

AP Statistics: Table of Contents

Power of a Hypothesis Test

The probability of *not* committing a [Type II error](#) is called the **power** of a hypothesis test.

Effect Size

To compute the power of the test, one offers an alternative view about the "true" value of the population parameter, assuming that the null hypothesis is false. The **effect size** is the difference between the true value and the value specified in the null hypothesis.

$$\text{Effect size} = \text{True value} - \text{Hypothesized value}$$

For example, suppose the null hypothesis states that a population mean is equal to 100. A researcher might ask: What is the probability of rejecting the null hypothesis if the true population mean is equal to 90? In this example, the effect size would be $90 - 100$, which equals -10 .

The power of a hypothesis test is affected by three factors.

- Sample size (n). Other things being equal, the greater the sample size, the greater the power of the test.
- Significance level (α). The lower the significance level, the lower the power of the test. If you reduce the significance level (e.g., from 0.05 to 0.01), the **region of acceptance** gets bigger. As a result, you are less likely to reject the null hypothesis. This means you are less likely to reject the null hypothesis when it is false, so you are more likely to make a Type II error. In short, the power of the test is reduced when you reduce the significance level; and vice versa.
- The "true" value of the parameter being tested. The greater the difference between the "true" value of a parameter and the value specified in the null hypothesis, the greater the power of the test. That is, the greater the effect size, the greater the power of the test.

Test Your Understanding

Problem 1

Other things being equal, which of the following actions will reduce the power of a hypothesis test?

- I. Increasing sample size.
- II. Changing the significance level from 0.01 to 0.05.
- III. Increasing beta, the probability of a Type II error.

- (A) I only
- (B) II only
- (C) III only
- (D) All of the above
- (E) None of the above



hypothesis test more likely to reject the null hypothesis, thus increasing the power of the test. Since, by definition, power is equal to one minus beta, the power of a test will get smaller as beta gets bigger.

Problem 2

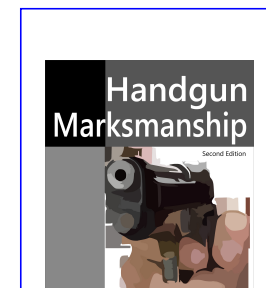
Suppose a researcher conducts an experiment to test a hypothesis. If she doubles her sample size, which of the following will increase?

- I. The power of the hypothesis test.
- II. The effect size of the hypothesis test.
- III. The probability of making a Type II error.

- (A) I only
- (B) II only
- (C) III only
- (D) All of the above
- (E) None of the above

Solution

The correct answer is (A). Increasing sample size makes the hypothesis test more sensitive - more likely to reject the null hypothesis when it is, in fact, false. Thus, it increases the power of the test. The effect size is not affected by sample size. And the probability of making a **Type II error** gets smaller, not bigger, as sample size increases.

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