

The STATA News

Statistics Graphics Data Management & Analysis

A free update to Stata 13 is available—Stata 13.1

For those who have Stata 13, just type **update query** in Stata, and follow the instructions, or select “Check for updates” from the Help menu. Stata 13.1 introduces several new features.

Censored outcomes

If you analyze data with Gaussian dependent variables that are censored, you will want to update to Stata 13.1. You can now do just about anything you want with such outcomes. Extensions of tobit and censored regression models include the following:

- Selection models
- Random effects and coefficients
- Endogenous covariates
- Treatment effects (ATEs)
- Multivariate models
- Unobserved components
- Endogenous switching models

All of these models may be combined with each other. For example, you can specify a tobit model with random effects, random coefficients, sample selection, and endogenous covariates. Moreover, the random coefficients can occur in both the outcome and selection models.

All of these features are implemented through extensions to Stata’s **gsem** (generalized SEM) command and graphical SEM Builder.

See page 3 for a discussion.

Power and sample size

The **power** command that was introduced in Stata 13 has new methods for analysis of ANOVA models:

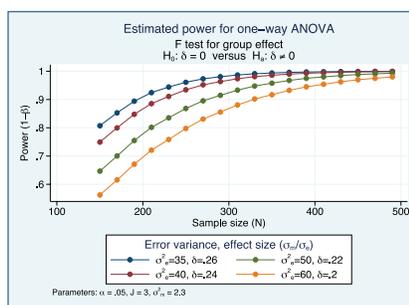
- One-way models
- Two-way models
- Repeated-measures models

Like other power methods, you can compute (1) sample size, (2) power, or (3) effect size. Compute any of the three given the other two.

You just tell **power** what you know, and it produces tables and graphs of what you want to know.

Stata 13.1 also introduces facilities to easily add your own new methods to the **power** command and produce tables and graphs of results automatically.

See page 2 for details.



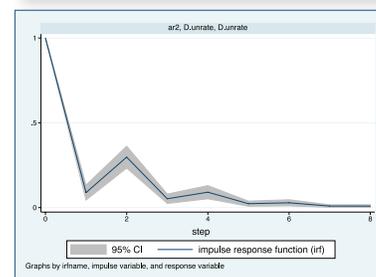
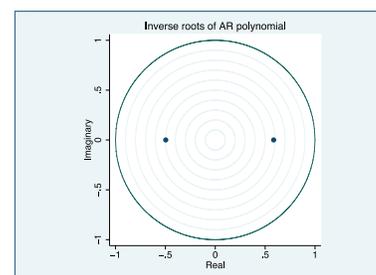
Time series

Stata 13.1 also adds several new features for the analysis of univariate time series:

- IRFs (impulse–response functions) for ARIMA and ARFIMA models
- Autocorrelation functions from ARIMA and ARFIMA models
- Parametric spectral densities for seasonal ARIMA models
- Stability checks for ARIMA models

All of your favorite multivariate tools can now be applied to univariate models.

See page 4 to see these features.



Haven't upgraded to Stata 13 yet?

You're missing one of the most exciting releases of Stata ever. Learn more on page 8.

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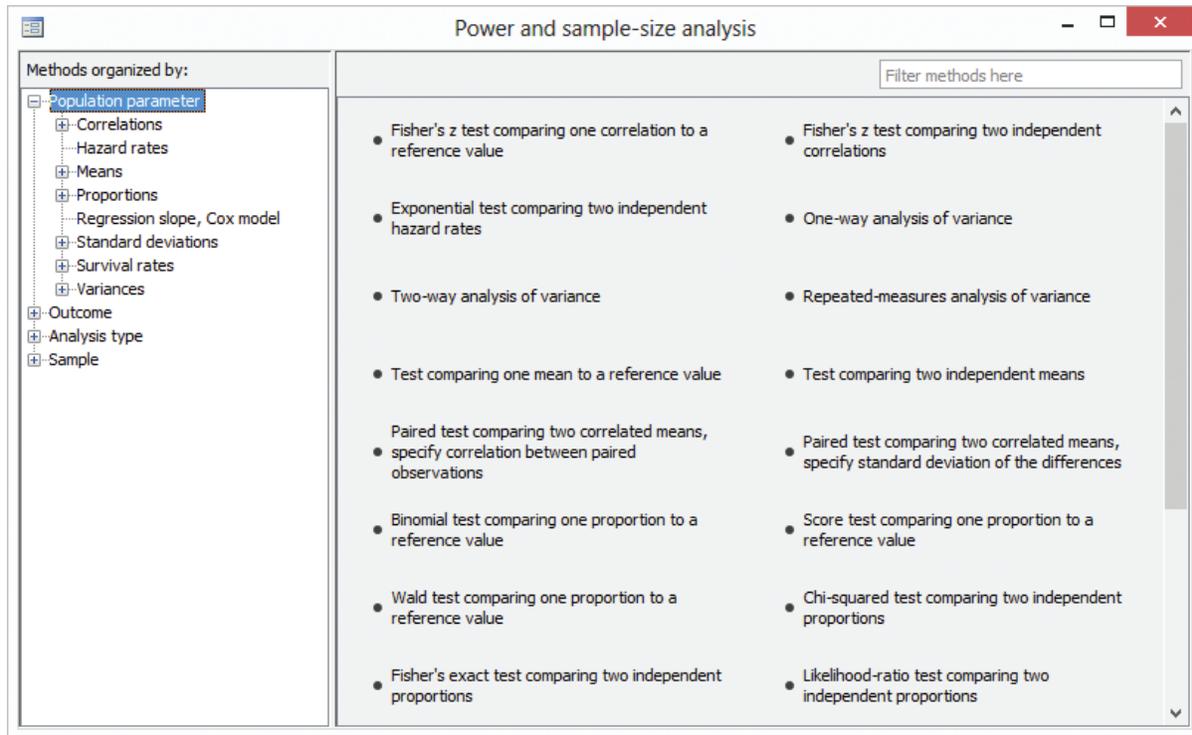
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The Stata News

Executive Editor..... Karen Strope
Production Supervisor ... Annette Fett



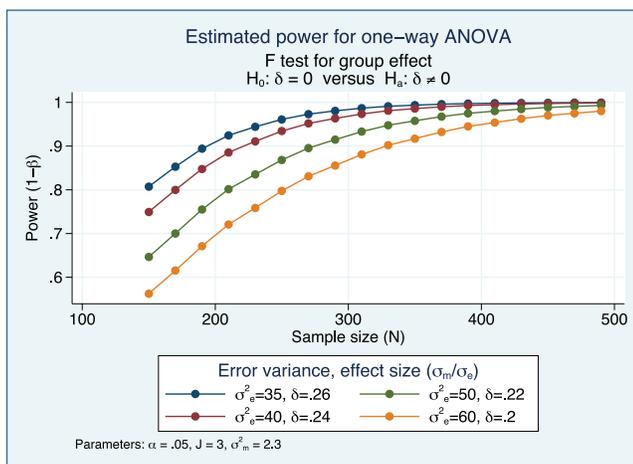
New power and sample size for ANOVA



Stata 13.1, a free update to Stata 13, adds three new methods for power and sample-size analysis of ANOVA models—**oneway**, **twoway**, and **repeated**:

- **power oneway**
performs analyses for one-way ANOVA
- **power twoway**
performs analyses for two-way ANOVA
- **power repeated**
performs analyses for repeated-measures ANOVA

These new facilities work just like the existing facilities for comparisons of means, proportions, correlations, and variances. You can specify single values or ranges of values for power and effect size to compute required sample size. You can specify sample size and effect size to compute power. Or you can specify power and sample size to compute effect size.



Your results can be displayed either in tabular form or as a graph. Multiple scenarios can be compared on a table or a graph.

For one-way ANOVA, you can perform analyses either on comparisons of means or on arbitrary contrasts of means. All methods work with unbalanced models.

You can specify your problem in the way you find most convenient. For example, to compute the required sample size for a one-way analysis, you can specify the projected group means directly, or you can specify between-group variability. **power oneway** will accommodate either of these specifications.

You can perform your analysis using either natural command syntax (see stata.com/stata13/power-and-sample-size) or the integrated power and sample-size control panel—a graphical interface to guide you through your analysis.

Read about all the new features provided for power and sample-size analysis in Stata 13 and 13.1 at stata.com/stata13/power-and-sample-size. There you will find highlights and a quick overview of the new features, links to videos, links to worked examples, and even a PDF of the new *Power and Sample-Size Reference Manual*.

New features for censored outcomes and tobit models

We often cannot observe or measure an outcome over its full range. Tests for detecting a toxin often require the toxin to exceed a threshold before it can be detected—left-censoring. Patients' weights will be censored at the upper limit of the scale used to weigh them—right-censoring.

Related to left- and right-censoring are interval measurements, or interval censoring. Income can be surveyed in ranges (\$0 to \$10,000, \$10,001 to \$30,000, \$30,001 to \$60,000, \$60,001 and up), or patient weight can be recorded in ranges (0–80 pounds, 81–120 pounds, 121–150 pounds, 151–180 pounds, 181–220 pounds, 221–250 pounds, over 250 pounds).

Stata has long been able to estimate regression models with censored outcomes. **tobit** can estimate models with left- or right-censoring at fixed values. **intreg** can estimate models with interval measurements or censoring that varies across observations.

New with the Stata 13.1 update, you can now estimate models with censored or interval-measured Gaussian outcomes that also include Heckman-style selection, endogenous treatments to obtain average treatment effects (ATEs), covariate measurement error, and unobserved components. You can include endogenous regressors in any part of the models. You can also estimate these models in a panel-data or multilevel-data context with random effects (intercepts) and random coefficients in any part or all parts of the model. All of these models can be estimated as parts of larger multivariate systems. Censored or interval-measured outcomes can even participate in endogenous switching models.

Imagine we have data on incomes. These data are often top coded, or censored at an upper limit, to increase reporting rates. If that limit were \$150,000, we could estimate a regression model of income on education and age by typing

```
. tobit income education age, ul(150000)
```

(We might prefer **log income**, but for simplicity, we will use **income** here.)

All the new features are obtained using Stata 13's generalized structural equation modeling command—**gsem**. The equivalent **gsem** command is

```
. gsem income <- education age, family(gaussian, rcensored(150000))
```

We can introduce an endogenous covariate, say, weeks worked, by adding an equation for **weeks** with instruments (**z1** and **z2**) and a common unobserved component (UC) with identifying constraints specified using **@**:

```
. gsem (income <- education age weeks UC, family(gaussian, rcensored(150000)))
      (weeks <- education age z1 z2 UC@1 , var(UC@1))
```

If we have panel data with repeated measurements on individuals (**id**), we can introduce a random effect (intercept) into the income model by adding **RE[id]**:

```
. gsem (income <- education age weeks UC RE[id], family(gaussian, rcensored(150000)))
      (weeks <- education age z1 z2 UC@1)
```

We can even add a random coefficient on **age** by interacting a random latent variable (**RC[id]**) with **age**:

```
. gsem (income <- education age c.age#RC[id] weeks UC RE[id], family(gaussian, rcensored(150000)))
      (weeks <- education age z1 z2 UC@1 , var(UC@1))
```

Continued on next page.

Handling Heckman-style selection in the **gsem** framework requires a bit of setup. See stata.com/manuals13/semexample45g.pdf for an example using an uncensored outcome variable. For censored outcomes, you merely need to add the suboption **lcensored()** or **rcensored()** to the **family()** option.

An endogenous treatment-effects example without censoring can be found at stata.com/manuals13/semexample46g.pdf. Again just add **lcensored()** or **rcensored()** to **family()** if the outcome is censored.

You can use either the commands shown above or Stata's SEM Builder to create and estimate these models.

Stata 13.1 provides everything you could want with censored outcomes.

Read about the other new features provided by generalized SEM at stata.com/stata13/generalized-sem. There you will find an overview of SEM and generalized SEM, links to videos, links to worked examples, and even the full PDF of Stata 13's *Structural Equation Modeling Reference Manual*.

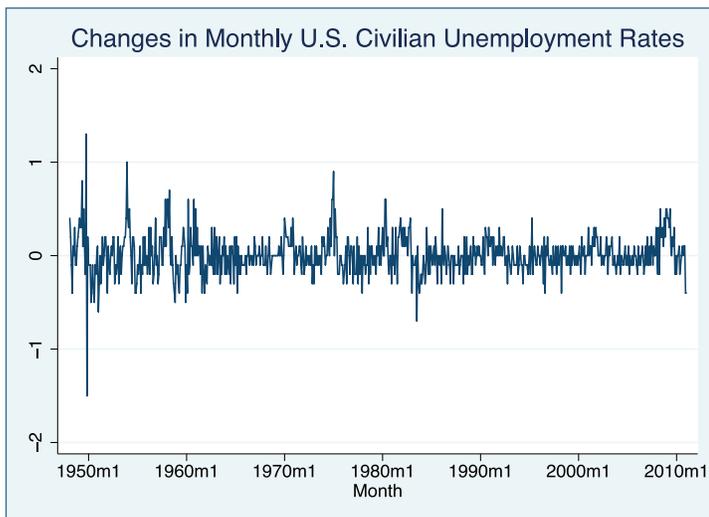
In the spotlight: New univariate time-series features added in 13.1

Stata 13.1 introduces four new features for univariate time series:

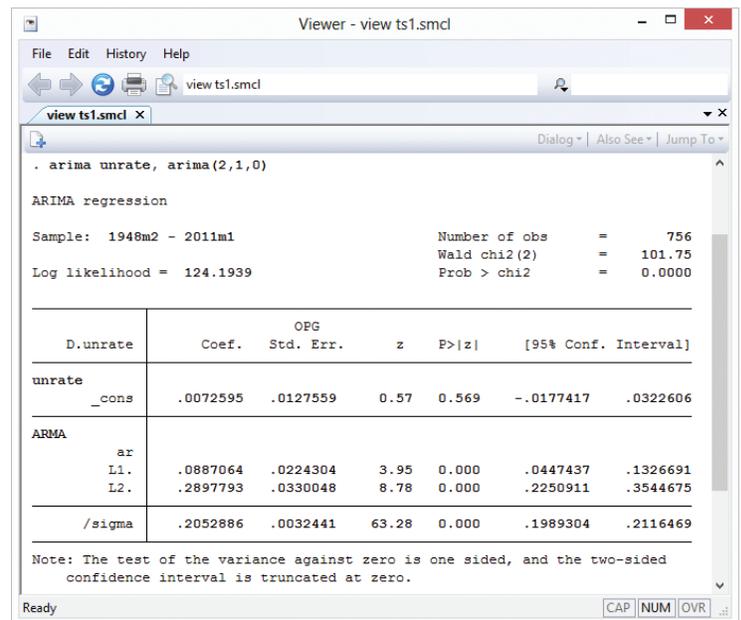
1. IRFs (impulse–response functions) for ARIMA and ARFIMA models
2. Parametric autocorrelation estimates from ARIMA and ARFIMA models
3. A check of stability conditions for ARIMA models
4. Spectral density estimation from seasonal ARIMA models

Individually, none of these features are earth shattering. However, the first three are some of my go-to concepts when teaching time-series analysis. Let's use an example to see why.

Here is a graph of changes in monthly U.S. civilian unemployment rates for the period 1948–2011.



We fit an ARIMA model with two autoregressive (AR) terms, first-differencing, and no moving-average terms.



The AR parameters are statistically significant, and they indicate a moderate degree of temporal dependence.

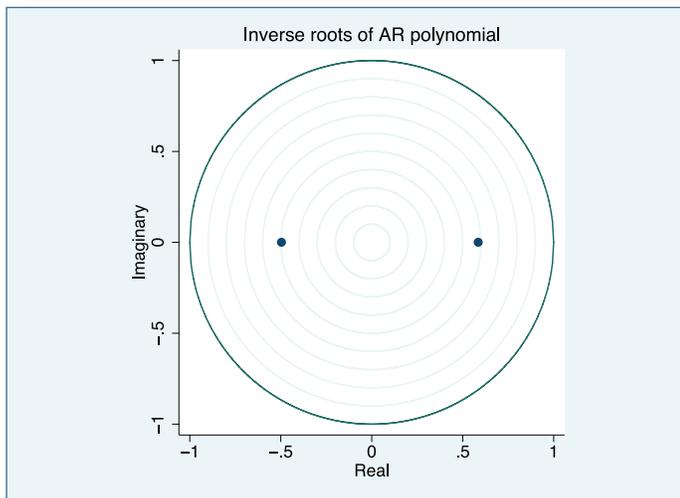
Inference after ARIMA requires that the ARMA (autoregressive moving-average) process be covariance stationary. The stationarity of an ARMA process depends on the AR parameters. The inverse roots of the AR polynomial must all lie inside the unit circle for the process to be stationary. We use the new **estat aroots** command to examine this requirement:

```
. estat aroots
```

Eigenvalue stability condition

Eigenvalue	Modulus
.5844888	.584489
-.4957824	.495782

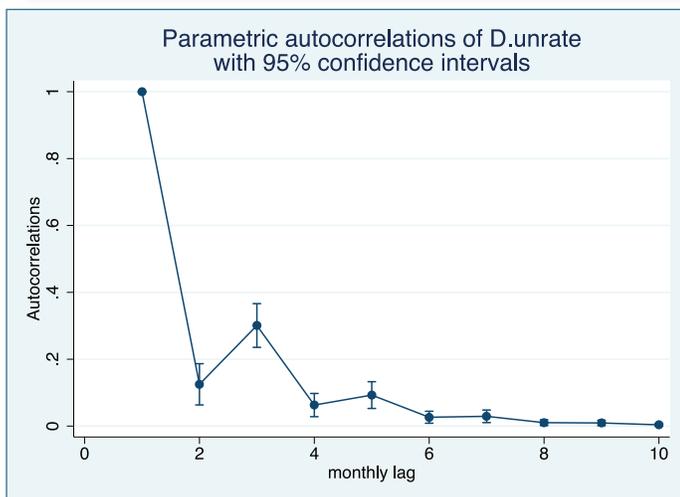
All the eigenvalues lie inside the unit circle.
AR parameters satisfy stability condition.



The ARMA process appears to be stationary because both inverse AR roots lie well inside the unit circle.

A crucial aspect of time-series processes are their autocorrelations. The autocorrelations provide a scale-free measure of the dependence structure of the process. We can obtain a graph of this structure using the new **estat acplot** command after estimating our ARIMA model:

```
. estat acplot, lags(10)
```



The graph shows that the autocorrelations decay exponentially toward 0, which is typical of a stationary AR process with positive coefficients.

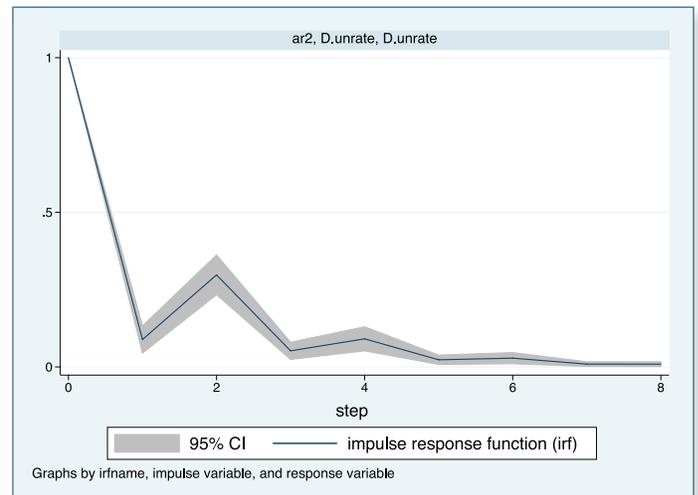
We often want to know how an exogenous shock feeds through our model and affects the series. This response, measured over time, is called the impulse-response function (IRF).

We create an IRF for our ARIMA model by typing

```
. irf create ar2, set(myirf)
```

and then graph that IRF by typing

```
. irf graph irf
```



The trajectory of the IRF shows that a positive shock initially causes an increase in unemployment but that the increase nears 0 by 5 months and completely dies out after 7 or 8 months.

You can see more examples of these new facilities in the manuals. See **arima postestimation** (stata.com/manuals13/tsarimapostestimation.pdf) and **arfima postestimation** (stata.com/manuals13/tsarfimapostestimation.pdf).

- Rafal Raciborski
Senior Statistical Developer

New distribution functions

Stata 13.1 adds three new functions that compute aspects of the noncentral chi-squared distribution:

nchi2den() density
nchi2tail() reverse cumulative
invnchi2tail() inverse of reverse cumulative

In the spotlight: Adding your own methods to analyze power and sample size

Stata 13 added a suite of **power** commands to analyze power and sample size. Stata 13.1 extends that suite to ANOVA.

In some cases, you may want to compute sample size or power yourself. For example, you may need to do this by simulation, or you may want to use a method that is not available in any software package. **power** makes it easy for you to add your own method. All you need to do is to write a program that computes sample size, power, or effect size, and the **power** command will do the rest for you. It will deal with the support of multiple values in options and with automatic generation of graphs and tables of results.

Suppose you want to add the method called **mymethod** to the **power** command. Just follow these three steps:

1. Create a program that computes sample size, power, or effect size and follows **power**'s naming convention—**power_cmd_mymethod.ado**.
2. Store results following **power**'s simple naming conventions for results. For example, store the value of power in **r(power)**, the value of sample size in **r(N)**, and so on.
3. Place your program **power_cmd_mymethod.ado** where Stata can find it.

To show how easy this all is, we'll write an ado program to compute power for a one-sample z test given sample size, standardized difference, and significance level. For simplicity, we assume a two-sided test.

We will call our new method **myztest**.

```

program power_cmd_myztest, rclass
  version 13.1

  // parse options
  syntax , n(integer)    /// sample size
          STDDiff(real)  /// standardized diff.
          Alpha(string)  /// significance level

  // compute power
  tempname power
  scalar `power' = normal(`stddiff'*sqrt(`n') - ///
    invnormal(1-`alpha'/2))

  // return results
  return scalar power = `power'
  return scalar N     = `n'
  return scalar alpha = `alpha'
  return scalar stddiff = `stddiff'
end

```

The computation in this program takes only one line, but it could be as complicated as we like. It could even involve simulation to compute the power.

With our program in hand, we can type

```
. power myztest, n(20) stddiff(1) alpha(.05)
```

power will find our ado program, supply it with the options **n(20)**, **stddiff(1)**, and **alpha(.05)**, and use its returned results to produce

```
. power myztest, n(20) stddiff(1) alpha(.05)
```

Estimated power
Two-sided test

alpha	power	N
.05	.994	20

That wasn't too impressive. Our program did all the work.

But what if we supplied **power** with a list of sample sizes?

```
. power myztest, n(10 15 20 25) stddiff(1)
```

Estimated power
Two-sided test

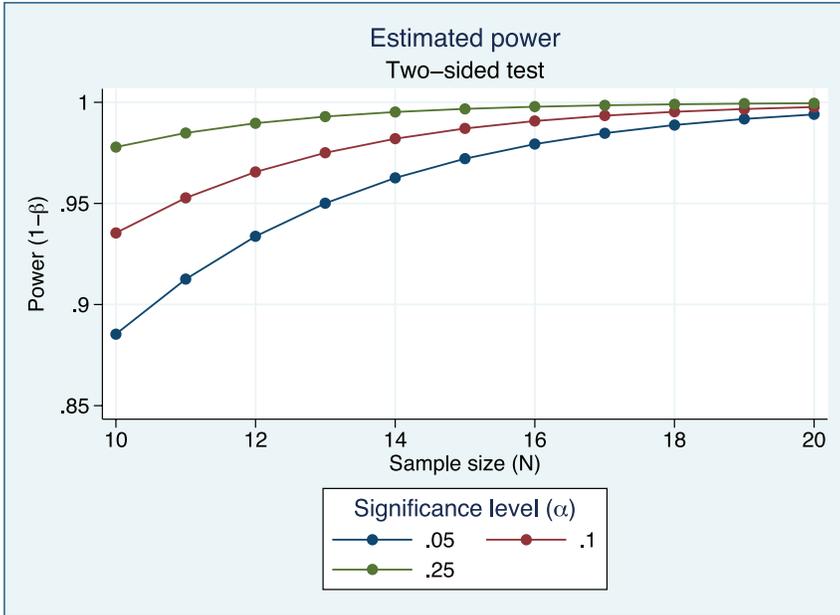
alpha	power	N
.05	.8854	10
.05	.9721	15
.05	.994	20
.05	.9988	25

power has taken our list of sample sizes and computed powers for all of them—even though our program could only compute a single power!

Moreover, we can use **power**'s standard **table()** option to control exactly how that table looks. **power** also has hooks that let our program determine how the columns are labeled and how the table appears.

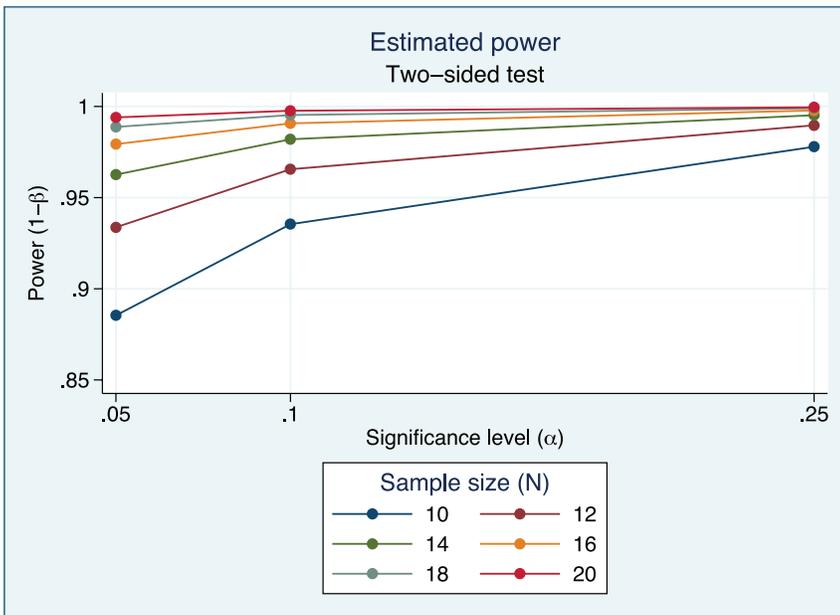
We can supply both sample sizes and significance levels and request a graph instead of a table:

```
. power myztest, n(10(1)20) alpha(.05 .10 .25) stddiff(1) graph
```



We can even request that the graph show α on the x axis with separate plots for each sample size.

```
. power myztest, n(10(2)20) alpha(.05 .10 .25) stddiff(1) graph(xdim(alpha))
```



Now all this may just make it worth writing more complicated programs to compute power for more complicated tests and comparisons.

We had room here to do just a simple example. More details and extensions of this example are covered in my presentation at the 2013 UK Stata Users Group meeting —

stata.com/meeting/uk13/abstracts/materials/uk13_marchenko.pdf. Complete documentation for user-programmed power and sample size can be found in Stata 13.1 by typing **help power userwritten**.

- Yulia Marchenko
Director of Biostatistics

STATA® 13

Stata 13 adds features and statistics for virtually every user in every field. Here are the highlights.

Treatment effects

You can now estimate the effect of treatments such as a new drug regimen, a surgical procedure, or a training program using inverse-probability weights (IPW), propensity-score matching, doubly robust methods, and other techniques. Your treatment can be binary, multilevel (for example, four dosages of the same drug), or multivalued (for example, four different drugs).

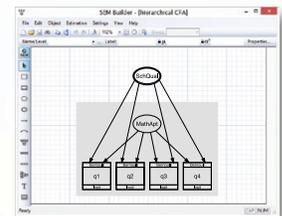


Multilevel models and panel data

Need to handle binary, ordered, count, and categorical outcomes in panel or repeated-measures data? Stata's extensive multilevel and panel-data modeling facilities have been extended to include probit, negative binomial, ordered logistic, ordered probit, and multinomial logistic—all with cluster-robust SEs.

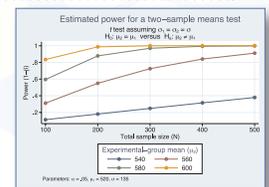
Generalized SEM

Tired of just linear SEMs? Stata 13 adds multilevel nested and crossed models. We also add support for binary, count, categorical, and ordered outcomes. With these new features, you can estimate a dizzying array of models—multilevel CFA with ordinal measurements, multilevel mediation, item-response theory (IRT) ... any multilevel SEM with generalized linear outcomes.



Power and sample size

Perform power and sample-size analyses from an integrated Control Panel. Get tables, graphs, or both at the click of a button. Enter lists of known or possible values, and solve for power, sample size, minimum detectable effect, or effect size.



Forecasting

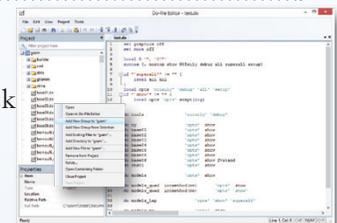
Estimate any number of models—regressions, simultaneous systems, VARs, etc.—and produce time-series forecasts from all the estimates. Create dynamic or static (one-step ahead) forecasts. Apply add factors and other adjustments, specify identities, and compare alternative scenarios—even produce confidence intervals via stochastic simulation.

Long strings

Maximum string length increases from 244 characters to 2 billion! Stata also now handles binary large objects (BLOBs) such as Word documents and JPEG images. These long strings work just as strings have always worked in Stata—all functions and commands work with them.

Project Manager

Keep all of your files associated with a Stata project in one place. Filter on filename, and click to open or run do-files, ado-files, datasets, raw files, graphs, etc. Create groups to categorize files. Create any number of projects that pass seamlessly across all of your computers, even across different operating systems.



And there are many more substantial additions, such as effect size, Poisson regression with endogenous regressors, probit with sample selection, and import delimited with preview.

Upgrade now at stata.com/stata13.

STATA Conference Boston 2014

Come join us in historic Boston, home to Fenway Park and the Harvard Museum of Natural History, for two days of networking and Stata exploration. Don't miss this opportunity to connect with colleagues and fellow researchers, as well as Stata developers.

Call for presentations

All users are encouraged to submit abstracts for possible presentations, which can address any Stata-related topic, including the following:

- New user-written commands, including commands for modeling and estimation, graphical analysis, data management, or reporting
- Use or evaluation of existing Stata commands
- Methods for teaching statistics with Stata or teaching the use of Stata
- Case studies of Stata use in novel areas or applications
- Surveys or critiques of Stata facilities in specific fields
- Comparisons of Stata with other software or use of Stata together with other software

Each user presentation should be either 15 or 25 minutes long and should be followed by 5 minutes for questions. Longer presentations will be considered at the discretion of the scientific committee.

For submission guidelines, visit stata.com/boston14. Submissions are due by February 21, 2014.

Scientific committee

- Stephen Soldz (Chair)
Boston Graduate School of Psychoanalysis
- Kit Baum
Boston College
- Marcello Pagano
Harvard University



Whether you stay for the JSM or just to relax, be sure to enjoy what Boston has to offer. Take a cruise in Boston Harbor, walk the Freedom Trail, visit Fenway Park, and have a bowl of "chowdah". Boston is a great city with plenty to do and see.

When	July 31–August 1, 2014
Where	Omni Parker House 60 School Street Boston, Massachusetts
Details	stata.com/boston14

Visit us at ASSA 2014

Philadelphia, Pennsylvania January 3–5, 2014

The Allied Social Science Association (ASSA) will have its annual meeting in Philadelphia, Pennsylvania, from January 3–5. For more information, visit aeaweb.org/Annual_Meeting.

Stata representatives, including David M. Drukker, Director of Econometrics, will be on hand to answer your questions on all things Stata. Stop by booth #405 to visit with the people who develop and support the software.

We're interviewing at ASSA! Go to stata.com/careers/assa14. Submit your completed application before December 16, 2013, and let us know that you would like to be considered for an interview at the meetings.

Econometrics Winter School using Stata

Timberlake (Portugal) and the Faculty of Economics at the University of Porto are jointly organizing a set of applied econometrics courses using Stata. The aim of these courses is to familiarize the participants with the basic econometric tools commonly used in applied research. The courses include a quick discussion of the relevant econometric theory as well as an in-depth discussion of empirical applications using real data. The courses, taught in English, will take place at FEP, University of Porto, on January 21–24, 2014.

Available courses

- Day 1: Data management and regression analysis (OLS, GLS)
- Day 2: IV and panel-data models
- Day 3: Discrete choice models
- Day 4: Duration models

For more information or to register, visit Timberlake's website at www.timberlake.pt/landings/v9.

Public training courses

Public training courses are intensive, in-depth courses taught by StataCorp at a third-party site.

Using Stata Effectively: Data Management, Analysis, and Graphics Fundamentals

January 7–8, 2014, Washington, DC

Aimed at both new Stata users and those who wish to learn techniques for efficient day-to-day use of Stata, this course enables you to use Stata in a reproducible manner, making collaborative changes and follow-up analyses much simpler. Exercises will supplement the lectures and Stata examples.

Estimating Average Treatment Effects Using Stata

March 6–7, 2014, Washington, DC

This course discusses methods in Stata that use observational data to estimate average treatment effects and average treatment effects on the treated. We will cover the conceptual and theoretical underpinnings of treatment effects as well as many examples using Stata.

Structural Equation Modeling Using Stata

March 24–25, 2014, Washington, DC

Learn how to illustrate, specify, and estimate structural equation models in Stata using both Stata's SEM Builder and the `sem` command. The course introduces several types of models, including path analysis, confirmatory factor analysis, full structural equation models, and latent growth curves. Exercises supplement the lessons and Stata examples.

Multilevel/Mixed Models Using Stata

April 23–24, 2014, Washington, DC

Measure and account for clustering and grouping at multiple levels. Whether linear or nonlinear, multilevel modeling allows for random intercepts and slopes at multiple levels, reducing the problems of too-much or too-little data aggregation. The course is interactive, uses real data, offers ample opportunity for specific research questions, and provides exercises to reinforce what you learn.

Find out more at stata.com/public-training.

NetCourses™

NetCourses are convenient web-based courses that teach you how to exploit the full power of Stata.

Introduction to Survival Analysis Using Stata



Intended for everyone who uses Stata to perform survival analysis, whether health researchers or social scientists, the course includes an introduction to concepts such as censoring, truncation, hazard rates, and survival functions. The remainder of the course focuses on the analysis of survival data. Topics include data preparation, descriptive statistics, life tables, Kaplan–Meier curves, and semiparametric (Cox) regression and parametric regression. Exercises are included to reinforce the course material. Some familiarity with Stata is important, but no prior knowledge of survival analysis is necessary.

Dates: January 17–March 7, 2014
Cost: \$295

Don't forget our other courses!

Introduction to Stata

Dates: January 17–February 28, 2014
Cost: \$95

Introduction to Stata Programming

Dates: January 17–February 28, 2014
Cost: \$125

Advanced Stata Programming

Dates: January 17–March 7, 2014
Cost: \$150

Introduction to Univariate Time Series Using Stata

Dates: January 17–March 7, 2014
Cost: \$295

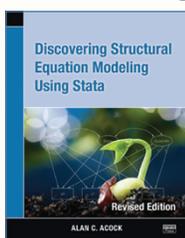
stata.com/netcourse

The dates above don't work for you? No problem! NetCourseNow allows you to set the schedule. Visit stata.com/netcourse/ncnow.

New from Stata Press

Discovering Structural Equation Modeling Using Stata, Revised Edition

Author: Alan C. Acock
 Copyright: 2013
 ISBN-13: 978-1-59718-139-6
 Pages: 306; paperback
 Price: \$48.00



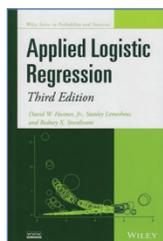
Discovering Structural Equation Modeling Using Stata, Revised Edition is an excellent resource both for those who are new to SEM and for those who are familiar with SEM but new to fitting these models in Stata. It is useful as a text for courses covering SEM as well as for researchers performing SEM.

The *Revised Edition* includes output, syntax, and instructions for fitting models with the SEM Builder that have been updated for Stata 13.

Read more or order online at
stata-press.com/discovering-sem.

Applied Logistic Regression, Third Edition

Authors: David W. Hosmer, Jr.,
 Stanley Lemeshow,
 and Rodney X.
 Sturdivant
 Publisher: Wiley
 Copyright: 2013
 ISBN-13: 978-0-470-58247-3
 Pages: 528; hardcover
 Price: \$94.75



The third edition of *Applied Logistic Regression*, by David W. Hosmer, Jr., Stanley Lemeshow, and Rodney X. Sturdivant, is the definitive reference on logistic regression models.

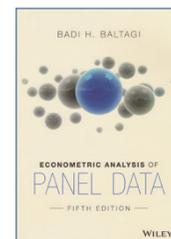
Most of the analyses in the book were performed using Stata and can be replicated using Stata and the data from the text. Also noteworthy is the book's use of multinomial fractional polynomial models that can be fit using Stata's **mfp** command.

Read more or order online at
stata.com/bookstore/applied-logistic-regression.

New from the Stata Bookstore

Econometric Analysis of Panel Data, Fifth Edition

Author: Badi H. Baltagi
 Publisher: Wiley
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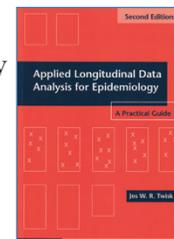
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