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Calculation of Blocked Squared R

In this document, I show you how to calculate Hayduk's (2006) blocked R squared for models with reciprocal causation and correlated errors. I use the results from the numerical example in Figure 16.1 from the main text of Chapter 16 to do so. I focus first on calculating the blocked squared R for the mediator M, then I turn to Y.

There are three computational steps. First, from the Mplus output in the primary analysis, I make note of the variance of the endogenous variable that I want to compute the blocked error squared R for. I locate the predicted variance in the section called `TECHNICAL 4 OUTPUT` in the subsection `ESTIMATED COVARIANCE MATRIX FOR THE LATENT VARIABLES`. The variance is in the diagonal element of the covariance matrix for the variable `M` and it equals 0.995.

Step 2 involves first noting the values of all the unstandardized parameter estimates for the path coefficients and the exogenous correlations in the `MODEL RESULTS` section, ignoring the means and intercepts. I reproduce them here:

```
MODEL RESULTS

                                                    Two-Tailed
                    Estimate       S.E.  Est./S.E.    P-Value

 LZ       BY
    Z2                 1.000      0.000    999.000    999.000
    Z3                 1.034      0.052     19.944      0.000

 LY       BY
    Y1                 1.000      0.000    999.000    999.000
    Y2                 0.860      0.068     12.689      0.000

 LY       ON
    LZ                 0.682      0.071      9.556      0.000
    M                  0.419      0.105      3.992      0.000
    T                  0.052      0.096      0.539      0.590

 M        ON
    LY                 0.289      0.085      3.415      0.001
    Z1                 0.393      0.071      5.526      0.000
    T                  0.042      0.118      0.357      0.721
```

```
 LZ       WITH
    Z1                 0.336      0.062      5.422      0.000
    T                  0.020      0.034      0.591      0.554

 M        WITH
    LY                -0.301      0.093     -3.244      0.001
 Z1       WITH
    T                  0.041      0.035      1.175      0.240

 Variances
    Z1                 0.995      0.085     11.661      0.000
    T                  0.250      0.001    353.482      0.000
    LZ                 0.829      0.104      7.959      0.000

 Residual Variances
    Z2                 0.166      0.035      4.706      0.000
    Z3                 0.110      0.030      3.696      0.000
    M                  0.675      0.071      9.519      0.000
    Y1                 0.121      0.039      3.108      0.002
    Y2                 0.348      0.043      8.072      0.000
    LY                 0.317      0.078      4.035      0.000
```

I then re-run the model but rather than estimate the above parameters, I fix them at the above values listed under `Estimate`, with one exception; I set the disturbance variance for the target variable, `M`, to 0 as well as its covariance with the disturbance term for `Ly` to zero, thereby negating the confound it carries to bias the estimate of the squared R. In short, I block the error. Table 1 presents the Mplus syntax I use:

Table 1 Intermediate Step to Calculated the Blocked R Squared

```
TITLE: Intermediate step
DATA: FILE IS recipmainM.txt ;
VARIABLE:
  NAMES ARE id z2 z3 m y1 y2 z1 t ;
  USEVARIABLES ARE z2 z3 m y1 y2 z1 t ;
ANALYSIS: ESTIMATOR = MLR;
MODEL:
  Lz@0.829 ;
  Lz BY z2@1.0 z3@1.034 ;
  Ly BY y1@1.0 y2@.860 ;
  y1@.121 ; y2@.348 ; z2@.166 ; z3@.110 ;
  m ON z1@.393 Ly@.289 t@.042 ;
  Ly on m@.419  Lz@.682  t@.052 ;
  !Ly@.317 ; m@.675 ;  !reminder of original disturbance variance
  Ly@.317 ; m@0 ;      !set M disturbance variance to 0
  Lz WITH z1@.336 ;
  LZ WITH t@.020 ;
```

```
z1 with t@.041 ;
m WITH Ly@0 ;        !set correlation between disturbances to zero
OUTPUT: TECH4 ;
```

I look in the in the section called `TECHNICAL 4 OUTPUT` in the subsection `ESTIMATED COVARIANCE MATRIX FOR THE LATENT VARIABLES` for the variance in the diagonal element of the covariance matrix for the variable `M` and it equals 0.345. I divide this value by the variance of M from the original analysis and obtain 0.345/0.995 = 0.347. This is the value of the blocked R square (the original R square was 0.321). I then apply analogous steps to Ly instead of M and I find the blocked R square was 0.905 (the original R square was 0.638). One minus these values are the estimated proportions of unexplained variance in the respective endogenous variables.