Extension of SPSS for Windows Meta-Analysis Macros (D. Wilson, 2001)

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Goal and Overview

The goal of the extension was to make the useful Anova and Regression macros by David Wilson (see Lipsey & Wilson, 2001) somewhat more flexible with regard to a number of data handling and analysis strategies (e.g., outlier exclusion etc.). The extension has proven quite helpful in one recent meta-analytic project involving a larger range of moderators, which is why I make it publicly available to other researchers intending to conduct their meta-analysis in SPSS.

The computational "core" of the macros by D. Wilson has been left untouched. However, I added three basic features that should make the use of both macros easier and less time-consuming, especially in cases involving a larger number of moderators or when the researcher is interested in conducting sensitivity analyses to check how certain variations in the meta-analytic procedure (e.g., fixed vs. random effects, outlier inclusion vs. exclusion) affect the outcome of the meta-analysis.

The basic idea of the package is as follows: The researcher first compiles a "list" of moderator analyses he or she wishes to conduct in separate syntax files ("Moderator Analyses.sps" & "Regression Analyses"). These are then called upon successively by an easy managable "Steering File" specifying all the necessary parameters to control the analysis (e.g., possible outlier threshold, type of model, minimal number of categories per group, see below). By starting the steering file, results are then computed in one "run" of the moderator analysis. Depending on the amount of computations this may give you enough time to get yourself a cup of coffee in the interim. Furthermore, results of all analyses will be summarized in .sav and .xls output files written into a folder specified by yourself. By simply clicking on the file, the .xls file can then be conveniently fed into an Excel-sheet designed to present the results in pre-arranged tables and graphs ("Tables & Graphs_ANOVA and Regression.xls") ready to be exported into, for instance, Word.

Quick Guide

I made numerous comments along the syntax files to support you in editing the necessary things. Also, the whole package can be run immediately with example syntax and data to illustrate its use. Here is a quick guide on how to connect the present syntax to your datafile and start the moderator analyses.

1. Open the steering file (Steering_File.sps). Specify the path of your desired output folder and the path for the "calculations"-folder (containing all computation files).

```
define !outputfolder ()'C:\Meta-Analysis\Analysis_1\'!enddefine.
define !calcfolder ()'C:\Meta-Analysis\calculations\'!enddefine.
```

2. As with the previous version, the macro takes the effect size as is, therefore, any desired transformations, e.g., Hedges' small sample size bias correction, should already be applied. Also, any averaging or (random) selection of effects within studies in order to arrive at one effect size per study (independence issue) must be done before running the macro commands. Your initial data file should therefore contain (a) a Study ID, (b) your

effect size variable, (c) a weight variable (e.g., inverse variance weights), (d) the number of N per study, and (e) all categorical and continuous variables of interest. The name of the data source file is specified in the following line of the steering file (the default for the example is “meta_data.sav”):

get file = 'C:\Meta-Analysis\meta_data.sav'.

3. Specify the moderators you wish to analyze. To this end, open the files “Anova_Analyses.sps” and “Regression_Analyses.sps” from the calculations folder. For the categorical moderators, simply enter the variable name of the moderator in the following line in the file “Anova_Analyses.sps” (e.g., instead of “mod1”):

rename var (mod1 = groupf).

In addition, you can give the moderator analysis a proper title in the jobti subcommand (default “Moderator_1”):

METAF number=1.00 / jobti=Moderator_1 / ES = !esM / W = !wM / GROUP = groupf / model = !modelM / failsafe=!failsafeM / outly=!outlyM / bygroup=!bygroupM / kselmin=!kselminM.

In the example, there are 4 moderators to be analyzed consecutively. You can extend the syntax to as many moderators as you wish by copying and pasting the syntax with the necessary adjustments. Only one moderator can be specified in each section. Also, make sure your moderator variables contain SPSS Value Lables since these will conveniently be used by the macro.

Specify the continuous moderators in a similar way (in the file “Regression_Analyses.sps”) by entering the variable name in the ivs subcommand of the macro:

metareg number=1.00/ jobti=Cont_Moderator_1/ es =!esM/ W =!wM/ ivs =Modr1/ model = !modelM/ outly=!outlyM.

Again, you can add a title (default here: “Cont_Moderator_1”). As with the original macro, you can also enter multiple predictors in one equation.

4. Now go back to the steering file and specify the overarching parameters for the run of the moderator analysis. You have the following options:

define !modelM () MM !enddefine.
define !outlyM () 3 !enddefine.
define !bygroupM () 0 !enddefine.
define !kselminM () 5 !enddefine.
define !failsafeM () 0.20 !enddefine.

!modelM: choose your meta-analytic model (FE = Fixed Effects; MM = Random Effects, Methods of Moments Estimation; ML = Random Effects, Maximum Likelihood Estimation; REML = Random, Restricted Maximum Likelihood; see Lipsey & Wilson, 2001, for more details).

!outlyM: Specify outlier threshold *t* (exludes effect sizes further than ± *t* SD units away from mean effect size). Put "999" if you do not want outlier exclusion. Note that the present version of the macro does not take care of outliers in the independent variables.

!bygroupM: Determine how outliers should be determined: (a) around the grand mean of the sample (bygroupM=0) or (b) around each specific moderator group mean (bygroupM=1). This parameter applies only to categorical moderator analysis.

!kselminM: Specify the minimal number x of study effect sizes for a given moderator category to be included in analyses (i.e., this drops very small categories with less than x data points; default = 3). This applies only to categorical moderator analysis. Note that in the macro, this parameter is applied after the outlier exclusion feature.

!failsafeM: Enter the effect size for the fail-safe statistic based on Orwin's (1983) variant of the Rosenthal (1979) formula. The macro then computes how many null findings would be needed to reduce the effect to the specified value (e.g., to a small effect of $d = .20$). Note that since the formula is $k_{failsafe} = k \times ((ES/!failsafe)-1)$, a value of zero cannot be entered. Note also that this statistic has not been without criticism and that some meta-analysts warned against using it. Simply disregard this setting and the respective output if you do not want to apply this statistic.

Note: The settings specified in the steering file uniformly apply to all analyses in the run, unless you make specific changes to override these settings in individual command lines in the Anova_Analyses.sps or Regression_Analyses.sps files.

5. Now you are all set. All that is left to do is to mark the whole steering file (CTRL+A) and run it (CTRL+R). If all things were specified correctly, SPSS will conduct the whole moderator analysis in one run.

6. Viewing the output can be done in three ways. First, the SPSS output file contains some but not all relevant statistics but with many moderators things quickly get messy. Second, view the spss summary files that have been created by the macro (outputfolder+jobtitle+anova.sav; outputfolder+jobtitle+regression.sav). Third—and this is what I strongly recommend—use Excel to visualize and further digest your results. To do this, simply klick on the two .xls files in the outputfolder that end with "allresults0.xls". In the next step, open the "Tables & Graphs_ANOVA and Regression.xls" viewing file (do not open all three .xls files at once). Excel should now automatically update results from the two output .xls files into the viewing file. Now you can conveniently view an ANOVA and a regression summary table containing the most relevant statistics which can also easily be copied into Word. An additional table "Figure Categorical Moderators" provides a graphical display of categorical moderator mean estimates and confidence intervals, as well as a graph you can use as a forest plot (needs to be rotated in Word).

Some Further Notes (of Caution)

1) The Macro has only been tested in SPSS 16. However, since I used only standard commands it should be compatible with other versions of SPSS that include the SPSS MACRO framework as well. For the macro to run properly, you also need to have a license for the Tables Module from SPSS (typically included).
2) Do not edit the Macros themselves unless you are sure what you are doing.

3) Due to outlier exclusion and the kselmin feature, it can happen that, for a given categorical variable, only 1 moderator group remains and, hence, a moderator analysis does not make sense. Whereas the initial macro caused the processor to terminate, I made the macro more stable by adding a pseudo-group, that is, a copy of the one included group. The result from this analysis is later deleted again when exporting the data.
4) As stated above, you should make sure that only one study effect size (per moderator category) is included in the analysis. In the case of averaging within studies (across moderator categories) this can result in different values on the effect size variable for different moderators due to missing data or the way moderators vary. There are two solutions to nevertheless make us of this macro. One is to use different aggregated effect size variables for different moderators beforehand and to specify each variable in the specific section of the moderator analysis (rather than to use one dependent variable across all analyses). The second strategy I recommend is to use a data source file containing the still non-aggregated data and to do the aggregation before each specific moderator analysis. For instance, you can insert the highlighted command to aggregate within studies across values of the moderator (renamed into groupf) before submitting the data to analysis.

   ```
   rename var (mod1 = groupf).
   AGGREGATE /OUTFILE=*/BREAK id groupf /es = mean(es) /  w = mean(w) / Ntot = max(ntot).
   SAVE OUTFILE = !calcfolder+'tempf.sav'.
   METAF …
   ```

5) The Extension makes a lot of use of saving and matching interim files (sorry I could not find a more elegant way). All these operations take place in the “calculations” folder. These computation files are overwritten in each new run of the analysis (whereas results files are saved to the specified output folder). Please make sure all the files in the calculation folder remain there as is, otherwise the macro will not work. Also, at least on my system, any SPSS help files need to be closed when running the macro. Otherwise SPSS may produce an error in saving the data and write it to a newly named file so that the connection among files is lost.
6) I had no problems in running both the ANOVA and regression macro in one run sequentially. However, if you also include David Wilson’s overall analysis macro (MEANES – not extended upon here), the two present macros do not function any more. So it is best to conduct the overall analysis and the moderator analyses in separate runs of SPSS.
7) It is also technically possible to start several runs of the analyses sequentially from a steering file (e.g., when comparing fixed versus random estimation in a sensitivity analysis). Make sure you use different output folders for different runs since otherwise results will get overwritten. Nevertheless, I recommend doing one run at a time and specifying beforehand a limited number of analyses based on your rationale for analysis.
8) In most cases of incidental breakdown of the SPSS processor (I hardly encountered any in the late stage of development), the best solution is always to try to locate the source of error and start SPSS anew.

I am happy about any suggestions or comments on these extensions and hope that they will be useful for meta-analysts using SPSS.