

What is Pooled Variance? (Definition & Example)

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Pooled variance refers to the combined measure of variability in a set of data from different groups or populations. It is calculated by pooling together the variances from individual groups, taking into account the sample sizes of each group. This results in a more accurate estimate of the overall variability in the data compared to simply averaging the individual variances.

For example, if a study is comparing the test scores of students from two schools, the pooled variance would consider the variability in scores from both schools rather than just looking at the variance within each school separately. This allows for a more comprehensive understanding of the variability in the entire population being studied.

In statistical analysis, pooled variance is often used in hypothesis testing and calculating confidence intervals. It provides a more precise estimate of the true variability of a population and allows for more accurate conclusions to be drawn from the data.

What is Pooled Variance? (Definition & Example)

In statistics, pooled variance simply refers to the average of two or more group variances.

We use the word "pooled" to indicate that we're "pooling" two or more group variances to come up with a single number for the common variance between the groups.

In practice, pooled variance is used most often in a , which is used to determine whether or not two population means are equal.

The pooled variance between two samples is typically denoted as s_p^2 and is calculated as:

$$sp^2 = ((n_1-1)s_1^2 + (n_2-1)s_2^2) / (n_1+n_2-2)$$

When the two sample sizes (n_1 and n_2) are equal, the formula simplifies to:

$$sp^2 = (s_1^2 + s_2^2) / 2$$

When to Calculate the Pooled Variance

When we want to compare two population means, there are two statistical tests we could potentially use:

1. : This test assumes the variances between the two samples are approximately equal. If we use this test, then we calculate the pooled variance.

2. : This test *does not* assume the variances between the two samples are approximately equal. If we use this test, we *do not* calculate the pooled variance. Instead, we use a different formula.

To determine which test to use, we use the following rule of thumb:

Rule of Thumb: If the ratio of the larger variance to the smaller variance is less than 4, then we can assume the variances are approximately equal and use the two

sample t-test.

For example, suppose sample 1 has a variance of 24.5 and sample 2 has a variance of 15.2. The ratio of the larger sample variance to the smaller sample variance would be calculated as:

Ratio: $24.5 / 15.2 = 1.61$

Since this ratio is less than 4, we could assume that the variances between the two groups are approximately equal. Thus, we would use the two sample t-test which means we would calculate the pooled variance.

Example of Calculating the Pooled Variance

Sample 1:

Sample size $n_1 = 40$ Sample variance $s_1^2 = 18.5$

Sample 2:

Sample size $n_2 = 38$ Sample variance $s_2^2 = 6.7$

Here is how to calculate the pooled variance between the two samples:

$$sp^2 = ((n_1-1)s_1^2 + (n_2-1)s_2^2) / (n_1+n_2-2) \\ sp^2 = ((40-1)*18.5 + (38-1)*6.7) / (40+38-2) \\ sp^2 = (39*18.5 + 37*6.7) / (76) = 12.755$$

The pooled variance is 12.755.

Notice that the value for the pooled variance is located between the two original variances of 18.5 and 6.7. This makes sense considering the pooled variance is just a weighted average of the two sample variances.

Bonus Resource: Use this to automatically calculate the pooled variance between two samples.