Regression in Stata

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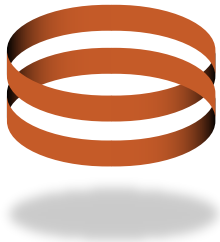

The Institute
for Quantitative Social Science
at Harvard University

Outline

1. Introduction
2. Univariate regression
3. Multiple regression
4. Interactions and Categorical IV
5. Exporting and saving results
6. Wrap-up

Topic

1 Introduction

2 Univariate regression

3 Multiple regression

4 Interactions and Categorical IV

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6 Wrap-up

Documents for today

USERNAME: dataclass PASSWORD: dataclass

- Find class materials at: Scratch > StataStatistics
- FIRST THING: copy this folder to your desktop!

Organization

- Please feel free to ask questions at any point if they are relevant to the current topic (or if you are lost!)
- There will be a Q&A after class for more specific, personalized questions
- Collaboration with your neighbors is encouraged
- If you are using a laptop, you will need to adjust paths accordingly
- Make comments in your Do-file rather than on hand-outs
- Save on flash drive or email to yourself

Today's Dataset

- We have data on a variety of variables for all 50 states
- Population, density, energy use, voting tendencies, graduation rates, income, etc.
- We're going to be predicting SAT scores
- Univariate Regression: SAT scores and Education Expenditures
- Does the amount of money spent on education affect the mean SAT score in a state?
- Dependent variable: csat
- Independent variable: expense

Opening Files in Stata

- Look at bottom left hand corner of Stata screen – This is the directory Stata is currently reading from
- Files are located in the StataDatMan folder
- Start by changing directory and loading the data

```
// change directory
cd "C:/Users/dataclass/Desktop/StataStatistics"
// use dir to see what is in the directory:
dir
// tell Stata to use the states data set
use states.dta
```

Steps for Running Regression

1. Examine descriptive statistics
2. Look at relationship graphically and test correlation(s)
3. Run and interpret regression
4. Test regression assumptions

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6 Wrap-up

Univariate Regression: Preliminaries

- We want to predict csat scores from expense
- First, let's look at some descriptives

```
// generate summary statistics for csat and expense
sum csat expense
// look at codebok
codebook csat expense
```

Univariate Regression

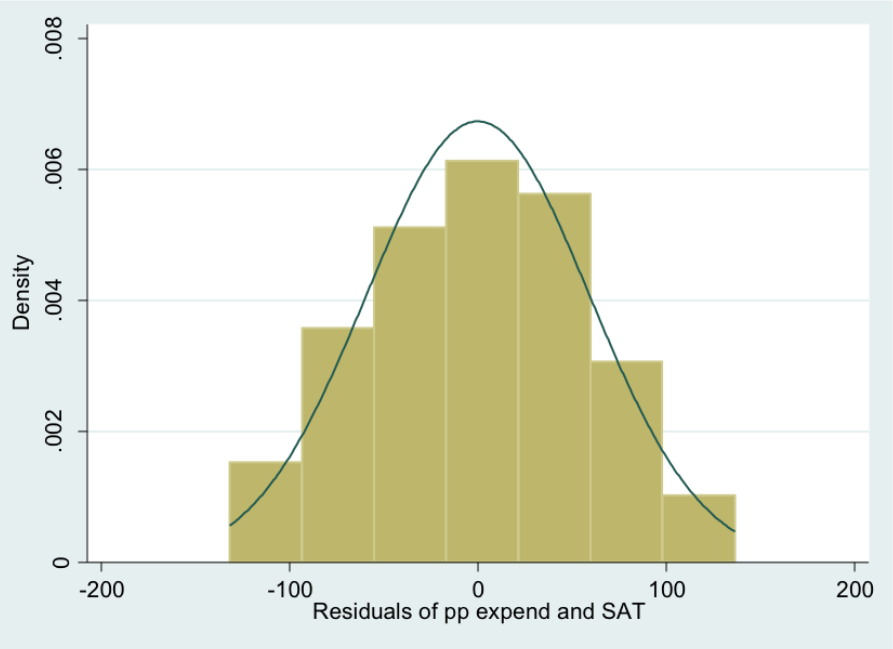
- Look at scatterplots, compute correlation matrix, and regress SAT scores on expenditures

```
// graph expense by csat
twoway scatter expense csat

// correlate csat and expense
pwcorr csat expense, star(.05)

// run the regression
regress csat expense
```

Postestimation Commands–Predicted and Residual Values

- Modeling functions in Stata usually save the results so you can do further computations with them–see `help regress` for the list of saved values
- We can use postestimation commands to do computations on the results
- For example, histogram of the residuals can be informative

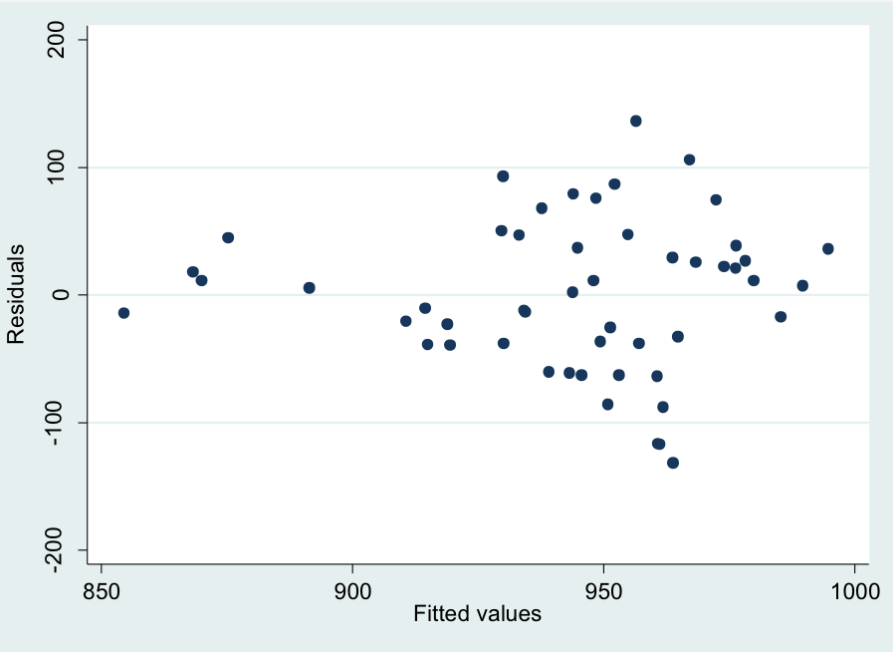
```
// graph the residual values of csat
predict resid, residual
histogram resid, normal
```



Postestimation Commands: rvfplot

- We could do this manually with the predicted and residual values we saved earlier, or we can have Stata do it for us with the `rvfplot` postestimation command:

`rvfplot`



Topic

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2 Univariate regression

3 Multiple regression

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6 Wrap-up

Multiple Regression

- Just keep adding predictors
- Let's try adding some predictors to the model of SAT scores

income % students taking SATs

percent % adults with HS diploma (high)

Multiple Regression Preliminaries

- As before, start with descriptive statistics and correlations

```
// descriptive statistics
sum income percent high

// generate correlation matrix
pwcorr csat expense income percent high

// regress csat on exense, income, percent, and high\
regress csat expense income percent high
```

Exercise 1: Multiple Regression

Open the datafile, states.dta.

1. Select a few variables to use in a multiple regression of your own. Before running the regression, examine descriptive of the variables and generate a few scatterplots.
2. Run your regression
3. Examine the plausibility of the assumptions of normality and homogeneity

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6 Wrap-up

Interactions

- What if we wanted to test an interaction between percent & high?
- Stata uses the # sign to represent interactions–see `help fvvarlist` for details

```
// use the # sign to represent interactions
regress csat percent high c.percent # c.high
// same as . regress csat c.percent##high
```

- Alternatively we can use the ## operator to automatically include the lower-order terms:

```
// use the # sign to represent interactions
regress csat percent high c.percent # c.high
// same as . regress csat c.percent##high
```

Categorical Predictors

- For categorical variables, we first need to dummy code
- Use region as example
  - Option 1: create dummy codes before fitting regression model

```
// create region dummy codes using tab
tab region, gen(region) // could also use gen / replace

//regress csat on region
regress csat region1 region2 region3
```

Categorical Predictors

- For categorical variables, we first need to dummy code using `i.` notation–see `help fvvarlist` for details
- Use region as example:

```
// regress csat on region using fvvarlist syntax
// see help fvvarlist for details
regress csat i.region
```

- You can change the reference level using `ib#` notation:

```
// regress csat on region using fvvarlist syntax
// see help fvvarlist for details
regress csat ib4.region
```

Exercise 2: Regression, Categorical Predictors, & Interactions

Open the datafile, states.dta.

1. Add on to the regression equation that you created in exercise 1 by generating an interaction term and testing the interaction.
2. Try adding a categorical variable to your regression. You could use region or high25, or generate a new categorical variable from one of the continuous variables in the data set.

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Saving and exporting regression tables

- Usually when we're running regression, we'll be testing multiple models at a time
- Can be difficult to compare results
- Stata offers several user-friendly options for storing and viewing regression output from multiple models
- First, download the necessary packages:

```
* install outreg2 package
findit outreg2
```

Saving and replaying

- You can store regression model results in Stata

```
// fit two regression models and store the results
regress csat expense income percent high
estimates store Model1
regress csat expense income percent high i.region
estimates store Model2
```

Saving and replaying

- Stored models can be recalled

```
// Display Model1
estimates replay Model1
```

Saving and replaying

- Stored models can be compared

```
// Compare Model1 and Model2 coefficients
estimates table Model1 Model2
```

Exporting into Excel

- Avoid human error when transferring coefficients into tables
- Excel can be used to format publication-ready tables

```
outreg2 [Model1 Model2] using csatprediction.xls, replace
```

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Help Us Make This Workshop Better

- Please take a moment to fill out a very short feedback form
- These workshops exist for you–tell us what you need!
- `ttp://tinyurl.com/StataRegressionFeedback`

Additional resources

- training and consulting
  - IQSS workshops:
    `http://projects.iq.harvard.edu/rtc/filter_by/workshops`
  - IQSS statistical consulting: `http://rtc.iq.harvard.edu`
- Stata resources
  - UCLA website: `http://www.ats.ucla.edu/stat/Stata/`
  - Great for self-study
  - Links to resources
- Stata website: `http://www.stata.com/help.cgi?contents`
- Email list: `http://www.stata.com/statalist/`