

Supplement 7.7. SAS computations: Using a statistical model having as many slopes as sites with observations in multiple years

N. Scott Urquhart, Retired, Department of Statistics, Colorado State University, Fort Collins, Colorado, USA.

This supplement provides SAS computation code relevant to Equation (7.12) and used for Chapter 7 examples. See Supplement 7.1 for additional details.

```

/*****
/*
/* N.S. Urquhart; August 28, 2009
/*
/*This program estimates the mixed linear model regression and
/*obtains estimates of components of variance. Output is tables
/*consisting of these estimates as well as other data parameters of
/*interest.
/* This program estimates one overall trend, but incorporates
/*a variance between trends at different sites.
/*****/

```

```

LIBNAME ODFW2008 'D:\SAS\ODFW2008';
RUN;

```

```

PROC IMPORT OUT= ODFW2008.DATA
FILE= "D:\SAS\ODFW2008\OrPlan_98_08_Reach_Reduced_UTM.xls"
DBMS=EXCEL REPLACE;
SHEET="OP_Habitat_ReachReduced_98_08";
GETNAMES=YES;
MIXED=NO;
SCANTEXT=YES;
USEDATE=YES;
SCANTIME=YES;
RUN;

```

```

PROC sort DATA=ODFW2008.DATA out=ODFW2008.DATA;
by GCG; RUN;

```

```

DATA ODFW2008.DATA;
set ODFW2008.DATA;
if GCG in('1-NC','2-MC','3-MS','5-SC','4-UMP');
TIME = YEAR - 1997;
RUN;

```

```

DATA ODFW2008.DATA;
ATTRIB GCG LENGTH=$5 FORMAT=$char5.;
Set ODFW2008.DATA;
RUN;

```

```

PROC contents DATA=ODFW2008.DATA;
RUN;

```

```

/*
Create a data set that contains each of the variables as an entry.
For use in macro
*/

```

```

DATA ODFW2008.dependent_vars;
input index varnames $16.;
cards;
1 PRICHNLL
2 SECCHNLL
3 PRICHNAREA

```

```

4 SECCHNAREA
5 PCTSCCHNLA
6 GRADIENT
7 VWIRCH
8 WIDTH
9 ACW
10 ACH
11 NOPOOLS
12 PCTPOOLS
13 PCTSCPPOOL
14 PCTSWPOOL
15 SCRPOOLD
16 RIFFLEDEP
17 LRGBLDR
18 PCTSNDR
19 PCTGRAVEL
20 PCTBEDROCK
21 POOL1P_KM
22 CWPOOL
23 PCTSHADE
24 PCTEROSION
25 PCTUNDERC
26 LWDPIECE1
27 LWDVOL1
28 KEYLWD1
29 RESIDPD
30 LRGBLDR1
31 CON_20PLUS
32 CON_36PLUS
33 BVR_DAM
;
RUN;

DATA;
current=time();
put current=time.;
RUN;

%macro odfw;
  %do i = 1 %to 33;

*brings in each of the 33 variables, one at a time;

  DATA _null_;
  set ODFW2008.dependent_vars;
  if index = &i then
    call symput("curr_var",varnames);
  RUN;

*the next two mixed procedures are identical in the;
*analysis. The first calls the 5 separate regions;
*by the line "BY GCG". The second is for all regions. ;

  TITLE "The current variable is &curr_var";
  PROC mixed DATA=ODFW2008.DATA method=type3 noclprint;

```

```

class ID_NUM YEAR;
model &curr_var = TIME/c1 covb s;
random ID_NUM YEAR ID_NUM*TIME;
BY GCG;
ODS OUTPUT covparms=ODFW2008.CP SolutionF=ODFW2008.Slope NObs=ODFW2008.NObs1;
RUN;

TITLE2 "ALL REGIONS";
PROC mixed DATA=ODFW2008.DATA method=type3 noclprint;
CLASS ID_NUM YEAR;
MODEL &curr_var = TIME/c1 covb s;
RANDOM ID_NUM YEAR ID_NUM*TIME;
ods output covparms=ODFW2008.CP2 SolutionF=ODFW2008.Slope2 NObs=ODFW2008.NObs2;
RUN;
TITLE2 " ";

DATA;
current=time();
put current=time.;
RUN;

*Places the label 'all' in the region column;

DATA ODFW2008.CP2;
GCG="ALL";
SET ODFW2008.CP2;
RUN;

*merging the parameter estimates into one temporary data set;

DATA ODFW2008.VarComps_temp;
Variable="&curr_var";
set ODFW2008.CP ODFW2008.CP2;
RUN;

%If &i=1 %then %Do;
DATA ODFW2008.VarComps;
Set ODFW2008.VarComps_temp;
%End;

%Else %Do;
DATA ODFW2008.VarComps;
set ODFW2008.VarComps ODFW2008.VarComps_temp;
%End; RUN;

DATA ODFW2008.Slope2;
GCG="ALL";
SET ODFW2008.Slope2;
RUN;

*merging the slope estimates into one temporary data set;

DATA ODFW2008.Slopes_temp;
Variable="&curr_var";
set ODFW2008.Slope ODFW2008.Slope2;

```

```

RUN;

%If &i=1 %then %Do;
    DATA ODFW2008.SlopesOut;
        Set ODFW2008.Slopes_temp;
    %End;

%Else %Do;
DATA ODFW2008.SlopesOut;
    set ODFW2008.SlopesOut ODFW2008.Slopes_temp;
%End; RUN;

DATA ODFW2008.NObs2;
    GCG="ALL ";
    SET ODFW2008.NOBS2;
    RUN;

DATA ODFW2008.NObs_temp;
    Variable="&curr_var";
    set ODFW2008.NObs1 ODFW2008.NObs2;
    RUN;

%If &i=1 %then %Do;
    DATA ODFW2008.NObsOut;
        Set ODFW2008.NObs_temp;
    %End;

%Else %Do;
DATA ODFW2008.NObsOut;
    set ODFW2008.NObsOut ODFW2008.NObs_temp;
%End; RUN;

%end;
%mend odfw;
RUN;

%odfw; RUN;

    *end of macro;

/* mean and variance of full DATA */

PROC means DATA=ODFW2008.DATA var;
TITLE "OVERALL SUMMARY";
var PRICHNLL SECCHNLL PRICHNAREA SECCHNAREA PCTSCCHNLA GRADIENT VWIRCH WIDTH ACW ACH
    NOPOOLS PCTPOOLS PCTSCPOOL PCTSWPOOL SCRPOOLD RIFFLEDEP LRGBLDR PCTSNDOR
    PCTGRAVEL PCTBEDROCK POOL1P_KM CWPOOL PCTSHADE PCTEROSION PCTUNDERC LWDPIECE1
    LWDVOL1 KEYLWD1 RESIDPD LRGBLDR1 CON_20PLUS CON_36PLUS BVR_DAM;
RUN;

/* mean and variance by region */

PROC means DATA=ODFW2008.DATA var;
TITLE "REGIONAL SUMMARIES";
var PRICHNLL SECCHNLL PRICHNAREA SECCHNAREA PCTSCCHNLA GRADIENT VWIRCH WIDTH ACW ACH
    NOPOOLS PCTPOOLS PCTSCPOOL PCTSWPOOL SCRPOOLD RIFFLEDEP LRGBLDR PCTSNDOR

```

```
PCTGRAVEL PCTBEDROCK POOL1P_KM CWPOOL PCTSHADE PCTEROSION PCTUNDERC LWDPIECE1  
LWDVOL1 KEYLWD1 RESIDPD LRGBLDR1 CON_20PLUS CON_36PLUS BVR_DAM;
```

```
by GCG;  
RUN;
```

```
PROC print DATA=ODFW2008.varcomps;  
    TITLE "ESTIMATES OF VARIANCE COMPONENTS";  
    RUN;
```

```
PROC print DATA=ODFW2008.SlopesOut;  
    TITLE "ESTIMATES OF SLOPES AND ALLIED QUANTITIES";  
    RUN;
```

```
/* The following four data steps extract only the desired information  
from the macro data sets and places it into one final data set  
in table 4. */
```

```
DATA ODFW2008.Table1;  
    SET ODFW2008.Varcomps;  
    IF CovParm="ID_NUM" THEN DO;  
        Site=Estimate; RETAIN Site;  
    END;  
    ELSE IF CovParm="YEAR" THEN DO;  
        Year=Estimate; RETAIN Year;  
    END;  
    ELSE IF CovParm="TIME*ID_NUM" THEN DO;  
        YearSlope=Estimate; RETAIN YearSlope;  
    END;  
    ELSE IF CovParm="Residual" THEN DO;  
        Residual=Estimate; SiteRes=Site+Residual;  
        OUTPUT;  
        End;  
    Drop CovParm Estimate;  
    RUN;
```

```
DATA ODFW2008.Table2;  
    SET ODFW2008.SlopesOut;  
    IF Effect="TIME" THEN DO;  
        Slope=Estimate; KEEP Variable GCG Slope;  
        OUTPUT;  
    END;  
    ELSE PUT;  
    RUN;
```

```
DATA ODFW2008.Table3;  
    SET ODFW2008.NObsOut;  
    IF Label="Number of Observations Read" THEN DO;  
        KEEP Variable GCG NObsRead NObsUsed;  
        OUTPUT;  
    END;  
    ELSE PUT;  
    RUN;
```

```
DATA ODFW2008.Table4;
```

```
MERGE ODFW2008.Table3 ODFW2008.Table2 ODFW2008.Table1;  
RUN;
```