Why doesn’t the test of the overall survey regression model in Stata match the results from SAS and SUDAAN?

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The discrepancy between the test of the overall survey regression model in Stata and the results from SAS and SUDAAN can be attributed to several factors. It is important to note that different statistical software programs may use different algorithms and methods to calculate the test results. This can lead to slight differences in the output, even though the same data and model are used. Additionally, Stata may use default settings that differ from those used in SAS and SUDAAN, which can also contribute to variations in the test results. Furthermore, the survey design and weights used in the analysis may not be identical in all three programs, which can affect the overall results. Therefore, it is important to carefully consider and understand the specific settings and procedures used in each software when interpreting and comparing test results.

Stata FAQ: Why doesn't the test of the overall survey regression model in Stata match the results from SAS and SUDAAN?

Version info: Code for this page was tested in Stata 12.

NOTE: We will use the NHANES II data as an example.

The question

Let's say that you ran an OLS regression model with survey data in Stata.

use http://www.stata-press.com/data/r12/nhanes2.dta, clear

svyset psu , strata(strata)

pweight: finalwgt
VCE: linearized

Single unit: missing

Strata 1: strata

SU 1: psu

FPC 1: <zero>

svy: regress weight height age female

(running regress on estimation sample)

Survey: Linear regression

Number of strata = 31 Number of obs = 10351

Number of PSUs = 62 Population size = 117157513

Design df = 31

F(3, 29) = 1177.18

Prob > F = 0.0000

R-squared = 0.2827

--

| Linearized

weight | Coef. Std. Err. t P>|t|

-------------+--

height | .7405073 .027744 26.69 0.000 .6839229 .7970917

age | .1484546 .0116501 12.74 0.000 .124694 .1722153

female | -2.898197 .5888597 -4.92 0.000 -4.099184 -1.697209

_cons | -57.6088 4.955696 -11.62 0.000 -67.716 -47.50159

--

At the top of the output, you see the test of the overall regression model:
F(3, 29) = 1177.18, p < 0.0000.

Next, you run the same model in SAS.

```
proc surveyreg data = nhanes2;
cluster psu;
strata strata;
weight finalwgt;
model weight = height age female ;
run;
```

The SURVEYREG Procedure

Regression Analysis for Dependent Variable weight

Data Summary

Number of Observations 10351
Sum of Weights 117157513
Weighted Mean of weight 71.90064

Weighted Sum of weight 8423699699

Design Summary

Number of Strata 31

Number of Clusters 62

Fit Statistics

R-square 0.2827

Root MSE 13.0725

Denominator DF 31

Tests of Model Effects

Effect Num DF F Value Pr > F

Model 3 1258.00 <.0001

Intercept 1 135.10 <.0001

height 1 712.19 <.0001

age 1 162.33 <.0001

female 1 24.22 <.0001

NOTE: The denominator degrees of freedom for the F tests is 31.

Estimated Regression Coefficients

Standard

Parameter Estimate Error t Value Pr > |t|

Intercept -57.608796 4.95641443 -11.62 <.0001

height 0.740507 0.02774807 26.69 <.0001

age 0.148455 0.01165183 12.74 <.0001

female -2.898197 0.58894508 -4.92 <.0001

NOTE: The denominator degrees of freedom for the t tests is 31.

The results for the overall test of the regression model are reported as F(3,
31) = 1258.00, p < .0001. Both the test statistic and denominator degrees
of freedom are different from your Stata output, so you decide to run the model
in SUDAAN.

```
proc regress data = nhanes2 filetype = sas design = wr;
weight finalwgt;
nest strata psu;
model weight = height age female;
run;
```

S U D A A N

Software for the Statistical Analysis of Correlated Data

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Release 10.0.1

DESIGN SUMMARY: Variances will be computed using the Taylor Linearization Method, Assuming a
With Replacement (WR) Design
Sample Weight: FINALWGT
Stratification Variables(s): STRATA
Primary Sampling Unit: PSU

Number of observations read : 10351 Weighted count:117157513
Observations used in the analysis : 10351 Weighted count:117157513
Denominator degrees of freedom : 31

Maximum number of estimable parameters for the model is 4

File NHANES2 contains 62 Clusters
62 clusters were used to fit the model
Maximum cluster size is 288 records
Minimum cluster size is 67 records

Weighted mean response is 71.900636

Multiple R-Square for the dependent variable WEIGHT: 0.282704

Independent P-value
Variables and Beta Lower 95% Upper 95% T-Test
Effects Coeff. SE Beta Limit Beta Limit Beta T-Test B=0 B=0

Intercept -57.61 4.96 -67.72 -47.50 -11.62 0.0000
HEIGHT 0.74 0.03 0.68 0.80 26.69 0.0000
AGE 0.15 0.01 0.12 0.17 12.74 0.0000
FEMALE -2.90 0.59 -4.10 -1.70 -4.92 0.0000

Contrast Degrees
of P-value

Freedom Wald F Wald F

OVERALL MODEL 4 58649.64 0.0000

MODEL MINUS

INTERCEPT 3 1258.36 0.0000

INTERCEPT 1 135.14 0.0000

HEIGHT 1 712.39 0.0000

AGE 1 162.38 0.0000

FEMALE 1 24.22 0.0000

The test of the overall model is F(3, 31) = 1258.36, p < 0.000. The test statistic is pretty close to the SAS output, and the denominator degrees of freedom match the SAS output. What is going on?

The answer

By default, Stata reports an adjusted Wald F test in the output, while SAS and SUDAAN do not. To have Stata match the results given by SAS and SUDAAN, you can use the nosvyadjust option on the

test command.
(We use the test command with all of the predictor variables in the model
to recreate the test of the overall regression shown at the top of the Stata output.)

svy: regress weight height age female
(running regress on estimation sample)

Survey: Linear regression

Number of strata = 31 Number of obs = 10351
Number of PSUs = 62 Population size = 117157513
Design df = 31
F(3, 29) = 1177.18
Prob > F = 0.0000
R-squared = 0.2827

--
| Linearized
weight | Coef. Std. Err. t P>|t|
-------------+--
height | .7405073 .027744 26.69 0.000 .6839229 .7970917
age | .1484546 .0116501 12.74 0.000 .124694 .1722153
female | -2.898197 .5888597 -4.92 0.000 -4.099184

-1.697209

_cons | -57.6088 4.955696 -11.62 0.000 -67.716 -47.50159

---

test height age female

Adjusted Wald test

(1) height = 0
(2) age = 0
(3) female = 0

F(3, 29) = 1177.18
Prob > F = 0.0000

The output from regress and test match.

test height age female, nosvyadjust

Unadjusted Wald test

(1) height = 0
(2) age = 0
(3) female = 0

F(3, 31) = 1258.36

Prob > F = 0.0000

The output from test, nosvyadjust is different from the above Stata output but match the SAS and SUDAAN output. Alternatively, you could use the adjwaldf and adjwaldp options on the print command in SUDAAN to reproduce the results given by default by Stata.

The "why" and the degrees of freedom

A discussion of the adjusted Wald test is given on page 2184 of the Stata 12 Reference Guide (in the section for the -test- command). This cites the 1990 American Statistician article by Edward Korn and Barry Graubard entitled "Simultaneous testing of regression coefficients with complex survey data: Use of Bonferroni t statistics". Basically, they argue that this test statistic is more appropriate when you have more

than a few terms being
tested simultaneously (in other words, more predictors in the model.)
The test statistic (what the authors call the Wald procedure) has numerator
degrees of freedom a p, the number of predictors (excluding the intercept), and
denominator degrees of freedom # of PSUs - # of strata - p + 1. In the
example above, we have 62 PSUs, 31 strata and 3 predictors. Hence, the
denominator degrees of freedom are calculated as 62 - 31- 3 + 1 = 29. In
SAS and SUDAAN, you see notes indicating that the denominator degrees of freedom
equals 31, which is simply 62 - 31 = 31.

References

Korn, E. and Graubard, B. (1990). Simultaneous testing of regression
coefficients with complex survey data: Use of Bonferroni t
statistics. American Statistician, Vol. 4, No. 4, pages 270-276.

Stata 12 Base Reference Manual. College Station, TX: Stata Press.