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Confidence interval for coefficients in sas proc

Getting confidence intervals for effect Sizes in multiple regression: SAS Proc GLM I usually prefer Proc Reg to perform multiple regression, but give confidence intervals for effect sizes. I have provided my students with an SAS and SPSS code that will receive such trust intervals, but another option is to use PROC GLM as shown below. Dependent variable glm procedure: PRODUCT 5 1724.594680 344.918936 31.11 <lt;.0001 71 787.119606 11.0861 92 76 2511.714286 0.686621 3.930380 3.329593 84.71429 What GLM calls o-square here is R-square. 1 362.1360039 362.1360039 32.67 <lt;.0001 0.1442 0.1392 0.0417 0.2640 0.3151 0.2914 0.1631 0.4235 1 1.5011896 1.5011896 0.14 0.7140 0.0006 - 0.0038 0.0000 0.0308 0.0019 -0.0114 0.0000 0.0453 1 349.4080293 349.4080293 31.52 <lt;.0001 0.1391 0.1341 0.0387 0.2584 0.3074 0.2838 0.1564 0.4165 1 3.2535983 3.2535983 0.29 0.5897 0.0013 -0.0031 0.0000 0.0408 0.0041 -0.0093 0.0000 0.0568 1 16.2419977 16.2419977 1.47 0.2301 0.0065 0.0020 0.0000 0.0660 0.0202 0.0060 0.0000 0.0960 Here we have confidence intervals for the squared semipartial correlation coefficients. 36.63575215 5.13429951 7.14 <lt;.0001 0.72849970 0.12746317 5.72 <lt;.0001 YYY -0.04529749 0.12309701 -0.37 0.7140 0. . . 614 36519 0.10943337 5.61 <lt;.0001 -0.07779428 0.14360081 -- 0.5 4 0.5897 0.00860670 0.00711063 1.21 0.2301 Here is a confidence interval for R2, manufactured by my SAS code. Here is the confidence interval for R2 produced by my SAS Code. The one with R Carl L. Wuensch, February, 2019 PROC REG is one of many regression procedures in the SAS system. This is the standard procedure for mounting linear regression models. The STB model declaration option in PROC REG directs the SAS to display standardized parameters, forecasts when reporting regression results. Unfortunately, there are no such possibilities for requiring standardised confidence intervals to be reported in the results – at least not at the time of such writing (April 2013). Additionally, there are no options for reporting standardized standard errors of parameter projections in the results of regression SAS regression, or, Decision 1: Since a standardised regression factor is calculated by dividing the estimate of the standard deviation ratio of the sample standard deviation of the dependent variable to the standard deviation of the sample from the regressor, the standardised assessment can be calculated manually and then done the same for the raw confidence interval limits. The equation should be, standardised regression factor = non-standardized parameter rating / (sample standard deviation of dependent variable / sample standard deviation of the regressor), which simplifies up, Bstd = Braw * (SDx / SDy), where SDx is the standard deviation of the predictor and SDy is the standard deviation of dependent Y The implementation of this confidence intervals, after which standardised confidence intervals are created. Decision 2: Since standardised regression coefficients are by definition assessments of parameters derived from a regression analysis carried out on variables that are standardised, a standardised assessment can be obtained by standardising the variables in a regression model and then performing the model as usual. So instead, proc reg data= work.fitness; oxygen model = Performance time Age body weight / stb; you can do this proc standard data = target = 0 std = 1 output = zfitness; tellies; oxygen model = Performance time Age body weight / stb; be implemented; opt out; standardised assessments, standardised standard forecast errors and standardised confidence intervals. Sample data set: The sample data set, suitability can be created by issuing this data step: working with data.fitness; Entry Age Weight OxygenNo weight Rest timeFulfill RunPulse MaxPulse @@; datalines;44 89.47 44.609 11.37 62 178 182 40 75.07 45.313 10.07 62 185 18544 85.84 54.297 8.65 45 156 168 42 68.15 59.571 8.17 40 166 17238 89.02 49.874 9.22 55 178 180 47 77.45 44.811 11.63 58 176 17640 75.98 45.681 11.95 70 176 180 43 81.19 49.091 10.85 64 162 17044 81.42 39.442 13.08 63 174 176 38 81.87 60.055 8.63 48 170 18644 73.03 50.541 10.13 45 168 168 45 87.66 37.388 14.03 56 186 19245 66.45 44.754 11.12 51 176 176 47 79.15 47.273 10.60 47 162 16454 83.12 51.855 10.33 50 166 170 49 81.42 49.156 8.95 44 180 18551 69.63 40.836 10.95 57 168 172 51 77.91 46.672 10.00 48 162 16848 91.63 46.774 10.25 48 162 164 49 73.37 50.388 10.08 67 168 16857 73.37 39.407 12.63 58 174 176 54 79.38 46.080 11.17 62 156 16552 76.32 45.441 9.63 48 164 166 50 70.87 54.625 8.92 48 146 15551 67.25 45.118 11.08 48 172 172 54 91 63 39 203 12.88 44 168 17251 73 71 45 790 10 47 59 186 1 88 57 59 08 50 545 9 93 49 0 148 15549 76.32 48 673 9 40 56 186 188 48 61.24 47 92 BGN > 11.50 52 170 17652 82.78 47 467 10 50 53 170 172;run; This page displays a sample regression analysis with footnotes explaining the output. This data (hsb2demo) is collected on 200 secondary school pupils and results from various tests, including science, mathematics, reading and social sciences (socst). A variable woman is a dichotoma variable encoded 1 if the student is a woman and 0 if a man. In the code below, the data = option in proc reg statement tells SAS where to find an SAS data set to use in the analysis. In the example, we define the regression model we want to implement, with the dependent variable (in this case science) to the left of the equality sign, and independent variables on the right side. We use the clb option after the slash of the report model to get 95% confidence of the parameter projections. The statement of refusal is because proc reg is an interactive procedure, and output says sas that not expect another proc reg immediately. % let the path=C:\temp; 2. 1000 000 000 000 000 000 000 prozreg data - idre.hsb2demo; model science = mathematics female socst read / clb; be implemented; opt out; Reg procedure model: MODEL 1 Dependent variable: Scientific score Dispersion analysis sum of average output DF squares F value Pr > F Model 4 9543.72074 2385.93019 46.69 <.0001 Error 195 9963.77926 51.70001 Adjusted total 199 19507 Root MSE 7.14817 R-square 0.4892 dependent average 51.85000 Adj R-sq 0.4788 Coeff Var 13.78624 Parameters Standard parameters Variables Label Approximate value t Value Pr > F Intercept Intercept 1 12.32529 3.19356 3.86 0.0002 math math score 1 0.38931 0.07412 5.25 <.0001 female 1 -2.00976 1.02272 -1.97 0.0508 socst social studies score 1 0.04984 0.06223 0.80 0.4241 read reading score 1 0.04984 0.06223 0.80 0.4241 read reading score 1 0.33530 0.07278 4.61 <.0001 Parameter Estimates Variab Label DF 95% Confidence Limits Intercept Intercept 1 -0.02694 0.53550 female 1 -4.02677 0.00724 socst social studies score 1 -0.07289 0.17258 read reading score 1 0.19177 0.47883 Anova Table Analysis of Variance Sum of Mean Sourcee DFB Squares Squared F Valuee Pr > F Model 4 9543.72074 2385.93019 46.69 <.0001 Error 195 9963.77926 51.09630 Corrected Total 199 19507 a. Source – This is the source of variance, Model, Residual, and Total. The total dispersion is divided into the dispersion, which can be explained by the independent variables (Model) and dispersion, which is not explained by the independent variables (Residual, sometimes called Error). Note that the amounts from the squares for the model and the residual are added to the overall difference, reflecting the fact that the total difference is divided into a pattern and residual deviation. b. DF – These are the degrees of freedom associated with sources of dispersion. The overall difference has N-1 degrees of freedom. In this case, there were N = 200 students, so DF total was 199. The degrees of freedom of the model correspond to the number of predictors minus 1 (K-1). You might think it will be 4-1 as there are 4 independent variables in modeling, mathematics, female, socst and reading). But the interception is automatically included in the model (unless you explicitly skip the interception). Including the interception, there are 5 predictor, so the model has 5-1=4 degrees of freedom. The residual degree of freedom is the total DF minus the DF model, 199 - 4 = 195 c. Sum of squares – These are the sum of squares associated with the three sources of dispersion, Total, Model and Residual. They can be calculated in many ways. Conceptually, these formulas can be expressed as: SSTotal Total variability around the average. 1. 1. SSRResidual The sum of square errors in the forecast. (SY – Y)2. SSMModel in the case of predictions using the predicted Y value only using the Y mean. Another way to think about it is SSMModel = SSTTotal - SSRResidual. Note that SSTTotal = SSMModel + SSRResidual. Note that the SSMModel/SSTotal is equal to .4892, the R-squared value. This is because R-square is the proportion of dispersion explained by independent variables, therefore it can be calculated by SSMModel/ SSTTotal. d. Medium square. – These are the middle squares, the sum of the squares divided into their respective DF. For the model, 9543.72074 / 4 = 2385.93019. For residuals, 9963.77926 / 195 = 51.0963039. They are calculated so that you can calculate the F ratio, dividing the average square pattern into the average square residual value to check the meaning of the predictors in the model. e. F Value and Pr > F – F-value is the average square model (2385.93019) divided by the average square residual value (51.0963039), giving F=46.69. This is the p-value associated with this value F is very small (0.0000). These values are used to answer the question Whether independent variables reliably predict the variable?. The P-value is compared to your alpha level (usually 0.05) and, if smaller, you can lock Yes, independent variables reliably predict the dependent variable. It can be said that the group of variable mathematics, female, socst and reading can be used to reliably predict science (the dependent variable). If the p-value is greater than 0.05, you would say that the independent variable group does not show a statistically significant relationship with a dependent variable or that the group of independent variables does not reliably predict a dependent variable. Note that this is a common significance test that assesses whether the group of independent variables, when used together, anticipates the dependent variable and does not consider the ability of any of the specific independent variables to predict the dependent variable. The ability of each individual independent variable to predict the dependent variable is addressed in the table below, where the individual variables are listed. Overall Model Fit Root MSE F 7.14817 R-Squaree 0.4892 Dependent Meang 51.85000 Adj R-Sq 0.4788 Coeff Varh 13.78624 f. Root MSE – Root MSE is the standard deviation of the error term and is the square root of the average square residual (or error). G. Dependent average – This is the average of the dependent variable. H. Coeff Var – This is the coefficient of variation, which is a unit of measurement for variation in the data. This is the MSE root divided by the average of the dependent variable multiplied by 100: (100* (7.15/51.85) = 13.79). i. R-Square – R-Square is dispersion in dependent dependents independent variables (mathematics, women, sex and reading). This figure shows that 48.92% of the dispersion in scientific assessments can be predicted by variable mathematics, female, socst and reading. Note that this is a comprehensive measure of the strength of the union and does not reflect the extent to which an independent variable is associated with the dependent variable. j. Adj R-Sq – Corrected R-square. As predictions are added to the pattern, each predictor will explain part of the deviation in the dependent variable simply because of randomness. Predictors may continue to be added to the model, which would continue to improve the ability of predictive means to explain the dependent variable, although part of this increase in R-square would be simply due to the accidental change in that particular sample. The corrected R-square is trying to get a fairer R-squared estimate for the population. The R-square value is .4892, while the value of the Corrected R-square is .4788 Adjusted R square is calculated by formula 1 – ((1–Rsq)/(N – 1)) / (N – k – 1), that when the number of observations is small and the number of predictive factors is large, there will be a much larger difference between R-square and adjusted R-square (because the ratio of (N – 1) / (N – k – 1) will be much less than 1). By contrast, when the number of observations is very large compared to the number of projections, the R-square and adjusted R-square value will be much closer, because the ratio of (N – 1) / (N – k – 1) will approach 1. Parameter Estimates Parameter Estimates Variab Label DF 95% Confidence Limits Intercept Intercept 1 12.32529 3.19356 3.86 0.0002 math math score 1 0.38931 0.07412 5.25 <.0001 female 1 -2.00976 1.02272 -1.97 0.0508 socst social studies score 1 0.04984 0.06223 0.80 0.4241 read reading score 1 0.33530 0.07278 4.61 <.0001 Parameter Estimates Variab Label DF 95% Confidence Limits Intercept Intercept 1 12.32529 3.19356 3.86 0.0002 female 1 -4.02677 0.00724 socst social studies score 1 -0.07289 0.17258 read reading score 1 0.19177 0.47883 k. Variable – This column shows the predictor variables (constant, math, female, socst, read). The first variable (constant) is the constant also indicated in the textbooks as interception Y, the height of the regression line when it crosses the Y axis. l. Label – This column gives a label for the variable. Typically, variable labels are added when the data set is created to make it clear what the variable is (since the variable name can sometimes be ambiguous). Sas has marked the Intercept variable for us by default, given that this is not added to the data set. m. DF – This column gives the degrees of freedom associated with each independent variable. All continuous variables have one degree of freedom, as well as binary variables (such as females). n. Forecast parameters – These are the values for the regression equation for predicting the dependent variable from an independent variable. The regression equation is presented in many different ways, for example: Ypredicted = b0 + b1*x1 + b2*x2 + b3*x3 + b4*x4 The rating column (coefficients or parameter estimates, hence on coefficient labels) provides the values for b0, b1, b2, b3 and b4 for this equation. Expressed in the parameters used in this example, the regression equation is science Predicted = 12.32529 + .3893102*math + - 2.009765*female+ .0498443*socst + .33529998*Read These estimates show you the relationship between the independent variables and the dependent variable. These estimates show how big the growth in science results is, which would predict a 1 unit increase in predictor. Note: For independent variables that are not significant, the coefficients do not differ materially from 0 to be taken into account when interpreting the coefficients. (See columns with the value of t and p-value to check that the coefficients are significant). math – The coefficient (estimate of parameters) is .3893102. So for each unit (i.e. point, as this is the indicator in which the tests are measured) an increase in mathematics is predicted, an increase of unit. .3893102 in science is predicted, with all other variables being constant. (It doesn't matter what value you hold other variable constants in, because it's a straight model.) Or, for each increase of one point in the math test, your science is expected to be higher by .3893102 points. This is significantly different from 0. Female – For each increase of the unit in the female there is -2.009765 unit reduction per unit in the predicted science result, conducting all other variable constants. Since the female is encoded 0/1 (0 = male, 1 = female), the interpretation can be put more simply. For women, the predicted science score will be 2 points lower than for men. The variable woman is technically not statistically different from 0, because the p-value is greater than .05. However, .05 is so close to .05 that some researchers will still consider it statistically significant. socst – The 100-point coefficient is .0498443. This means that to increase to 1 unit as a result of social research, we expect an approximately .05 point increase in scientific outcome. This is not statistically significant; in other words, .0498443 is no different from 0. read – The reading factor is .3352998. Therefore, for every increase in the number of readings, we expect a 34-point increase in science. This is Significant. o. Standard error – these are the standard errors related to the odds. The standard error is used to verify that the parameter differs significantly from 0 by dividing the parameter assessment with the standard error to obtain a t-value (see column with t-values and p-values). Standard errors can also be used to form a confidence interval for the parameter, as shown in the last two columns of this table. p. t Value and Pr > F; |t|: These columns provide the value of t and z get to know the p-value used in testing a zero hypothesis that the coefficient/parameter is 0. If you use a 2 tensile test, you will compare each p-value with the pre-selected alpha value. The coefficients that have p-values less than alpha are statistically significant. For example, if you chose alpha to be 0.05, coefficients with a p-value of 0.05 or less will be statistically significant (i.e. you can reject the zero hypothesis and say that the coefficient is significantly different from 0). If you are using one tail test (i.e. predict that the parameter will go in a certain direction), then you can split the p-value into 2 before comparing it to the alpha level you selected in advance. In a bilateral test and an alpha of 0.05, the zero hypothesis that the coefficient for the female is equal to 0 may be rejected. The coefficient of -2.009765 is significantly greater than 0. However, if you used two-eyed and alpha at 0.01, the p-value of .0255 was greater than 0.01 and the female coefficient would not be significant at level 0.01. If you had predicted that this coefficient would be positive (i.e. one tail test), you would be able to divide the p-value by 2 before comparing it to alpha. This would result in a one-sided p-value of 0.00945 that is less than 0.01, and then you can conclude that this coefficient is greater than 0 with one alpha tail of 0.01. The mathematics factor differs significantly from 0 using alpha of 0.05, because its p-value is 0.000, which is less than 0.05. The socst coefficient (0.0498443) does not differ statistically significantly from 0, because its p-value is definitely greater than 0.05. The reading factor (0.3353) is statistically significant because its p-value of 0.000 is less than .05. The constant (cons) differs significantly from 0 to level 0.05 alpha. However, a significant interception is rarely interesting. q. 95% confidence limits – This indicates a 95% confidence interval for the coefficient. This is very useful as it helps you understand how high and how low the actual parameter population value can be. Confidence intervals are associated with p-values so that the coefficient is not statistically significant if the confidence interval includes 0. If you look at the confidence interval for the female, you will see that it is simply 0 (-4 to .007). Because .007 is so close to 0, the p-value is close to .05. If the upper confidence limit was slightly lower so as not to include 0, the coefficient for the female would be statistically significant. Also, consider the odds for the female (-2) and read (.34). You will immediately see that the rating for the female is much higher, but check the confidence interval for it (-4 to .007). Now check the reading confidence interval (.19 to .48). Although the female has a larger coefficient (in absolute values), it can be as small as -4. By contrast, the lower level of reading confidence is .19, which is still above 0. So, although the female has a larger coefficient, the read is significant, and even the smallest value in the confidence interval is still higher than 0. The same cannot be said for the socst coefficient. Such confidence intervals help you put the factor score into perspective by seeing how much the value may vary. Varies.

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