

diff - diff

v3.0

**The first DiD library with
design-based survey inference.**

Strata + PSU + FPC

TSL, replicate weights, survey bootstrap

Survey support across all 16 estimators*

Validated against R's survey package

*Variance paths vary by estimator. See docs for support matrix.

The Forced Tradeoff

Correct DiD method with wrong SEs,
or correct SEs with naive DiD.

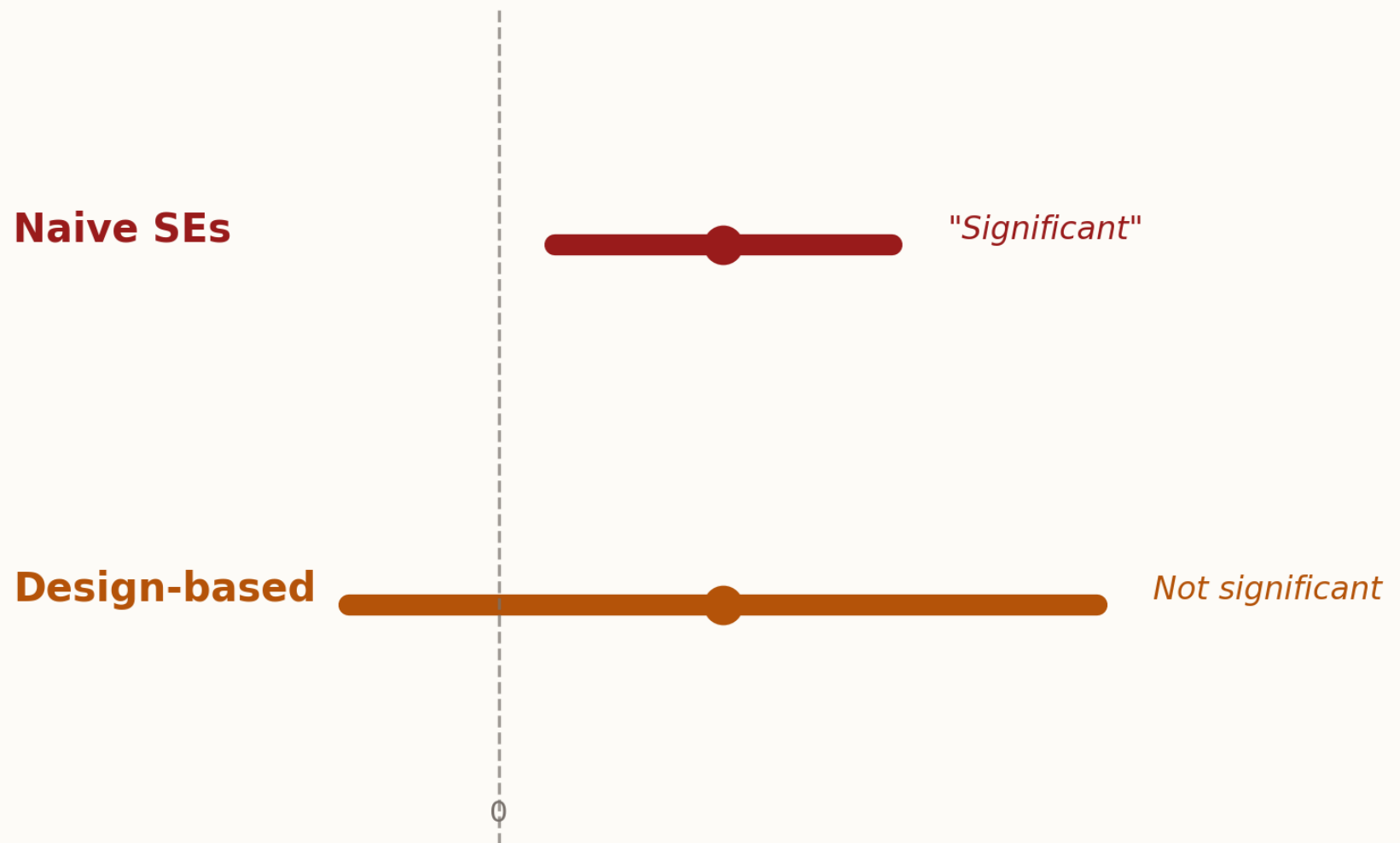
	Strata	FPC	Replicate Weights
diff-diff v3	✓	✓	✓
R did	✗	✗	✗
Stata csdid	✗	✗	✗

All packages support cluster-robust inference.

R did v2.1 CRAN; Stata help csdid (Rios-Avila et al.)

The Design Effect

Same ATT, Different Conclusions



Ignoring survey design doesn't just

affect precision -- it changes your conclusions.

Why It Works

Binder (1983) applied to DiD influence functions

$$\hat{V}(\hat{\theta}) = \sum_h (1 - f_h) \frac{n_h}{n_h - 1} \sum_{j=1}^{n_h} (\psi_{hj} - \bar{\psi}_h)^2$$

where

$$\psi_{hj} = \sum_{i \in \text{PSU } j, \text{ stratum } h} \psi_i$$

- Most modern DiD estimators are smooth functionals of F
- Their IFs are well-defined and design-independent
- Binder's theorem: plug IFs into the survey variance formula
- SyntheticDiD and TROP: Rao-Wu survey bootstrap instead

Binder (1983), Demnati & Rao (2004)

github.com/igerber/diff-diff/blob/main/docs/methodology/survey-theory.md

What's Supported

Taylor Series Linearization

Strata + PSU + FPC + Lonely PSU handling

Replicate Weights

BRR, Fay, JK1, JK_n, SDR -- five methods

Survey-Aware Bootstrap

Design structure preserved in resampling

Survey support across all 16 estimators.*

**Variance paths vary by estimator. See docs for support matrix.*

Validated Against R

Cross-validated against R's survey package

API Dataset

TSL with strata, FPC, Fay's BRR replicates

< 1e-10

NHANES

TSL with strata + PSU + nest=TRUE

< 1e-10

RECS 2020

JK1 replicate weights, 60 replicate columns

< 1e-10

Machine precision on point estimates and standard errors.

DiD and TWFE cross-validated on real federal survey data.

7 estimators validated against R reference implementations.

The Code

Three lines from flat weights to design-based inference

```
from diff_diff import CallawaySantAnna

from diff_diff import SurveyDesign


design = SurveyDesign(

    weights='pw',

    strata='stratum',

    psu='cluster',

    fpc='pop_size')


cs = CallawaySantAnna()

result = cs.fit(data,

    outcome='y',

    unit='id', time='t',

    first_treat='g',

    survey_design=design)
```

Same fit() API as every diff-diff estimator.

Just add survey_design=...

Get Started

```
$ pip install --upgrade diff-diff
```

github.com/igerber/diff-diff

diff - diff

Difference-in-Differences for Python