Abstract

“Applied Econometrics with R” (Kleiber and Zeileis 2008, Springer-Verlag, ISBN 978-0-387-77316-2, pp. vii+222) is the first book on applied econometrics using the R system for statistical computing and graphics (R Core Team 2019). It presents hands-on examples for a wide range of econometric models, from classical linear regression models for cross-section, time series or panel data and the common non-linear models of microeconomics, such as logit, probit, tobit models as well as regression models for count data, to recent semiparametric extensions. In addition, it provides a chapter on programming, including simulations, optimization and an introduction to R tools enabling reproducible econometric research. The methods are presented by illustrating, among other things, the fitting of wage equations, growth regressions, dynamic regressions and time series models as well as various models of microeconomics.

The book is accompanied by the R package AER (Kleiber and Zeileis 2019) which contains some new R functionality, some 100 data sets taken from a wide variety of sources, the full source code for all examples used in the book, as well as further worked examples, e.g., from popular textbooks.

This vignette provides an overview of the package contents and contains a list of errata for the book.

Keywords: econometrics, statistical software, R.

1. Package overview

1.1. R code from the book

The full R code from the book is provided in the demos for the package AER. The source scripts can be found in the demo directory of the package and executed interactively by calling demo(), as in

R> demo("Ch-Intro", package = "AER")

One demo per chapter is provided:

- Ch-Intro (Chapter 1: Introduction),
- Ch-Basics (Chapter 2: Basics),
- Ch-LinearRegression (Chapter 3: Linear Regression),
• Ch-Validation (Chapter 4: Diagnostics and Alternative Methods of Regression),
• Ch-Microeconometrics (Chapter 5: Models of Microeconometrics),
• Ch-TimeSeries (Chapter 6: Time Series),
• Ch-Programming (Chapter 7: Programming Your Own Analysis).

This list of demos is also shown by `demo(package = "AER")`.

The same scripts are contained in the `tests` directory of the package so that they are automatically checked and compared with the desired output provided in `.Rout.save` files.

To make the code fully reproducible and to avoid some lengthy computations in the daily checks, a few selected code chunks are commented out in the scripts. Also, for technical reasons, some graphics code chunks are repeated, once commented out and once without comments.

1.2. Data sets

The AER package includes some 100 data sets from leading applied econometrics journals and popular econometrics textbooks. Many data sets have been obtained from the data archive of the *Journal of Applied Econometrics* and the (now defunct) data archive of the *Journal of Business & Economic Statistics* (see note below). Some of these are used in recent textbooks, among them Baltagi (2002), Davidson and MacKinnon (2004), Greene (2003), Stock and Watson (2007), and Verbeek (2004). In addition, we provide all further data sets from Baltagi (2002), Franses (1998), Greene (2003), Stock and Watson (2007), and Winkelmann and Boes (2009). Selected data sets from Franses, van Dijk, and Opschoor (2014) are also included.

Detailed information about the source of each data set, descriptions of the variables included, and usually also examples for typical analyses are provided on the respective manual pages.

A full list of all data sets in AER can be obtained via

```
R> data(package = "AER")
```

In addition, manual pages corresponding to selected textbooks are available. They list all data sets from the respective book and provide extensive code for replicating many of the empirical examples. See, for example,

```
R> help("Greene2003", package = "AER")
```

for data sets and code for Greene (2003). Currently available manual pages are:

• Baltagi2002 for Baltagi (2002),
• CameronTrivedi1998 for Cameron and Trivedi (1998),
• Franses1998 for Franses (1998),
• Greene2003 for Greene (2003),
• WinkelmannBoes2009 for Winkelmann and Boes (2009).

1.3. New R functions

AER provides a few new R functions extending or complementing methods previously available in R:

• tobit() is a convenience interface to survreg() from package survival for fitting tobit regressions to censored data. In addition to the fitting function itself, the usual set of accessor and extractor functions is provided, e.g., print(), summary(), logLik(), etc. For more details see ?tobit.

• ivreg() fits instrumental-variable regressions via two-stage least squares. It provides a formula interface and calls the workhorse function ivreg.fit() which in turn calls lm.fit() twice. In addition to the fitting functions, the usual set of accessor and extractor functions is provided, e.g., print(), summary(), anova(), etc. For more details see ?ivreg, ?ivreg.fit, and ?summary.ivreg, respectively.

• dispersiontest() tests the null hypothesis of equidispersion in Poisson regressions against the alternative of overdispersion and/or underdispersion. For more details see ?dispersiontest.

2. Errata and comments

Below we list the errors that have been found in the book so far. Please report any further errors you find to us.

We also provide some comments, for example on functions whose interface has changed.

• p. 5–9, 46–53: There are now very minor differences in the plots pertaining to Example 2 (Determinants of wages) in Chapter 1.1 and Chapter 2.8 (Exploratory Data Analysis with R) due to a missing observation. Specifically, the version of the CPS1985 data used for the book contained only 533 observations, the original observation 1 had been omitted inadvertently.

• p. 38, 48, 85: By default there is less rounding in calls to summary() starting from R 3.4.0.

• p. 63–65, 130, 143: The function linear.hypothesis() from the car package is now defunct, it has been replaced by linearHypothesis() starting from car 2.0-0.

• p. 85–86: Due to a bug in the summary() method for “plm” objects, the degrees of freedom reported for the F statistics were interchanged and thus the p values were not correct. Therefore, the p values printed in the book at the end of summary(gr_fe) and summary(gr_re) are not correct, they should both be < 2.22e-16. Using plm 1.1-1 or higher, the code produces the correct output. Also the degrees-of-freedom adjustment in the p values for the coefficient tests in summary(gr_re) were corrected.
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• pp. 88–89: As of version 1.3-1 of the plm package, summaries of “pgmm” objects provide robust standard errors by default. The output presented on pp. 88–89 is still available, but now requires `summary(empl_ab, robust = FALSE)`.

Also, the formula interface for pgmm() has changed: as of version 1.7-0 of the plm package, the function `dynformula()` is deprecated. Instead, lags should now be specified via the package’s `lag()` function. In addition, instruments should now be specified via a two-part formula.

Using the new interface, the function call for the Arellano-Bond example is

```r
R> empl_ab <- pgmm(log(emp) ~ lag(log(emp), 1:2) + lag(log(wage), 0:1) +
+      lag(capital) + lag(log(output), 0:1) | lag(log(emp), 2:99),
+      data = EmplUK, index = c("firm", "year"),
+      effect = "twoways", model = "twosteps")
```

• p. 92: Exercise 6 cannot be solved using PSID1982 since that data set only contains a cross-section while Hausman-Taylor requires panel data. A panel version has been available in the plm package under the name Wages; we have now added PSID7682 to AER for completeness (and consistent naming conventions). Use PSID7682 for the exercise.

• pp. 98–100: R only provides a function `dffits()` but not `dffit()` as claimed on p. 99. Somewhat confusingly the corresponding column in the output of `influence.measures()` (as shown on p. 100) is called `dffit` by R (rather than `dffits`).

• p. 124: The argument `ylevels = 2:1` in the spinogram is no longer needed because the default ordering of the y-levels changed in R 4.0.0.

• p. 141: The log-likelihood for the tobit model lacked a minus sign. The correct version is

\[ \ell(\beta, \sigma^2) = \sum_{y_i > 0} \left( \log \phi\left(\frac{y_i - x_i^\top \beta}{\sigma}\right) - \log \sigma \right) + \sum_{y_i = 0} \log \Phi\left(-\frac{x_i^\top \beta}{\sigma}\right). \]

• p. 149: The standard error (and hence the corresponding z test) of `admin|manage` in the output of `coeftest(bank_polr)` is wrong, it should be 1.4744. This was caused by an inconsistency between `polr()` and its `vcov()` method which has now been improved in the MASS package (≥ 7.3-6).

• p. 167: The truncation lag parameter in the output of `kpss.test(log(PepperPrice[, "white"]))` is wrong, it should be 5 instead of 3, also leading to a somewhat smaller test statistic and larger p value. This has now been corrected in the tseries package (≥ 0.10-46).

• p. 169: The comment regarding the output from the Johansen test is in error. The null hypothesis of no cointegration is not rejected at the 10% level. Nonetheless, the table corresponding to Case 2 in Juselius (2006, p. 420) reveals that the trace statistic is significant at the 15% level, thus the Johansen test weakly confirms the initial two-step approach.

• p. 179: For consistency, the GARCH code should be preceded by `data("MarkPound")`. 
• p. 192: The likelihood for the generalized production function was in error (code and computations were correct though).

The correct likelihood for the model is

$$L = \prod_{i=1}^{n} \left\{ \frac{1}{\sigma} \phi \left( \frac{\varepsilon_i}{\sigma} \right) \cdot \frac{1 + \theta Y_i}{Y_i} \right\},$$

giving the log-likelihood

$$\ell = \sum_{i=1}^{n} \{ \log(1 + \theta Y_i) - \log Y_i \} - n \log \sigma + \sum_{i=1}^{n} \log \phi(\varepsilon_i/\sigma).$$

• p. 205: The reference for Henningsen (2008) should be:


*Note:* Currently, all links on manual pages corresponding to data sets taken from the Journal of Business & Economic Statistics (JBES) archive are broken (data sets MarkPound, and RecreationDemand). The reason is the redesign of the American Statistical Association (ASA) website, rendering the old ASA data archive nonfunctional. The ASA journals manager currently appears to supply data on a case-by-case basis. The problem awaits a more permanent solution.

**References**


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