MVRRC User's Guide

1. Description

The program performs multivariate range restriction correction, using the Lawley (1943) correction formulae. It applies to the following situation. Suppose one has data on the variances and covariances of p variables as computed on the complete sample. These p variables are henceforth referred to as the non-restricted or selection variables and the corresponding variance/covariance matrix (of order $p \times p$) is denoted as ${}_p\mathbf{V}_p$. Suppose furthermore that $n-p$ additional variables are measured in a subset of the initial complete sample, where the subset is selected on the basis of the scores on the selection variables. Denoting the variance/covariance matrix of the total set of n variables as computed for the selected subset sample as ${}_n\mathbf{W}^R{}_n$, it is now obvious that the variances and covariances related to the $n-p$ non-selection variables will be deflated as compared to the corresponding values in the total initial sample. If the total total sample would have been screened on all n variables, the non-range restricted variance/covariance matrix ${}_n\mathbf{W}_n$, instead of the actually observed matrix ${}_n\mathbf{W}^R{}_n$, would have been obtained.

Given p, n, ${}_n\mathbf{W}^R{}_n$ and ${}_p\mathbf{V}_p$, the program computes the non-range restricted variance/covariance matrix ${}_n\mathbf{W}_n$ according to the results implied by Lawley's (1943) theorem. The variances of the $n-p$ non-selection variables and the covariances of these variables with the p selection variables, as obtained in this non-range restricted variance/covariance matrix ${}_n\mathbf{W}_n$, then provide an estimate of the corresponding variances and covariances in the total population.

If required, the program also corrects the above obtained, range restriction corrected correlations for imperfect reliability of the criterion measures. This produces the range restriction corrected complete correlation matrix with attenuation correction for the criterion unreliabilities.

The program source, called `mvrrc.f`, is on the `fliev` directory. It can handle up to 50 variables (i.e., $n \leq 50$); but the printout is at present limited to 6 variables. To execute the program, a personal computer, running under Microsoft Windows 95, 98, XP, NT or 2000, is required.

2. Input

- # 1: **NP, NN, IREL**
  Three integer values, separated by a blank, with
  - **NP**: the number of selection variables.
  - **NN**: the total number of variables (NN $\leq$ 50).

  - **IREL**: if IREL = 1, then the correction for attenuation will be performed to account for unreliability in the criterion (i.e., non-selection) variables. If IREL = 1, no correction for attenuation is performed.

- # 2 and following: **W^R(I,J)** with I = 1, ..., NN and J = 1, ..., NN
  Row by row, NN *real* values, separated by a blank. W^R specifies the range restricted variance/covariance matrix of all NN variables in the selected sample. The first NP rows and columns of the matrix relate to the NP selection variables, in the same order as they appear in the V matrix.

- # 3 and following: **V(I,J)** with I = 1, ..., NP and J = 1, ..., NP
  Row by row, NP *real* values, separated by a blank. V specifies the non-range restricted variance/covariance matrix of the NP selection variables in the complete sample.

- # 4 (only if IREL = 1): the **unrestricted** reliabilities of the criterion (non-selection) variables.

3. Sample Input File

Important: in preparing the input file, use a simple text editor such as Notepad, Wordpad or any other standard ASCII producing editor. DO NOT USE TEXT PROCESSING PROGRAMS SUCH AS MS-WORD or WORDPERFECT. Also, when saving the input file in Notepad, use the option "All Files" in the "Save as type" box. When saving in Wordpad, use the "Text Document-MS-DOS Format" option in the "Save as type" box, and be **aware that Wordpad has the nasty habit of adding the extension .txt to the file name that you specify**. Thus, with Wordpad, if you specify the name of the input file as "MINPUT", the file will in fact be saved as "MINPUT.TXT"; and this is the name that you have to use in the command to run the present program.

Here are two sample input file for the `mvrrc` program.

```
 2  4  1
 25.3110   -1.6725    13.0447    5.0939
 -1.6725   17.7073   -10.7549    9.4680
 13.0477  -10.7549  1372.0356   52.7834
  5.0939    9.4680    52.7834  351.5625
36.4816   6.1608
 6.1608  16.6464
0.81  0.64

 2  4  0
 9.0000    0.9000    7.3500    7.3500
```

```
  0.9000     9.0000     3.1500    -4.2000
  7.3500     3.1500    49.0000    19.6000
  7.3500    -4.2000    19.6000    49.0000
 100.0000   75.0000
  75.0000  100.0000
```

4. Running the Program

Suppose you copied the executable source of the program to the `d:ssel` directory on your machine. In that case, the input file must also be saved in the `d:ssel` directory. Next, to run the program, you have to open an MS-DOS Command window. The way to do this varies from one operating system (i.e., Windows 95, 98, NT a.s.o.) to the other, and you should use your local "HELP" button when in doubt about this feature.

In the MS-DOS Command window you type `d:`, followed by RETURN or ENTER, and your computer will return the `D:\>` command prompt. Next, you type `cd ssel` after the `D:\>` command prompt, again followed by RETURN or ENTER, and your computer will respond with the `D:\ssel>` command prompt. Now, you can execute the program by typing `mvrrc < minput > moutput` where "minput" is the name of the input file and "moutput" is the name of the output file. At the end of the execution, the PC will return the command prompt `D:\ssel>`. You can then inspect the output by editing the output file with either Notepad, Wordpad or any other simple editor program.

5. Sample Output

Only the output corresponding to the first input file is given.

```
Program execution starts on 25/ 2/2004 at 14:16:22

                          ++++++++++++
                          +  MVRRC   +
                          ++++++++++++

Multivariate range restriction correction using the Lawley
(1943) correction formulae.

Program written by Anonymous

The program uses routines from the Slatec library (see
http://www.geocities.com/Athens/Olympus/5564).
At present, the program is limited to a total of 50
variables.
```

```
PROBLEM SPECIFICATION

Number of non-restricted variables:  2
Total number of variables:  4

Complete range restricted var/cov matrix
  1  25.3110  -1.6725  13.0447   5.0939
  2  -1.6725  17.7073 -10.7549   9.4680
  3  13.0477 -10.75491372.0356  52.7834
  4   5.0939   9.4680  52.7834 351.5625

Var/cov matrix of the non-restricted variables
  1  36.4816   6.1608
  2   6.1608  16.6464

Reliabilities criterion variables
        0.810     0.640

PROGRAM OUTPUT

Range restriction corrected complete variance/covariance matrix
  1  36.4816   6.1608  13.9829  12.1178
  2   6.1608  16.6464  -6.4124  10.7418
  3  13.9829  -6.41241370.0429  55.4263
  4  12.1178  10.7418  55.4263 353.9444

Range restriction corrected complete correlation matrix
  1   1.0000   0.2500   0.0625   0.1066
  2   0.2500   1.0000  -0.0425   0.1399
  3   0.0625  -0.0425   1.0000   0.0796
  4   0.1066   0.1399   0.0796   1.0000

Range restriction corrected complete correlation matrix with
attenuation correction for unreliability in the criterion measures
  1   1.0000   0.2500   0.0695   0.1333
  2   0.2500   1.0000  -0.0472   0.1749
  3   0.0695  -0.0472   1.0000   0.1105
  4   0.1333   0.1749   0.1105   1.0000
```

```
CPU TIME IN SECONDS          0.00
```

6. Description of Output

The output is self-explanatory.

7. Dependencies and Acknowledgment

The present program is written in Fortran77. It was compiled to an executable code for WIN32 PCs (i.e., Windows 95/98/ME/XP or NT/2000) with the GNU Fortran G77 compiler (cf. `http://www.geocities.com/Athens/Olympus/5564/`). The program uses routines from the SLATEC program library (cf. Fong et a., 1993; `http://www.geocities.com/Athens/Olympus/5564/`).

When the user reports results obtained by the present program, reference should be made to Anonymous (2004).

8. References

Anonymous. (2004). MVRRC User's Guide.

Fong, K. W., Jefferson, T. H., Suyehiro, & Walton, L. (1993). Guide to the SLATEC common mathematical library (`http://www.netlib.org/slatec/`).

Lawley, D. N. (1943). A note on Karl Pearson's selection formulae. *Proceedings of the Royal Society of Edinburgh*, *62* (Section A, pt.1), 28–30.