Title

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tebalance summarize — Covariate-balance summary statistics

Description

`tebalance summarize` reports diagnostic statistics that are used to check for covariate balance over treatment groups after estimation by a `teffects` inverse-probability-weighted (IPW) estimator, a `teffects` matching estimator, or an `stteffects` IPW estimator.

Quick start

Raw and weighted standardized differences and variance ratios of all covariates from the most recently estimated `teffects` model or `stteffects` model

```
tebalance summarize
```

As above, but report statistics only for covariates `x1` and `x2`

```
tebalance summarize x1 x2
```

Baseline means and variances for treated and control groups

```
tebalance summarize, baseline
```

Menu

Statistics > Treatment effects > Balance > Summaries

Syntax

```
tebalance summarize [varlist] [, baseline]
```

varlist may contain factor variables; see [U] **11.4.3 Factor variables**.
`collect` is allowed; see [U] **11.1.10 Prefix commands**.

Option

Main

`baseline` specifies that `tebalance summarize` report means and variances by treatment level.

Remarks and examples

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When the distribution of a covariate is the same for all treatment levels, the covariate is said to be balanced. `tebalance summarize` reports diagnostic statistics to check for covariate balance after `teffects` or `stteffects`. `tebalance summarize` can be executed after all `teffects` estimators with the exception of `teffects ra` and executed after `stteffects ipw` and `stteffects ipwra`.

We recommend that you read [TE] **tebalance** before proceeding; it provides an introduction to covariate balance and an overview of the implemented methods. See [TE] **stteffects intro** for survival-time discussion and examples.

▷ Example 1: Checking covariate balance after psmatch

Using an extract from the data used by Cattaneo (2010), we use `teffects psmatch` to estimate the effect of a mother's smoking behavior (`mbsmoke`) on the birthweight of her child (`bweight`), controlling for marital status (`mmarried`), the mother's age (`mage`), whether the mother had a prenatal doctor's visit in the baby's first trimester (`prenatal1`), and whether this baby is the mother's first child (`fbaby`).

```
. use https://www.stata-press.com/data/r17/cattaneo2
(Excerpt from Cattaneo (2010) Journal of Econometrics 155: 138-154)
. teffects psmatch (bweight) (mbsmoke mmarried mage prenatal1 fbaby),
> generate(matchv)
Treatment-effects estimation                   Number of obs      =      4,642
Estimator      : propensity-score matching     Matches: requested =          1
Outcome model  : matching                                  min =          1
Treatment model: logit                                     max =        139
```

bweight	Coefficient	AI robust std. err.	z	P>|z|	[95% conf.	interval]
ATE						
mbsmoke (Smoker vs Nonsmoker)	-235.1714	27.74409	-8.48	0.000	-289.5488	-180.794

We specified the option `generate(matchv)` to speed up the postestimation commands that compute balance statistics, as discussed in example 3 under *Remarks and examples* in [TE] **tebalance**. We do not interpret the estimated effect produced by this preliminary model but rather check the specification.

We begin by looking at the standardized differences and variance ratios for the raw data and the matched sample.

```
. tebalance summarize
Covariate balance summary
                          Raw       Matched
------------------------------------------
Number of obs =         4,642         9,284
Treated obs   =           864         4,642
Control obs   =         3,778         4,642
------------------------------------------
```

	Standardized differences		Variance ratio	
	Raw	Matched	Raw	Matched
mmarried	-.5953009	.0014107	1.335944	.9987659
mage	-.300179	-.0120277	.8818025	.9952916
prenatal1	-.3242695	.0333609	1.496155	.9491524
fbaby	-.1663271	-.0117326	.9430944	.9969095

The matched sample results indicate that matching on the estimated propensity score balanced the covariates. The standardized differences are all close to zero, and the variance ratios are all close to one. This inference is informal because we do not have standard errors for these statistics.

We may also wish to see the baseline summary statistics.

```
. tebalance summarize, baseline
Covariate balance summary
                          Raw       Matched
------------------------------------------
Number of obs =         4,642         9,284
Treated obs   =           864         4,642
Control obs   =         3,778         4,642
------------------------------------------
```

	Means		Variances	
	Control	Treated	Control	Treated
mmarried	.7514558	.4733796	.1868194	.2495802
mage	26.81048	25.16667	31.87141	28.10429
prenatal1	.8268925	.6898148	.1431792	.2142183
fbaby	.4531498	.3715278	.2478707	.2337654

While we rely on the standardized differences for conclusions about balance in the unmatched sample from this output, the baseline means and variances give us some idea of the scale of the differences.

◁

Example 2: Multivalued treatments

In the multivalued-treatment case, `tebalance summarize` produces output grouped by treatment level. In the Cattaneo (2010) extract, the variable `msmoke` is an ordered categorical variable specifying the number of cigarettes smoked. We begin by tabulating `msmoke`.

```
. tabulate msmoke
```

Cigarettes smoked during pregnancy	Freq.	Percent	Cum.
0 daily	3,778	81.39	81.39
1–5 daily	200	4.31	85.70
6–10 daily	337	7.26	92.96
11+ daily	327	7.04	100.00
Total	4,642	100.00	

All the treatment groups have significantly smaller numbers of observations than the control group of not smoking. Still, each group has at least 200 observations. We continue by quietly fitting a candidate IPW model and reporting the baseline summaries.

```
. quietly teffects ipw (bweight) (msmoke mmarried mage prenatal1 fbaby)
. tebalance summarize, baseline
Covariate balance summary
```

Treatment	Observations Raw	Weighted
0 daily =	3,778	1,164.8
1–5 daily =	200	1,164.4
6–10 daily =	337	1,157.9
11+ daily =	327	1,154.9
Total =	4,642	4,642.0

	Means		Variances	
	Control	Treated	Control	Treated
1–5 daily				
mmarried	.7514558	.455	.1868194	.2492211
mage	26.81048	24.64	31.87141	31.44764
prenatal1	.8268925	.695	.1431792	.2130402
fbaby	.4531498	.48	.2478707	.2508543
6–10 daily				
mmarried	.7514558	.4480712	.1868194	.2480394
mage	26.81048	25.06231	31.87141	27.07051
prenatal1	.8268925	.6795252	.1431792	.2184188
fbaby	.4531498	.3827893	.2478707	.2369648
11+ daily				
mmarried	.7514558	.5107034	.1868194	.250652
mage	26.81048	25.59633	31.87141	26.93471
prenatal1	.8268925	.6972477	.1431792	.2117409
fbaby	.4531498	.293578	.2478707	.2080261

The results for the control level of `0 daily` are repeated for the treatment group. These results give a sense of the scale of imbalance in the raw data. Now we compute the balance statistics.

```
. tebalance summarize
Covariate balance summary
                              Observations
Treatment                   Raw     Weighted
------------------------------------------------
0 daily     =             3,778      1,164.8
1-5 daily   =               200      1,164.4
6-10 daily  =               337      1,157.9
11+ daily   =               327      1,154.9
Total       =             4,642      4,642.0
------------------------------------------------
```

	Standardized differences		Variance ratio	
	Raw	Weighted	Raw	Weighted
1-5 daily				
mmarried	-.634909	-.0016208	1.334021	1.001406
mage	-.3857482	-.0219656	.9867038	.9905584
prenatal1	-.312519	-.0012611	1.487927	1.001898
fbaby	.053769	.0422102	1.012037	1.008631
6-10 daily				
mmarried	-.6506304	-.0108454	1.327696	1.009331
mage	-.3220222	-.0836571	.8493666	.7984901
prenatal1	-.3465797	-.0100232	1.525493	1.015051
fbaby	-.1429048	.0268118	.9560018	1.005899
11+ daily				
mmarried	-.5147672	-.0212969	1.34168	1.018136
mage	-.2239116	-.0636951	.8451058	.8468934
prenatal1	-.3077549	-.0380744	1.478852	1.056645
fbaby	-.3342243	.0155427	.8392526	1.003598

These results indicate that the IPW estimator probably did not fully balance the covariates (the variance ratios for `mage` at the daily levels of 6–10 cigarettes and 11-plus cigarettes are not close to 1). At this point, we would use a richer model and see whether it balanced the covariates.

Note that we cannot use `tebalance overid`, because it has not been implemented for multivalued treatments.

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Stored results

`tebalance summarize` stores the following in `r()`:

Matrices

`r(size)`	number of observations in the raw and matched or weighted samples
`r(table)`	table of covariate statistics

Reference

Cattaneo, M. D. 2010. Efficient semiparametric estimation of multi-valued treatment effects under ignorability. *Journal of Econometrics* 155: 138–154. https://doi.org/10.1016/j.jeconom.2009.09.023.

Also see

[TE] **stteffects intro** — Introduction to treatment effects for observational survival-time data

[TE] **stteffects ipw** — Survival-time inverse-probability weighting

[TE] **stteffects ipwra** — Survival-time inverse-probability-weighted regression adjustment

[TE] **tebalance** — Check balance after teffects or stteffects estimation

[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] **teoverlap** — Overlap plots