

Economics 217

Homework #2

Due Thursday, Jan 25th

Problem 1

Consider the following poisson model that uses a log link as follows:

$$\log(\mu_i) = \beta_0 + \beta_1 x_i$$

- a. Please derive the score functions for this Poisson model.

- b. Consider an alternate estimator based on non-linear least squares of an exponential function with linear parameters inside:

$$y_i = \exp(\beta_0 + \beta_1 x_i) + \epsilon_i$$

Minimizing $SSR = \sum_i \epsilon_i^2$, please derive the first order conditions for β_0 and β_1 and compare with the poisson model with log link.

Problem 2

Consider the following function

$$f = (\log(x) - 4)$$

Obviously we can find the zero of this function by hand, but your job is to find this using Newton-Raphson. For this question, you may find the following "snippet" of code helpful.

```
NR(x) <- function(x) {  
  counter <- 1  
  while(some condition is met) {  
    Do something with x  
    counter <- counter + 1  
  }  
}
```

Basically, you're writing a function to execute Newton-Raphson, which is an iterative procedure while some condition is met. For both questions, you may use 1×10^{-8} as "zero".

- a. Starting from an initial value of one, please find the zero of the function using Newton-Raphson.

b. Calculating the derivative of f is easy. In some cases this is not easy, and Broyden's method must be used, which approximates the derivative. Please augment your code in (a) to approximate the derivative of f numerically (please code this, do not use a function that automatically approximates a derivative). Please time the execution of your code and comment on any differences. You may use 1 as an initial estimate of the derivative to get the algorithm started.

Problem 3

In this question, we will study labor force participation, demographics and geography. To do so, we would like to estimate the impact of education, gender, ethnicity, and age on labor force participation. Please use an empirical model that (1) appropriately bounds the dependent variable, (2) restricts the ORG data to the year 2013, and (3) is derived from the log-odds ratio.

a. What is the relationship between gender and labor force participation? Please calculate a marginal effect of gender on labor force participation for a white individual who's maximum level of education is college.

b. Above, we have not included any controls for geography in the US, which may be important for understanding labor force participation. Assuming that geography is appropriately accounted for by the variable "state", please test this hypothesis at the 95% level.