Z_validity_test: A Test for Instrument Validity

In CarrThomas/TestforInstrumentValidity: A Test for Instrument Validity

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Description

`Z_validity_test` performs the test for instrument validity described in Kitagawa (2015) in the case of a binary treatment, an instrument that can take many values, and no conditioning covariates.

Usage

```
Z_validity_test(Y, D, Z, Z_order, xis, B = 500, alpha = c(0.1, 0.05, 0.01))
```

Arguments

Y	A vector containing observations of the outcome variable.
D	A vector containing observations of the treatment variable.
Z	A vector containing observations of the instrument variable.
Z_order	A vector containing the unique values of the instrument variable ordered so that the propensity score is increasing with the value of the instrument. For example, if the instrument takes values *1, 2, 3* and we belive that *P(D=1|Z=1) < P(D=1|Z=2) < P(D=1|Z=3)*, then `Z_order` would be `c(1, 2, 3)`.
xis	A vector containing values of the trimming constant. Individual entries should be *>0*. For example, `c(0.05, 0.1, 0.3, 0.5)`.
B	The number of bootstrap iterations when constructing standard errors. Defaults to `500`.
alpha	A vector of significance levels for which critical values will be calculated. Each entry should be between *0* and *1*. By default, critical values are returned for the 10%, 5% and 1% levels of significance.

Details

a

Value

teststat	A vector with `length(xis)` entries containing the value of the test statistic corresponding to each value of the trimming constant.
pvals	A vector of with `length(xis)` containing the p-value corresponding to each value of the trimming constant.
cvs	A matrix with `length(alpha)` rows and `length(xis)` columns. Entry *(i,j)* is the critical value for significance level `alpha[i]` when the trimming constant is `xis[j]` .

Examples

```
## Example where the null is valid

set.seed(1234);
Z <- c(rep(1, 1000), rep(0, 1000));
D <- rbinom(2000, 1, 1 / 2);
Y <- D + rnorm(2000);

xis <- c(sqrt(0.005 * (1 - 0.005)), sqrt(0.05 * (1 - 0.05)), sqrt(0.1 * (1 - 0.1)), 1);
Z_validity_test(Y, D, Z, c(0, 1), xis)

# Returns
$teststat
[1] 3.1702131 2.1545545 1.5652476 0.4695743

$pvals
[1] 0.710 0.912 0.978 0.984

$cvs
        [,1]     [,2]     [,3]     [,4]
90% 3.855944 3.449081 3.218573 1.274559
95% 4.036757 3.693522 3.532302 1.408723
99% 4.245746 4.039350 3.953901 1.677051

## Example where the null is not valid

set.seed(5678);
Z <- c(rep(1, 1000), rep(0, 1000));
D <- rbinom(2000, 1, 0.55 * Z + 0.45 * (1 - Z));
Y <- (1 - D * (1 - Z)) * rnorm(2000) + D * (1 - Z) * rnorm(2000, -0.7, 1);

xis <- c(sqrt(0.005 * (1 - 0.005)), sqrt(0.05 * (1 - 0.05)), sqrt(0.1 * (1 - 0.1)), 1);
Z_validity_test(Y, D, Z, c(0, 1), xis)

# Returns
$teststat
[1] 7.261042 7.261042 7.261042 2.593839

$pvals
[1] 0 0 0 0
```

```
90% 3.868514 3.466813 3.282482 1.299155
95% 4.059778 3.718391 3.624888 1.431084
99% 4.331277 4.254834 4.018666 1.744133
```