

## Econometrics II - Spring 2018

### The maximum likelihood estimation

#### Data

We use data on vintage 1978 automobiles sold in the United States. This is one of the example datasets, which is included in Stata. To open the dataset you can simply type `sysuse auto`.

The datasets includes the following variables:

make	Make and Model
price	Price
mpg	Mileage (in miles per gallon)
rep78	Repair Record 1978
headroom	Headroom (in inches)
trunk	Trunk space (in cubic feet)
weight	Weight (in pounds)
length	Length (in inches)
turn	Turn Circle (in feet)
displacement	Displacement (in cubic inches)
gear_ratio	Gear Ratio
foreign	Car type

#### Questions

We would like to fit a linear regression of `mpg` on `weight` and `displacement`.

1. What is the log likelihood for the linear regression model (using the normal distribution)?
2. Write a program to evaluate the log-likelihood function. Use the following syntax:

```
program program_name
    args lnf theta1 [theta2 ...]
    quietly replace 'lnf' = ...
end
```

where '**lnf**' is a variable to be filled in with the values of  $\ln l_j$ , and '**theta1**' is a variable containing the evaluation of the  $i$ -th equation  $\theta_{ij} = x_{ij}\beta_i$ . Note: name of  $i$ -th dependent variable is saved as a global macro `$ML_yi`.

3. Specify the particular model to be fit. Use the syntax below.  

```
ml model ([equation_name:][varlist_y = ][varlist_x = ][, noconstant]
```
4. Fit a linear regression of `mpg` on `weight` and `displacement`. Graph the log-likelihood iteration values.
5. We suspect that foreign made cars consume less energy per unit of distance traveled. Use likelihood ratio test to test if `foreign` should be included in the regression.