Chapter 2
Structural Equation Modeling
Merle Canfield

The next three computer runs demonstrate the use of multiple regression in decomposing variance.

LSQREG2.SPS

```
set printer=off.
set eject on.
set echo on.
set screen=off.
set length=59.
translate from 'aftrel.dbf'/type=db4/
keep =
ENJOY    FGOOD    WORTH    FEARFUL  ANGRY    TENSE    SHY
SAD      BORED    FUN      WORRIED  SORRY    OUTGOING  COPERTIV
SUSPICIS  SATISFID  CHARM    TOUCHED
PEOPLE   DISAGREE  SIXSENSE  HCONFLIC  ARRANGE   INCLUDED  GENTLE
LIKEME   OUTSELF   ALONG    CONFRONT  RESOLVED  FRCONFLT
FRFEE    FRSUPP   FRPROD   FRLEIS   TTALK.
MISSING VALUES enjoy to ttalk (9).
compute shy=ln(shy).
compute bored=ln(bored).
compute sorry=ln(sorry).
compute suspicis=ln(suspicis).
REGRESSION
  DESCRIPTIVES=MEAN STDDEV CORR N
  /variables = fgood worth angry arrange copertiv outgoing
  /statistics = r coeff anova outs zpp cha
  /DEPENDENT=angry
  /method=enter arrange copertiv
  /method=enter outgoing.
finish.
```

Notice the two variables of ARRANGE and COPERTIV are forced to enter the equation first (/method=enter ARRANGE COPERTIV) and then the variable OUTGOING is entered (/method=enter OUTGOING). Partial output follows:

```
Equation Number 1    Dependent Variable..   FGOOD
Beginning Block Number  1.  Method:  Enter       ARRANGE   COPERTIV


Variable(s) Entered on Step Number
   1..     COPERTIV
   2..     ARRANGE


Multiple R            .60306
```

```
R Square              .36368          R Square Change     .36368
Adjusted R Square    .34985          F Change          26.29122
Standard Error      1.46552          Signif F Change     .0000

Equation Number 1    Dependent Variable..   FGOOD
Beginning Block Number  2.  Method:  Enter      OUTGOING

Variable(s) Entered on Step Number
   3..     OUTGOING
Multiple R           .67478
R Square              .45533          R Square Change     .09164
Adjusted R Square    .43737          F Change          15.31104
Standard Error      1.36331          Signif F Change     .0002
```

It is the R Square Change of the last step that is of interest. Note that R Square Change was .09 (that means that OUTGOING accounts for 9% of the variance of FGOOD that is not accounted for by ARRANGE and COPERTIV combined). The next jobstream will test the amount of variance that ARRANGE accounts for in FGOOD beyond OUTGOING and COPERTIV.

Part of LSQREG2.SPS revised

```
REGRESSION
  DESCRIPTIVES=MEAN STDDEV CORR N
  /variables = fgood worth angry arrange copertiv outgoing
  /statistics = r coeff anova outs zpp cha
  /DEPENDENT=angry
  /method=enter outgoing copertiv
  /method=enter arrange.
finish.
```

```
equation Number 1    Dependent Variable..   FGOOD
Beginning Block Number  1.  Method:  Enter      OUTGOING COPERTIV
Variable(s) Entered on Step Number
   1..     OUTGOING
   2..     COPERTIV

Multiple R           .64035
R Square              .41005          R Square Change     .41005
Adjusted R Square    .39722          F Change          31.97260
Standard Error      1.41112          Signif F Change     .0000
```

```
Equation Number 1     Dependent Variable..   FGOOD
Beginning Block Number  2.  Method:  Enter       ARRANGE
Variable(s) Entered on Step Number
   3..     ARRANGE

Multiple R            .67478
R Square               .45533          R Square Change     .04528
Adjusted R Square     .43737           F Change           7.56482
Standard Error       1.36331           Signif F Change     .0072
```

Note in the R Square Change of the last step that ARRANGE account for 5% (rounded and converted from .04528) of the variance of FGOOD beyond OUTGOING and COPERTIV. The next partial jobstream computes the amount of variance accounted for by COPERTIV in FGOOD beyond that of OUTGOING and ARRANGE.

Part of LSQREG2.SPS revised

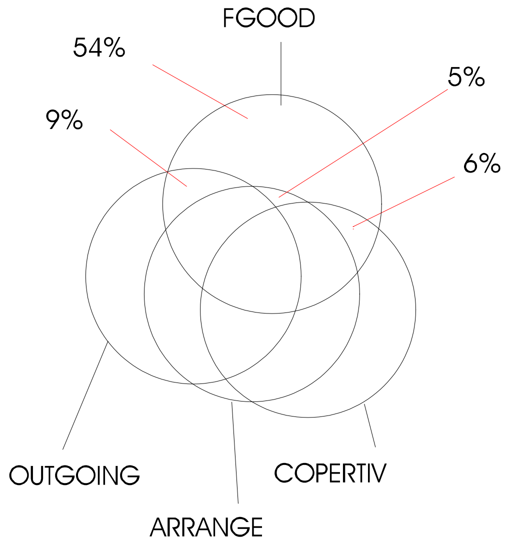
```
REGRESSION
  DESCRIPTIVES=MEAN STDDEV CORR N
  /variables = fgood worth angry arrange copertiv outgoing
  /statistics = r coeff anova outs zpp cha
  /DEPENDENT=angry
  /method=enter outgoing arrange
  /method=enter copertiv.
finish.
```

```
Equation Number 1     Dependent Variable..   FGOOD
Beginning Block Number  1.  Method:  Enter       OUTGOING ARRANGE
Variable(s) Entered on Step Number
   1..     OUTGOING
   2..     ARRANGE

Multiple R            .62595
R Square               .39182          R Square Change     .39182
Adjusted R Square     .37860           F Change           29.63507
Standard Error       1.43276           Signif F Change     .0000

Equation Number 1     Dependent Variable..   FGOOD
Beginning Block Number  2.  Method:  Enter       COPERTIV
Variable(s) Entered on Step Number
   3..     COPERTIV
```

Multiple R	.67478		
R Square	.45533	R Square Change	.06351
Adjusted R Square	.43737	F Change	10.61100
Standard Error	1.36331	Signif F Change	.0016

Note that the R Square Change was .06351 (indicating 6% change) when COPERTIV was entered last. This indicates that COPERTIV accounted for 6% of the variance of FGOOD beyond that of OUTGOING and ARRANGE.

The above data is expressed in the following Venn diagrams.



R SQUARE = .46

CHANGE WITH OUTGOING = 9%
p=0002 % VAR WITH Y = 29

CHANGE WITH ARRANGE = 5%
p=.007 % VAR WITH Y = 25

CHANGE WITH COPERTIV = 6%
p=.002 % VAR WITH Y = 20

(COMPUTED BY CHANGING LSQREG2.SPS)

Comment [COMMENT1]: lsqreg2.cdr

In the next three jobstreams WORTH will be considered as the dependent variable and the same three variables of OUTGOING, ARRANGE, and COPERTIV will once again be treated as independent variables.

Part of LSQREG2.SPS revised

```
REGRESSION
  DESCRIPTIVES=MEAN STDDEV CORR N
  /variables = fgood worth angry arrange copertiv outgoing
  /statistics = r coeff anova outs zpp cha
  /DEPENDENT=angry
  /method=enter arrange copertiv
  /method=enter outgoing.
finish.
```

```
Equation Number 1    Dependent Variable..   WORTH
Beginning Block Number  1.  Method:  Enter      ARRANGE  COPERTIV
Variable(s) Entered on Step Number
   1..    COPERTIV
   2..    ARRANGE
Multiple R           .48775
R Square             .23790          R Square Change    .23790
Adjusted R Square    .22058          F Change         13.73533
Standard Error      1.83878          Signif F Change    .0000

Equation Number 1    Dependent Variable..   WORTH
Beginning Block Number  2.  Method:  Enter      OUTGOING
Variable(s) Entered on Step Number
   3..    OUTGOING
Multiple R           .55210
R Square             .30482          R Square Change    .06692
Adjusted R Square    .28084          F Change          8.37421
Standard Error      1.76626          Signif F Change    .0048
```

Part of LSQREG2.SPS revised

```
REGRESSION
  DESCRIPTIVES=MEAN STDDEV CORR N
  /variables = fgood worth angry arrange copertiv outgoing
  /statistics = r coeff anova outs zpp cha
  /DEPENDENT=angry
  /method=enter copertiv outgoing
  /method=enter arrange.
finish.
```

```
Equation Number 1    Dependent Variable..   WORTH
Beginning Block Number  1.  Method:  Enter      COPERTIV OUTGOING
Variable(s) Entered on Step Number
   1..    OUTGOING
   2..    COPERTIV
Multiple R           .52735
R Square             .27810          R Square Change    .27810
```

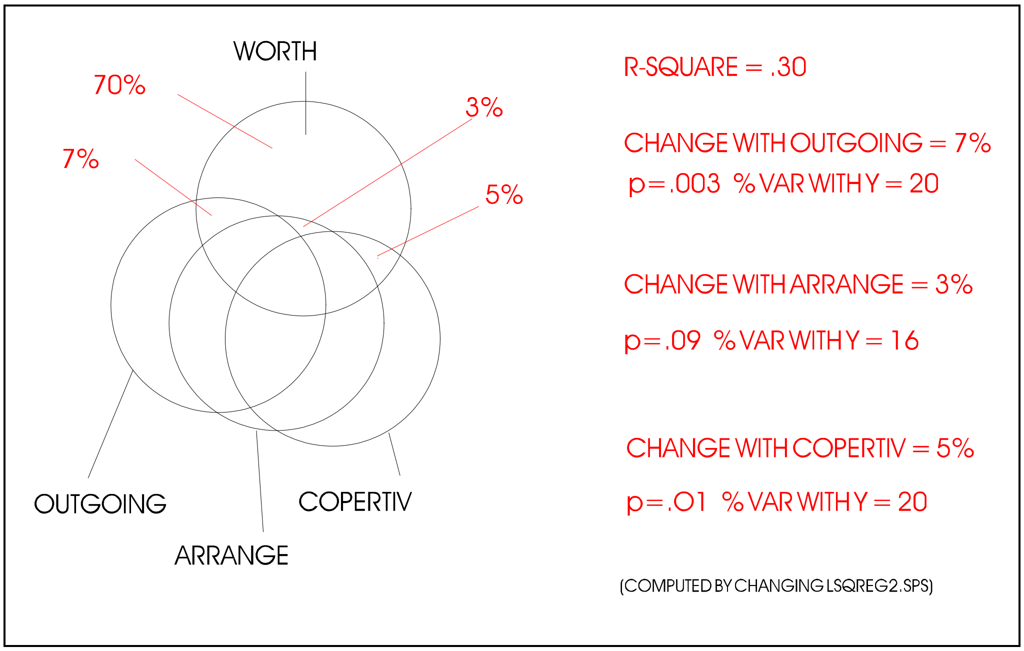
```
Adjusted R Square    .26169          F Change         16.95029
Standard Error      1.78962          Signif F Change    .0000

Equation Number 1    Dependent Variable..   WORTH
Beginning Block Number  2.  Method:  Enter      ARRANGE
Variable(s) Entered on Step Number
   3..    ARRANGE
Multiple R           .55210
R Square             .30482          R Square Change    .02672
Adjusted R Square    .28084          F Change          3.34348
Standard Error      1.76626          Signif F Change    .0709
```

Part of LSQREG2.SPS revised

```
REGRESSION
  DESCRIPTIVES=MEAN STDDEV CORR N
  /variables = fgood worth angry arrange copertiv outgoing
  /statistics = r coeff anova outs zpp cha
  /DEPENDENT=angry
  /method=enter arrange outgoing
  /method=enter copertiv.
finish.
```

```
Equation Number 1    Dependent Variable..   WORTH
Beginning Block Number  1.  Method:  Enter      ARRANGE  OUTGOING
Variable(s) Entered on Step Number
   1..    OUTGOING
   2..    ARRANGE
Multiple R           .50420
R Square             .25422          R Square Change    .25422
Adjusted R Square    .23727          F Change         14.99834
Standard Error      1.81899          Signif F Change    .0000

Equation Number 1    Dependent Variable..   WORTH
Beginning Block Number  2.  Method:  Enter      COPERTIV
Variable(s) Entered on Step Number
   3..    COPERTIV
Multiple R           .55210
R Square             .30482          R Square Change    .05060
Adjusted R Square    .28084          F Change          6.33249
Standard Error      1.76626          Signif F Change    .0137
```

The above analysis is demonstrated by the following Venn diagrams.



Comment [COMMENT2]: lsqreg1.cdr

part of revised jobstream LSQREG2.SPS

```
REGRESSION
  DESCRIPTIVES=MEAN STDDEV CORR N
  /variables = fgood worth angry arrange copertiv outgoing
  /statistics = r coeff anova outs zpp cha
  /DEPENDENT=angry
  /method=enter copertive arrange
  /method=enter outgoing.
```

```
finish.
```

```
Equation Number 1    Dependent Variable..   ANGRY
Beginning Block Number  1.  Method:  Enter      COPERTIV ARRANGE
Variable(s) Entered on Step Number
   1..    COPERTIV
   2..    ARRANGE

Multiple R           .43846
R Square             .19224          R Square Change    .19224
Adjusted R Square    .17468          F Change         10.94789
Standard Error      1.70038          Signif F Change    .0001

Equation Number 1    Dependent Variable..   ANGRY
Beginning Block Number  2.  Method:  Enter      OUTGOING
Variable(s) Entered on Step Number
   3..    OUTGOING

Multiple R           .48304
R Square             .23333          R Square Change    .04108
Adjusted R Square    .20805          F Change          4.87627
Standard Error      1.66565          Signif F Change    .0297
```

part of revised jobstream LSQREG2.SPS

```
REGRESSION
  DESCRIPTIVES=MEAN STDDEV CORR N
  /variables = fgood worth angry arrange copertiv outgoing
  /statistics = r coeff anova outs zpp cha
  /DEPENDENT=angry
  /method=enter copertive outgoing
  /method=enter arrange.
finish.
```

```
Equation Number 1    Dependent Variable..   ANGRY
Beginning Block Number  1.  Method:  Enter      COPERTIV OUTGOING
Variable(s) Entered on Step Number
   1..    OUTGOING
   2..    COPERTIV

Multiple R           .44650
R Square             .19937          R Square Change    .19937
Adjusted R Square    .18196          F Change         11.45445
Standard Error      1.69287          Signif F Change    .0000
```

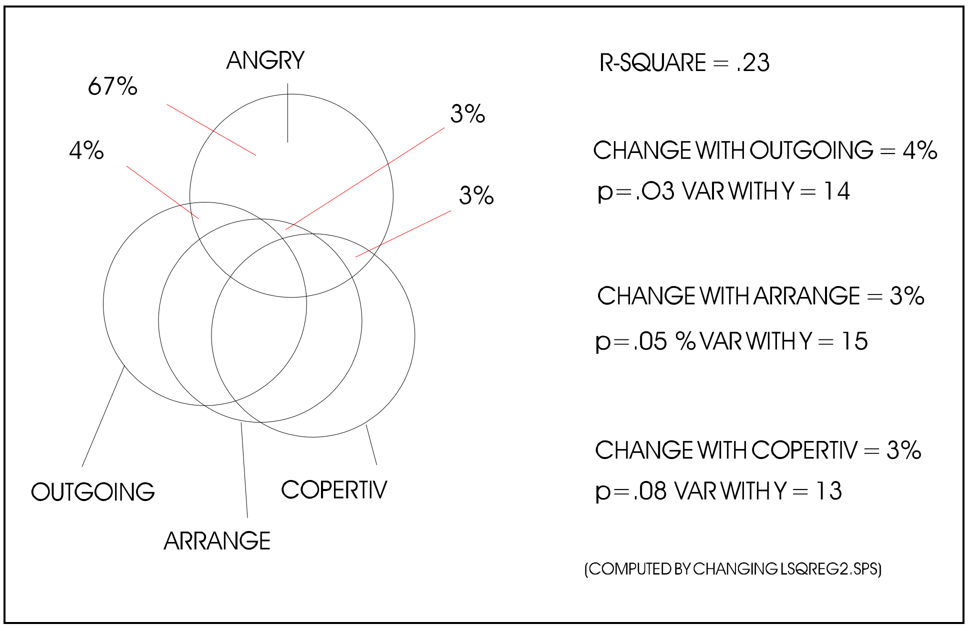
```
Equation Number 1    Dependent Variable..   ANGRY
Beginning Block Number  2.  Method:  Enter      ARRANGE
Variable(s) Entered on Step Number
   3..    ARRANGE

Multiple R           .48304
R Square             .23333          R Square Change    .03396
Adjusted R Square    .20805          F Change          4.03094
Standard Error      1.66565          Signif F Change    .0476
```

part of revised jobstream LSQREG2.SPS

```
REGRESSION
  DESCRIPTIVES=MEAN STDDEV CORR N
  /variables = fgood worth angry arrange copertiv outgoing
  /statistics = r coeff anova outs zpp cha
  /DEPENDENT=angry
  /method=enter arrange outgoing
  /method=enter copertiv.
finish.
```

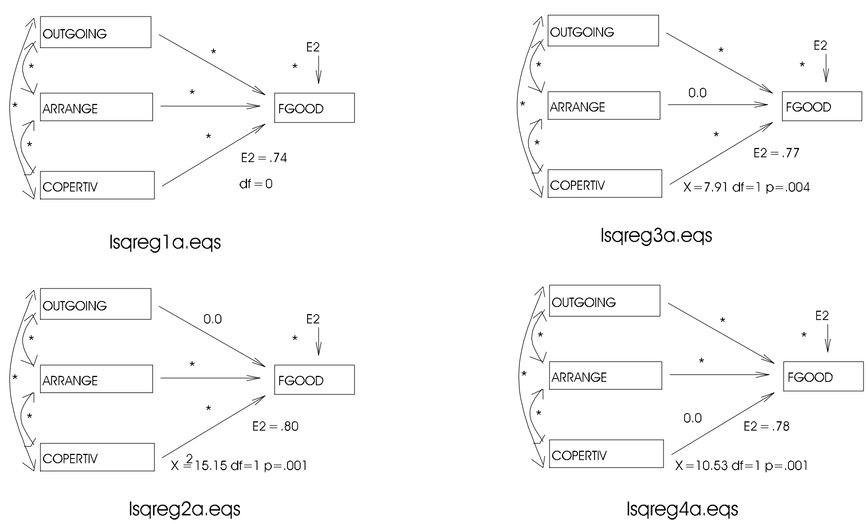
```
Equation Number 1    Dependent Variable..   ANGRY
Beginning Block Number  1.  Method:  Enter      ARRANGE  OUTGOING
Variable(s) Entered on Step Number
   1..    OUTGOING
   2..    ARRANGE

Multiple R           .45520
R Square             .20721          R Square Change    .20721
Adjusted R Square    .18997          F Change         12.02270
Standard Error      1.68456          Signif F Change    .0000

Equation Number 1    Dependent Variable..   ANGRY
Beginning Block Number  2.  Method:  Enter      COPERTIV
Variable(s) Entered on Step Number
   3..    COPERTIV

Multiple R           .48304
R Square             .23333          R Square Change    .02612
Adjusted R Square    .20805          F Change          3.10026
Standard Error      1.66565          Signif F Change    .0816
```

The above data is represented by the following Venn diagrams.


ANGRY
67%
4%
3%
3%
OUTGOING
ARRANGE
COPERTIV
R-SQUARE = .23
CHANGE WITH OUTGOING = 4%
p=.O3 VAR WITH Y = 14
CHANGE WITH ARRANGE = 3%
p=.05 % VAR WITH Y = 15
CHANGE WITH COPERTIV = 3%
p=.08 VAR WITH Y = 13
(COMPUTED BY CHANGING LSQREG2.SPS)

The same task can be accomplished using EQS. In order to determine variance accounted for by V11 (OUTGOING) the arrow going from V11 to V1 (FGOOD) is eliminated. The following diagram shows first the model with the arrow free (estimated -- the variance of OUTGOING is assessed when it is estimated), and then again when the arrow is set to 0 or is missing (the results are the same when the arrow is set to 0 or is missing).

Comment [COMMENT3]: lsqreg1a.cdr



Some hand calculations need to be performed in order to obtain the results found in the multiple regression. In the multiple regression it was found that OUTGOING accounted for 9% unique variance of FGOOD. This result can be obtained in the following manner. In the first run of EQS where all three variables were predicting FGOOD E2 was .74. That number squared in the proportion of error variance (.5476). That is the same as was found in the multiple regression solution. There is a slight difference because of the different methods of calculation. At any rate when this is subtracted from 1 the result is .4524; the proportion FGOOD variance accounted for by OUTGOING, ARRANGE, and COPERTIV. The amount of unique variance accounted for by OUTGOING is obtained by squaring 80 (80 * 80 = .64), subtracting that result from 1 (1 - .64 = .36), and then subtraction that from the variance accounted for by all three (.4524 - .36 = .0924) indication .09 proportion or 9% variance. Each of the other unique variances can be accounted for in the same manner.

The jobstreams for the four models in the figure are as follows:

LSQREG1A.EQS

```
/TITLE

   multiple regression model 1
/SPE

  CASE=97; VAR = 19;  ME=ML;
DA='lsqcor1.cv1';
/LABELS
  v1=ENJOY;     v2=FGOOD;     v3=WORTH;     v4=FEARFUL;   v5=ANGRY;
  v6=TENSE;     v7=SHY;       v8=FUN;       v9=SORRY;     v10=SUSPICIS;
  v11=OUTGOING; v12=arrange;  v13=copertiv; v14=PEOPLE;   v15=INCLUDED;
  v16=CONFRONT; v17=frsupp;   v18=FRLEIS;   v19=TTALK;
/wtest
/lmtest
/EQU

  V2 =*v11 + *v12 + *v13 + e2;
/VAR
  v11=*;v12=*;v13=*;
  e2 = *;
/cov
  v11,v12=*;
  v11,v13=*;
  v12,v13=*;
/END
```

LSQREG2A.EQS

```
/TITLE

   multiple regression model 1
/SPE

  CASE=97; VAR = 19;  ME=ML;
DA='lsqcor1.cv1';
/LABELS
  v1=ENJOY;     v2=FGOOD;     v3=WORTH;     v4=FEARFUL;   v5=ANGRY;
  v6=TENSE;     v7=SHY;       v8=FUN;       v9=SORRY;     v10=SUSPICIS;
```

```
  v11=OUTGOING; v12=arrange;  v13=copertiv; v14=PEOPLE;   v15=INCLUDED;
  v16=CONFRONT; v17=frsupp;   v18=FRLEIS;   v19=TTALK;
/wtest
/lmtest
/EQU

  V2 =0v11 + *v12 + *v13 + e2;
/VAR
  v11=*;v12=*;v13=*;
  e2 = *;
/cov
  v11,v12=*;
  v11,v13=*;
  v12,v13=*;
/END
```

LSQREG3A.EQS

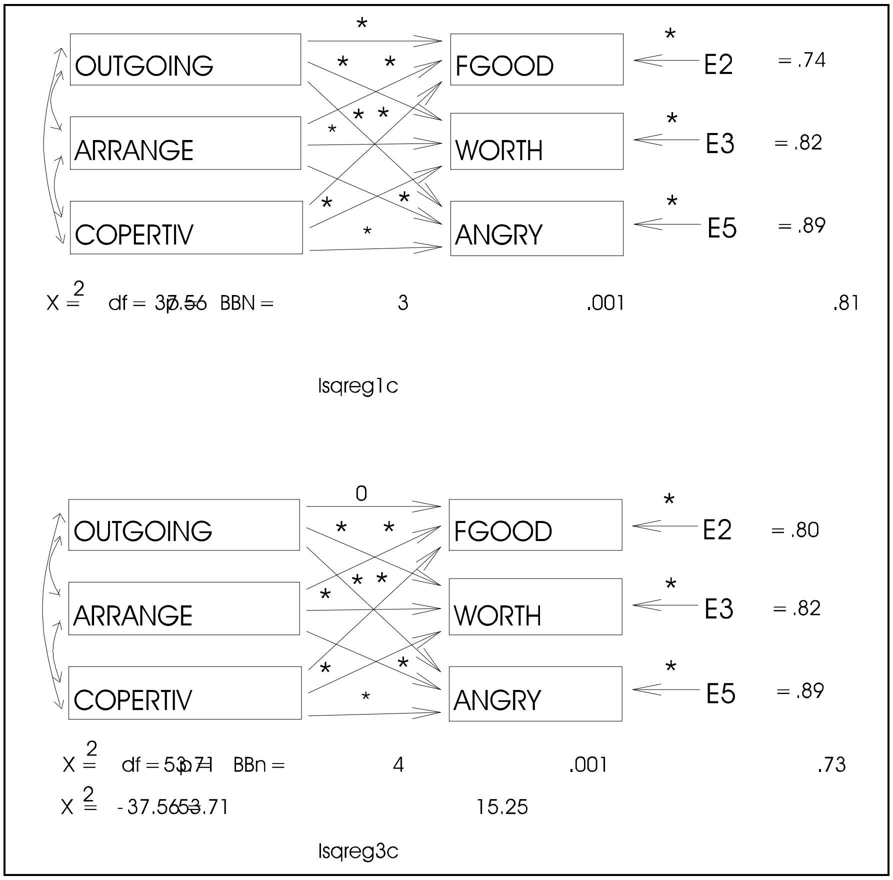
```
/TITLE

   multiple regression model 1
/SPE

  CASE=97; VAR = 19;  ME=ML;
DA='lsqcor1.cv1';
/LABELS
  v1=ENJOY;     v2=FGOOD;     v3=WORTH;     v4=FEARFUL;   v5=ANGRY;
  v6=TENSE;     v7=SHY;       v8=FUN;       v9=SORRY;     v10=SUSPICIS;
  v11=OUTGOING; v12=arrange;  v13=copertiv; v14=PEOPLE;   v15=INCLUDED;
  v16=CONFRONT; v17=frsupp;   v18=FRLEIS;   v19=TTALK;
/wtest
/lmtest
/EQU

  V2 =*v11 + 0v12 + *v13 + e2;
/VAR
  v11=*;v12=*;v13=*;
  e2 = *;
/cov
  v11,v12=*;
  v11,v13=*;
  v12,v13=*;
/END
```

LSQREG4A.EQS

```
/TITLE

   multiple regression model 1
/SPE

  CASE=97; VAR = 19;  ME=ML;
```

```
DA='lsqcor1.cv1';
/LABELS
  v1=ENJOY;     v2=FGOOD;     v3=WORTH;     v4=FEARFUL;   v5=ANGRY;
  v6=TENSE;     v7=SHY;       v8=FUN;       v9=SORRY;     v10=SUSPICIS;
  v11=OUTGOING; v12=arrange;  v13=copertiv; v14=PEOPLE;   v15=INCLUDED;
  v16=CONFRONT; v17=frsupp;   v18=FRLEIS;   v19=TTALK;
/wtest
/lmtest
/EQU

  V2 =*v11 + *v12 + 0v13 + e2;
/VAR
  v11=*;v12=*;v13=*;
  e2 = *;
/cov
  v11,v12=*;
  v11,v13=*;
  v12,v13=*;
/END
```

The problem with using this method is that the difference between each model and the original cannot be assessed because the original has 0 degrees of freedom and consequently, no chi-square. However, the next method solves the problem. Note which path is set to equal 0 in each of the models. In the first model (the comparison model) all paths are free to be estimated (indicated with an "*"). In the next model (labeled "lsqreg3c" in the figure) the path from OUTGOING to FGOOD is set to be 0. Consequently, the variance of FGOOD that was accounted by OUTGOING (beyond ARRANGE and COPERTIV) will not be accounted for in model lsqreg3c. Both the amount of variance accounted and its level of significance can now be determined. The amount of variance accounted for is computed by taking the difference between the error variances of FGOOD for the two models. The error variance for FGOOD in model lsqreg1c was .74, and .80 for lsqreg3c. These numbers were obtained from the Standardized Solution of the EQS output.



Comment [COMMENT4]: LSQREG1C.CDR

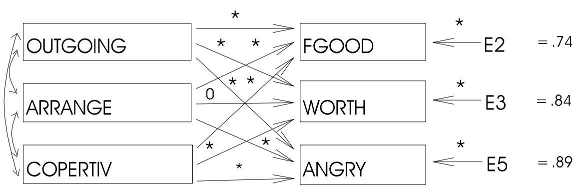
The jobstreams for running the above models are as follows.

```
LSQREG1C.EQS

/TITLE
   multiple regression model 1
/SPE
  CASE=97; VAR = 19;  ME=ML;
DA='lsqcor1.cv1';
/LABELS
  v1=ENJOY;     v2=FGOOD;     v3=WORTH;     v4=FEARFUL;   v5=ANGRY;
  v6=TENSE;     v7=SHY;       v8=FUN;       v9=SORRY;     v10=SUSPICIS;
  v11=OUTGOING; v12=arrange;  v13=copertiv; v14=PEOPLE;   v15=INCLUDED;
  v16=CONFRONT; v17=frsupp;   v18=FRLEIS;   v19=TTALK;
/wtest
/lmtest
/EQU
  V2 =*v11 + *v12 + *v13 + e2;
  v3 =*v11 + *v12 + *v13 + e3;
  v5 =*v11 + *v12 + *v13 + e5;
/VAR
  v11=*;v12=*;v13=*;
  e2, e3, e5 = *;
/cov
```

```
  v11,v12=*;
  v11,v13=*;
  v12,v13=*;
/END
```

LSQREG3C.EQS

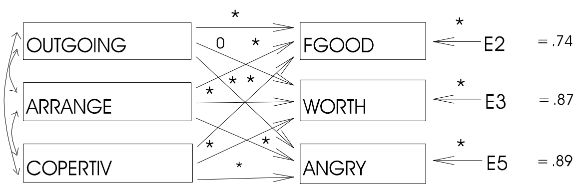
```
/TITLE                                        multiple regression model 1
/SPE                                          CASE=97; VAR = 19;  ME=ML;
DA='lsqcor1.cv1';
/LABELS
  v1=ENJOY;     v2=FGOOD;     v3=WORTH;     v4=FEARFUL;   v5=ANGRY;
  v6=TENSE;     v7=SHY;       v8=FUN;       v9=SORRY;     v10=SUSPICIS;
  v11=OUTGOING; v12=arrange;  v13=copertiv; v14=PEOPLE;   v15=INCLUDED;
  v16=CONFRONT; v17=frsupp;   v18=FRLEIS;   v19=TTALK;
/wtest
/lmtest
/EQU
  V2 =0v11 + *v12 + *v13 + e2;
  v3 =*v11 + *v12 + *v13 + e3;
  v5 =*v11 + *v12 + *v13 + e5;
/VAR
  v11=*;v12=*;v13=*;
  e2, e3, e5 = *;
/cov
  v11,v12=*;
  v11,v13=*;
  v12,v13=*;
/END
```



X 2 = df = 40.45 p = BBn = 4 .001 .80
X 2 = - 37.56 = 40.45 2.895 p = ns

lsqreg2c

Comment [COMMENT5]: LSQREG2C.CDR [GEM]



X 2 = df = 46.87 p = BBn = 4 .001 .76
X 2 = - 37.56 46.87 9.26

lsqreg4c

Comment [COMMENT6]: LSQREG2C.CDR [GEM]

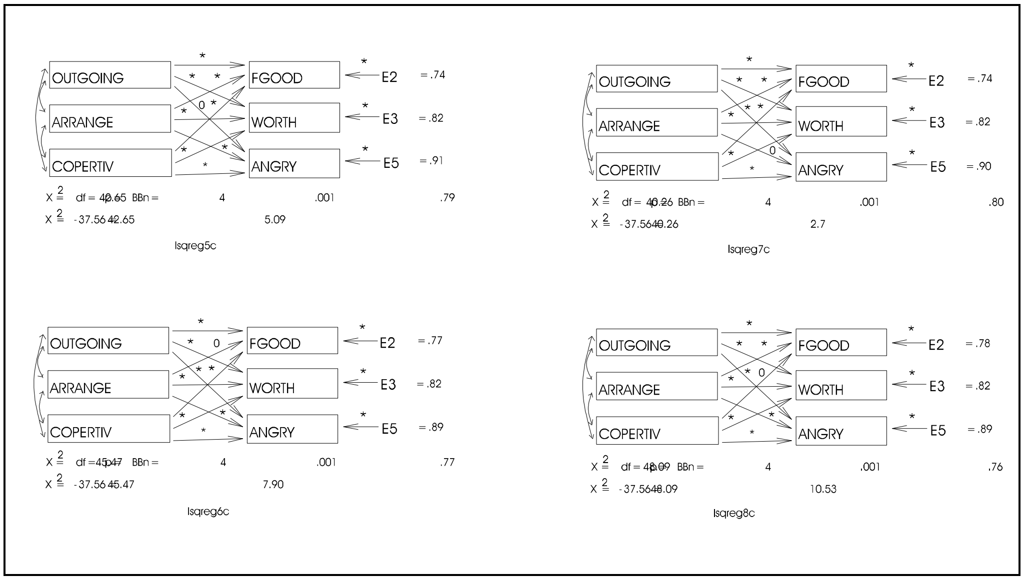
LSQREG4C.EQS

```
/TITLE    multiple regression model 1
/SPE    CASE=97; VAR = 19;  ME=ML;
DA='lsqcor1.cv1';
/LABELS
  v1=ENJOY;    v2=FGOOD;    v3=WORTH;    v4=FEARFUL;   v5=ANGRY;
  v6=TENSE;    v7=SHY;      v8=FUN;      v9=SORRY;     v10=SUSPICIS;
  v11=OUTGOING; v12=arrange;  v13=copertiv; v14=PEOPLE;  v15=INCLUDED;
  v16=CONFRONT; v17=frsupp;   v18=FRLEIS;   v19=TTALK;
/wtest
/lmtest
/EQU
  V2 =*v11 + *v12 + *v13 + e2;
  v3 =0v11 + *v12 + *v13 + e3;
```

```
  v5 =*v11 + *v12 + *v13 + e5;
/VAR
  v11=*;v12=*;v13=*;
  e2, e3, e5 = *;
/cov
  v11,v12=*;
  v11,v13=*;
  v12,v13=*;
/END
```

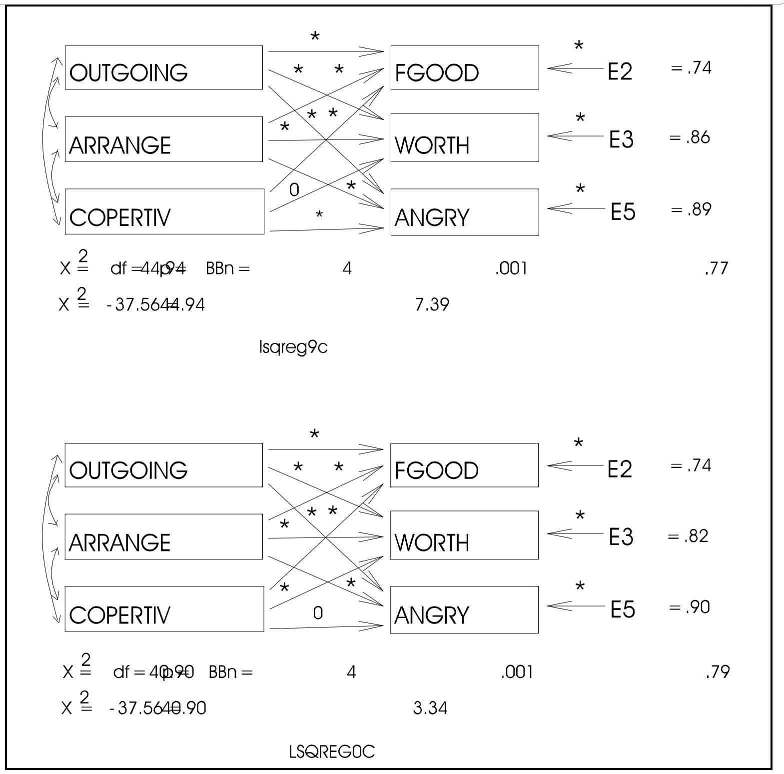
Notice that the only difference between the two jobstreams is the a 0 is added before "V11" in the first line of the equation section in the second jobstream. This next figure shows ___ models.

Comment [COMMENT7]: LSQREG5C.CDR [GEM]



All of the necessary jobstreams for the above or below models are not shown since there would be considerable redundancy.

[enter lsqreg9c.dc2 here]



Comment [COMMENT8]: LSQREG9C.CDR [GEM]

Now we will move to the next level of analysis in parceling variance. Up until now all of the calculations could be accomplished using multiple regression. These next models could not be done using multiple regression. In the first example a factor will be used in place of a single measured variable. It is similar to multiple regression in that there is a number of dependent variables and a single independent (variable), however, in this case the dependent variable is a factor.

[enter lsqreg1e.dc2 here]

Comment [COMMENT9]: LSQREG1E.CDR [GEM]

The jobstreams for running the above models follow.

partial jobstream LSQREG1E.EQS

```
/LABELS
 v1=ENJOY;    v2=FGOOD;    v3=WORTH;    v4=FEARFUL;  v5=ANGRY;
 v6=TENSE;    v7=SHY;      v8=FUN;      v9=SORRY;    v10=SUSPICIS;
 v11=OUTGOING; v12=arrange;  v13=copertiv; v14=PEOPLE;   v15=INCLUDED;
 v16=CONFRONT; v17=frsupp;   v18=FRLEIS;   v19=TTALK;
/wtest
/lmtest
/EQU
 V2 =*f2 + e2;
 v3 = f2 + e3;
 v5 =*f2 + e5;
 f2 = *v11 + *v12 + *v13 + d2;
/VAR
 d2=*;
 v11=*;v12=*;v13=*;
 e2, e3, e5 = *;
/cov
 v11,v12=*;
 v11,v13=*;
 v12,v13=*;
```

partial jobstream LSQREG2E.EQS

```
/LABELS
 v1=ENJOY;    v2=FGOOD;    v3=WORTH;    v4=FEARFUL;   v5=ANGRY;
 v6=TENSE;    v7=SHY;      v8=FUN;      v9=SORRY;     v10=SUSPICIS;
 v11=OUTGOING; v12=arrange;  v13=copertiv; v14=PEOPLE;   v15=INCLUDED;
 v16=CONFRONT; v17=frsupp;   v18=FRLEIS;   v19=TTALK;
/wtest
/lmtest
/EQU
 V2 =*f2 + e2;
 v3 = f2 + e3;
 v5 =*f2 + e5;
 f2 = 0v11 + *v12 + *v13 + d2;
/VAR
 d2=*;
 v11=*;v12=*;v13=*;
 e2, e3, e5 = *;
/cov
 v11,v12=*;
 v11,v13=*;
 v12,v13=*;
```

Two more models are presented without jobstreams.

[enter lsqreg3e.dc2 here]

In the above examples we have been able to assess the variance accounted for in a variable or factor by using the error variance of the dependent variable. This next set of models shows some restrictions in using this method. Particularly, the point is made that in order to parse out variance and use the error variance as the residual, the two models used to show the change must meet the two following restrictions: (1) one model must be nested in the other model (must be the same number of measured and latent variables), (2) the difference between the two models must only be an arrow that points at the variable in question (the one that you are attempting to account for the variance of).

[enter lsqregb.dc2 here]

[enter lsqreg1b.dc2 here]

The FGOOD variable of models "lsqreg1b" cannot be assessed for the variance accounted for by the factor F1, but the models LSQREGB can be assessed for the variance accounted for by the factor (you should note that all models labeled LSQREG1B are identical and all models labeled LSQREG1B are identical).

The rule for the LSQREG1B's is that in attempting to assess variance accounted for you cannot reduce (eliminate) an arrow that estimates from a factor. The arrow that is eliminated must be pointing at the variable that the error variance is being assessed. Only an arrow pointing at a variable will result in being able to test D2. Arrows point away will test that and other things.