

**Example 36g** — MIMIC model (generalized response)

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## Description

To demonstrate a multiple-indicators multiple-causes (MIMIC) model with generalized indicators, we use the same data used in [\[SEM\] Example 35g](#):

```
. use https://www.stata-press.com/data/r18/gsem_issp93
(Selection for ISSP 1993)
. describe
Contains data from https://www.stata-press.com/data/r18/gsem_issp93.dta
Observations:      871           Selection for ISSP 1993
Variables:         8           21 Mar 2022 16:03
                          (_dta has notes)
```

Variable name	Storage type	Display format	Value label	Variable label
id	int	%9.0g		Respondent identifier
y1	byte	%26.0g	agree5	Too much science, not enough feelings & faith
y2	byte	%26.0g	agree5	Science does more harm than good
y3	byte	%26.0g	agree5	Any change makes nature worse
y4	byte	%26.0g	agree5	Science will solve environmental problems
sex	byte	%9.0g	sex	Sex
age	byte	%9.0g	age	Age (6 categories)
edu	byte	%20.0g	edu	Education (6 categories)

Sorted by:

```
. notes
_dta:
1. Source: Data from pages 42-43 of Greenacre, M. J., and J. Blasius. 2006.
Multiple Correspondence Analysis and Related Methods. Boca Raton, FL:
Chapman & Hall. Data are part of the International Social Survey Program
(ISSP) 1993.
2. Full text of y1: We believe too often in science, and not enough in
feelings and faith.
3. Full text of y2: Overall, modern science does more harm than good.
4. Full text of y3: Any change humans cause in nature, no matter how
scientific, is likely to make things worse.
5. Full text of y4: Modern science will solve our environmental problems
with little change to our way of life.
```

See [Structural models 10: MIMIC models](#) in [\[SEM\] Intro 5](#) for background.

## Remarks and examples

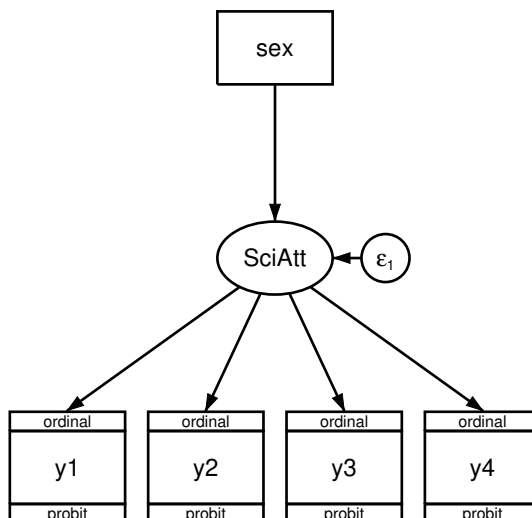
Remarks are presented under the following headings:

[Fitting the MIMIC model](#)  
[Fitting the model with the Builder](#)

## Fitting the MIMIC model

For a refresher on MIMIC models, see [SEM] Example 10. In the data above, we have ordered categorical indicators. For an explanation on how we are about to treat these indicators with ordered probit, see [SEM] Example 35g.

We wish to fit the following model:



We fit the model in the command language by typing

```
. gsem (y1 y2 y3 y4 <- SciAtt) (SciAtt <- sex), oprobit
Fitting fixed-effects model:
Iteration 0: Log likelihood = -5227.8743
Iteration 1: Log likelihood = -5227.8743
Refining starting values:
Grid node 0: Log likelihood = -5230.8106
Fitting full model:
Iteration 0: Log likelihood = -5230.8106 (not concave)
Iteration 1: Log likelihood = -5132.1065 (not concave)
Iteration 2: Log likelihood = -5066.8481
Iteration 3: Log likelihood = -5033.2807
Iteration 4: Log likelihood = -5032.7884
Iteration 5: Log likelihood = -5032.3837
Iteration 6: Log likelihood = -5032.3778
Iteration 7: Log likelihood = -5032.3778
```

Generalized structural equation model

Number of obs = 871

Response: y1  
 Family: Ordinal  
 Link: Probit

Response: y2  
 Family: Ordinal  
 Link: Probit

Response: y3  
 Family: Ordinal  
 Link: Probit

Response: y4  
 Family: Ordinal  
 Link: Probit

Log likelihood = -5032.3778

( 1) [y1]SciAtt = 1

		Coefficient	Std. err.	z	P> z	[95% conf. interval]	
y1	SciAtt	1 (constrained)					
y2	SciAtt	1.405732	.2089672	6.73	0.000	.9961641	1.8153
y3	SciAtt	1.246449	.1710771	7.29	0.000	.911144	1.581754
y4	SciAtt	-.0345517	.0602017	-0.57	0.566	-.1525449	.0834415
	SciAtt						
	sex	-.2337427	.0644245	-3.63	0.000	-.3600124	-.1074729
/y1	cut1	-1.469615	.0855651			-1.63732	-1.301911
	cut2	-.10992	.0615897			-.2306336	.0107937
	cut3	.6729334	.0644695			.5465755	.7992914
	cut4	1.879901	.0996675			1.684557	2.075246
/y2	cut1	-2.16739	.1480596			-2.457582	-1.877199
	cut2	-.9912152	.0943091			-1.176058	-.8063727
	cut3	-.1118914	.075311			-.2594982	.0357154
	cut4	1.252164	.0983918			1.05932	1.445008
/y3	cut1	-1.412372	.0977772			-1.604012	-1.220733
	cut2	-.0230879	.0687432			-.1578221	.1116464
	cut3	.8209522	.0771653			.6697109	.9721935
	cut4	1.966042	.1196586			1.731515	2.200568
/y4	cut1	-1.47999	.0650596			-1.607505	-1.352476
	cut2	-.4218768	.0443504			-.508802	-.3349516
	cut3	.172995	.0432394			.0882473	.2577427
	cut4	.9454906	.0507422			.8460376	1.044944
	var(e.SciAtt)	.5283629	.0978703			.3675036	.7596315

Notes:

1. Our latent variable measures a negative attitude toward science, just as it did in [SEM] Example 35g.
2. In this MIMIC model, we allow males and females to have different underlying attitudes toward science.
3. The coefficient for `SciAtt <- sex` is  $-0.234$ . Variable `sex` is equal to 1 for females, thus females have a lower mean value for `SciAtt` by 0.234. Because our `SciAtt` measure is reversed, this means that females have a more positive attitude toward science. The effect is significant at better than the 1% level.
4. The difference between males and females in `SciAtt` is  $-0.234$ . Is that big or small, practically speaking?

In the ordered probit specification, predicted agreement with questions is determined by an index into a  $N(0, 1)$  distribution. The value of the index is then compared with the cutpoints to determine the probability that the response is 1, 2, 3, 4, or 5.

For statement 1, the loading on `SciAtt` is 1, and therefore the average difference in the probit index for males and females is  $-0.234 \times 1 = -0.234$  standard deviation units. Females are 0.234 standard deviations to the left of males on average.

For statement 2, the loading on `SciAtt` is 1.41, and therefore the average difference in the probit index is  $-0.234 \times 1.41 = -0.33$  standard deviation units.

You can work out the effect size for the other statements. We would say that the effect is medium sized.

## Fitting the model with the Builder

Use the diagram in *Fitting the MIMIC model* above for reference.


1. Open the dataset.


In the Command window, type

```
. use https://www.stata-press.com/data/r18/gsem_issp93
```

2. Open a new Builder diagram.

Select menu item **Statistics > SEM (structural equation modeling) > Model building and estimation**.


3. Put the Builder in `gsem` mode by clicking on the  button.
4. Create the measurement component for `SciAtt`.


Select the Add measurement component tool, , and then click in the diagram halfway down and slightly left of the center.



In the resulting dialog box,

- a. change the *Latent variable name* to `SciAtt`;
- b. select `y1`, `y2`, `y3`, and `y4` by using the *Measurement variables* control;
- c. check *Make measurements generalized*;
- d. select `Ordinal`, `Probit` in the *Family/Link* control;
- e. select `Down` in the *Measurement direction* control;
- f. click on **OK**.


If you wish, move the component by clicking on any variable and dragging it.

5. Create the variable for the formative indicator of `SciAtt`.
  - a. Select the Add observed variable tool, , and then click in the diagram directly above the oval for `SciAtt` and about one-fourth of the way down from the top. After adding it, you can click inside the rectangle to move the variable if you wish.
  - b. In the Contextual Toolbar, select `sex` with the *Variable* control.
6. Create the path from the formative indicator to `SciAtt`.


- a. Select the Add path tool, .
  - b. Click in the bottom of the `sex` rectangle (it will highlight when you hover over it), and drag a path to the top of the `SciAtt` oval (it will highlight when you can release to connect the path).
7. Clean up the direction of the error.

The error on `SciAtt` is likely to have been created below the oval for `SciAtt`. Choose the Select tool, , and then click in the `SciAtt` oval. Click on one of the **Error rotation** buttons, , in the Contextual Toolbar until the error is where you want it.

8. Clean up the location of the path.

If you do not like where the path between `sex` and `SciAtt` has been connected to its variables, use the Select tool, , to click on the path, and then simply click on where it connects to a rectangle or oval and drag the endpoint.

9. Estimate.

Click on the **Estimate** button, , in the Standard Toolbar, and then click on **OK** in the resulting *GSEM estimation options* dialog box.

You can open a completed diagram in the Builder by typing

```
. webgetsem gsem_mimic
```

## Reference

Greenacre, M. J. 2006. From simple to multiple correspondence analysis. In *Multiple Correspondence Analysis and Related Methods*, ed. M. J. Greenacre and J. Blasius. Boca Raton, FL: Chapman and Hall.

## Also see

[SEM] [Example 10](#) — MIMIC model

[SEM] [Example 35g](#) — Ordered probit and ordered logit

[SEM] [Intro 5](#) — Tour of models

[SEM] [gsem](#) — Generalized structural equation model estimation command

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