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Is Student's t test a Wald test?

Asked 5 years, 2 months ago   Active 4 years, 5 months ago   Viewed 12k times

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Is Student's t test a Wald test?

I've read the description of Wald tests from Wasserman's *All of Statistics*.

It seems to me that the Wald test includes t-tests. Is that correct? If not, what makes a t-test not a Wald test?

hypothesis-testing   t-test

asked Sep 13 '14 at 18:06

guest
191   1   1   3

The Wald test statistic is almost but not exactly equal to the square of the t-test statistic - see the accepted answer stats.stackexchange.com/questions/60438/... – marsei
Sep 13 '14 at 20:54

@sed so the t-test is not a Wald test? – guest Sep 13 '14 at 22:01

1   when *n* is large, the t-test is **essentially** identical to the wald test. – marsei Sep 13 '14 at 22:20

@sed what are the "essential" elements of the tests that compare identical? Are you saying the t-test **is the** wald test when n is large? What aspects are not identical when n is large? – guest Sep 13 '14 at 22:33 ✏️

2 Answers

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As Wasserman defines the Wald test, the *statistic* used in the t-test is certainly the Wald-statistic defined there:

$$W = \frac{\hat{\theta} - \theta_0}{\hat{se}(\hat{\theta})}$$

However, the Wald test uses an asymptotic argument to compare that statistic with a standard normal distribution. [The Wald test when dealing with a single parameter can be cast either as a Z-test or a chi-square; in the section being discussed, Wasserman is talking about the Z-form]

The *t-test* relies on an exact small-sample argument to compare the test statistic with a t-distribution.

So, to answer your title question, strictly speaking, no the t-*test* is not a Wald test.

Note, though, that they're asymptotically equivalent (i.e. as the sample size, $n \to \infty$, they will reject the same cases); certainly some people - if a bit loosely - call a test based on a t-statistic a Wald-test, whether the statistic is compared with the asymptotic normal distribution or the small-sample result (t-distribution).

edited Jun 16 '15 at 10:33   answered Sep 14 '14 at 7:45

Glen_b -Reinstate
Monica
228k   23   457   809

@Glen_b has provided an excellent answer to the topic. I want to add that, in the t-test, the distribution is the t-distribution. For example, you'd need to know the degree of freedom for your statistics. However, the wald-test relies on the chi-square distribution (square of standard normal). Of course, as the degree of freedom goes to infinity, they're both asymptotically equivalent.

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One would prefer only the wald-test for a sufficient large sample.

answered Jun 16 '15 at 9:52

SmallChess
6,332   4   21   42