

Preface

Think back to the first time you learned about simple linear regression. You probably learned about the underlying theory of linear regression, the meaning of the regression coefficients, and how to create a graph of the regression line. The graph of the regression line provided a visual representation of the intercept and slope coefficients. Using such a graph, you could see that as the intercept increased, so did the overall height of the regression line, and as the slope increased, so did the tilt of the regression line. Within Stata, the `graph twoway lfit` command can be used to easily visualize the results of a simple linear regression.

Over time we learn about and use fancier and more abstract regression models—models that include covariates, polynomial terms, piecewise terms, categorical predictors, interactions, and nonlinear models such as logistic. Compared with a simple linear regression model, it can be challenging to visualize the results of such models. The utility of these fancier models diminishes if we have greater difficulty interpreting and visualizing the results.

With the introduction of the `marginsplot` command in Stata 12, visualizing the results of a regression model, even complex models, is a snap. As implied by the name, the `marginsplot` command works in tandem with the `margins` command by plotting (graphing) the results computed by the `margins` command. For example, after fitting a linear model, the `margins` command can be used to compute adjusted means as a function of one or more predictors. The `marginsplot` command graphs the adjusted means, allowing you to visually interpret the results.

The `margins` and `marginsplot` commands can be used following nearly all Stata estimation commands (including `regress`, `anova`, `logit`, `ologit`, and `mlogit`). Furthermore, these commands work with continuous linear predictors, categorical predictors, polynomial (power) terms, as well as interactions (for example, two-way interactions, three-way interactions). This book uses the `marginsplot` command not only as an interpretive tool, but also as an instructive tool to help you understand the results of regression models by visualizing them.

Categorical predictors pose special difficulties with respect to interpreting regression models, especially models that involve interactions of categorical predictors. Categorical predictors are traditionally coded using dummy (indicator) coding. Many research questions cannot be answered directly in terms of dummy variables. Furthermore, interactions involving dummy categorical variables can be confusing and even misleading. Stata 12 introduces the `contrast` command, a general-purpose command that can be

used to precisely test the effects of categorical variables by forming contrasts among the levels of the categorical predictors. For example, you can compare adjacent groups, compare each group with the overall mean, or compare each group with the mean of the previous groups. The `contrast` command allows you to easily focus on the comparisons that are of interest to you.

The `contrast` command works with interactions as well. You can test the simple effect of one predictor at specific levels of another predictor or form interactions that involve comparisons of your choosing. In the parlance of analysis of variance, you can test simple effects, simple contrasts, partial interactions, and interaction contrasts. These kinds of tests allow you to precisely understand and dissect interactions with surgical precision. The `contrast` command works not only with the `regress` command, but also with commands such as `logit`, `ologit`, `mlogit`, as well as random-effects models like `xtmixed`.

As you can see, the scope of the application of the `margins`, `marginsplot`, and `contrast` commands is broad. Likewise, so is the scope of this book. It covers continuous variables (modeled linearly, using polynomials, and piecewise), interactions of continuous variables, categorical predictors, interactions of categorical predictors, as well as interactions of continuous and categorical predictors. The book also illustrates how the `margins`, `marginsplot`, and `contrast` commands can be used to interpret results from multilevel models, models where time is a continuous predictor, models with time as a categorical predictor, nonlinear models (such as logistic regression or ordinal logistic regression), and analyses that involve complex survey data. However, this book does not contain information about the theory of these statistical models, how to perform diagnostics for the models, the formulas for the models, and so forth. The summary section concluding each chapter includes references to books and articles that provide background for the techniques illustrated in the chapter.

My goal for this book is to provide simple and clear examples that illustrate how to interpret and visualize the results of regression models. To that end, I have selected examples that illustrate large effects generally combined with large sample sizes to create patterns of effects that are easy to visualize. Most of the examples are based on real data, but some are based on hypothetical data. In either case, I hope the examples help you understand the results of your regression models so you can interpret and present them with clarity and confidence.