

COMPARING THE DURABILITY OF TIRES

4. Displaying Data

Graphical displays of the data can be very helpful for understanding the information contained in the data. We will compare the durability of the two brands of tires using scatterplots, boxplots, and histograms.

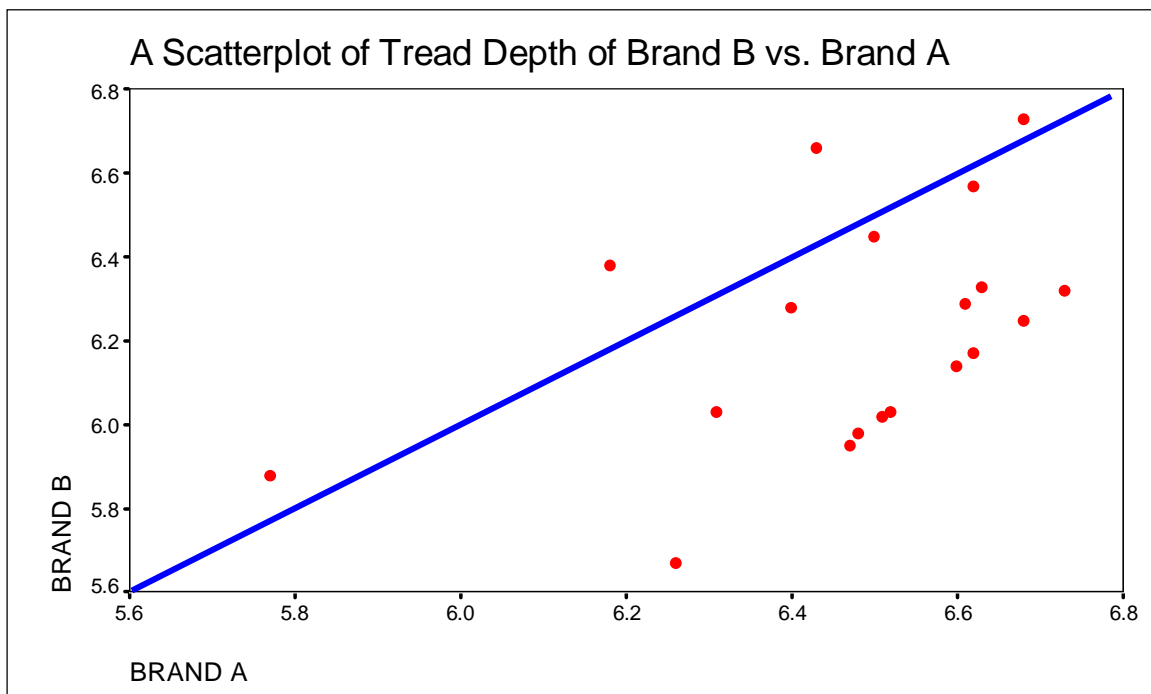
4.1 Scatterplot of Tread Depths of Brand A versus Brand B

4.2 Boxplot of Differences

4.3 Histogram of Differences

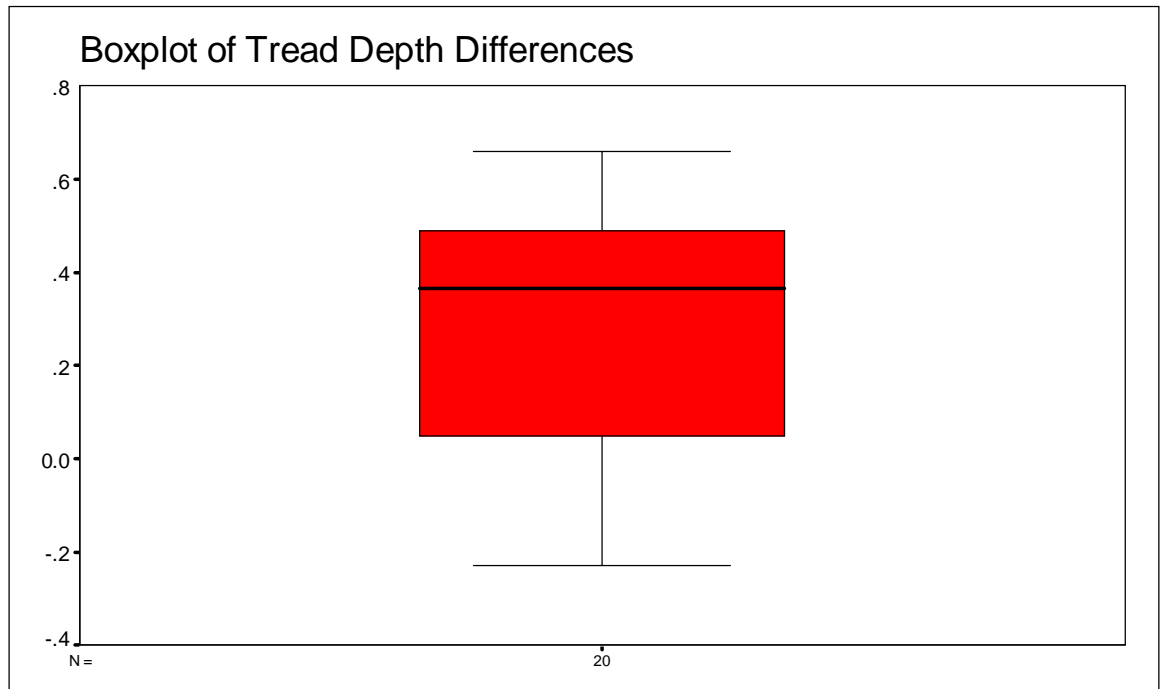
4.4 Boxplots of Tread Depth for Brand A and Brand B

- 4.1 For an experiment that produces paired data, a scatterplot is a useful display for gaining insight into the results. The figure below gives such a scatterplot for the data in our experiment.



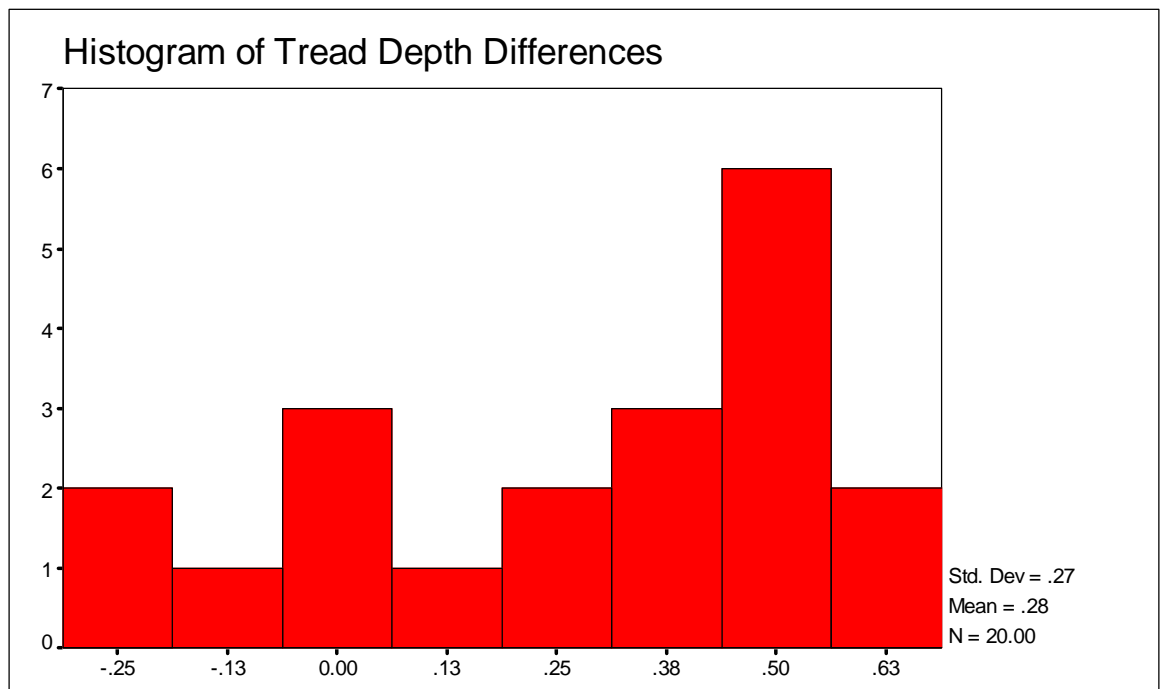
The 45-degree line in the plot represents the pairs with X equal to Y (the tread depths of brand A are equal to the tread depths of brand B). If there is no difference in the durability between brand A and brand B tires, then the pairs of points should be randomly scattered about the $X=Y$ line. If the new tires are more durable, we expect that the tread depths of brand A tires be larger than the corresponding tread depths of brand B tires. In this case, most of the points should be below the $X=Y$ line. In fact, this is the case in our plot. Sixteen of the 20 pairs are in the region below the $X=Y$ line. Therefore, the plot supports the claim that the tread depth of brand A tends to be larger than the corresponding tread depth of brand B.

- 4.2 A boxplot of the tread depth differences for brand A and brand B is displayed below.



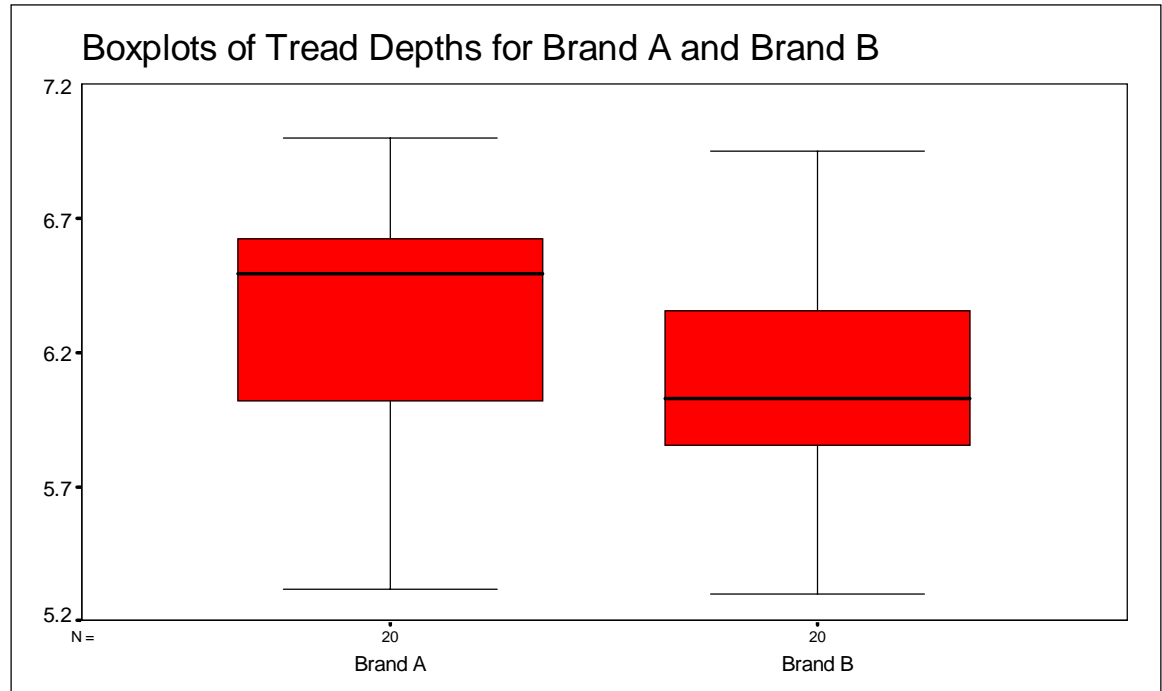
As you can see, the first quartile is above zero. That means that over 75% of the differences are positive. The median is approximately 0.4. The distribution of differences is skewed to the left. There are no outliers. The SPSS instructions used to obtain the plot are available in the corresponding *Computer Instructions* module.

- 4.3 The histogram of the differences has the following form:



The histogram is skewed to the left. The center of the distribution is at the value close to 0.4. The bulk of the differences is included in the range from 0.25 to 0.70. The shape of the histogram indicates that the assumption of normality necessary to make inferences using the t-tools might be violated.

- 4.4 SPSS produces the following side-by-side boxplots for the tread depths of brand A and brand B.



Note large variation within each sample reflected by the lengths of the boxes in comparison to the relatively small variation for the sample of differences displayed in 4.2. Indeed, the tread depths are of approximately the same magnitude for a particular automobile but vary significantly from one automobile to another due to driving habits of a driver, road surface, and so on. This is why we cannot compare the durability of the two brands by comparing the boxplots. The durability of the two brands can be compared by examining the distribution of differences. The differencing removes sources of variation caused by driving habits, balance of the wheels, road geometry and surface, etc. and displays the real difference in the durability between the two brands.