

MIXOR for Windows

Overview

MIXOR is a program that provides estimates for mixed-effects ordinal (and binary) regression models. This model can be used for analysis of clustered or longitudinal (i.e., 2-level) outcome data. Several response functions are available:

- probit
- logistic
- log-log
- complementary log-log

For clustered data, the mixed-effects model does not assume that each observation is independent, but does assume data within clusters are dependent to some degree. The degree of this dependency is estimated along with estimates of the usual model parameters, thus adjusting these effects for the dependency resulting from the clustering of the data. Similarly, for longitudinal data, the mixed-effects approach can allow for individual-varying intercepts and slopes across time, and can estimate the degree to which these time-related terms vary. Model covariates can be either time-varying or time-invariant.

MIXOR uses a maximum marginal likelihood solution, specifically implementing a Fisher-scoring algorithm; as a result, standard errors are provided for all model terms. Numerical integration is used to integrate over the distribution of random effects. At present, two possibilities are possible for the random-effects distribution, namely normal distribution and uniform distribution.

For models with one random effect specified or scalar random effect multiplication, the program produces empirical Bayes estimates of the random effects for each level-2 unit. These can be found in the file MIXOR.RES after running the program. The information in MIXOR.RES is, in order:

- level-2 ID
- number of level-1 observations
- empirical Bayes estimate (the mean of the posterior distribution)
- precision associated with the empirical Bayes estimate (the standard deviation of the posterior distribution)

Also, for all analyses, two other files are produced upon program completion. MIXOR.EST which contains all parameter estimates, and MIXOR.VAR which contains the asymptotic variance-covariance matrix of the parameter estimates.

For basic MIXOR usage, as described in the manual published in *Computer Methods and Programs in Biomedicine* (1996), vol 49:157-176, the user only needs to select

options on the first four index cards, Configuration, Variables, Starting Values, and Missing Values. Simply leave the Advanced index card with its default values.

Several new features have been implemented on the Advanced index card, including estimation of partial-proportional odds models, allowing for right-censoring of the ordinal outcome, allowing for different types of random-effect variance structure, and allowing the random-effect variance structure to vary by level-2 or level-1 covariates. Some examples of these extended features can be found in the file MIXORE.ZIP that can be obtained at URL:

<http://www.uic.edu/~hedeker/mixdos.html>

The MIXOR user interface is relatively simple to use. Information about your data must be described to the program as laid out on five index cards:

- Configuration
- Variables
- Starting Values
- Missing Values
- Advanced

Then, with one click or keystroke, your estimates will be determined and the output displayed. A further click or keystroke allows you to print your output file. At any time, and in any order, you may alter the program settings describing your data.

To use MIXOR:

1. Click on the Configuration Card tab and enter the appropriate values. Note that any table can be maximized by double-clicking anywhere in the table. To minimize the table, simply double-click again.
2. Repeat (1) for each of the Variables, Starting Values, Missing Values and Advanced cards.
3. When all data has been entered to your satisfaction, click on Run.
4. The output will be automatically displayed. It can viewed at any time by clicking on View Output.
5. To print the output, click on Print from the output viewer.

Each time you run an analysis, or exit from MIXOR, the current program settings will be written to the MIXOR.DEF file. Supposing you vary your settings, run an analysis and then realize the settings should not have been changed. As the MIXOR.DEF file now contains the latest settings, you will have to re-input the correct settings. A solution to this scenario is to save the settings in an additional definition file. To restore these settings, you simply indicate the name of this file as the definition file.

To create and save program settings values:

1. Enter your desired values in all program settings.

2. On the Configuration card, enter a name other than MIXOR.DEF as the Definition File.
3. Click on Run or Exit (this will save the values to your definition file and to MIXOR.DEF).

To restore the values:

1. Click on the Configuration tab.
2. Enter the name of the file you specified above, as the Definition File.

The User Interface

All user-actions can be carried out by mouse or by using the keyboard. For brevity, the written documentation and on-line help are usually written with the intent of using the mouse. However, some of the corresponding keyboard and mouse actions are described below.

Note: The MIXOR window is a non-sizable window.

Using the mouse:

1. To access any index card simply click on the desired index tab (across the top of the screen).
2. To initiate the action of a command button, click directly on that button.
3. To access a field (which could be a table) click directly into that field. Tables can be maximized (or minimized) by double-clicking anywhere in the table
4. To use a list box, click on the arrow of the list box to view all available selections. Scroll through the list until your selection is found. Click on your selection.
5. To close down MIXOR, click on the Exit button.
OR Access the system menu by clicking once on the system icon (at the upper left corner of the window). Then click on the word 'Close'.
OR Double-click on the system icon.
6. To minimize the MIXOR window, access the system menu and click on the word 'Minimize'.
7. To maximize the MIXOR icon, click on the icon in the task bar, or double-click on the icon on the desktop (depending on your version of Windows).
8. To move the MIXOR window, hold down the mouse button while the mouse is over the title bar, drag the MIXOR window to your desired location, and then release the mouse.
9. To find out the version number of your copy of MIXOR, or the program credits, access the system and click on 'About MIXOR'.
10. To select a file from lists of existing files (see the Configuration Card steps 4, 5, or 6.)
 - a) While in a file setting of the Configuration Card, double-click to invoke the Select File dialog.
 - b) Click on the name of the desired file.
 - c) If the file is not present in the scrollable list, try looking elsewhere by opening (double-clicking on) other directory names. The default location is the directory where MIXOR has been installed.
 - d) If the file is still not present in the scrollable list, use the list box to show additional file types.
 - e) Click on OK to accept the file name. You will return to the Configuration card.
 - f) If you do not wish to continue with the file selection, click on Cancel. You will return to the Configuration card

Using the Keyboard:

1. To access any index card, press the `TAB` key to cycle through the present card until the desired index tab (at the top of the screen) has the focus. Press the `ENTER` key.
2. To initiate the action of a command button, press `TAB` and cycle through the present card until the desired button has the focus. Press `ENTER`.
3. Pressing the `SHIFT` key, followed by the `TAB` key will cycle through all fields of the present card in reverse order.
4. To access a field, press `TAB` repeatedly to cycle through the present card until the desired field has the focus. Note: The field could be a table.
 - There are two modes to table usage, movement and edit.
 - To use edit mode, press `ENTER` and you will be able to change the value in a table cell. Then press `ENTER` again to leave edit mode.
 - If you are not in edit mode, you can use the arrow keys to move about the various cells of the table.
5. To use a list box, press `TAB` to move to the list box. Press the arrow keys to move through the available selections until your choice is found.
6. To close down MIXOR, press `TAB` until the Exit button has the focus. Press `ENTER`.

Command Buttons

The following command buttons are accessible from any index card so that you have the most flexibility in using the program.

Exit

If you would like to end your MIXOR session, click on the Exit button. The position of the MIXOR window will be saved if you ended the session while the window was maximized (that is, not minimized to an icon).

All information currently present in the program settings will be saved in the MIXOR.DEF file (as well as the file of your choice if you have identified another file as the Definition File).

Run

When you click on the Run button the data specified in your input file and the current program settings are used to determine the estimates for mixed-effects ordinal (and binary) regression models. The current program settings will be stored to the file specified by the Definition File and to MIXOR.DEF (if that is not the Definition File).

The outcome of the analysis is saved to the file specified by the Output File of the Configuration Card and is displayed in the output viewer. After you have viewed the file, you can return to the index cards and alter the values if desired. The output can be viewed at any time by clicking on the View button.

View

Clicking on either the View Output or View Results button displays the contents of either the output or the results file (MIXOR.RES - see below). The output file displayed is the one specified by the Output File of the Configuration Card. If the output file does not exist, MIXOR will prompt you to check the path of the output file listed. If the output file field is completely blank, the viewer will show you an empty file.

View Output is automatically executed after issuing the Run command. To print the file, click on Print.

In addition to the output file you name, three other files are produced

- MIXOR.RES This results file is only created when there is only one random effect or scalar random effect multiplication. In this case, the file contains the empirical Bayes estimates of the random effects for each level-2 unit.
- MIXOR.EST This file contains the estimated parameters (with labels)
- MIXOR.VAR This file contains the large-sample variance covariance matrix of the parameter estimates (the inverse of the information matrix).

Default

When you start MIXOR up, it will appear with the program settings as they are defined in the MIXOR.DEF file. If the MIXOR.DEF file is not present on your computer, the program settings will be defined with a set of default values. These default values are among the most commonly used and provide a good starting point for entering data. If you would like to use these values, click on the Default button.

Since selecting the Default button will change all of your current program settings, a confirmation message will appear asking if you wish to change your values. Click on Yes to continue, or No to cancel the operation.

If you wish to permanently save your current (non-default) values, it is necessary to store them in another definition file. See the first page of MIXOR for Windows, for more information about creating and restoring program settings.

Help

MIXOR provides a complete on-line help facility. Click on the Help button to access the help information for that card. Also, pressing F1 will display the help information for that card unless the focus is on a command button. If this is the case, you will be shown the help information for that command.

Once you have entered Help you can move to any topic page. Click on the Contents button at the upper left corner of the window to display the opening screen of Help. From the opening screen you can obtain step by step instructions for using any command or card of MIXOR.

To leave Help and return to your originating position in MIXOR, select Exit from the File Menu.

Index Cards

The program settings used by MIXOR are described on five index cards, Configuration, Variables, Starting Values, Missing Values and Advanced. When MIXOR starts, it will appear with the program settings that are defined in the MIXOR.DEF file. If the MIXOR.DEF file is not present on your computer, the program settings will be given a default set of values (see Default Command Button).

Configuration

To define Configuration program settings:

1. Click on the Configuration tab.
2. Enter the title of your choice as the main title. The maximum length is 60 characters; longer titles are automatically clipped.
3. Enter the subtitle of your choice. The maximum length is 60 characters; longer titles are automatically clipped.
4. Enter the name and path of the file which is to be used for saving and restoring all program settings. If you use a name other than MIXOR.DEF, all your program settings will be saved to both files.
OR Double-click in the field for selection from a list.
5. Enter the name and path of the file from which the data is to be read.
OR Double-click in the field for selection from a list.
6. Enter the name and path of the file to which the output should be written.
OR Double-click in the field for selection from a list.
7. Enter the number of data fields to be read from your input file.
8. Enter the convergence criterion. It is usually set to 0.001 or 0.0001.
9. Enter the number of individuals whose data will be listed on screen; it is usually set to 1.
10. Indicate the field of your input file which contains the level-2 unit IDs.
11. Use the list box to indicate the type of unit weighting for the level-2 units (which may be a person or cluster). You may choose either **equal** or **differential**.
If you choose **differential** you must indicate the field of your input file which contains the weight to be assigned to each level-2 unit.
12. Use the list box to indicate the type of function model. You may choose a **probit**, **logistic**, **complementary log-log** or **log-log** response function.
13. Enter the number of quadrature points (per random-effect dimension) to use in the numerical integration. It is usually set to 10 for 1 random-effect models, and, between 5 and 10 for models with 2 or 3 random-effects.
14. Use the list box to indicate the prior distribution to be assumed for the random effects. You may choose **specific** or **empirical**.
15. Use the list box to indicate the prior for numerical quadrature to be assumed for the random effects. You may choose **normal** or **uniform**.

Variables

Within the Variables card, the following settings may require additional information, depending on what values are entered:

- Categories for Ordinal Outcome Variable
- Number of Random Effects
- Number of Explanatory Variable Effects
- Perform Crosstabulation

If more information is required, a table will appear (or become larger). The number of rows of the table will depend on the value entered. If there is insufficient space to display all rows of the table, scroll bars will automatically appear.

Tables can be maximized (similarly, minimized) by double-clicking anywhere in the table.

To define Variables program settings:

1. Click on the Variables tab.
2. Indicate the field of your input file which contains the dichotomous or ordinal dependent variable.
3. Enter the text of your choice as the label for the ordinal outcome variable. The maximum length is 8 characters; longer labels are automatically clipped.
4. Enter the number of ordered categories for ordinal outcome variable. You may have 2 to 16 categories. Press `TAB`. For each ordered category of the ordinal outcome variable, enter its value.
5. Enter the number of random effects. The maximum number of random effects is 8. Press `TAB`. If a non-zero value was entered, a table will appear. For each random effect, enter its field from your input file and its label. As before the maximum length of the label is 8 characters.
6. Enter the number of explanatory variable effects. The maximum number of explanatory variable effects is 40. Press `TAB`. If a non-zero value was entered, a table will appear. For each explanatory variable effect, enter its field from your input file and its label. As before the maximum length of the label is 8 characters.
7. Use the list box to indicate if a crosstabulation of any variable by the outcome variable is to be performed. You may choose **yes** or **no**.
If you choose **yes** additional fields will appear:
 - a) Indicate the variable to be crosstabulated by entering its field from your input file.
 - b) Enter the number of levels for the variable to be crosstabulated. The maximum number of levels is 60.
 - c) For each level of the crosstabulated variable, enter its value.

Starting Values

To define Starting Values program settings:

1. Click on the Starting Values tab.
2. Use the list box to indicate the type of starting values. You may choose **automatic** or **user-defined**.

If you select **user-defined** additional fields will appear:

- a) If you had a non-zero number of random effects (see the Variables card) and the random effects mean vector is set to estimate (see the Advanced card) you must fill the table with the starting values for the means of the random effects.
- b) If you had a non-zero number of explanatory variables (see the Variables card) you must fill the table with their starting values
- c) If you had a non-zero number of random effects, you must fill the table with the starting values for the (co)variances of the random effects.
- d) You must fill the table with the starting values for the thresholds.
The threshold values must be monotonically increasing and greater than zero.

Missing Values

To define Missing Values program settings:

1. Click on the Missing Values tab.
2. Use the list box to indicate whether there are missing values present. You may choose **true** or **false**.

If you select **true** additional information is required:

- a) Enter the missing value code for the dependent (count) variable.
- b) If you had a non-zero number of random effects (see the Variables card) you must fill the table with the missing values codes for the random effects.
- c) If you had a non-zero number of explanatory variable effects (see the Variables card) you must fill the table with the missing value codes for the explanatory variables.

Advanced

To define Advanced program settings:

1. Click on the Advanced tab.
2. Use the list box to indicate whether right censoring should be included or not. You may choose **include** or **none**.
If you select **include** enter the field of your input file that contains the censor variable.
3. Use the list box to indicate how to treat the model terms with the thresholds. You may choose **add** or **subtract**. Simply put, this option reverses the sign (+ or -) of the estimated regression coefficients.
4. Use the list box to indicate how to treat the mean vector of random effects. You may choose **estimate** or **fix to zero**.
5. If the number of random effects (see the Variables card) is greater than one, you may consider two mutually exclusive options. For the first, use the list box to indicate that the multiple random effects are separate grouping variables. In this case, you may choose **yes** or **no**. If you decline the first option (that is, choose no) another list box will appear. With this second option you may specify that the multiple random effects are either **correlated** or **independent**.
6. Enter the number of explanatory variable effects to interact with the threshold parameters. Press TAB. If a non-zero value was entered a table will appear. Enter the starting values for the threshold interaction terms.
7. Enter the number of linear transforms of the estimated parameters to estimate. The maximum number is 200.
8. For each linear transform (use the scroll bar to move through the transforms, or enter its number in the text box and press TAB) enter the following:
 - a) If you had a non-zero number of random effects (see the Variables card), you must fill the table with the values for the random effect mean vectors.
 - b) If you had a non-zero number of explanatory variable effects (see the Variables card) you must fill the table with the values of explanatory variable effects.
 - c) If you had a non-zero number of random effects, you must fill the table with the values for the (co)variances of the random effects.
 - d) Enter the values for the thresholds.
 - e) If you entered a non-zero number of explanatory variable effects to interact with the threshold parameters, enter the values of the thresholds interaction terms.

Printing from within MIXOR

From the View option, clicking on Print will invoke the Windows Print Dialog from where you can begin printing. Since this dialog box is shared amongst all printing tasks, selections that are not applicable to MIXOR are greyed out.

The following information is displayed:

- The default printer. If you wish to change the default printer, click on Setup (see Print Setup).
- The print range set to All. This cannot be changed.
- The print quality.
- The number of copies.

To print:

1. Check that the printer is correct.
2. Verify that the quality is correct, or use the list box to change the quality.
3. Indicate the number of copies.
4. Begin printing by clicking on OK.

Note: Output will always be printed with portrait orientation.

To cancel printing:

If you wish to abort a print job, you must do so from within Print Manager. Do not use the Escape key; MIXOR will ignore it. For further information about Print Manager, consult your Windows reference materials.

Print Setup

The Print Setup dialog will display the default printer settings as they are defined in your **Windows installation**. Take care when using this option! If you make any changes in this dialog box, it will affect the operation of other Windows applications yet MIXOR may not recognize it.

The following information is displayed:

- **Orientation:** MIXOR will always issue its output in portrait orientation, even if you change the orientation in the Setup dialog. So, if you choose landscape, MIXOR output will still appear in portrait form, yet output from other Window's applications may appear in landscape.
- **Printers:** The only change that MIXOR will act upon is the choice of printer. But again, changing the printer in MIXOR will cause the printer settings in other Windows applications to change as well.