Maths Project

-Netra Neelakantan
11 B (ISC Humanities)
Roll no.17

Introduction:

Topic

Identify the variability and consistency of two sets of statistical data using the concept of coefficient of variation as my Maths Project.

In this project, I have decided to compute the variability and consistency of the two finalists teams from Euro 2020 football cup, Italy and England, whose Final match was played on 12th July 2021.

I have taken all the goals scored by these two teams from the qualifying rounds, up to the Final match and have displayed the variability and consistency of these two data sets(teams) using the concept of coefficient of variation.

Aim:

To identify from the given data sets, which team was more consistent (less variable). using the concept of coefficient of variation.

The two sets of data taken here are the number of goals scored by Italy and by England throughout the entire Euro 2020 Tournament.

Mathematical Process:

Definitions & Terminology

Arithmetic Mean:

The arithmetic mean is the simple average, or sum of a series of numbers divided by the count of that series of numbers. It is also commonly known as Average

Dispersion: The degree to which numerical data tends to spread about an average value is called the dispersion of the data. Various measures of dispersion are available, the common ones being range, mean deviation, and standard deviation.

Standard Deviation: It is defined as the positive square root of the arithmetic mean of the squares of the deviations of the given observations from their arithmetic mean. It is denoted by the Greek Letter σ.
Standard Deviation is an important measure of dispersion and is widely used in many statistical formulae.

Coefficient of Variation: The coefficient of variation is the ratio of the standard deviation to the mean. The coefficient of variation is the best measure to compare the variability of two given series of data.
The series for which the coefficient of variation is greater is said to be more variable or less consistent). On the other hand, the series for which the variation is less is said to be less variable or more consistent.

Formula Used

- Mean =

  Mean of a discrete, that is, an ungrouped frequency distribution: If X_1, X_2 ,....X_n are the values of a variable with frequencies f_1, f_2…. F_n, then

$$\overline{X} = \frac{\Sigma fi\, Xi}{\Sigma fi}$$

- Standard Deviation

$$\sigma = \sqrt{\frac{\Sigma\ fiXi^2}{\Sigma\ f} - \left(\frac{\Sigma\ fiX}{\Sigma\ f}\right)^2}$$

- Coefficient of Variation (CV)

  C.V = $\left(\frac{\sigma}{\overline{X}}\right) * 100$

Data - Number of Goals

	Match	Italy	England
Qualifiers	1	2	511
Qualifiers	2	6	5
Qualifiers	3	3	4
Qualifiers	4	2	5
Qualifiers	5	3	1
Qualifiers	6	2	6
Qualifiers	7	2	7
Qualifiers	8	5	4
Qualifiers	9	3	-
Qualifiers	10	9	-
Group Stage	11	3	1
Group Stage	12	3	0
Group Stage	13	1	1
Round of 16	14	2	2
QF	15	2	4
SF	16	1	2
Final	17	1	1

Analysis of Data

ITALY				
Number of Goals	Number of Matches			
X_i	**f_i**	**x_if_i**	**x_i^2**	**f_ix_i^2**
0	0	0	0	0
1	3	3	1	3
2	6	12	4	24
3	5	15	9	45
4	0	0	16	0
5	1	5	25	25
6	1	6	36	36
7	0	0	49	0
8	0	0	64	0
9	1	9	81	81
	17	**41**	**204**	**133**

Mean = $\frac{41}{17}$ **=** **2.4**

S.D **1.417**

C.V **59%**

ENGLAND				
No of Goals	Number of Matches			
X_i	**f_i**	**x_if_i**	**x_i^2**	**f_ix_i^2**
0	1	0	0	0
1	4	4	1	4
2	2	4	4	8
3	0	0	9	0
4	3	12	16	48
5	3	15	25	75
6	1	6	36	36
7	1	7	49	49
8	0	0	64	0
	15	**48**	**204**	**220**

Mean = $\frac{48}{15}$ **=** **3.2**

S.D **2.104**

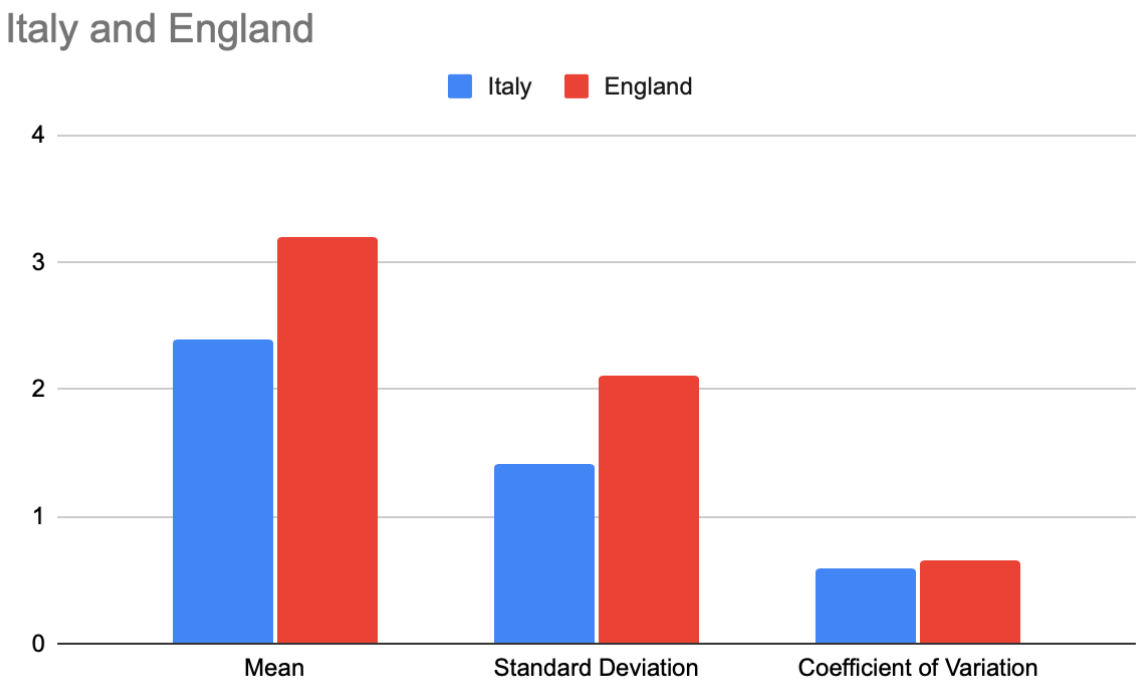
C.V **66%**

Interpretation

Team	Mean	Standard Deviation	Coefficient of Variation
Italy	**2.4**	**1.417**	**59%**
England	**3.2**	**2.104**	**66%**

Average number of Goals England > Average number of Goals by Italy

Coefficient of Variation of England > Coefficient of Variation of Italy



Limitation of the Measure

When the mean is very close to zero, the coefficient of variation will approach infinity and is hence sensitive to small changes in the mean.

Conclusion

Comparing the two data sets we find that Italy (with C.V of 59%) is more consistent than England (with C.V of 66%)