

The Normal-Theory and Asymptotic Distribution-Free (ADF) Covariance
Matrix of Standardized Regression Coefficients:
Theoretical Extensions and Finite Sample Behavior

In this document we show how to use the `seBeta` R function (Jones & Waller, 2013) to compute confidence intervals for standardized regression coefficients. Our example uses the `Salaries` data from the `car` R package (Fox & Weisberg, 2011). In the following code, we regress the variable `Professor Salaries` (y) on `Years Since Ph.D.` (X_1) and `Years in Service` (X_2) and request 95% ADF confidence intervals for the standardized regression coefficients using the `seBeta` function:

```
> library(car); data(Salaries)
> seBeta(X=Salaries[,c(3,4)], y = Salaries[,6], alpha = .05, ADF=TRUE, digits=3)

95% CIs for Standardized Regression Coefficients:

lbound estimate ubound
beta_1  0.440  0.665  0.889
beta_2 -0.525 -0.270 -0.015
```

Next, we request Normal-theory confidence intervals for these data by setting “ADF=FALSE” in the `seBeta` function.

```
> seBeta(X=Salaries[,c(3,4)], y = Salaries[,6], ADF=FALSE, digits=3)

95% CIs for Standardized Regression Coefficients:

      lbound estimate ubound
beta_1  0.459      0.665  0.871
beta_2 -0.483     -0.270 -0.057
```

When raw data are not available, the normal-theory intervals can also be derived from covariances or correlations. This method is particularly useful in secondary data analyses or in meta-analytic research. The following snippets demonstrate how to call `seBeta` with covariances or correlations.

```
> covX <- cov(Salaries[,c(3,4)])
> covXy <- cov(Salaries[,c(3,4)], Salaries[,6])
> var.y <- var(Salaries[,6])
```

```

> seBeta(cov.x = covX, cov.xy = covXy, var.y = var.y,
+       N = 397, alpha = .05, ADF=FALSE, digits =3)

95% CIs for Standardized Regression Coefficients:

      lbound estimate ubound
beta_1 0.459      0.665 0.871
beta_2 -0.483    -0.270 -0.057

> corX <- cor(Salaries[,c(3,4)])
> corXy <- cor(Salaries[,c(3,4)], Salaries[,6])
>
> seBeta(cov.x = corX, cov.xy = corXy, var.y = 1,
+       N = 397, alpha = .05, ADF=FALSE, digits =3)

95% CIs for Standardized Regression Coefficients:

      lbound estimate ubound
beta_1 0.459      0.665 0.871
beta_2 -0.483    -0.270 -0.057

```

References

- Jones, J. A. & Waller, N. G. (2013). The Normal-Theory and Asymptotic Distribution-Free (ADF) Covariance Matrix of Standardized Regression Coefficients: Theoretical Extensions and Finite Sample Behavior. *Psychometrika*.
- Fox J. & Weisberg, S. (2011) *An R Companion to Applied Regression, Second Edition*. Thousand Oaks, CA: Sage.