Recursive model

To illustrate fitting a recursive model with SIMPLIS syntax, we use data from McDonald and Clelland (1984) on union sentiment of southern non-union textile workers. These data were subsequently reanalyzed by Bollen (1989) after transformation of one variable and treatment of outliers.

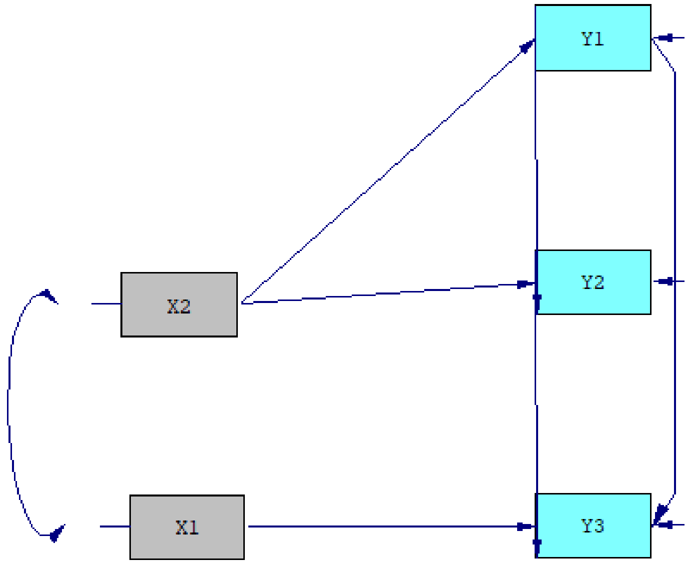
Instead of raw data, we opt to use the covariance matrix as input. The variables of interest are:

- y_1 : deference (submissiveness) to managers
- y_2 : support for labor activism
- y_3 : sentiment towards unions
- x_1 : logarithm of years worked in textile mill
- x_2 : age

The covariance matrix for these variables is

y_1	y_2	y_3	x_1	x_2
14.610				
-5.250	11.017			
-8.057	11.087	31.971		
-0.482	0.677	1.559	1.021	
-18.857	17.861	28.250	7.139	215.662

The model we are interested in is shown as a path diagram below:



This model can be specified using the Relationships statement in SIMPLIS as

```
Relationships
   Y1 = X2
   Y2 = Y1 X2
   Y3 = Y1 Y2 X1
```

These three lines indicate that:

- y_1 depends on x_2
- y_2 depends on y_1 and x_2
- y_3 depends on y_1, y_2 and x_1.

The complete input file for this analysis is shown below. This model makes a distinction between two kinds of variables. We have *dependent* variables, i.e. variables that are supposed to be explained by the *independent* variables. Dependent variables are always on the left side of the '=' sign in the Relationship paragraph. They correspond to those variables in the path diagram which have one-way arrows pointing towards them. The distinction between these two types of variables is also noticeable in the labels, as *x*-variables are independent and *y*-variables dependent.

union1a.spl

```
Title
   Union Sentiment of Textile Workers
   Variables: Y1 = deference (submissiveness) to managers
              Y2 = support for labor activism
              Y3 = sentiment towards unions

              X1 = years in textile mill
              X2 = age

Observed Variables: Y1 - Y3 X1 X2
Covariance matrix:
   14.610
   -5.250  11.017
   -8.057  11.087  31.971
   -0.482   0.677   1.559   1.021
  -18.857  17.861  28.250   7.139 215.662
Sample Size 173
Relationships
   Y1 = X2
   Y2 = Y1 X2
   Y3 = Y1 Y2 X1
Path Diagram
End of problem
```

Results for this analysis is as follows:

```
   Structural Equations


      Y1 =  - 0.0874*X2, Errorvar.= 12.961, R² = 0.113
Standerr     (0.0187)              (1.402)
Z-values     -4.664                 9.247
P-values      0.000                 0.000

      Y2 =  - 0.285*Y1 + 0.0579*X2, Errorvar.= 8.488 , R² = 0.230
Standerr     (0.0619)   (0.0161)              (0.918)
Z-values     -4.598      3.597                 9.247
P-values      0.000      0.000                 0.000

      Y3 =  - 0.218*Y1 + 0.850*Y2 + 0.861*X1, Errorvar.= 19.454, R² = 0.390
Standerr     (0.0974)   (0.112)    (0.341)              (2.104)
Z-values     -2.235      7.555      2.526                9.247
P-values      0.025      0.000      0.012                0.000


NOTE: R² for Structural Equations are Hayduk's (2006) Blocked-Error R²

        Reduced Form Equations

      Y1 = 0.0*X1 - 0.0874*X2, Errorvar.= 12.961, R² = 0.113
Standerr           (0.0188)
Z-values           -4.650
P-values            0.000

      Y2 = 0.0*X1 + 0.0828*X2, Errorvar.= 9.538, R² = 0.134
Standerr           (0.0161)
Z-values            5.135
P-values            0.000

      Y3 = 0.861*X1 + 0.0894*X2, Errorvar.= 28.320, R² = 0.112
Standerr  (0.342)    (0.0184)
```

```
 Z-values   2.518      4.858
 P-values   0.012      0.000
```

We see that all estimated coefficients are statistically significant. The R^2 indicate that the model for y_2 fits the best of the three.

Goodness-of-fit statistics are also provided.

```
Degrees of Freedom for (C1)-(C2)                     3
 Maximum Likelihood Ratio Chi-Square (C1)             1.259 (P = 0.7390)
 Browne's (1984) ADF Chi-Square (C2_NT)               1.255 (P = 0.7398)
```

The chi-squares indicate that the current model fits the data well. When the fact that all coefficients in the three estimated equations are statistically significant, we conclude that the model describes the data reasonably well. Equivalent LISREL syntax is given in **union1b.lis**. This file can be found in the **MVABOOK Examples\Chapter 2** folder.