 - Poverty rate for Canada (7.4%), falls in the data range and is an example of **interpolation**.

7.4%

In 2021, there were about 405,000 more people living in poverty than in 2020. Canada's overall poverty rate rose by 1.0 percentage point to 7.4%, up from 6.4% in 2020. This is equal to a 15.6% increase in the poverty rate between 2020 and 2021.

Oct 30, 2023



Canada.ca

<https://www.canada.ca/reports/2023-annual>

the 2023 report of the National Advisory Council on Poverty

Predictions – Example of Extrapolation



Predicting the literacy rate of the country of Guinea based on its poverty rate...

- Poverty rate of Guinea = 66.2% (United Nations Development Programme, n.d.).
- Predicted literacy rate = **36.732%**
 - *Literacy rate was predicted by plugging 66.2 into trendline equation... $0.95(66.2) + 99.613 = 36.732$.*

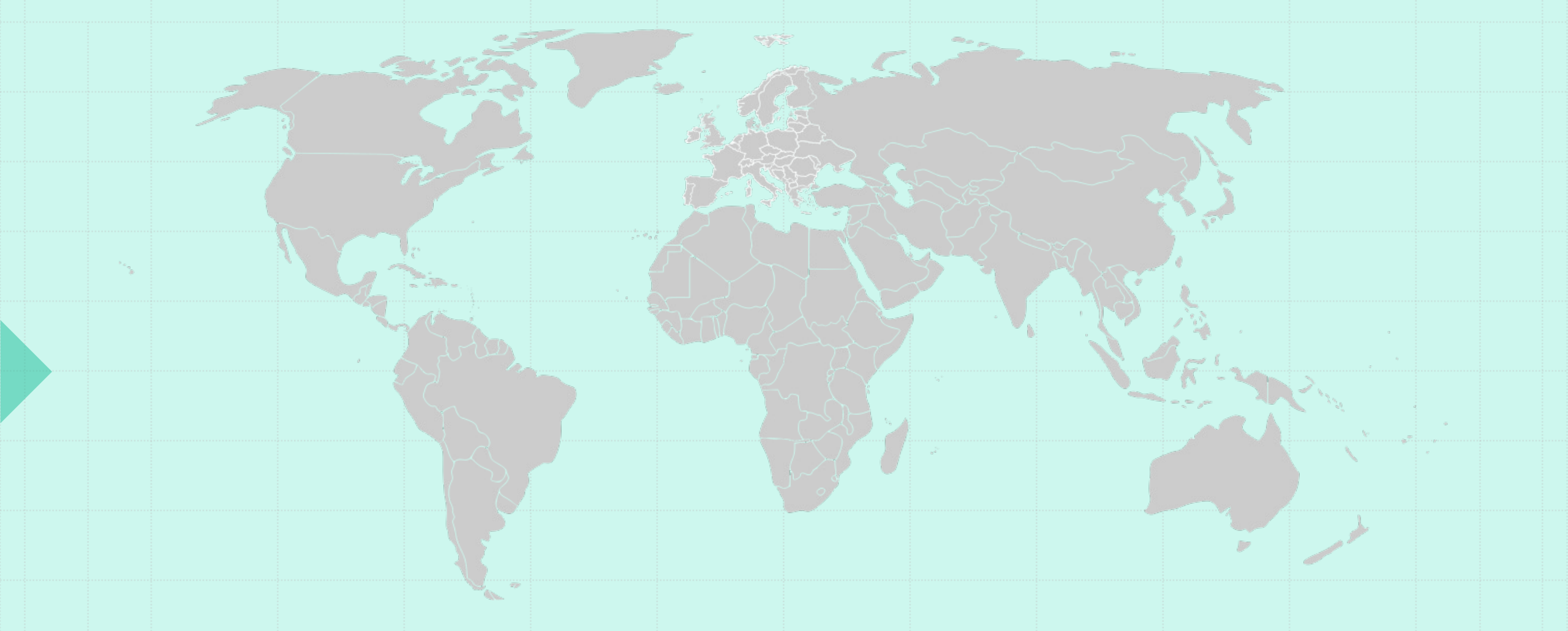
Conclusion:

- *This prediction is **NOT reliable** because:*
 - Poverty rate for Guinea (66.2%), falls above the data range and therefore is an example of **extrapolation**.
 - Extrapolation is never reliable.

Based on these estimates, 66.2 percent of the population in Guinea (8,960 thousand people in 2021) is multidimensionally poor while an additional 16.4 percent is classified as vulnerable to multidimensional poverty (2,220 thousand people in 2021).

 United Nations Development Programme
<https://hdr.undp.org/default/files/MPI/GIN> PDF

Guinea - Human Development Reports



CONCLUSION

Bringing it all together...

Conclusion

It can be concluded that there is strong correlation between poverty rate and literacy rate.

High Poverty Rate/Low Literacy Rate:

- Developing countries are less likely to have access to educational opportunities and resources (examples: books, writing materials, technology, and internet to name a few). Education is not always priority in all developing countries. These factors can help to explain a low literacy rate.
- In addition, poverty can also be associated with external factors including poor living conditions (inadequate nutrition, limited access to healthcare, clean water shortages, and sanitation issues). These poor living conditions can negatively contribute to individual health and overall learning. All these external factors can help explain low literacy rate.

Low Poverty Rate/High Literacy Rate:

- Countries with economic stability are industrialized and have the financial means to establish an organized educational system. Due to high standards of living, educational opportunities and resources are available. Developed countries are less likely to experience the poor living conditions and external factors evident in the developing world. Lastly, many developed countries have established laws and regulations that guide the educational system.

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