

# R Packages

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## References

**Cheung et al.: semlbci: An R package for forming likelihood-based confidence intervals for parameter estimates, correlations, indirect effects, and other derived parameters**

**Cheung-Pesigan-2023**

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Shu Fai Cheung and Ivan Jacob Agaloos Pesigan. “semlbci: An R package for forming likelihood-based confidence intervals for parameter estimates, correlations, indirect effects, and other derived parameters”. In: *Structural Equation Modeling: A Multidisciplinary Journal* (May 2023), pp. 1–15. DOI: [10.1080/10705511.2023.2183860](https://doi.org/10.1080/10705511.2023.2183860).

Abstract: There are three common types of confidence interval (CI) in structural equation modeling (SEM): Wald-type CI, bootstrapping CI, and likelihood-based CI (LBCI). LBCI has the following advantages: (1) it has better coverage probabilities and Type I error rate compared to Wald-type CI when the sample size is finite; (2) it correctly tests the null hypothesis of a parameter based on likelihood ratio chi-square difference test; (3) it is less computationally intensive than bootstrapping CI; and (4) it is invariant to transformations. However, LBCI is not available in many popular SEM software packages. We developed an R package, semlbci, for forming LBCI for parameters in models fitted by lavaan, a popular open-source SEM package, such that researchers have more options in forming CIs for parameters in SEM. The package supports both unstandardized and standardized

estimates, derived parameters such as indirect effect, multisample models, and the robust LBCI proposed by Falk.

**Ou et al.: What’s for dynr: A package for linear and nonlinear dynamic modeling in R**  
**Ou-Hunter-Chow-2019**

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Lu Ou, Michael D. Hunter, and Sy-Miin Chow. “What’s for dynr: A package for linear and nonlinear dynamic modeling in R”. In: *The R Journal* 11.1 (2019), p. 91. DOI: [10.32614/rj-2019-012](https://doi.org/10.32614/rj-2019-012).

Abstract: Intensive longitudinal data in the behavioral sciences are often noisy, multivariate in nature, and may involve multiple units undergoing regime switches by showing discontinuities interspersed with continuous dynamics. Despite increasing interest in using linear and nonlinear differential/difference equation models with regime switches, there has been a scarcity of software packages that are fast and freely accessible. We have created an R package called dynr that can handle a broad class of linear and nonlinear discrete and continuous-time models, with regime-switching properties and linear Gaussian measurement functions, in C, while maintaining simple and easy-to-learn model specification functions in R. We present the mathematical and computational bases used by the dynr R package, and present two illustrative examples to demonstrate the unique features of dynr.

**Pesigan et al.: betaDelta and betaSandwich: Confidence intervals for standardized regression coefficients in R**  
**Pesigan-Sun-Cheung-2023**

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Ivan Jacob Agaloos Pesigan, Rong Wei Sun, and Shu Fai Cheung. “betaDelta and betaSandwich: Confidence intervals for standardized regression coefficients in R”. In: *Multivariate Behavioral Research* (Apr. 2023), pp. 1–4. DOI: [10.1080/00273171.2023.2201277](https://doi.org/10.1080/00273171.2023.2201277).

Abstract: The multivariate delta method was used by Yuan and Chan to estimate standard errors and confidence intervals for standardized regression coefficients. Jones and Waller extended the earlier work to situations where data are nonnormal by utilizing Browne’s asymptotic distribution-free

(ADF) theory. Furthermore, Dudgeon developed standard errors and confidence intervals, employing heteroskedasticity-consistent (HC) estimators, that are robust to nonnormality with better performance in smaller sample sizes compared to Jones and Waller's ADF technique. Despite these advancements, empirical research has been slow to adopt these methodologies. This can be a result of the dearth of user-friendly software programs to put these techniques to use. We present the `betaDelta` and the `betaSandwich` packages in the R statistical software environment in this manuscript. Both the normal-theory approach and the ADF approach put forth by Yuan and Chan and Jones and Waller are implemented by the `betaDelta` package. The HC approach proposed by Dudgeon is implemented by the `betaSandwich` package. The use of the packages is demonstrated with an empirical example. We think the packages will enable applied researchers to accurately assess the sampling variability of standardized regression coefficients.