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## Description

`irtgraph tcc` plots the test characteristic curve (TCC) for the currently fitted IRT model.

## Quick start

2PL model for binary items b1 to b10

```
irt 2pl b1-b10
```

Plot the TCC for the fitted model

```
irtgraph tcc
```

Plot the TCC, and show the expected score for the latent trait level of  $-1$  and  $1$

```
irtgraph tcc, thetalines(-1 1)
```

Plot the TCC, and show the latent trait level for the expected scores of  $5$  and  $8$

```
irtgraph tcc, scorelines(5 8)
```

Fit a group 2PL model

```
irt 2pl b1-b9, group(female)
```

Plot the TCCs for both groups

```
irtgraph tcc
```

Plot the TCCs, and show the latent trait level for the expected scores of  $5$  and  $8$  for group  $1$

```
irtgraph tcc, scorelines(1: 5 8)
```

## Menu

Statistics > IRT (item response theory)

## Syntax

```
irtgraph tcc [ , options ]
```

<i>options</i>	Description
<b>Plots</b>	
<code>scorelines([ #: ] <i>numlist</i> [ , <i>refopts</i> ])</code>	add $x$ and $y$ reference lines at each score value in <i>numlist</i>
<code>thetalines([ #: ] <i>numlist</i> [ , <i>refopts</i> ])</code>	add $x$ and $y$ reference lines at each $\theta$ value in <i>numlist</i>
<code>range(##)</code>	plot over $\theta = \#$ to $\#$
<b>Add plots</b>	
<code>addplot(<i>plot</i>)</code>	add other plots to the TCC plot
<b>Y axis, X axis, Titles, Legend, Overall</b>	
<code>twoway_options</code>	any options other than <code>by()</code> documented in <a href="#">[G-3] twoway_options</a>
<b>Data</b>	
<code>n(##)</code>	evaluate curves at $\#$ points; default is <code>n(300)</code>
<code>data(filename [ , replace ])</code>	save plot data to a file
<hr/>	
<code>scorelines()</code> and <code>thetalines()</code> can be specified multiple times.	
<code>#: </code> plots lines for the specified group; allowed only after a group IRT model.	
<hr/>	
<i>refopts</i>	Description
<code>line_options</code>	affect rendition of the plotted expected score and $\theta$ lines
<code>noxlines</code>	suppress the corresponding reference lines for $\theta$ values
<code>noylines</code>	suppress the corresponding reference lines for score values

## Options

### Plots

`scorelines([ #: ] numlist [ , refopts ])` adds  $x$  and  $y$  reference lines at each score value in *numlist*.

For group IRT models, reference lines are plotted for all groups. You can specify the optional `#:`  to restrict reference lines to a specific group.

`thetalines([ #: ] numlist [ , refopts ])` adds  $x$  and  $y$  reference lines at each  $\theta$  value in *numlist*.

For group IRT models, reference lines are plotted for all groups. You can specify the optional `#:`  to restrict reference lines to a specific group.

*refopts* affect the rendering of expected score and  $\theta$  lines:

*line\_options* specify how the expected score and  $\theta$  lines are rendered; see [\[G-3\] line\\_options](#).

`noxlines` suppresses the corresponding reference line for  $\theta$ .

`noylines` suppresses the corresponding reference line for scores.

`range(##)` specifies the range of values for  $\theta$ . This option requires a pair of numbers identifying the minimum and maximum. The default is `range(-4 4)`.

## Add plots

`addplot(plot)` allows adding more graph twoway plots to the graph; see [G-3] [addplot\\_option](#).

## Y axis, X axis, Titles, Legend, Overall

`twoway_options` are any of the options documented in [G-3] [twoway\\_options](#), excluding `by()`. These include options for titling the graph (see [G-3] [title\\_options](#)) and for saving the graph to disk (see [G-3] [saving\\_option](#)).

## Data

`n(#)` specifies the number of points at which the TCCs are to be evaluated. The default is `n(300)`.

`data(filename [, replace])` saves the plot data to a Stata data file.

## Remarks and examples

`irtgraph tcc` plots the TCC after estimating the parameters of an IRT model using `irt`. The curve is also known as the “total characteristic curve”. The TCC is the sum of ICCs for the entire instrument and thus plots the expected score on the test along the latent trait continuum.

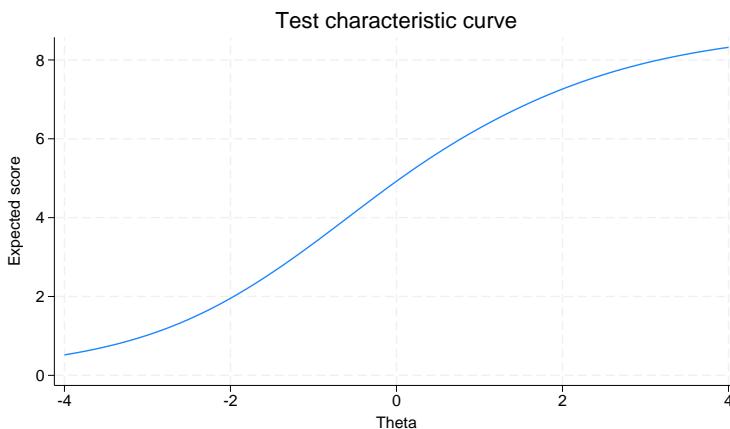
### ► Example 1: TCC for binary items

We continue with the 2PL model from [example 1](#) of [IRT] [irt 2pl](#). Recall that we fit a 2PL model to the nine binary items.

```
. use https://www.stata-press.com/data/r19/masc1
(Data from De Boeck & Wilson (2004))
. irt 2pl q1-q9
(output omitted)
```

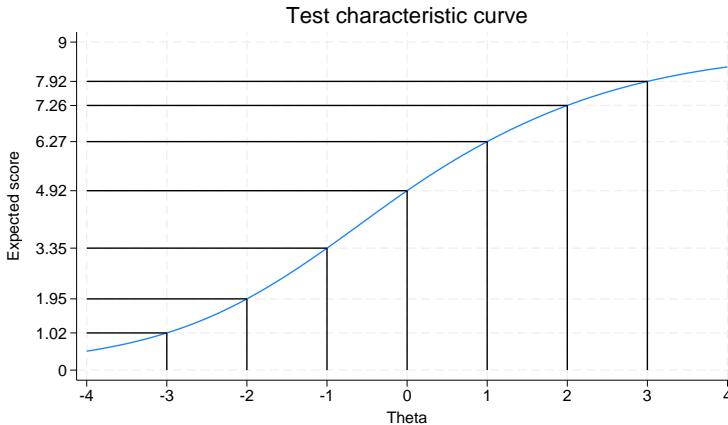
Because our instrument contains nine binary items, each coded as a 0 or a 1, the lowest possible score is 0, and the highest possible score is 9. Here we plot the TCC for the fitted model to see the expected score for a given range of the latent trait  $\theta$ .

```
. irtgraph tcc
```



We can provide `irtgraph tcc` with a list of  $\theta$  values, and `irtgraph tcc` will plot the corresponding expected scores. Here we ask for the expected scores corresponding to the latent trait level  $-3$  to  $3$  in steps of  $1$ .

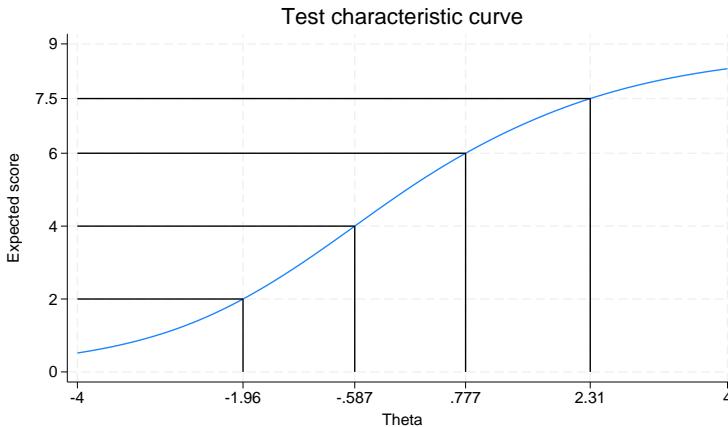
```
. irtgraph tcc, thetalines(-3/3)
```



We see that for an examinee with the latent trait level equal to  $0$ , the expected score on the test is  $4.92$ .

We can also provide `irtgraph tcc` with a list of expected scores, and `irtgraph tcc` will plot the corresponding latent trait values.

```
. irtgraph tcc, scorelines(2 4 6 7.5)
```



We see that examinees with a latent trait level of  $0.78$  and above are expected to obtain a score of  $6$  or more on the test.



#### □ Technical note

For nominal items, a score has no meaning other than to designate the response category, and a total score cannot be obtained. `irtgraph tcc` will plot the TCC in the presence of nominal outcomes, treating them as ordinal, and print a warning note alerting the user to the situation.



## Stored results

`irtgraph tcc` stores the following in `r()`:

Macros

<code>r(xvals)</code>	values used to label the $x$ axis
<code>r(yvals)</code>	values used to label the $y$ axis

## Reference

Raciborski, R. 2015. Spotlight on irt. *The Stata Blog: Not Elsewhere Classified*. <https://blog.stata.com/2015/07/31/spotlight-on-irt/>.

## Also see

- [IRT] [irt](#) — Introduction to IRT models
- [IRT] [irt 1pl](#) — One-parameter logistic model
- [IRT] [irt 2pl](#) — Two-parameter logistic model
- [IRT] [irt 3pl](#) — Three-parameter logistic model
- [IRT] [irt grm](#) — Graded response model
- [IRT] [irt hybrid](#) — Hybrid IRT models
- [IRT] [irt nrm](#) — Nominal response model
- [IRT] [irt pcm](#) — Partial credit model
- [IRT] [irt rsm](#) — Rating scale model
- [IRT] [irtgraph icc](#) — Item characteristic curve plot

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