

DEPENDENT-ALPHA CALCULATOR: TESTING THE DIFFERENCES BETWEEN DEPENDENT COEFFICIENTS ALPHA

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Abstract: Coefficient alpha (α) was first introduced by Lee J. Cronbach in 1951 and since then it continues to serve as a valuable index of reliability within different areas of research. According to the Social Sciences Citation Index, between 1951 and 2010, Cronbach's seminar article (Cronbach, 1951) was cited 6,912 times by other published articles and numerous other publications often cite secondary sources in support of the use of coefficient alpha.

Key words: *Dependent-Alpha Calculator; Dependent Coefficients Alpha*

Although most statistical packages offer computation of coefficient alpha, no widely available package incorporates tests comparing two coefficients alpha in dependent samples as may arise when testing the equality of alpha across time or when testing the equality of alpha for two test scores within the same sample. For a dependent group analysis, a feasible research question might be "Does reducing test length or changing mode of item presentation significantly impact internal consistency?" In this case, the null and alternative hypotheses are $H_0: \alpha_{dif} = 0$ and $H_1: \alpha_{dif} \neq 0$ where $\alpha_{dif} = \alpha_1 - \alpha_2$, and α_1 and α_2 are alpha coefficients for two different test scores in the same population.

According to Feldt, Wodruf, and Salih (1987), the methodology for the case of dependent statistics was first developed for $H_0: \alpha_{dif} = 0$ ($H_0: \zeta_1 = \zeta_2$). Feldt (1980) recommended the following test statistic

$$t = \frac{(\hat{\zeta}_1 - \hat{\zeta}_2)(N - 2)^{1/2}}{[4(1 - \hat{\zeta}_1)(1 - \hat{\zeta}_2)(1 - \hat{\rho}^2)]^{1/2}} \quad (DF = N - 2)$$

Where $\hat{\zeta}_1$ denotes coefficient alpha for the first test, $\hat{\zeta}_2$ denotes coefficient alpha for the second test, $\hat{\rho}^2$ denotes the squared Pearson's correlation coefficient between the two total-test scores for the sample.

Although a FORTRAN program was developed for this purpose and made available by Lautenschlager (1989; Merino & Lautenschlager, 2003), it is not very accessible to users. The new Dependent-Alpha Calculator provides a user-friendly interface based on Microsoft Excel for testing hypotheses in line with the formula presented in Feldt et al. (1987) to allow tests for differences among a user-defined set of coefficient alpha values for dependent samples.

Input and Output

The user is queried by the Dependent-Alpha Calculator for coefficients alpha for both tests, sample size, and the Pearson's correlation coefficient between both tests. The Dependent-Alpha Calculator responds by calculating parts of the equation suggested by Feldt et al. (1987). The output includes the *t* test statistic and degrees of freedom. There is a built-in note in the Dependent-Alpha Calculator to help users determine the significance level of *t* tests statistic at both .05 and .01 significance levels.

Dependent-Alpha Calculator	
Please enter the values shown in red. No other changes can be made to this calculator. © 2011	
Cronbach's alpha for Test 1	0.84
Cronbach's alpha for Test 2	0.73
Sample Size	200
Pearson's Correlation Coefficient between Test 1 and Test 2	0.35
SUK1=a1-a2	0.11
SUK 2=(n-2) ^{1/2}	14.07124728
SUK1*SUK2	1.547837201
DNM1=1-a1	0.16
DNM2=1-a2	0.27
DNM3=1-r ²	0.806225775
(4*d1*s2*d3) ^{1/2}	0.373250337
SUK / DNM	4.146914412
DF	198
T	4.146914412
T statistic significance level	
Two-Tailed T critical is 1.96 for p < .05 and 2.58 for p < .01	
One-Tailed T critical is 1.65 for p < .05 and 2.33 for p < .01	
Reference	
Feldt, L. S., Woodruff, D.J., Salih, F.A. (1987). Statistical inference for coefficient alpha. <i>Applied Psychological Measurement</i> , 11, 93-103.	

Availability

The program is available-by contacting either author- as a Microsoft Excel file.

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