

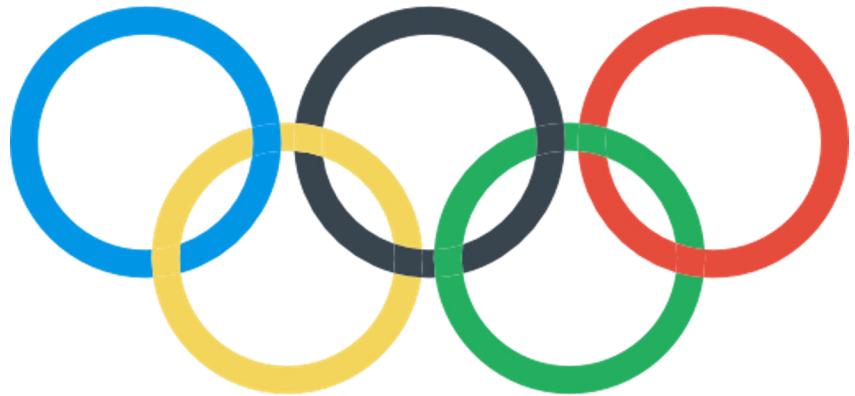


Does Money buy Medals?

CONTENTS

- 
- 01 Introduction**
Overview of Analysis
 - 02 Exploratory Data Analysis**
Summary and Plots
 - 03 Analysis 1**
Hypothesis Test, Regression
 - 04 Analysis 2**
Additional Analysis
 - 05 Conclusion**
Conclusion of Analysis

Introduction



Introduction

The number of Medals



Gross Domestic Product



Introduction

- ❑ Winter Olympics
- ❑ 175 rows · 12 columns
- ❑ the countries that won medals
- ❑ 1984 Sarajevo Olympics to the 2018 Pyeongchang Olympics

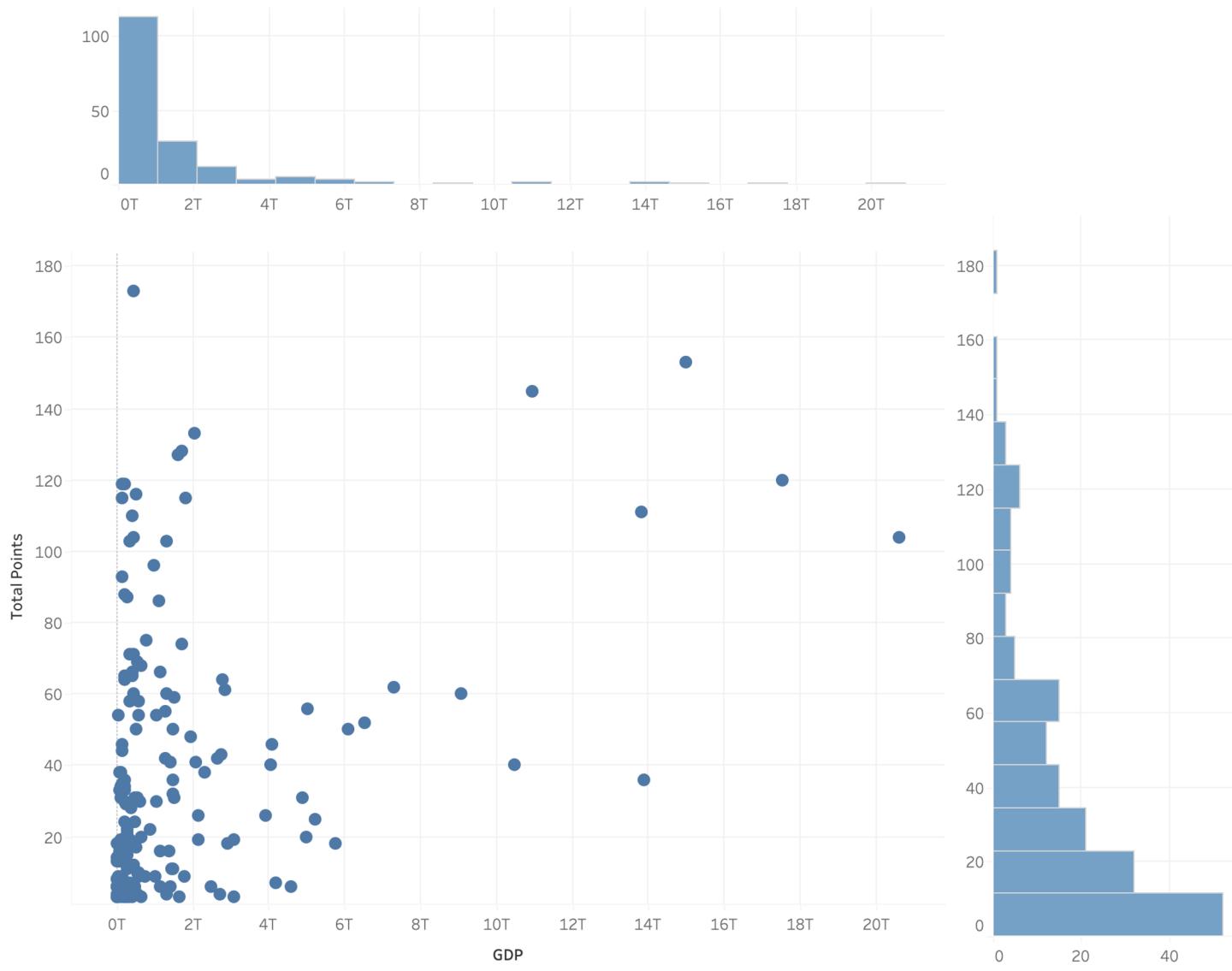
year
host_country
host_city
country_name
country_code
Gold
Silver
Bronze
GDP
gdp_per_capita
Athletes
Total Points



Total_Points =
 $\text{Gold} \times 6 + \text{Silver} \times 4 + \text{Bronze} \times 3$



Exploratory Data Analysis



Exploratory Data Analysis

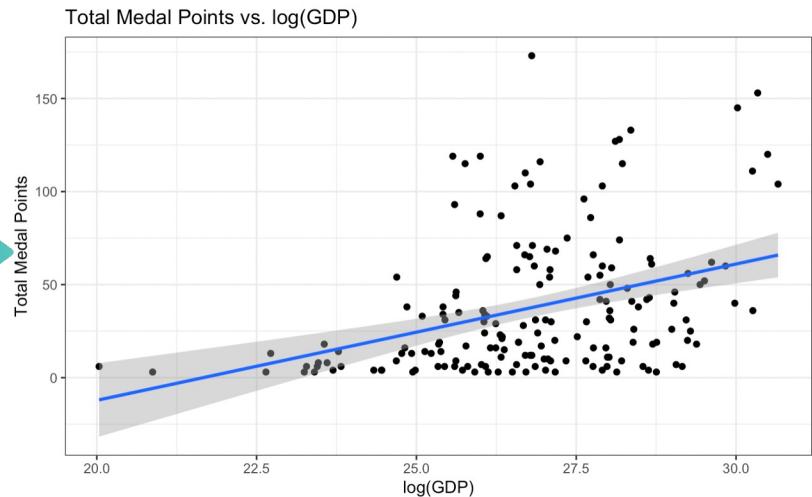
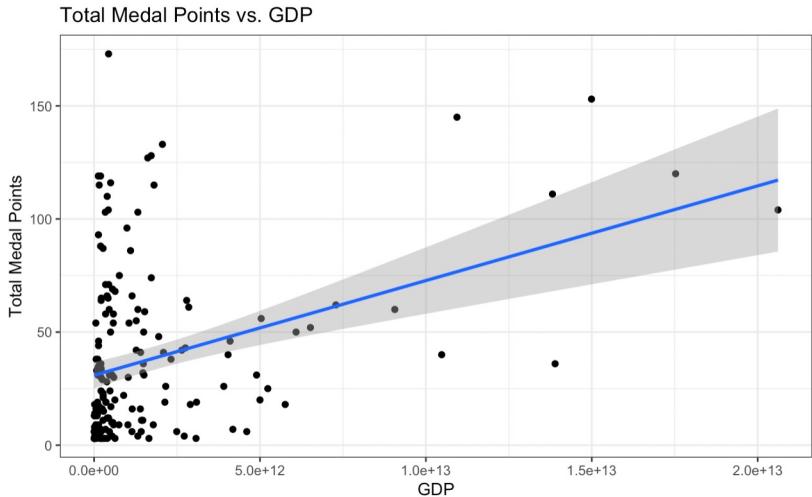
Rank	country_name	Total_Points
1	Norway	173
2	Canada	128
3	United States	104
4	South Korea	74
5	Sweden	69
6	France	64
7	Austria	60
8	Japan	56
9	Italy	41
10	China	36

Rank	country_name	GDP (in USD)
1	United State	20.611 Trillion
2	China	13.894 Trillion
3	Japan	5.036 Trillion
4	Great Britain	2.900 Trillion
5	France	2.789 Trillion
6	Italy	2.090 Trillion
7	South Korea	1.724 Trillion
8	Canada	1.721 Trillion
9	Australia	1.428 Trillion
10	Spain	1.420 Trillion

2018 PyeongChang Olympics

Exploratory Data Analysis

- ❑ Sample size: 175 countries
- ❑ Took the log of GDP



- ❑ Summary statistics

Variables	mean(sd)
Total Medal Points	37.71 (36.76)
GDP	1.63e+12 (3.14e+12)
log(GDP)	26.81 (1.82)



Population Model and Hypotheses

$$Total\ Medal\ Points_i = \beta_0 + \beta_1 \log(GDP)_i + \epsilon_i$$

Response variable(Y): **Total Medal Points**

Explanatory variable(X): **log(GDP)**

β_0 : the average total medal points for countries with $\log(GDP) = 0$

β_1 : the average difference in total medal points for countries whose $\log(GDP)$ differs by one unit

Distribution Assumption: the residuals are i.i.d. $\text{Normal}(0, \sigma^2)$.



Hypotheses

H0: $\beta_1 = 0$

There is no relationship between log(GDP) and total medal points.

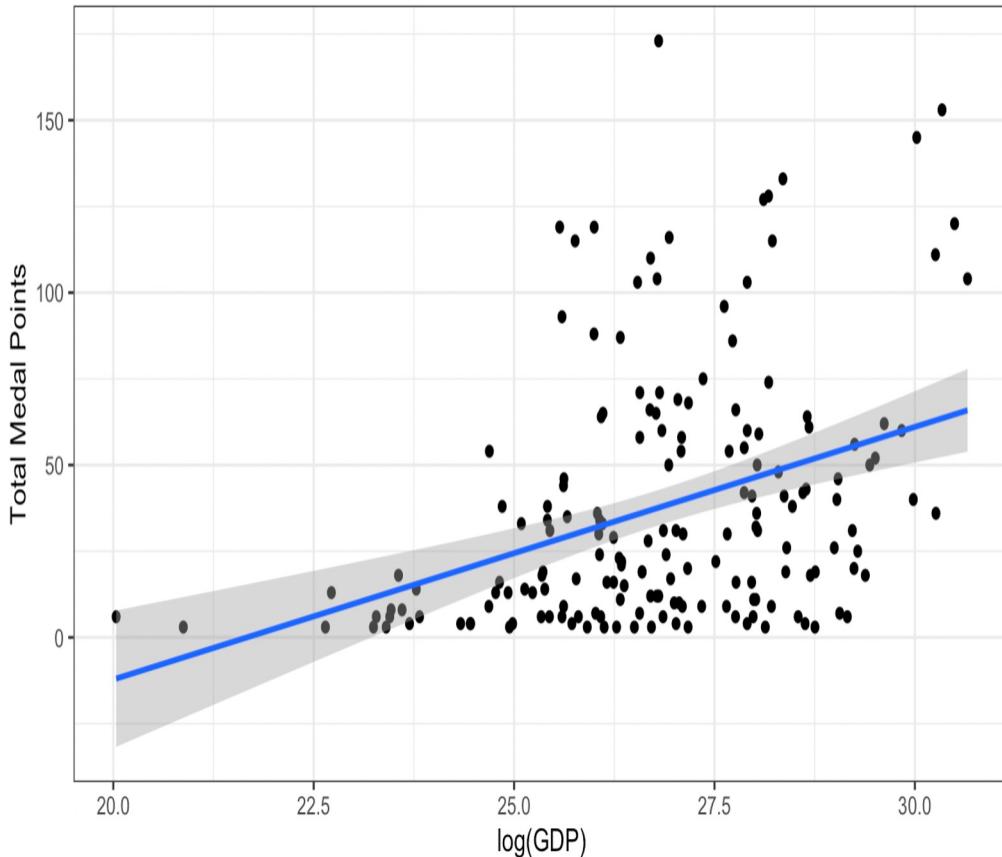
HA: $\beta_1 > 0$

There is a positive relationship between log(GDP) and total medal points.

Check Conditions

1. Linearity

Total Medal Points vs. $\log(\text{GDP})$

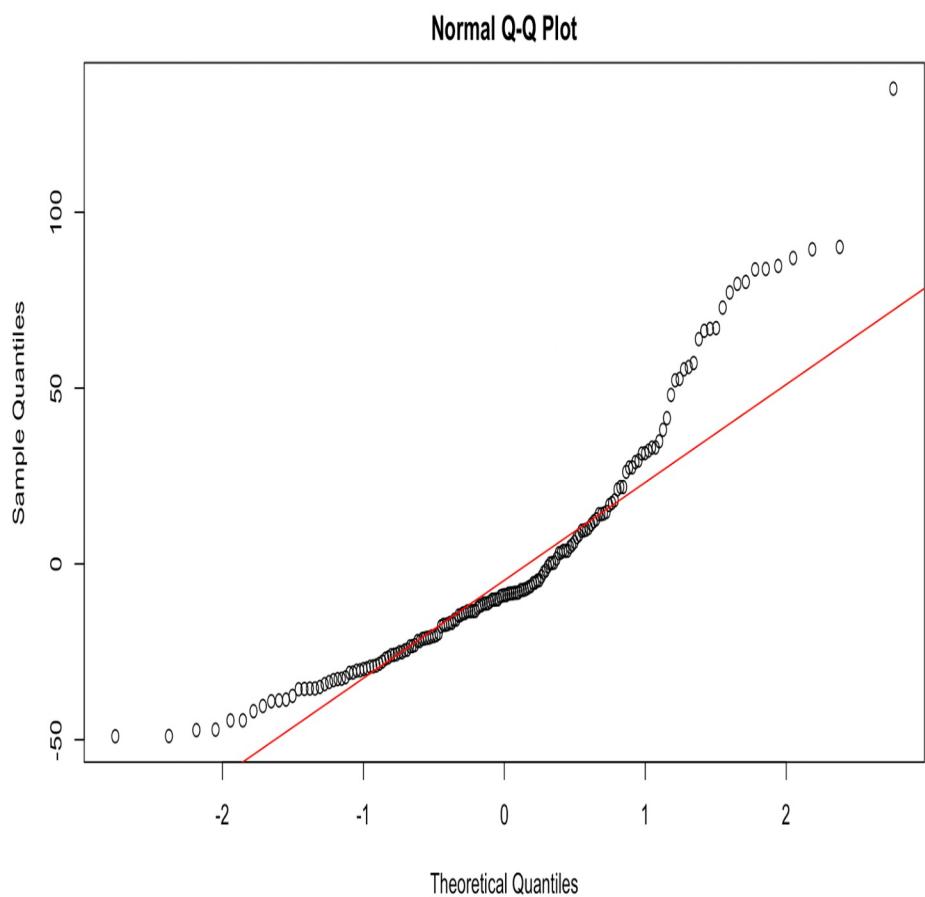


2. Independence

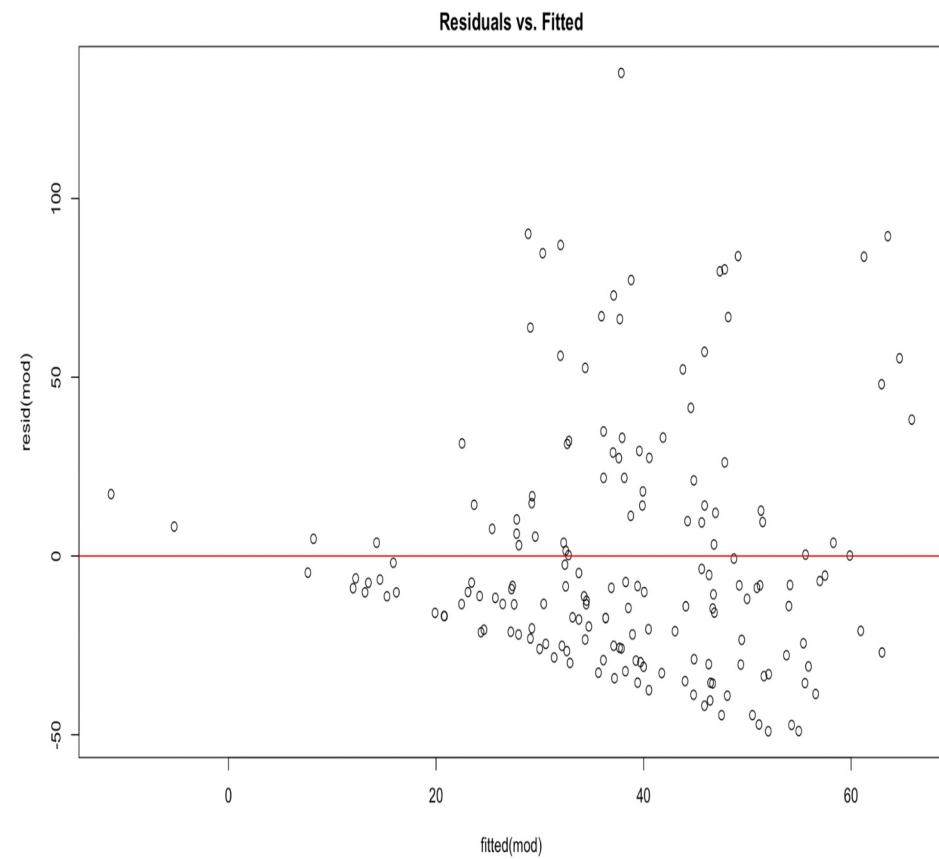
Each country is **independent** of one another.

We assume that all the country's GDP and number of medals are **independent**.

3. Normality



4. Equal Variance



Estimated Model and Results

$$\widehat{TotalMedalPoints}_i = \hat{\beta}_0 + \hat{\beta}_1 \log(GDP)_i$$

$\hat{\beta}_0$: the estimated average total medal points for countries with $\log(GDP)$ of 0

$\hat{\beta}_1$: the estimated average difference in total medal points for countries whose

$\log(GDP)$ differs by one unit

$\hat{\beta}_0$	-158.733
$\hat{\beta}_1$	7.326
p-value ($\hat{\beta}_1$)	3.83e-07
Confidence Interval ($\hat{\beta}_1$)	(4.51, 10.14)





Time for a Decision!!



Do we **Reject** or **Fail to Reject**?



Conclusion



There is a positive relationship between $\log(\text{GDP})$ and the average total medal points. The country's economic level contributes to the sports industry, leading to more Olympic medals.

Secondary Analysis

$$\widehat{TotalMedalPoints}_i = \hat{\beta}_0 + \hat{\beta}_1 \text{ Number of Athletes}_i$$

$\hat{\beta}_0$: the estimated average total medal points for countries who send 0 athlete

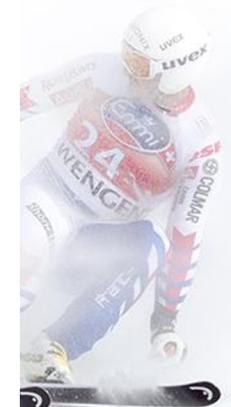
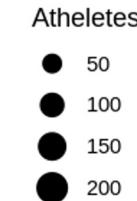
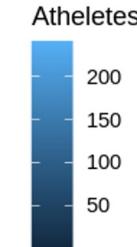
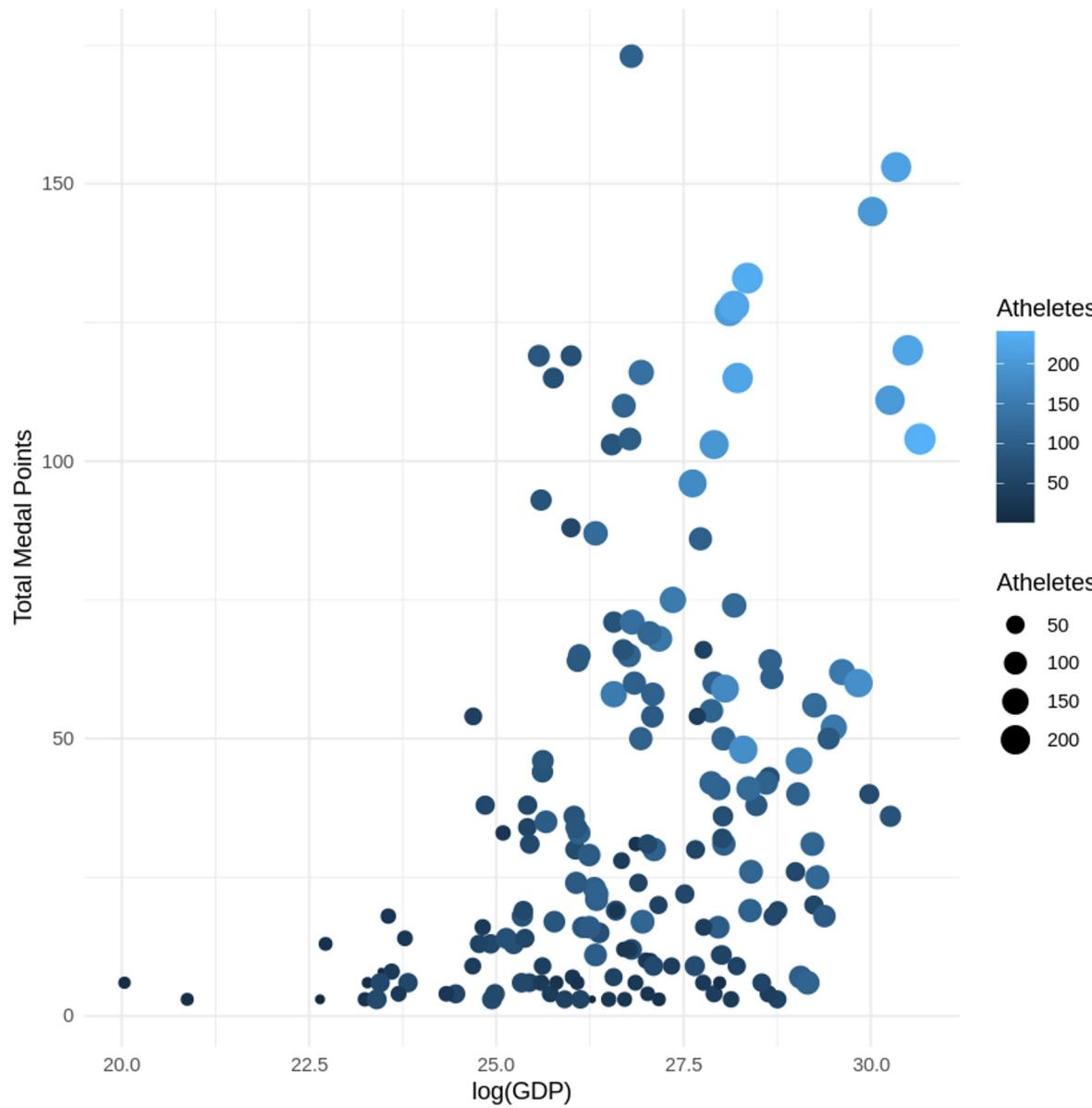
$\hat{\beta}_1$: the estimated average difference in total medal points for countries whose

number of athletes differs by one unit

$\hat{\beta}_0$	-5.06204
$\hat{\beta}_1$	0.52762
p-value ($\hat{\beta}_1$)	< 2e-16
Confidence Interval ($\hat{\beta}_1$)	(0.45, 0.60)



GDP & Total medal points & Athletes



Other Factors

Economic

GDP per capita
GNI, GNI/person
Export

Geographic

Area
Latitude



Other

Hosting Effect
Life Expectancy
Population



Limitations

- Total Medal Points
- Top 3 ranks
- YoY changes in GDP



Ideas of Future Work

- Multi Regression
- Prediction
- Host Effect

Questions



A dynamic photograph of a skier in mid-turn on a snowy mountain slope. The skier is leaning into the turn, with their skis angled down the hill. A significant spray of white snow is kicked up behind them, partially obscuring the lower part of the image. The skier's legs and skis are visible in the upper right, wearing blue and red ski gear. The background shows the textured surface of the snow-covered slope.

Thank You

References

Kaggle

[Winter Olympics Prediction - Fantasy Draft Pick](#)

[Winter Olympic Medals 1924 - 2018](#)

The World Bank

[GDP Data](#)

Articles

[Does economy determine a country's performance at Olympics?](#)