

Practical Meta-Analysis Analysis Exercise using SPSS

Start SPSS and open the data file called “D:\DATA\PROBLEM2.SAV. This is an SPSS system file that has been created for this example. It contains 16 records or cases and 7 variables. Each record represents a unique, juvenile delinquency challenge program. The variables are:

StudyID	The unique study identification code
NTx	The treatment group sample size
NCtrl	The control group sample size
ES	The standardized mean difference effect size for the treatment versus control group on a delinquency outcome measure
Type	Type of activities (1=Natural; 2=Contrived; 3=Both)
Physical	Occurs in the wilderness? (1=Yes; 0=No)
Thrust	Is the thrust of the program a challenge program? (1=Yes; 0=No)
Random	Assignment to conditions was random? (1=Yes; 0=No)

Helpful hint. Before we get to far, it is a good idea to change the default output behavior of SPSS when performing the analyses below such that SPSS includes the syntax commands on the output (log) file. To do this, open the options dialog box (Edit, Options). Select the Viewer tab. Click (select) the box next to the line “Display commands in the log.” Click OK.

You can open the data set through the menu (File, Open, Data, etc.) or through syntax commands.

```
GET FILE 'D:\DATA\PROBLEM2.SAV' .
EXECUTE .
```

First, you need calculate any adjustments you wish to make to the effect size. In this case, the small sample size bias adjustment is appropriate and can be calculated using the following SPSS command syntax (type these commands in a “syntax window”, then run):

```
COMPUTE D = (1 - (3 / (4 * (NTX+NCTRL) - 9))) * ES .
EXECUTE .
```

Second, you need to compute the variance (v) and the inverse variance (w):

```
COMPUTE V = ((NTX+NCTRL) / (NTX*NCTRL)) +
              ((D**2) / (2 * (NTX+NCTRL))) .
COMPUTE W = 1/V .
EXECUTE .
```

I have written several SPSS macros that perform meta-analytic analyses based on an effect size and an inverse variance weight. These include the “meanes.sps”, “metaf.sps”, and “metareg.sps” that perform an overall mean effect size, analog-to-the ANOVA moderator analysis, and meta-analytic regression moderator analysis, respectively.

To use one of these macros, you need to first initialize the macro within SPSS using the INCLUDE command. The SPSS command syntax is:

```
INCLUDE 'D:\SPSS\MEANES.SPS' .
```

When you run this command you will see a set of instructions on the output screen. These specify the proper syntax for the macro. For this macro you simply need to specify the variable name for the effect size and the variable name for the inverse variance weight. In our example, these are *d* and *w*. The SPSS command syntax is:

```
MEANES ES = D /W = W .
```

This is instructing MEANES to use “D” as the effect size, and “W” as the weight.

Your output should look as follows:

```
Run MATRIX procedure:
```

```
***** Meta-Analytic Results *****

----- Distribution Description -----
      N      Min ES      Max ES      Wgtd SD
  16.000      -.420      .644      .299

----- Fixed & Random Effects Model -----
      Mean ES      -95%CI      +95%CI      SE      Z      P
Fixed      .1814      .0902      .2726      .0465      3.8999      .0001
Random      .1725      .0115      .3334      .0821      2.0996      .0358

----- Random Effects Variance Component -----
v =      .062702

----- Homogeneity Analysis -----
      Q      df      p
  41.2545      15.0000      .0003

Random effects v estimated via noniterative method of moments.

----- END MATRIX -----
```

Once this macro has been initialized, it can be used repeatedly during a single SPSS session.

The macro METAF (as in meta-analysis F test) performs the analog to the ANOVA. The syntax is similar to the above except that you must specify the name of the variable that indicates the subsets or groups to be compared. To compute separate mean effect size statistics for the random and nonrandom studies and test the significance of this difference, run the SPSS commands:

```
INCLUDE 'D:\SPSS\METAF.SPS' .
METAF ES = D /W = W /GROUP = RANDOM .
```

```
Run MATRIX procedure:
```

```
***** Inverse Variance Weighted Oneway ANOVA *****
```

```

***** Fixed Effects Model via OLS *****

----- Analog ANOVA table (Homogeneity Q) -----
              Q          df          p
Between      8.0862      1.0000      .0045
Within      33.1683     14.0000      .0027
Total       41.2545     15.0000      .0003

----- Q by Group -----
      Group      Q      df      p
.0000    31.2456    9.0000    .0003
1.0000    1.9227    5.0000    .8597

----- Effect Size Results Total -----
      Mean ES      SE      -95%CI      +95%CI      Z      P      N
Total    .1814      .0465      .0902      .2726      3.8999      .0001    16.0000

----- Effect Size Results by Group -----
      Group      Mean ES      SE      -95%CI      +95%CI      Z      P      N
.0000    .2847      .0590      .1690      .4004      4.8239      .0000    10.0000
1.0000    .0120      .0756      -.1361      .1602      .1592      .8735     6.0000

----- END MATRIX -----

```

Note: SPSS cannot handle all three macros within a single SPSS session. As such, to use the METAREG macro after you have already used both the MEANES and METAF macros, you must restart SPSS and only load the METAREG macro. Therefore, restart SPSS (after saving your work, of course) and initialize and run only the METAREG macro for the next exercise.

A weighted multiple regression analysis can be performed using the macro METAREG (as in meta-analysis regression). First open a new data file PROBLEM3.SAV.

```

GET FILE 'D:\DATA\PROBLEM3.SAV' .
EXECUTE .

```

This data file has 39 cases and the following variables

ID	Unique study identification number
Random	Assignment to conditions was random? (1=Yes; 0=No)
TxVar1	Treatment descriptor variable 1
TxVar2	Treatment descriptor variable 2
TxN	Treatment group sample size
CgN	Control group sample size
ES	Effect size with small sample size correction bias applied
V	Variance of the effect size
W	Inverse variance weight

Next, initialize the METAREG macro with the following command:

```
INCLUDE 'D:\SPSS\METAREG.SPS' .
```

Next, run the macro specifying the effect size, inverse variance weight and the list of independent variables. The following command uses *random* and *thrust* as the independent variables:

```
METAREG ES = D /W = W /IVS = RANDOM TXVAR1 .
```

Additional independent variables can be added. For example:

```
METAREG ES = D /W = W /IVS = RANDOM TXVAR1 TXVAR2 .
```

METAF and METAREG can perform mixed effects (also called random effects) models. Both of these macros accept the optional statement /MODEL=, accepting the options FE for fixed effect (the default), MM for method of moments estimated maximum likelihood, ML for full-information maximum likelihood, and REML for restricted information maximum likelihood. ML is a good choice if you don't understand the differences.

```
METAREG ES=D /W=W /IVS = RANDOM TXVAR1 TXVAR2 /MODEL=ML .
```

Congratulations! You have just performed a very complex series of meta-analytic analyses. Most all analyses in meta-analysis are of one of the above forms. Compare the results to those of the fixed effects regression output.

Extra Credit Assignment (a perfect way to get an A)!!

Perform the regression analysis using SPSS's built-in regression module and compare output with the fixed effects regression output obtained from METAREG.SPS.

What's different? What's the same?

Can't Get Enough Number Crunching?

For those of you who are fast at this number crunching stuff, play around with the data file called SEXOFFENDER.SAV. This data file has odds-ratio type effect sizes. Selected variables include:

RANDOM	Randomized design (1=yes; 0=no)
SOURCE	Source of recidivism data (1=self-report; 0=other)
INSTITUT	Treatment provided in an institution
TX_TYPE	Treatment type
JOURNAL	Journal publication (1=yes; 0=no)
CJ	Treatment provided by a criminal justice agency (1=yes; 0=no)
ODDSRATI	Odds-ratio
LGORES	Logged odds-ratio (what you analyze!)

VLGORES Variance of the logged odds-ratio
WLGORES Inverse variance weight

Use the LGORES as the effect size variable. Experiment with the optional statement /PRINT=EXP to have the results reported as odds-ratios rather than as logged odds-ratios.