# Package: tsriadditive (via r-universe)

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**Title** Two Stage Residual Inclusion Additive Hazards Estimator

**Version** 1.0.0

**Description** Programs for A.Ying, R. Xu and J. Murphy. 'Two-Stage Residual Inclusion under the Additive Hazards Model - An Instrumental Variable Approach with Application to SEER-Medicare Linked Data.' Statistics in Medicine, to appear, 2018.

**Depends** R (>= 3.5.0)

**Imports** survival

**License** LGPL (>= 2)

**Encoding** UTF-8

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**Repository** https://andrewyyp.r-universe.dev

**RemoteUrl** https://github.com/andrewyyp/tsriadditive

**RemoteRef** HEAD

**RemoteSha** 343ba095788b900c2474c567e19b4ca7563cf352

## Contents

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`baselineest` *The baseline hazards function*

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## Description

This gives the estimate of baseline hazards function

## Usage

```
baselineest(cause, s_zero, Z_int, coef_est)
```

### Arguments

| | |
|---|---|
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause. |
| s_zero | the S_zero in the paper |
| Z_int | the integration of Z_bar |
| coef_est | the coefficent estimate from the fit |

### Value

the baseline hazard function estimate

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## betaconfint *the confidence interval for our beta estimator*

---

### Description

the confidence interval for our beta estimator

### Usage

```
betaconfint(coef_est, vcov, alpha)
```

### Arguments

| | |
|---|---|
| coef_est | the estimate for beta |
| vcov | the variance covariance matrix for beta estimate |
| alpha | the prespecified level |

### Value

a list containing the (1 - alpha) level confidence interval

---

## betavarest *betavarest function*

---

### Description

This gives the variance estiamte for heta

### Usage

```
betavarest(fit)
```

### Arguments

| | |
|---|---|
| `fit` | the fitting object after fitting our model |

### Value

the variance matrix of finite dimensional parameter part

---

## `coefest` *The finite dimensional coefficients estimator*

---

### Description

This function returns us the estimate the finite dimensional part

### Usage

```
coefest(N, omega_inv, score_process)
```

### Arguments

| | |
|---|---|
| `N` | the sample size |
| `omega_inv` | the inverse of omega matrix in the paper |
| `score_process` | the score process in the paper |

### Value

the coefficent estimate from the fit

---

## `Dhatt` *Dhatt function*

---

### Description

This prepares for the variance estiamte of baseline hazards function

### Usage

```
Dhatt(fit)
```

### Arguments

| | |
|---|---|
| `fit` | the fitting object after fitting our model |

### Value

D_hat part in the paper

## Ehatt *Ehatt function*

### Description

This prepares for the variance estiamte of baseline hazards function

### Usage

```
Ehatt(fit, i)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |
| i | the ith round of our data |

### Value

an integrated function with speed O(n) by recording each time result

## EThetaEpart *EThetaEpart function*

### Description

This prepares for the variance estiamte of baseline hazards function

### Usage

```
EThetaEpart(fit)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

### Value

E_Theta_E part in the paper

## Ghatt *Ghatt function*

### Description

This prepares for the variance estiamte of baseline hazards function

### Usage

```
Ghatt(fit, newobsz)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |
| newobsz | the new obtained Z value |

### Value

G_hat in the paper, the only part that changes with newobsz

## Gint *Gint function*

### Description

This is the integration of our censorsurv from somewhere to infinity

### Usage

```
Gint(survtime, censorsurv)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| censorsurv | the estimate for the censoring distribution |

## GZint *GZ_int function*

### Description

This is the integration of our censorsurv from somewhere to infinity

### Usage

```
GZint(survtime, Z_bar, censorsurv)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| Z_bar | defined in the paper |
| censorsurv | the estimate for the censoring distribution |

## hazardpred *A hazard prediction function*

### Description

the predict function associated with our class

### Usage

```
hazardpred(fit, newtreatment = NULL, newIV = NULL,
  newcovariates = NULL)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |
| newtreatment | the new treatment value |
| newIV | new instrumental variable value |
| newcovariates | new observed covariates |

### Value

an object recording the corresponding predicted survival curve and corresponding pointwise confidence interval

## hazardpredvarest *hazardpredvarest function*

### Description

This gives the variance estimate for our prediction of the hazard function

### Usage

```
hazardpredvarest(newobsz, fit = NULL)
```

### Arguments

| | |
|---|---|
| newobsz | the new obtained Z value |
| fit | the fitting object after fitting our model |

### Value

the variance of hazard function at each time point

## leadpart *leadpart function*

### Description

This prepares for the variance estiamte of baseline hazards function

### Usage

```
leadpart(fit)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

### Value

the leading part in our variance estimate

## lowerconfint *the pointwise lower confidence interval for the survival curve*

### Description

the pointwise lower confidence interval for the survival curve

### Usage

```
lowerconfint(hazard_pred, hazardpredvar_est, newobsz, alpha)
```

### Arguments

| | |
|---|---|
| hazard_pred | the predicted hazard function |
| hazardpredvar_est | the variance of the estimator of the hazard function |
| newobsz | the new obtained Z value |
| alpha | the prespecified level |

### Value

the lower (1 - alpha) level pointwise confidence interval for the hazard function

## omegainv *Omega inverse function*

### Description

This is for inverse of omega, which is part of the sandwich estimator

### Usage

```
omegainv(N, survtime, Z, Z_int, cause, comp = FALSE, censorsurv = NULL,
  G_int = NULL, GZ_int = NULL)
```

### Arguments

| | |
|---|---|
| N | the sample size |
| survtime | the event time |
| Z | a variable contains all the regressors |
| Z_int | the integration of Z_bar |
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause |

| | |
|---|---|
| comp | indicator of whether we are under competing risks setting |
| censorsurv | the estimate for the censoring distribution |
| G_int | the integration of G function |
| GZ_int | the integration of GZ |

## Value

the Omega matrix appear in the paper

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`pihatt` *pihatt function*

---

## Description

This gives the pihatt part in the sigmathree estiamte

## Usage

```
pihatt(fit)
```

## Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

## Value

pi_hatt part in sigma_three, only appears in competing risks setting, in the paper

---

`plot.tsriadditive` *plot function associated with our class*

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## Description

this function will plot the predicted curve and corresponding pointwise confidence interval at level alpha

## Usage

```
## S3 method for class 'tsriadditive'
plot(fit, newtreatment = NULL, newIV = NULL,
  newcovariates = NULL, alpha = 0.05, unit = "", ...)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |
| newtreatment | the new treatment value |
| newIV | new instrumental variable value |
| newcovariates | new observed covariates |
| alpha | the level for confidence interval |
| unit | the time unit we focus |
| ... | the other arguments you want to put in the built-in plot function |

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## predict.tsriadditive *the predict function associated with our class*

---

### Description

the predict function associated with our class

### Usage

```
## S3 method for class 'tsriadditive'
predict(fit, newtreatment = NULL, newIV = NULL,
  newcovariates = NULL)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |
| newtreatment | the new treatment value |
| newIV | new instrumental variable value |
| newcovariates | new observed covariates |

### Value

an object recording the corresponding predicted survival curve and corresponding pointwise confidence interval

## print.tsriadditive *the print function associated with our class*

### Description

This function will print our coefficients, the variance covariance matrix of the coeffieients, and the estimate for the baseline hazard function

### Usage

```
## S3 method for class 'tsriadditive'
print(fit)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

## psihat *psihat function*

### Description

This gives the psihat part in the sigmatwo estiamte

### Usage

```
psihat(fit)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

### Value

psi_hat in the paper

## qhatt *qhatt function*

### Description

This gives the qhatt part in the sigmathree estiamte

### Usage

```
qhatt(fit)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

### Value

q_hatt part in sigma_three, only appears in competing risks setting, in the paper

## qprimehatt *qprimehatt function*

### Description

This prepares for the variance estiamte of baseline hazards function

### Usage

```
qprimehatt(fit, i)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |
| i | the i-th round |

### Value

update the fit, add qprime_hatt

## qprimepihatt *qprimepihatt function*

### Description

This prepares for the variance estiamte of baseline hazards function

### Usage

```
qprimepihatt(fit)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

### Value

the integration of squares of q_t(u) over pi(u) in the paper, introduced by competing risks

## regadditivefit *regadditivefit function*

### Description

fit an additive hazard without using IV method

### Usage

```
regadditivefit(survtime, cause, comp = FALSE, treatment = NULL,
  covariates = NULL)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause. |
| comp | the indicator of whether modeling subdistribution hazard |
| treatment | the treatment variable, can be null |
| covariates | all the observed confounders |

### Value

the fitting result, a list containing the cofficients, the baseline function, the variance covariance function of the coefficients and the byproduct including some pieces during the computing process

## regcompadditivefit *regcompadditivefit function*

### Description

fit an additive hazard without using IV method under competing risks settings

### Usage

```
regcompadditivefit(survtime, cause, Z = NULL)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause. |
| Z | a variable contains all the regressors |

### Value

the fitting result, a list containing the cofficients, the baseline function and

## regsurvadditivefit *regsuradditivefit function*

### Description

fit an additive hazard without using IV method under survival settings

### Usage

```
regsurvadditivefit(survtime, cause, Z = NULL)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause. |
| Z | a variable contains all the regressors |

### Value

the fitting result, a list containing the cofficients, the baseline function and the byproduct including some pieces during the computing process

## scoreprocess *A scoreprocess function*

### Description

This gives us the scoreprocess function defined in the paper

### Usage

```
scoreprocess(Z, Z_bar, cause)
```

### Arguments

| | |
|---|---|
| Z | a variable contains all the regressors |
| Z_bar | defined in the paper |
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause. |

### Value

the score_process

## sigmaone *sigmaone function*

### Description

This gives the sigmaone part in the variance estiamte

### Usage

```
sigmaone(fit)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

### Value

the sigma_one in the paper

## sigmathree *sigmathree function*

### Description

This gives the sigmathree part in the variance estiamte

### Usage

```
sigmathree(fit)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

### Value

the sigma_three in the paper

## sigmatwo *sigmatwo function*

### Description

This gives the sigmatwo part in the variance estiamte

### Usage

```
sigmatwo(fit)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

### Value

the sigma_two in the paper

## sone *sone function*

### Description

The s_one function defined in the paper

### Usage

```
sone(survtime, cause = NULL, Z, comp = FALSE, censorsurv = NULL)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause. |
| Z | a variable contains all the regressors |
| comp | the indicator of whether modeling subdistribution hazard |
| censorsurv | the estimate for the censoring distribution |

### Value

s_one defined in the paper

## summary.tsriadditive *the summary function associated with our class*

### Description

This function will print our coefficients, the variance covariance matrix of the coeffieients, and the corresponding P-values

### Usage

```
## S3 method for class 'tsriadditive'
summary(fit)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

## survivalpred *A survival prediction function*

### Description

The predict function associated with our class

### Usage

```
survivalpred(fit, newtreatment = NULL, newIV = NULL,
  newcovariates = NULL)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |
| newtreatment | the new treatment value |
| newIV | new instrumental variable value |
| newcovariates | new observed covariates |

### Value

an object recording the corresponding predicted survival curve and corresponding pointwise confidence interval

## survprobconfint *the pointwise confidence interval for the survival curve*

### Description

the pointwise confidence interval for the survival curve

### Usage

```
survprobconfint(hazard_pred, newobsz, fit = NULL, alpha)
```

### Arguments

| | |
|---|---|
| hazard_pred | the predicted hazard function |
| newobsz | the new obtained Z value |
| fit | the fitting object after fitting our model |
| alpha | the prespecified level |

### Value

a list containing (1 - alpha) level pointwise confidence interval for the hazard function

## szero *szero function*

### Description

The s_zero function defined in the paper

### Usage

```
szero(survtime, cause = NULL, comp = FALSE, censorsurv = NULL)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause. |
| comp | the indicator of whether modeling subdistribution hazard |
| censorsurv | the estimate for the censoring distribution |

### Value

s_zero defined in the paper

## szeroint *szeroint function*

### Description

This prepares for the variance estiamte of baseline hazards function

### Usage

```
szeroint(fit)
```

### Arguments

| | |
|---|---|
| fit | the fitting object after fitting our model |

### Value

szero_int part in the paper

## tsriadditive *tsriadditive generic*

### Description

tsriadditive generic

### Usage

```
tsriadditive(...)
```

### Arguments

| | |
|---|---|
| ... | the other arguments |

## tsriadditive.default *fit an additive hazards model with two stage residual inclusion method*

### Description

fit an additive hazards model with two stage residual inclusion method

### Usage

```
## Default S3 method:
tsriadditive(survtime, cause = NULL,
  treatment = NULL, IV = NULL, covariates = NULL)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause. |
| treatment | the treatment variable, can be null |
| IV | the instrumental variable |
| covariates | all the observed confounders |

### Value

the fitting result, a class called "tsriadditive"

## tsriadditivefit *fit an additive hazard using two stage residual inclusion method*

### Description

fit an additive hazard using two stage residual inclusion method

### Usage

```
tsriadditivefit(survtime, cause, comp = FALSE, treatment = NULL,
  IV = NULL, covariates = NULL)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause. |
| comp | the indicator of whether modeling subdistribution hazard |
| treatment | the treatment variable, can be null |
| IV | the instrumental variable |
| covariates | all the observed confounders |

### Value

the fitting result, a list containing the cofficients, the baseline function, the variance covariance

## tsricompadditivefit *fit an additive hazard without using IV method under competing risks settings*

### Description

fit an additive hazard without using IV method under competing risks settings

### Usage

```
tsricompadditivefit(survtime, cause = NULL, Z)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause. |
| Z | a variable contains all the regressors |

### Value

the fitting result, a list containing the cofficients, the baseline function and the byproduct including some pieces during the computing process

---

## tsrisurvadditivefit *fit an additive hazard using IV method under survival settings*

---

### Description

fit an additive hazard using IV method under survival settings

### Usage

```
tsrisurvadditivefit(survtime, cause = NULL, Z)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| cause | the indicator records the cause. Default to all one. Zero means right censoring. Greater than or equal to two means other cause. |
| Z | a variable contains all the regressors |

### Value

the fitting result, a list containing the cofficients, the baseline function and the byproduct including some pieces during the computing process

---

## upperconfint *the pointwise upper confidence interval for the survival curve*

---

### Description

the pointwise upper confidence interval for the survival curve

### Usage

```
upperconfint(hazard_pred, hazardpredvar_est, newobsz, alpha)
```

### Arguments

| | |
|---|---|
| hazard_pred | the predicted hazard function |
| hazardpredvar_est | the variance of the estimator of the hazard function |
| newobsz | the new obtained Z value |
| alpha | the prespecified level |

### Value

the upper (1 - alpha) level pointwise confidence interval for the hazard function

---

`YGint` *YGint function*

---

### Description

This prepares for the variance estiamte of baseline hazards function

### Usage

```
YGint(fit)
```

### Arguments

| | |
|---|---|
| `fit` | the fitting object after fitting our model |

### Value

YG_int part in the paper

---

`Yint` *Yint function*

---

### Description

This prepares for the variance estiamte of baseline hazards function

### Usage

```
Yint(fit)
```

### Arguments

| | |
|---|---|
| `fit` | the fitting object after fitting our model |

### Value

Y_int part in the paper

## Zbar *Zbar function*

### Description

A function for computing Z_bar in the paper

### Usage

```
Zbar(s_zero, s_one)
```

### Arguments

| | |
|---|---|
| s_zero | s_zero function |
| s_one | s_one function |

### Value

the Z_bar value in the paper, no difference for two settings

## Zint *Zint function*

### Description

A function for computing the integration for Z_bar from zero to some time t

### Usage

```
Zint(survtime, Z_bar)
```

### Arguments

| | |
|---|---|
| survtime | the event time |
| Z_bar | the Z_bar value |

### Value

the integration of Z_bar from zero to all the event time t

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