

## **Topic**

Did the government spend too much on environmental factors which were less effective on childhood obesity issue throughout the past ten years?

## **Introduction**

In recent years, the UK government has been paying tremendous efforts in coping with childhood obesity. They spent approximately £5.1 billion on obesity supports in 2014/15 (GOV.UK, 2017). Budgets covered widely from environmental to psychological elements, such as better air quality and raising children awareness. It raises a doubt whether the government spent appropriately.

## **Research question**

In this paper, it is going to investigate whether the government spent too much on environmental factors which have less effect on childhood obesity throughout the past ten years.

Factors will be categorized by:

- 1) Environmental factors ("clean\_air"; "clean\_environ")
- 2) Educational factors, which is more psychological ("health\_training"; "school\_awareness"; "media\_awareness"; "sub\_counselling")

In order to reach the answer to this question, the main objectives are to compare the environmental budget and total budget distributions, as well as the relationship between cases and the environmental budget over the past.

## **Presentation of Data**

The data is obtained from the Department of Health at GOV.UK. The children data observed is aged 4-5 and 10-11. 95% confidence intervals should be considered when conducting a direct comparison. The data could have a potential error in the collection, collation and interpretation of the data. Data was released from the year 2014.

Table 1 demonstrates the incremental columns added on the original dataset. In which, the average budgets for both two factors are the environmental/ educational budget in 2018 minus 2008 divided by ten years. The "average\_increased\_cases" is the cases in 2018 minus in 2008 divided by ten years, measuring how many cases inflated.

	environ_budget	educat_budget	average_environ_budget	average_educat_budget	average_increased_cases
0	43000	96000	4300	9600	17.0
1	67000	153000	6700	15300	23.4
2	86000	74000	8600	7400	16.7
3	75000	86000	7500	8600	3.8
4	89000	41000	8900	4100	5.6
...	...	...	...	...	...
147	116000	93000	11600	9300	42.7
148	61000	48000	6100	4800	5.0
149	45000	156000	4500	15600	28.6
150	240000	230000	24000	23000	51.9
151	44000	96000	4400	9600	24.4

(Table 2)

## **Methodology**

The processing and visualisation of data are produced by the *Python* programming language. All the analysis is reproducible and publicly shared on the *Github* hyperlink provided in the Reference section.

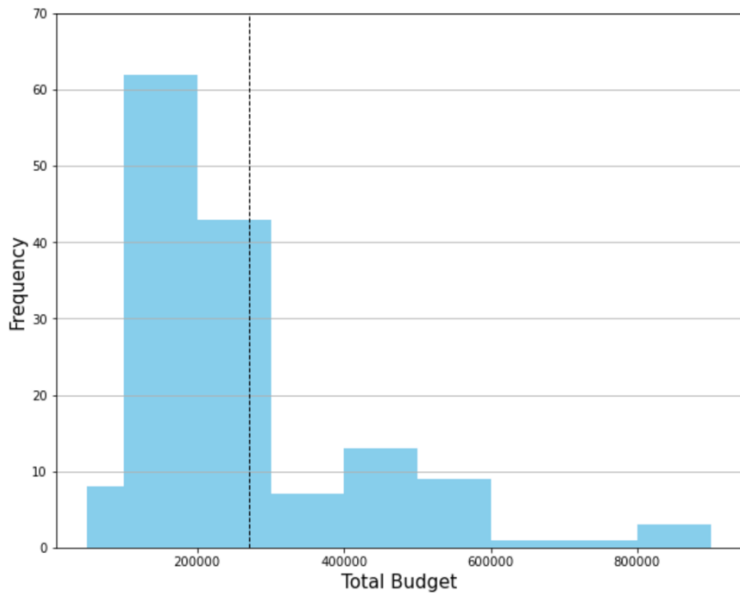
In order to discover the research topics and reach the objectives, the analysis is going to be separated into three main parts with different statistical approaches.

Firstly, it is to produce a histogram for observing how the total environmental budget and the total budget are distributed. It is to provide an insight into the underlying frequency distribution of these subsets, indicating how the total budget interrelates with the environmental elements. The result would help to determine whether such environmental spending is part of the “huge economic costs”. Secondly, by using Spearman’s Rank Correlation, to test the relationship between average cases and the average environmental budget over the past ten years. Furthermore, the third method is going to use a single linear regression to model the relationship between these two variables by fitting a linear line. The total environmental budget is selected as independent variable and total cases in 2018 as dependent variable. It is because it aims to discover how much the accumulated environmental spending affected the cases recorded in the latest year from the data.

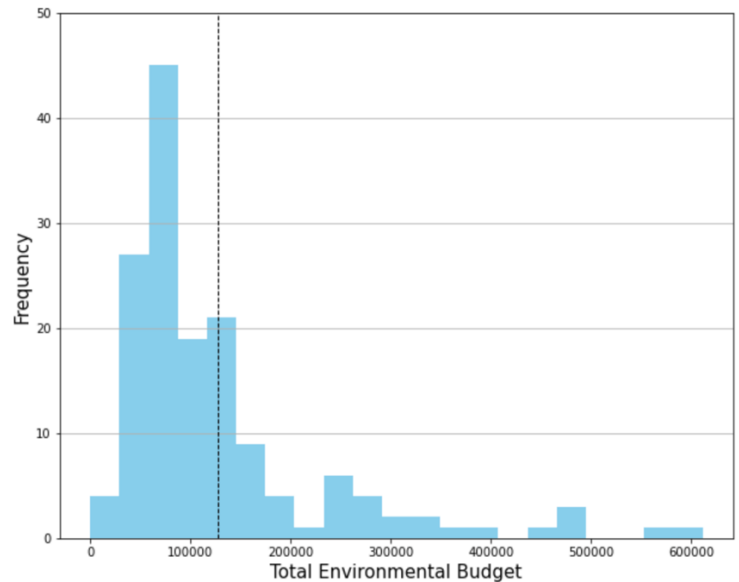
## **Results and Discussion**

For the first objective, *Figure 1a* and *1b* demonstrate the distribution of the total budget and total environmental budget. The dashed line indicates the mean for the specific subset. However, due to the distributions of these two data are not normal, the mean does not provide useful information. Besides, we can see that there are some outliers on the right side in *Figure 1b*, which have a significant dispersion. Thus, the outliers are being removed and to compare with the total budget (*Figure 1c*).

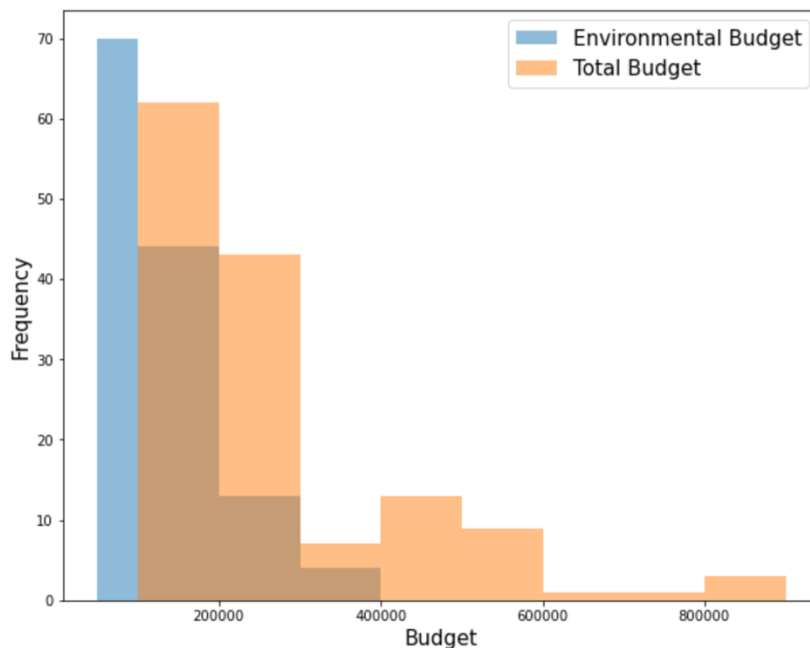
After removing the outliers, the environmental budget is shown as positively skewed meanwhile the total budget is approximately skewed with a long tail end to the right. Both categories record similar highest frequency in the range below £ 200,000, with  $2.17 \times 10^{-5}$  in Chi-Squared test. Surprisingly, the frequency of only two elements from the total budget would distribute closely with the total. Also, since the Chi-Squared is less than 0.05, we can conclude that that the level of the total budget is linked to the proportion of the environmental budget.



(Figure 1a)



(Figure 1b)



(Figure 1c)

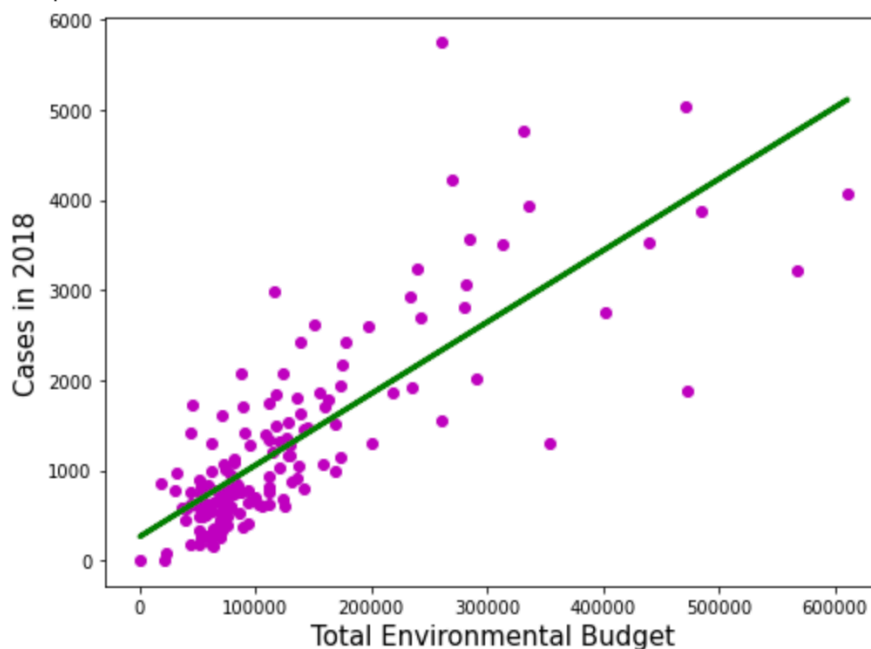
For the second objective, by using the Spearman's Rank Correlation Coefficient, the result is shown below:

Spearman's correlation coefficient: 0.714

Samples are correlated (reject  $H_0$ )  $p=0.000$

Since the result is between 0 and 1, it reflects that, with 95% confidence, the relationship between average increase cases and average environmental budget over the past ten years is positively correlated. In other words, it could mean that the high increase in average cases comes with a high amount of accumulated environmental spending. However, the evidence of correlation is still insufficient to demonstrate the effectiveness of childhood obesity issue.

After ensuring the correlation, for elaborating the second method, *Figure 2* describes the linear relationship between the total environmental budget and the total cases in the latest year from the data. The R-Squared statistic of 0.6367 is positive and relatively high, suggesting it is a reasonable model. The calculated slope illustrates that the total environmental budget increases slightly by 0.0079 when a case rises by one. Although there is a positive correlation between these two variables, it does not provide sufficient statistical evidence that the amount of environmental budget causes a significant impact on the obesity cases.



(Figure 2)

### **Limitations**

The analysis above assumes all other variables do not affect environmental budget. The meaning could vary under different situations, for instance, such budget is determined by the level of population.

### **Conclusion**

To sum up, several statistical evidence indicate that the government has been spending excessively and ineffectively on environmental factors towards dealing with childhood obesity. Two out of six elements from the total budget contribute closely to the most frequent amount of total budget. Despite the marginal increase of environmental budget was minimal in rising the cases, budget spent should not have a negative outcome. In the future, the budget is recommended to reallocate and spend it on the areas which effectively help in reducing the childhood obesity cases.

## **Reference**

GitHub: [https://github.com/wingochau/QM\\_Coursework1\\_2020.git](https://github.com/wingochau/QM_Coursework1_2020.git)

GOV.UK (2017). *Childhood obesity: a plan for action*. Available at: <https://www.gov.uk/government/publications/childhood-obesity-a-plan-for-action/childhood-obesity-a-plan-for-action> [Accessed: 15 November 2020].