Title

persuasio4ytz — Conduct causal inference on persuasive effects for binary outcomes *y*, binary treaments *t* and binary instruments *z*

Syntax

persuasio4ytz *depvar treatvar instrvar* [*covariates*] [*if*] [*in*] [, **level**(#) **model**(*string*) **method**(*string*) **nboot**(#) **title**(*string*)]

Options

option	*Description*
level(#)	Set confidence level; default is **level**(95)
model(*string*)	Regression model when *covariates* are present
method(*string*)	Inference method; default is **method**("normal")
nboot(#)	Perform # bootstrap replications
title(*string*)	Title of estimation

Description

persuasio4ytz conducts causal inference on persuasive effects.

It is assumed that binary outcomes *y*, binary treatments *t*, and binary instruments *z* are observed. This command is for the case when persuasive treatment (*t*) is observed, using estimates of the lower and upper bounds on the average persuation rate (APR) via this package's commands **aprlb** and **aprub**.

varlist should include *depvar treatvar instrvar covariates* in order. Here, *depvar* is binary outcomes (*y*), *treatvar* is binary treatments, *instrvar* is binary instruments (*z*), and *covariates* (*x*) are optional.

There are two cases: (i) *covariates* are absent and (ii) *covariates* are present.

- Without *x*, the lower bound (**theta_L**) on the APR is defined by

$$\textbf{theta\_L} = \{Pr(y{=}1|z{=}1) - Pr(y{=}1|z{=}0)\}/\{1 - Pr(y{=}1|z{=}0)\},$$

and the upper bound (**theta_U**) on the APR is defined by

$$\textbf{theta\_U} = \{E[A|z{=}1] - E[B|z{=}0]\}/\{1 - E[B|z{=}0]\},$$

where $A = 1(y{=}1,t{=}1)+1-1(t{=}1)$ and $B = 1(y{=}1,t{=}0)$.

The lower bound is estimated by the following procedure:

1. $Pr(y{=}1|z{=}1)$ and $Pr(y{=}1|z{=}0)$ are estimated by regressing y on z.
2. **theta_L** is computed using the estimates obtained above.
3. The standard error is computed via STATA command **nlcom**.

The upper boound is stimated by the following procedure:

1. $E[A|z{=}1]$ is estimated by regressing A on z.
2. $E[B|z{=}0]$ is estimated by regressing B on z.
3. **theta_U** is computed using the estimates obtained above.
4. The standard error is computed via STATA command **nlcom**.

Then, a confidence interval for the APR is set by

[*est_lb* - *cv* * *se_lb* , *est_ub* + *cv* * *se_ub*],

where *est_lb* and *est_ub* are the estimates of the lower and upper bounds, *se_lb* and *se_ub* are the corresponding standard errors, and *cv* is the critical value obtained via the method of Stoye (2009).

- With x, the lower bound (**theta_L**) on the APR is defined by

$$\textbf{theta\_L} = E[\textbf{theta\_L}(x)],$$

where

$$\textbf{theta\_L}(x) = \{Pr(y{=}1|z{=}1,x) - Pr(y{=}1|z{=}0,x)\}/\{1 - Pr(y{=}1|z{=}0,x)\},$$

and the upper bound (**theta_U**) on the APR is defined by

$$\textbf{theta\_U} = E[\textbf{theta\_U}(x)],$$

where

$$\textbf{theta\_U}(x) = \{E[A|z{=}1,x] - E[B|z{=}0,x]\}/\{1 - E[B|z{=}0,x]\}.$$

The lower bound is estimated by the following procedure:

If **model**("no_interaction") is selected (default choice),

1. Pr(*y*=1|*z*,*x*) is estimated by regressing *y* on *z* and *x*.

Alternatively, if **model**("interaction") is selected,

1a. Pr(*y*=1|*z*=1,*x*) is estimated by regressing *y* on *x* given *z* = 1.
1b. Pr(*y*=1|*z*=0,*x*) is estimated by regressing *y* on *x* given *z* = 0.

Ater step 1, both options are followed by:

2. For each x in the estimation sample, **theta_L**(x) is evaluated.
3. The estimates of **theta_L**(x) are averaged to estimate **theta_L**.

The upper booound is stimated by the following procedure:

If **model**("no_interaction") is selected (default choice),

1. E[*A*|*z*=1,*x*] is estimated by regressing *A* on *z* and *x*.
2. E[*B*|*z*=0,*x*] is estimated by regressing *B* on *z* and *x*.

Alternatively, if **model**("interaction") is selected,

1. E[*A*|*z*=1,*x*] is estimated by regressing *A* on *x* given *z* = 1.
2. E[*B*|*z*=0,*x*] is estimated by regressing *B* on *x* given *z* = 0.

Ater step 1, both options are followed by:

3. For each *x* in the estimation sample, **theta_U**(*x*) is evaluated.
4. The estimates of **theta_U**(*x*) are averaged to estimate **theta_U**.

Then, a bootstrap confidence interval for the APR is set by

[bs_est_lb(*alpha*) , bs_est_ub(*alpha*)],

where bs_est_lb(*alpha*) is the *alpha* quantile of the bootstrap estimates of **theta_L**, bs_est_ub(*alpha*) is the 1 - *alpha* quantile of the bootstrap estimates of **theta_U**, and 1 - *alpha* is the confidence level.

The resulting coverage probability is 1 - *alpha* if the identified interval never reduces to a singleton set. More generally, it will be 1 - 2**alpha* by Bonferroni correction.

The bootstrap procedure is implemented via STATA command **bootstrap**.

Options

model(*string*) specifies a regression model of *y* on *z* and *x*.

This option is only relevant when *x* is present. The default option is "no_interaction" between *z* and *x*. When "interaction" is selected, full interactions between *z* and *x* are allowed.

level(#) sets confidence level; default is **level**(95).

method(*string*) refers the method for inference.

The default option is **method**("normal"). By the naure of identification, one-sided confidence intervals are produced.

1. When *x* is present, it needs to be set as **method**("bootstrap"); otherwise, the confidence interval will be missing.

2. When *x* is absent, both options yield non-missing confidence intervals.

nboot(#) chooses the number of bootstrap replications.

The default option is **nboot**(50). It is only relevant when **method**("bootstrap") is selected.

title(*string*) specifies the title of estimation.

Remarks

It is recommended to use **nboot**(#) with # at least 1000. A default choice of 50 is meant to check the code initially because it may take a long time to run the bootstrap part. The bootstrap confidence interval is based on percentile bootstrap. A use of normality-based bootstrap confidence interval is not recommended because bootstrap standard errors can be unreasonably large in applications.

Examples

We first call the dataset included in the package.

```
. use GKB, clear
```

The first example conducts inference on the APR without covariates, using normal approximation.

```
. persuasio4ytz voteddem_all readsome post, level(80) method("normal")
```

The second example conducts bootstrap inference on the APR.

```
. persuasio4ytz voteddem_all readsome post, level(80)
method("bootstrap") nboot(1000)
```

The third example conducts bootstrap inference on the APR with a covariate, MZwave2, interacting with the instrument, post.

```
. persuasio4ytz voteddem_all readsome post MZwave2, level(80)
model("interaction") method("bootstrap") nboot(1000)
```

Stored results

Matrices

e(apr_est): (1*2 matrix) bounds on the average persuasion rate in the form of [lb, ub]

e(apr_ci): (1*2 matrix) confidence interval for the average persuasion rate in the form of [lb_ci, ub_ci]

Macros

e(cilevel): confidence level

e(inference_method): inference method: "normal" or "bootstrap"

Authors

Sung Jae Jun, Penn State University, <sjun@psu.edu>

Sokbae Lee, Columbia University, <sl3841@columbia.edu>

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References

Sung Jae Jun and Sokbae Lee (2019), Identifying the Effect of Persuasion, arXiv:1812.02276 [econ.EM]