Package: acsmoe (via r-universe)

May 29, 2026

Title Propagate Uncertainty for ACS Tabular Estimates

Version 0.1.0

Description Utilities for propagating uncertainty in American Community Survey tabular workflows that use published estimates and margins of error, following U.S. Census Bureau derived-estimate guidance and complementing 'tidycensus' margin-of-error workflows. Includes covariance-aware derived estimates, simulation helpers, geographic aggregation, confidence-interval conversion, and reliability diagnostics.

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URL https://dshkol.github.io/acsmoe/, https://github.com/dshkol/acsmoe

BugReports https://github.com/dshkol/acsmoe/issues

Encoding UTF-8

Language en-US

RoxygenNote 7.3.2

Imports stats

Suggests dplyr, ggplot2, knitr, rmarkdown, scales, sf, testthat (>= 3.0.0), tidycensus

VignetteBuilder knitr

Config/testthat/edition 3

NeedsCompilation no

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Repository https://cran.r-universe.dev

Date/Publication 2026-05-29 12:30:29 UTC

RemoteUrl https://github.com/cran/acsmoe

RemoteRef HEAD

RemoteSha f7e2a09d9ec3c7f66e4ca9d83c4faf1f1b3b0f3a

Contents

`acs_aggregate` *Aggregate paired ACS estimate and MOE columns by group.*

Description

Aggregate paired ACS estimate and MOE columns by group.

Usage

```
acs_aggregate(
  data,
  group_var,
  value_cols,
  moe_cols,
  cov_strategy = c("zero", "supplied", "constant"),
  cov_value = 0,
  conf = 0.9
)
```

Arguments

`data`	A data frame containing ACS estimate and MOE columns.
`group_var`	Name of the grouping column, supplied as a single string.
`value_cols`	Character vector of estimate column names to aggregate.
`moe_cols`	Character vector of MOE column names paired with `value_cols`.
`cov_strategy`	Covariance strategy: `"zero"`, `"supplied"`, or `"constant"`.
`cov_value`	For `"constant"`, a scalar correlation. For `"supplied"`, a named list of full covariance matrices keyed by estimate column.
`conf`	Confidence level associated with input and output MOEs.

Details

`cov_strategy = "constant"` interprets `cov_value` as a correlation, not a covariance. This differs from scalar `cov` arguments in core propagation functions, where a scalar means an off-diagonal covariance on the standard-error scale.

Output rows are ordered by first appearance of each group level in `data`, not alphabetically.

Value

A data frame with one row per group and aggregated estimate/MOE columns.

Examples

```
tracts <- data.frame(
  region = c("north", "north", "south", "south"),
  pop = c(1000, 1200, 900, 1100),
  pop_moe = c(120, 140, 100, 130)
)
acs_aggregate(tracts, "region", "pop", "pop_moe")
acs_aggregate(tracts, "region", "pop", "pop_moe",
              cov_strategy = "constant", cov_value = 0.25)
```

---

acs_cv *Calculate coefficient of variation from an ACS estimate and MOE.*

Description

Calculate coefficient of variation from an ACS estimate and MOE.

Usage

```
acs_cv(estimate, moe, conf = 0.9)
```

Arguments

`estimate`	Numeric estimate.
`moe`	Numeric MOE.
`conf`	Confidence level associated with `moe`.

Value

Numeric coefficient of variation, using standard error divided by absolute estimate.

Examples

```
acs_cv(estimate = 1000, moe = 80)
acs_cv(estimate = c(1000, 100, 0), moe = c(80, 60, 5))
```

acs_diff *Propagate ACS uncertainty for a difference.*

Description

Propagate ACS uncertainty for a difference.

Usage

```
acs_diff(estimate1, moe1, estimate2, moe2, cov = 0, conf = 0.9)
```

Arguments

estimate1	First estimate.
moe1	MOE for estimate1.
estimate2	Second estimate.
moe2	MOE for estimate2.
cov	Covariance between the two estimates on the standard-error scale.
conf	Confidence level associated with input and output MOEs.

Value

A data frame with estimate, moe, and se.

Examples

```
acs_diff(100, 10, 40, 8)
acs_diff(100, 10, 40, 8, cov = 5)
```

acs_linear *Propagate ACS uncertainty for a linear combination.*

Description

Propagate ACS uncertainty for a linear combination.

Usage

```
acs_linear(estimates, moes, weights, cov = NULL, conf = 0.9)
```

Arguments

estimates	Numeric estimates.
moes	Numeric MOEs corresponding to estimates.
weights	Numeric weights for the linear combination.
cov	Optional covariance matrix on the standard-error scale. A scalar is interpreted as a common off-diagonal covariance.
conf	Confidence level associated with input and output MOEs.

Details

A scalar cov is a covariance, not a correlation. In contrast, acs_aggregate(cov_strategy = "constant") accepts a scalar correlation because that interface derives covariances from group-specific MOEs.

Value

A one-row data frame with estimate, moe, and se.

Examples

```
acs_linear(c(100, 50, 25), c(10, 8, 6), weights = c(2, -1, 0.5))
```

---

acs_product *Propagate ACS uncertainty for a product.*

Description

Propagate ACS uncertainty for a product.

Usage

```
acs_product(estimate1, moe1, estimate2, moe2, cov = 0, conf = 0.9)
```

Arguments

estimate1	First estimate.
moe1	MOE for estimate1.
estimate2	Second estimate.
moe2	MOE for estimate2.
cov	Covariance between the two estimates on the standard-error scale.
conf	Confidence level associated with input and output MOEs.

Value

A data frame with estimate, moe, and se.

Examples

```
acs_product(10, 2, 50, 5)
```

`acs_prop` *Propagate ACS uncertainty for a proportion.*

Description

Propagate ACS uncertainty for a proportion.

Usage

```
acs_prop(num, num_moe, denom, denom_moe, cov = 0, conf = 0.9)
```

Arguments

`num`	Numerator estimate.
`num_moe`	Numerator MOE.
`denom`	Denominator estimate.
`denom_moe`	Denominator MOE.
`cov`	Numerator-denominator covariance on the standard-error scale.
`conf`	Confidence level associated with input and output MOEs.

Details

This function follows the Census approximation used for proportions where the numerator is a subset of the denominator. It does not validate that `num <= denom`; behavior for non-nested ratios is formulaic rather than a claim that the inputs define a valid proportion.

Value

A data frame with `estimate`, `moe`, and `se`.

Examples

```
acs_prop(num = 10, num_moe = 2, denom = 50, denom_moe = 5)
```

acs_ratio *Propagate ACS uncertainty for a ratio.*

Description

Propagate ACS uncertainty for a ratio.

Usage

```
acs_ratio(num, num_moe, denom, denom_moe, cov = 0, conf = 0.9)
```

Arguments

num	Numerator estimate.
num_moe	Numerator MOE.
denom	Denominator estimate.
denom_moe	Denominator MOE.
cov	Numerator-denominator covariance on the standard-error scale.
conf	Confidence level associated with input and output MOEs.

Value

A data frame with estimate, moe, and se.

Examples

```
acs_ratio(num = 10, num_moe = 2, denom = 50, denom_moe = 5)
```

acs_reliability *Categorize ACS estimate reliability by CV thresholds.*

Description

Categorize ACS estimate reliability by CV thresholds.

Usage

```
acs_reliability(
  estimate,
  moe,
  conf = 0.9,
  thresholds = c(reliable = 0.12, caveat = 0.4)
)
```

Arguments

estimate	Numeric estimate.
moe	Numeric MOE.
conf	Confidence level associated with moe.
thresholds	Named numeric vector with reliable and caveat CV thresholds. Defaults of 0.12 and 0.40 reflect commonly used applied conventions (e.g., reliable below 12% CV, unreliable above 40% CV); these are not a Census Bureau standard and should be adjusted to your domain, agency guidance, or project-specific quality standard.

Value

Ordered factor with levels reliable, caveat, unreliable.

Examples

```
acs_reliability(estimate = 1000, moe = 80)
acs_reliability(estimate = c(1000, 200, 50), moe = c(80, 60, 50))
```

---

acs_simulate *Simulate ACS estimates from published estimates and MOEs.*

Description

Simulate ACS estimates from published estimates and MOEs.

Usage

```
acs_simulate(
  estimates,
  moes,
  cov = NULL,
  n_sims = 1000,
  dist = c("normal", "censored_normal"),
  conf = 0.9
)
```

Arguments

estimates	Numeric estimates.
moes	Numeric MOEs corresponding to estimates.
cov	Optional covariance matrix on the standard-error scale.
n_sims	Number of Monte Carlo simulations.
dist	Distribution assumption: "normal" or "censored_normal". The censored variant replaces below-zero draws with zero, matching the convention used in Napierala & Denton (2017) for ACS counts.
conf	Confidence level associated with input MOEs.

Value

A numeric matrix of simulated draws.

Examples

```
set.seed(1)
acs_simulate(c(x = 100, y = 50), c(10, 5), n_sims = 5)
```

`acs_simulate_fn` *Simulate a derived ACS statistic.*

Description

Simulate a derived ACS statistic.

Usage

```
acs_simulate_fn(
  estimates,
  moes,
  fn,
  cov = NULL,
  n_sims = 1000,
  dist = c("normal", "censored_normal"),
  conf = 0.9,
  summary = c("mean", "median", "ci"),
  point = c("mean", "median")
)
```

Arguments

`estimates`	Numeric estimates.
`moes`	Numeric MOEs corresponding to `estimates`.
`fn`	Function applied to each simulated row.
`cov`	Optional covariance matrix on the standard-error scale.
`n_sims`	Number of Monte Carlo simulations.
`dist`	Distribution assumption: `"normal"` or `"censored_normal"`. The censored variant replaces below-zero draws with zero, matching the convention used in Napierala & Denton (2017) for ACS counts.
`conf`	Confidence level associated with input MOEs.
`summary`	Summary to return: `"mean"`, `"median"`, or `"ci"`.
`point`	For `summary = "ci"`, point estimate to report alongside the percentile interval: `"mean"` (default) or `"median"`.

Details

For `summary = "ci"`, the returned interval is the central `conf`-level percentile interval of the simulated derived values. The reported `estimate` is the chosen `point` summary of those values.

Value

A data frame summarizing the simulated derived statistic.

Examples

```
set.seed(1)
acs_simulate_fn(c(100, 50), c(10, 5), fn = sum, n_sims = 500)
set.seed(1)
acs_simulate_fn(c(100, 50), c(10, 5), fn = sum, n_sims = 500,
                summary = "ci", conf = 0.90)
```

---

acs_sum *Propagate ACS uncertainty for a sum.*

Description

Propagate ACS uncertainty for a sum.

Usage

```
acs_sum(estimates, moes, cov = NULL, conf = 0.9)
```

Arguments

`estimates`	Numeric estimates to sum.
`moes`	Numeric MOEs corresponding to `estimates`.
`cov`	Optional covariance matrix on the standard-error scale. A scalar is interpreted as a common off-diagonal covariance.
`conf`	Confidence level associated with input and output MOEs.

Details

A scalar `cov` is a covariance, not a correlation. In contrast, `acs_aggregate(cov_strategy = "constant")` accepts a scalar correlation because that interface derives covariances from group-specific MOEs.

Value

A one-row data frame with `estimate`, `moe`, and `se`.

Examples

```
acs_sum(c(100, 50, 25), c(12, 8, 6))
acs_sum(c(100, 50), c(12, 8), cov = 5)
```

moe_ci — *Convert an ACS MOE to lower and upper confidence bounds.*

Description

Convert an ACS MOE to lower and upper confidence bounds.

Usage

```
moe_ci(estimate, moe, conf_in = 0.9, conf_out = 0.95)
```

Arguments

estimate	Numeric estimate.
moe	Numeric margin of error.
conf_in	Confidence level associated with moe.
conf_out	Desired confidence level for the returned interval.

Value

A data frame with estimate, lower, upper, and moe.

Examples

```
moe_ci(estimate = 100, moe = 10)
moe_ci(estimate = c(100, 200), moe = c(10, 25), conf_out = 0.99)
```

moe_to_se — *Convert an ACS margin of error to a standard error.*

Description

Convert an ACS margin of error to a standard error.

Usage

```
moe_to_se(moe, conf = 0.9)
```

Arguments

moe	Numeric margin of error.
conf	Confidence level associated with moe.

Value

Numeric standard error.

Examples

```
moe_to_se(c(10, 25, 100))
moe_to_se(10, conf = 0.95)
```

`se_to_moe` *Convert a standard error to an ACS-style margin of error.*

Description

Convert a standard error to an ACS-style margin of error.

Usage

```
se_to_moe(se, conf = 0.9)
```

Arguments

`se`	Numeric standard error.
`conf`	Desired confidence level.

Value

Numeric margin of error.

Examples

```
se_to_moe(c(6, 15, 60))
se_to_moe(6, conf = 0.95)
```

Index