Using car and effects Functions in Other Functions

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Abstract

The car package (Fox and Weisberg, 2019) provides many functions that are applied to a fitted regression model, perform additional calculations on the model or possibly compute a different model, and then return values and graphs. In some cases, users may wish to write functions that call functions in car for a particular purpose. Because of the scoping rules used in R, several functions in car that work when called from the command prompt may fail when called inside another function. We discuss how users can modify their programs to avoid this problem.

Some users of the car and effects package have found it convenient to write their own functions that call the functions in car or effects. While this will generally occur as expected, in some instances calls to car or effects functions will fail because the results of an input fitted model may not be available inside a user-written function. This brief note describes how this problem can be solved.

For an illustration of the problem, the function car::ncvTest (Fox and Weisberg, 2019, Sec. 8.5.1) computes tests for non-constant variance in linear models as a function of the mean, the default, or any other linear function of regressors, even for regressors not part of the mean function. For example,

\[
 m2 <- \text{lm}(\text{prestige} \sim \text{education}, \text{data} = \text{carData::Prestige})
\]

\[
 \text{car::ncvTest}(m2, \sim \text{income})
\]

Non-constant Variance Score Test
Variance formula: \( \sim \text{income} \)
\( \text{Chisquare} = 1.521, \text{Df} = 1, \ p = 0.22 \)

This fits prestige as a linear function of education, and tests for nonconstant variance as a function of income, another regressor in the data set Prestige. Embedding this in a function fails:

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f3 <- function(meanmod, dta, varmod) {
  m3 <- lm(meanmod, dta)
  car::ncvTest(m3, varmod)
}

f3(meanmod=prestige ~ education, dta=carData::Prestige, varmod ~ income)

Error in eval(data, envir = environment(formula(model))) :
  object 'dta' not found

The arguments dta and meanmod are defined in the environment of the function, but the call to lm looks for them in the global environment, and they are therefore invisible when lm is called. A solution is to copy dta to the global environment.

f4 <- function(meanmod, dta, varmod) {
  assign(".dta", dta, envir=.GlobalEnv)
  assign(".meanmod", meanmod, envir=.GlobalEnv)
  m1 <- lm(.meanmod, .dta)
  ans <- car::ncvTest(m1, varmod)
  remove(".dta", envir=.GlobalEnv)
  remove(".meanmod", envir=.GlobalEnv)
  ans
}

f4(prestige ~ education, carData::Prestige, ~income)

Non-constant Variance Score Test
Variance formula: ~ income
Chisquare = 1.521, Df = 1, p = 0.22

The assign function copies the dta and meanmod arguments to the global environment where ncvTest will be evaluated, and the remove function removes them before exiting the function. This is an inherently problematic strategy, because an object assigned in the global environment will replace an existing object of the same name. Consequently we renamed the dta argument .dta, with an initial period, but this is not a guarantee that there was no preexisting object with this name.

The functions effects::Effect and effects::predictorEffect may fail similarly when embedded in user-written functions because of scoping. Assigning arguments to the global environment as illustrated with the car::ncvTest function can again be applied.

The following function will fail:

fc <- function(dta, formula, terms) {
  if (!require("effects")) stop("effects package unavailable")
  print(m1 <- lm(formula, dta))
  Effect(terms, m1)
}
form <- prestige ~ income*type + education
terms <- c("income", "type")
fc(carData::Duncan, form, terms)

Error in is.data.frame(data) : object 'dta' not found

Assigning .dta to the global environment solves the problem:

fc.working <- function(dta, formula, terms) {
  if (!require("effects")) stop("effects package unavailable")
  assign(".dta", dta, env=.GlobalEnv)
  print(m1 <- lm(formula, .dta))
  e1 <- Effect(terms, m1)
  remove(".dta", envir=.GlobalEnv)
  e1
}

form <- prestige ~ income*type + education
terms <- c("income", "type")
fc.working(carData::Duncan, form, terms)

Call:
lm(formula = formula, data = .dta)

Coefficients:
  (Intercept) income typeprof typewc
   -4.732  0.776  31.712 -1.637
education income:typeprof income:typewc
  0.357  -0.370  -0.360

income*type effect
type
income  bc  prof  wc
  7  19.48 48.60 15.32
 30  37.33 57.95 24.88
 40  45.09 62.01 29.04
 60  60.61 70.14 37.35
 80  76.14 78.27 45.67

Assigning formula to the global environment is not necessary here because it is used by lm but not by Effect.

References