# teffects overlap — Overlap plots

## Syntax

```
teffects overlap [ , treat_options kden_options ]
```

### treat_options

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ptlevel(treat_level)</strong></td>
</tr>
<tr>
<td><strong>tlevels(treatments)</strong></td>
</tr>
<tr>
<td><strong>nolabel</strong></td>
</tr>
</tbody>
</table>

### kden_options

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>kernel(kernel)</strong></td>
</tr>
<tr>
<td><strong>n(#)</strong></td>
</tr>
<tr>
<td><strong>bw(##)</strong></td>
</tr>
<tr>
<td><strong>at(var_x)</strong></td>
</tr>
</tbody>
</table>

### Kernel plots

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>line#opts(cline_options)</strong></td>
</tr>
</tbody>
</table>

### Add plots

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>addplot(plot)</strong></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><strong>twoway_options</strong></td>
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</table>

## kernel

<table>
<thead>
<tr>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>triangle</strong></td>
</tr>
<tr>
<td><strong>epanechnikov</strong></td>
</tr>
<tr>
<td><strong>epan2</strong></td>
</tr>
<tr>
<td><strong>biweight</strong></td>
</tr>
<tr>
<td><strong>cosine</strong></td>
</tr>
<tr>
<td><strong>gaussian</strong></td>
</tr>
<tr>
<td><strong>parzen</strong></td>
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<tr>
<td><strong>rectangle</strong></td>
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</table>
One of the assumptions required to use the `teffects` estimators is the overlap assumption, which states that each individual has a positive probability of receiving each treatment level. `teffects overlap`, a postestimation command, plots the estimated densities of the probability of getting each treatment level. These plots can be used to check whether the overlap assumption is violated.

### Options

**ptlevel(treat_level)** specifies that predicted probabilities be calculated for treatment level `treat_level`. The default is `ptlevel(first)`, where `first` is the first treatment level.

**tlevels(treatments)** specifies the observations for which to obtain predicted probabilities. By default, all treatment levels are used. Specify `treatments` as a space-delimited list.

For instance,

```
. teffects overlap, ptlevel(1) tlevels(1 2)
```

says to predict the probability of getting treatment level 1 for those subjects who actually obtained treatment levels 1 or 2.

**nolabel** specifies that treatment level values and not value labels be used in legend and axis titles.

**kernel(kernel)** specifies the kernel function for use in calculating the kernel density estimates. The default kernel is the triangle kernel (`triangle`).

**n(#)** specifies the number of points at which the density estimate is to be evaluated. The default is `e(N)`, the estimation sample size.

**bwidth(#)** specifies the half-width of the kernel, the width of the density window around each point. If `bwidth()` is not specified, the “optimal” width is calculated and used; see [R] `kdensity`. The optimal width is the width that would minimize the mean integrated squared error if the data were Gaussian and a Gaussian kernel were used, so it is not optimal in any global sense. In fact, for multimodal and highly skewed densities, this width is usually too wide and oversmooths the density (Silverman 1992).

**at(var)*** specifies a variable that contains the values at which the density should be estimated. This option allows you to more easily obtain density estimates for different variables or different subsamples of a variable and then overlay the estimated densities for comparison.

**line#opts(cline_options)** affect the rendition of the plotted kernel density estimates. See [G-3] `cline_options`.

**addplot(plot)** provides a way to add other plots to the generated graph. See [G-3] `addplot_option`. 


*Remarks and examples*

`teffects overlap` plots the estimated densities of the probability of getting each treatment level after `teffects`.

These plots can be used to check whether the overlap assumption is violated. The overlap assumption is satisfied when there is a chance of seeing observations in both the control and the treatment groups at each combination of covariate values; see [TE] `teffects intro` or [TE] `teffects intro advanced`.

The overlap assumption is required by the estimators implemented in `teffects`. Intuitively, when the overlap assumption is violated, we cannot predict, or otherwise account for, the unobserved outcomes for some individuals.

There is evidence that the overlap assumption is violated when an estimated density has too much mass around 0 or 1; see Busso, DiNardo, and McCrary (2011). An implication of this point is that when the overlap assumption is violated, the estimated densities will have relatively little mass in the regions in which they overlap.

**Example 1: Assumption not violated**

Continuing with example 1 of [TE] `teffects ipw`, we estimate the average treatment effect of smoking on birthweight and then draw the overlap plot:

```
use http://www.stata-press.com/data/r13/cattaneo2
.teffects ipw (bweight) (mbsmoke mmarried c.mage##c.mage fbaby medu, probit)
Iteration 0: EE criterion = 4.622e-21
Iteration 1: EE criterion = 8.070e-26
Treatment-effects estimation          Number of obs  =  4642
Estimator : inverse-probability weights
Outcome model : weighted mean
Treatment model: probit

  bweight |      Coef.     Std. Err.      z    P>|z|     [95% Conf. Interval]
---------+----------------------------------*
    ATE   |  mbsmoke (smoker vs nonsmoker)  |    
        |                                 |    
        |                                     |    
        |  -230.6886   25.81524   -8.94  0.000   -281.2856   -180.0917   

  POmean |      Coef.     Std. Err.      z    P>|z|     [95% Conf. Interval]
---------+----------------------------------*
    ATE   |  mbsmoke nonsmoker               |    
        |                                 |    
        | 3403.463     9.571369  355.59  0.000    3384.703    3422.222   
```
The graph displays the estimated density of the predicted probabilities that a nonsmoking mother is a nonsmoker and the estimated density of the predicted probabilities that a smoking mother is a nonsmoker.

Neither plot indicates too much probability mass near 0 or 1, and the two estimated densities have most of their respective masses in regions in which they overlap each other. Thus there is no evidence that the overlap assumption is violated.

Example 2: Assumption violated

This example produces an overlap plot that indicates a failure of the overlap assumption. We will use simulated data, so we know that the assumption is not true.

In our simulated dataset, some of the 1,000 adult males were given drug XY1 for high blood pressure and others were not. A scatterplot of systolic blood pressure (systolic) and weight (weight) reveals that heavier men were given the treatment. (The scatterplots corresponding to the treatment group are colored red, while the scatterplots corresponding to the control group are colored blue.)
. use http://www.stata-press.com/data/r13/systolic2
(Systolic blood pressure)
. twoway (scatter systolic weight if xy1==1, mcolor(red))
>       (scatter systolic weight if xy1==0, mcolor(blue)),
>       legend(label(1 "Treated") label(2 "Untreated"))

There are no observations in the treated group for small weights, and there are no observations in the control group for large weights. There is clear evidence that the overlap assumption is violated.

Drawing an overlaid scatterplot is a straightforward way to check the overlap assumption in this example because there is only one covariate. This method is not available when there is more than one covariate. The predicted probability is a one-dimensional measure that captures the relevant multivariate information.

Below we estimate the parameters needed to calculate the predicted probabilities. The `pstolerance(1e-8)` option is specified to ensure that estimation is performed as long as the predicted probabilities are at least as large as $1e^{-8}$.

```
. teffects ipw (systolic) (xy1 weight), pstolerance(1e-8)
Iteration 0: EE criterion = 9.523e-18
Iteration 1: EE criterion = 8.779e-28
Treatment-effects estimation Number of obs = 1000
Estimator : inverse-probability weights
Outcome model : weighted mean
Treatment model: logit

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<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>Std. Err.</td>
</tr>
<tr>
<td><strong>ATE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>xy1</td>
<td>-16.23679</td>
<td>2.191703</td>
</tr>
<tr>
<td>(Treated vs Untreated)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>POmean</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>xy1</td>
<td>127.9094</td>
<td>.7004533</td>
</tr>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
Now we can obtain the overlap plot.

```
. teffects overlap
```

The estimated density of the predicted probabilities that a treated individual is not assigned to \(XY_1\) treatment has most of its mass near 0. The estimated density of the predicted probabilities that an untreated individual is not assigned to \(XY_1\) treatment has most of its mass near 1. Note that the two have very little mass in the region in which they overlap. There is clear evidence that the overlap assumption is violated.

---

**Stored results**

`teffects overlap` stores the following in `r()`:

**Scalars**

- `r(bwidth)` kernel bandwidth for treatment level \(j\)
- `r(nj)` number of points at which the estimate was evaluated for treatment level \(j\)
- `r(scalej)` density bin width for treatment level \(j\)

**Macros**

- `r(kernel)` name of kernel

**References**


Also see

[TE] **teffects** — Treatment-effects estimation for observational data
[TE] **teffects aipw** — Augmented inverse-probability weighting
[TE] **teffects ipw** — Inverse-probability weighting
[TE] **teffects ipwra** — Inverse-probability-weighted regression adjustment
[TE] **teffects nnmatch** — Nearest-neighbor matching
[TE] **teffects psmatch** — Propensity-score matching
[TE] **teffects ra** — Regression adjustment