

## Title

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**aprub** — Estimate the upper bound on the average persuasion rate

## Syntax

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```
aprub depvar treatrvar instrvar [covariates] [if] [in] [,  
model(string) title(string)]
```

## Options

<i>option</i>	<i>Description</i>
<b>model</b> ( <i>string</i> )	Regression model when <i>covariates</i> are present
<b>title</b> ( <i>string</i> )	Title of estimation

## Description

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**aprub** estimates the upper bound on the average persuasion rate (APR). *varlist* should include *depvar treatrvar instrvar covariates* in order. Here, *depvar* is binary outcomes (*y*), *treatrvar* is binary treatment (*t*), *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 upper bound (**theta\_U**) on the APR is defined by

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

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

The estimate and its standard error are obtained 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**.

- With  $x$ , the upper bound (**theta\_U**) on the APR is defined by

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

where

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

The estimate is obtained 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  $z = 0$ .

After 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**.

When *covariates* are present, the standard error is missing because an analytic formula for the standard error is complex. Bootstrap inference is implemented when this package's command **persuasio** is called to conduct inference.

## **Options**

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**model**(*string*) specifies a regression model.

This option is only relevant when  $x$  is present. The dependent variable is either  $A$  or  $B$ . The default option is "no\_interaction" between  $z$  and  $x$ . When "interaction" is selected, full interactions between  $z$  and  $x$  are allowed.

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

## **Remarks**

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It is recommended to use this package's command **persuasio** instead of calling **aprub** directly.

## **Examples**

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We first call the dataset included in the package.

```
. use GKB, clear
```

The first example estimates the upper bound on the APR without covariates.

```
. aprub voteddem_all readsome post
```

The second example adds a covariate.

```
. aprub voteddem_all readsome post MZwave2
```

The third example estimates the upper bound by the covariate.

```
. by MZwave2,sort: aprub voteddem_all readsome post
```

## **Stored results**

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### **Scalars**

**e(N)**: sample size

**e(ub\_coef)**: estimate of the upper bound on the average persuasion rate

**e(ub\_se)**: standard error of the upper bound on the average persuasion rate

### **Macros**

**e(outcome)**: variable name of the binary outcome variable

**e(treatment)**: variable name of the binary treatment variable

**e(instrument)**: variable name of the binary instrumental variable

**e(covariates)**: variable name(s) of the covariates if they exist

**e(model):** regression model specification ("no\_interaction" or "interaction")

**Functions:**

**e(sample):** 1 if the observations are used for estimation, and 0 otherwise.

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**References**

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Sung Jae Jun and Sokbae Lee (2019), Identifying the Effect of Persuasion, [arXiv:1812.02276](https://arxiv.org/abs/1812.02276) [[econ.EM](#)]