

COMPARING THE DURABILITY OF TIRES

3. Preliminary Data Analysis

The data obtained are reliable if the same method was used to measure the tread depth of the old technology tires and the new technology tires. We assume that this is the case in our experiment. Let us look at the data.

AUTOMOBILE	BRAND A	BRAND B	DIFFERENCE
1	8.46	8.05	0.41
2	6.47	5.95	0.52
3	6.63	6.33	0.30
4	5.98	5.52	0.46
5	6.61	6.29	0.32
6	6.06	5.40	0.66
7	5.77	5.88	-0.11
8	6.62	6.17	0.45
9	5.32	5.55	-0.23
10	6.31	6.03	0.28
11	6.51	6.02	0.49
12	6.18	6.38	-0.20
13	5.95	5.83	0.12
14	6.62	6.57	0.05
15	6.68	6.25	0.43
16	6.52	6.03	0.49
17	6.68	6.73	-0.05
18	6.48	5.98	0.50
19	5.89	5.30	0.59
20	7.00	6.95	0.05
AVERAGE	6.44	6.16	0.28

At first glance, there appears to be little difference between the brand A and brand B measurements. There is a great deal of variability in each sample, and it looks as though any differences between the samples can be attributed to this variability. However, when we look at the pair of observations for each car, a different view emerges. The pair of observations, an A and a B, for a particular automobile are of approximately the same magnitude for a particular automobile but vary from one automobile to another. The pairs tend to rise and fall together as we go from pair to pair. This, of course, is exactly what we might expect. Tire wear is determined not only by its quality but also by driving habits, the balance of the wheels, and the road surface and geometry, and many other factors. Since each automobile had a different driver, we would expect a large amount of variability in the data from one automobile to another.

On the other hand, to each particular automobile two different types of tires A and B were assigned. This eliminates the effect of the car-to-car variability and yields more information on the mean difference in the wearing quality for the two tire brands.

Does the data seem to imply that the brand A tires have higher durability or equivalently larger tread depth? In order to answer the question, let us look at the sample means. The

difference between the two sample means is $\bar{A} - \bar{B} = 6.44 - 6.16 = 0.28$, a rather small quantity, considering the variability of the data and the number of observations involved. Thus, at first glance it would seem that there is a little evidence to indicate a difference between the quality of the tires.

On the other hand, a more careful analysis of the data reveals an inconsistency with this conclusion. We note that the tread depth for the brand A tires is larger than the corresponding value for brand B for 16 of 20 automobiles involved. This, in itself, seems to provide strong evidence to indicate that the tread depth of brand A tends to exceed the tread depth of brand B.