

Description

The IRT Control Panel allows you to perform a complete IRT analysis. From the Control Panel, you can fit IRT models, create customized reports of the results, and produce graphs of item characteristic curves (ICCs), category characteristic curves (CCCs), test characteristic curves (TCCs), item information functions (IIFs), and test information functions (TIFs).

Remarks and examples

You can perform IRT analyses using the `irt` commands, `estat report`, `estat greport`, and the `irtgraph` commands, or you can perform complete analyses interactively using the IRT Control Panel. Any analysis that you can perform with the `irt` commands, you can also perform from the Control Panel. This includes customizing graphs and reports and testing for differential item functioning.

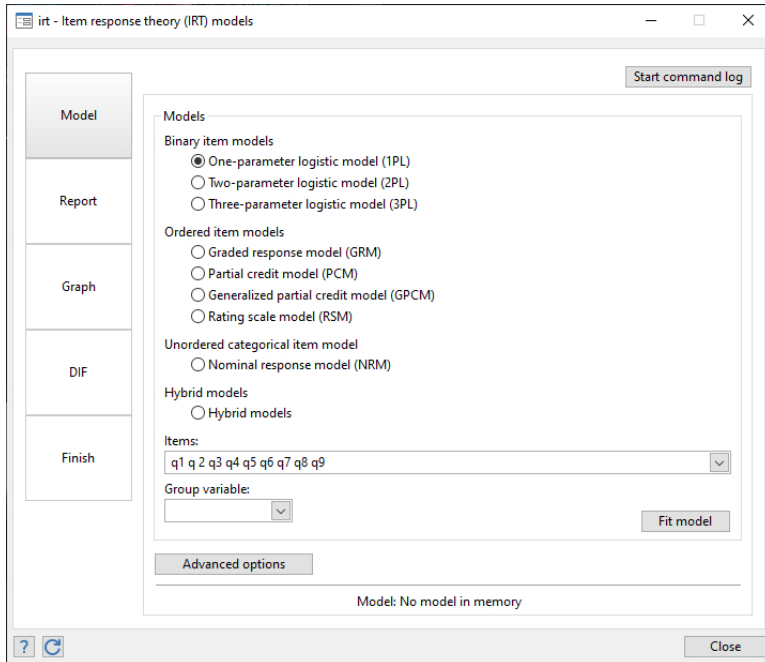
To demonstrate the IRT Control Panel, we will work [example 1](#) of [\[IRT\] irt](#). We open the abridged version of the mathematics and science data from [De Boeck and Wilson \(2004\)](#) by typing

```
. use https://www.stata-press.com/data/r19/masc1
```

in the Command window. This dataset contains 9 binary items, `q1` through `q9`, coded as 1 for correct and 0 for incorrect.

To open the IRT Control Panel, we select **Statistics > IRT (item response theory)** from the Stata menu.

The Control Panel opens to the *Model* tab, where we select the type of IRT model we wish to fit. Our example begins by fitting a one-parameter logistic (1PL) model to all nine items in the dataset, so we choose the *One-parameter logistic model (1PL)* radio button. Then, we select items q1 through q9 in the *Items* control.



We click on **Fit model**, and the results appear in the Results window.

```
. irt 1pl q1 q2 q3 q4 q5 q6 q7 q8 q9
```

Fitting fixed-effects model:

```
Iteration 0: Log likelihood = -4275.6606
Iteration 1: Log likelihood = -4269.7861
Iteration 2: Log likelihood = -4269.7825
Iteration 3: Log likelihood = -4269.7825
```

Fitting full model:

```
Iteration 0: Log likelihood = -4153.3609
Iteration 1: Log likelihood = -4142.374
Iteration 2: Log likelihood = -4142.3516
Iteration 3: Log likelihood = -4142.3516
```

One-parameter logistic model

Number of obs = 800

Log likelihood = -4142.3516

		Coefficient	Std. err.	z	P> z	[95% conf. interval]	
	Discrim	.852123	.0458445	18.59	0.000	.7622695	.9419765
q1	Diff	-.7071339	.1034574	-6.84	0.000	-.9099066	-.5043612
q2	Diff	-.1222008	.0963349	-1.27	0.205	-.3110138	.0666122
q3	Diff	-1.817693	.1399523	-12.99	0.000	-2.091994	-1.543391
q4	Diff	.3209596	.0976599	3.29	0.001	.1295498	.5123695
q5	Diff	1.652719	.1329494	12.43	0.000	1.392144	1.913295
q6	Diff	.6930617	.1031842	6.72	0.000	.4908243	.8952991
q7	Diff	1.325001	.1205805	10.99	0.000	1.088668	1.561335
q8	Diff	-2.413443	.1691832	-14.27	0.000	-2.745036	-2.08185
q9	Diff	-1.193206	.1162054	-10.27	0.000	-1.420965	-.965448

Next, we want to report the results sorted by difficulty. On the left of the Control Panel, we select the *Report* tab.

At the top, we select the *Report estimated IRT parameters* radio button. Then under *Sort order of item estimates*, we select the *Sort by parameter b (difficulty)* radio button, and under *Grouping of estimates*, we select the *Group estimates into parameter classes (a, b, and c)* radio button. By default, the report is created for all items in the model, so we do not need to select items q1 through q9 in the *Items* control. We click on the **Submit** button, and the new report appears in the Results window.

```
. estat report, sort(b) byparm
```

One-parameter logistic model

Number of obs = 800

Log likelihood = -4142.3516

	Coefficient	Std. err.	z	P> z	[95% conf. interval]	
Discrim	.852123	.0458445	18.59	0.000	.7622695	.9419765
Diff						
q8	-2.413443	.1691832	-14.27	0.000	-2.745036	-2.08185
q3	-1.817693	.1399523	-12.99	0.000	-2.091994	-1.543391
q9	-1.193206	.1162054	-10.27	0.000	-1.420965	-.965448
q1	-.7071339	.1034574	-6.84	0.000	-.9099066	-.5043612
q2	-.1222008	.0963349	-1.27	0.205	-.3110138	.0666122
q4	.3209596	.0976599	3.29	0.001	.1295498	.5123695
q6	.6930617	.1031842	6.72	0.000	.4908243	.8952991
q7	1.325001	.1205805	10.99	0.000	1.088668	1.561335
q5	1.652719	.1329494	12.43	0.000	1.392144	1.913295

We are now ready to graph the ICCs for our items. On the left of the Control Panel, we select the *Graph* tab. Under *Graph type*, we select the *Item characteristic curves (ICCs)* radio button.

irt - Item response theory (IRT) models

Model

Report

Graph

DIF

Finish

Graph type

☒ Item characteristic curves (ICCs)

☐ Category characteristic curves (CCCs)

☐ Item information functions (IIFs)

☐ Test characteristic curve (TCC)

☐ Test information function (TIF)

Common graphs

☐ Add vertical lines for estimated item difficulties

ICCs for:

All items

Selected items

Submit Add options

Submit Add options

Note: Plots boundary characteristic curves for categorical items.

Custom graphs

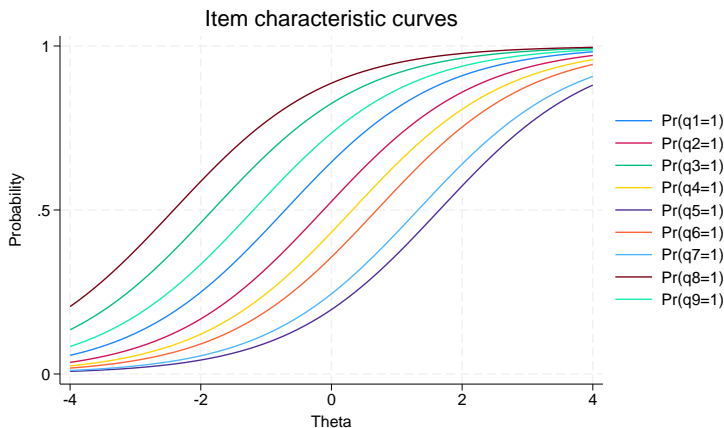
Customized graph starting from all items

Customized graph of selected items

Model: One-parameter logistic model

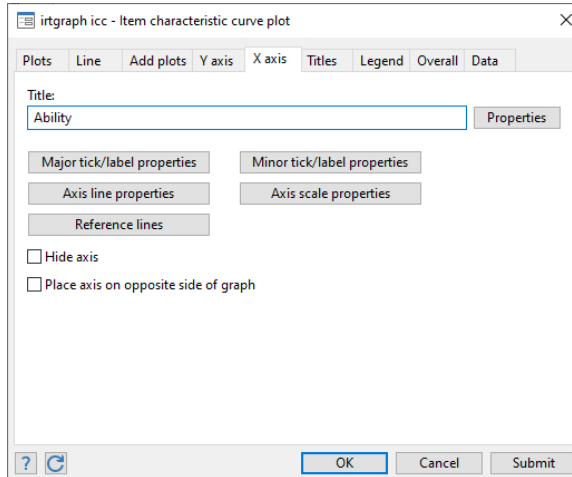
Close

Then, in the *Common graphs* section, we simply click on the **Submit** button on the line requesting ICCs for all items to create the following graph.

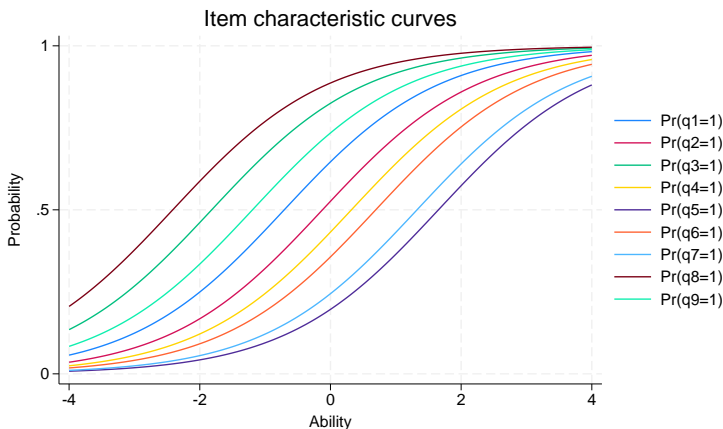


In [IRT] **irt**, lines were included in the graph to show the estimated difficulty for each item. If we want to add these lines, we can check *Add vertical lines for estimated item difficulties* before clicking on the **Submit** button.

The **Add options** button allows us to modify the appearance of the graph. We can change the title of the graph and its size, add a caption, change the title displayed along each axis, change the placement and appearance of labels on each axis, change the color and pattern of lines, change the placement and appearance of the legend, and much more. To demonstrate this, we change the title on the x axis from the default of θ to Ability. We click on the **Add options** button on the line for ICCs for all items. In the resulting dialog box, we select the **X axis** tab and type Ability in the *Title:* box.



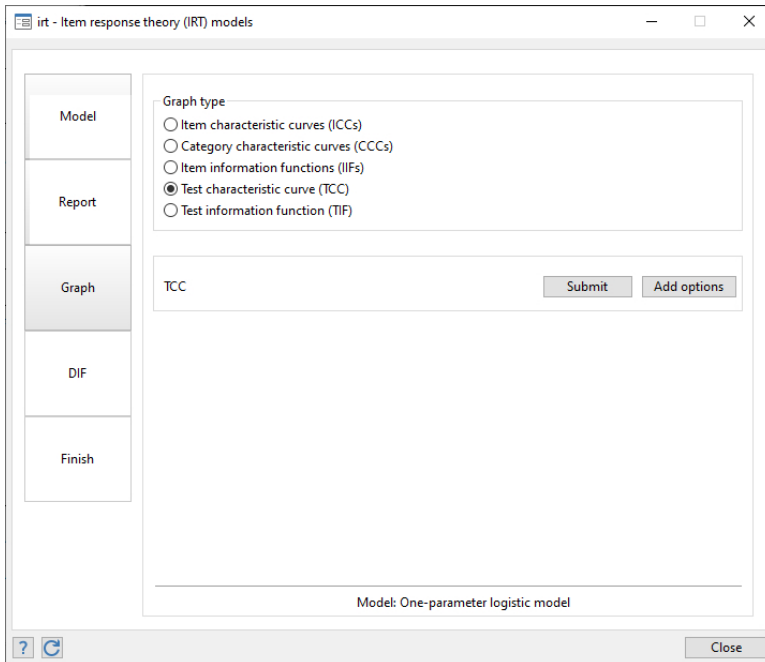
We click on **Submit** to re-create our previous graph but with the modified title on the x axis.



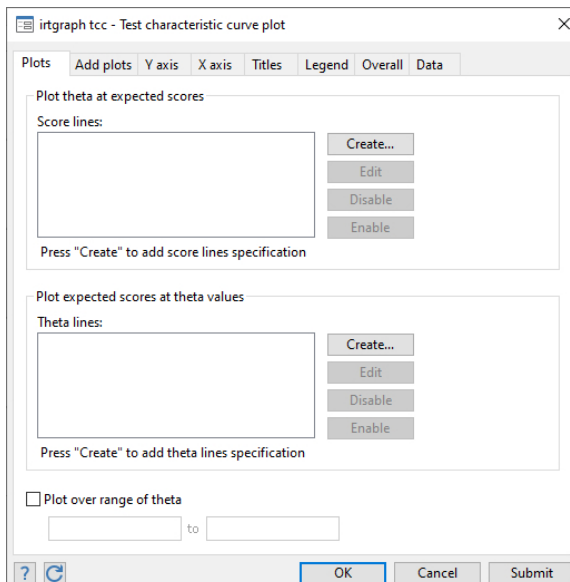
By clicking on **Submit** rather than on **OK**, we keep the dialog box open so that we can continue modifying the look of the graph. We will not make any further modifications at this point, so we will close the dialog box.

Back on the *Graph* tab of the Control Panel, there are two additional buttons in the *Custom graphs* section. Even further customization of graphs is available by clicking on the **Customized graph starting from all items** button or the **Customized graph of selected items** button. These allow us to change the appearance of each curve individually. For instance, we can specify a color or line pattern for one item or for a group of items. We can also make any of the modifications that are available through the **Add options** buttons.

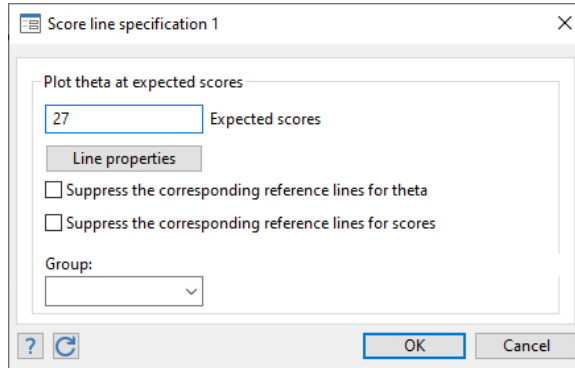
The example in [IRT] irt also graphs the TCCs. To create this graph, we select the *Test characteristic curve (TCC)* radio button from the *Graph* tab and click on the **Submit** button next to *TCC*.



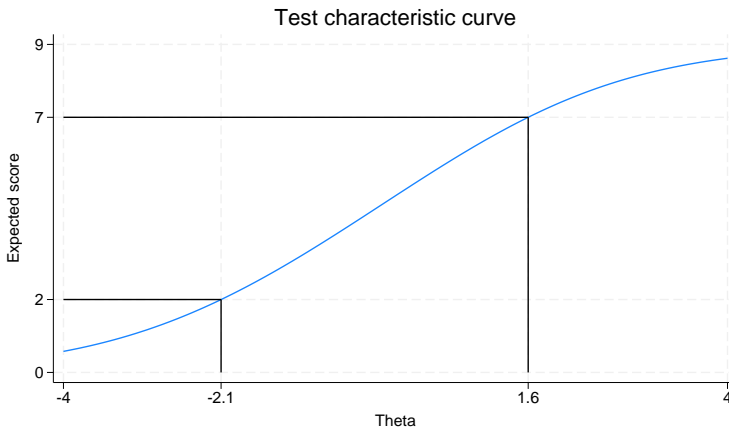
To add lines corresponding to the value of θ for expected scores of 2 and 7, we click on the **Add options** button. In the resulting dialog, we click on the **Create...** button next to the *Score lines*: box.



In the dialog box that opens, we type 27 in the box for *Expected scores*.



Then, we click on **OK** twice, and the following TCC graph is produced.



Although the example continues in [IRT] [irt](#), we will stop at this point. We have now demonstrated the use of the *Model*, *Report*, and *Graph* tabs on the IRT Control Panel. You can use the Control Panel in a similar manner to fit any IRT model, to produce other types of reports, and to create graphs of ICCs, CCCs, TCCs, IIFs, and TIFs.

For reproducible research, you can create a command log containing all the commands that are issued from the Control Panel. To create the command log, click on the **Start command log** button on the *Model* tab before fitting a model. In the dialog box that opens, specify the name of the command log, say, `Ex_1p1`, to create a file named `Ex_1p1.txt` in your current working directory. Next, click on **OK**. Now you are ready to perform your analysis, storing all the commands that the Control Panel issues. Once you have completed your analysis, go to the *Finish* tab and click on the **Close command log** button. The `Ex_1p1.txt` file will contain all of your commands, which can be rerun to easily reproduce your analysis.

Reference

De Boeck, P., and M. Wilson, eds. 2004. *Explanatory Item Response Models: A Generalized Linear and Nonlinear Approach*. New York: Springer. <https://doi.org/10.1007/978-1-4757-3990-9>.

Also see

[IRT] [irt](#) — Introduction to IRT models

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