Assignment #2 (Count Data – Poisson Regression)

CE 614 – Statistical and Econometric Methods I

Smart Student, September 29, 2009

Introduction

A survey of 204 Seattle-area commuters was conducted to examine the number of departure-time changes made from the work-to-home in the week before the survey was conducted. Although data were obtained from 204 commuters from the travel survey conducted in the Seattle metropolitan area, only 96 of these commuters indicated that they ever delayed their work-to-home trip departure time. For these 96 commuters, we wish to develop a model of the number of times they changed their departure time on their work-to-home trip to avoid traffic congestion in the last week. Please note that there will be zeros because, even though everyone in the 96-commuter sample indicated they sometimes delay, some of these may not have delayed in the last week. These data are non-negative integers and are thus well suited to the Poisson regression approach. However, because there are only 5 work days in the work week, the data are truncated.

Analysis

The variables available for model estimation are shown in Table 1. In terms of summary statistics for the dependent variable, the mean number of departure-time changes per week is 1.833 with a variance of 1.877 (standard deviation of 1.37). These numbers are extremely close and will most certainly satisfy the Poisson assumption that the mean and variance are equal (more on this in the next section).

Model estimation results (with corresponding average marginal effects) are given in Table 2. The results show that commuters whose work-to-home routes included State Route 520 and Interstate 5 were less likely to delay their departure times. The marginal effects show that State Route 520 users have an average mean departure-time changes per week that is 0.874 lower and Interstate 5 users are 0.582 lower. It was also found that the more cars in the household, the fewer the departure-time changes, with each additional car resulting in an average drop of a 0.191 in the mean departure-time changes per week. This result could reflect the possibility that households with a greater number of cars have less scheduling flexibility. Marginal effects show that commuters with flexible work hours had an average drop of a 0.613 in the mean departure-time changes per week. This is likely because commuters with flexible work hours adjust their arrival at work to avoid the afternoon traffic and thus are less likely to delay their work-to-home departure. It was also found that as the distance from work to home increased the mean departure-time changes per week decreased (by an average of 0.22 per kilometer). Finally, commuters that used car and commuters that were less than 31 year old were both found to have higher mean departure-time changes per week (by an average of 0.430 and 0.448 respectively as indicated by the marginal effects).

In terms of overall model fit, Table 2 shows the model has a ρ^2 of 0.204, which is a reasonable value given the amount of variance in the data. Finally, Limdep output for the final model is presented in the Appendix.

TABLE 1
Variables Available to Model the Number of Departure-Time Changes per Week.

Variable No.	Variable Description
1	Household number
2	Do you ever delay work-to-home departure to avoid traffic congestion? 1if yes, 0 if no
3	If sometimes delay, on average how many minutes do you delay?
4	If sometimes delay, do you 1if perform additional work, 2 if engage in non-work activities, or 3-do both?
5	If sometimes delay, how many times have you delayed in the past week?
6	Mode of transportation used work-to-home: 1 if car, 2 if carpool, 3 if vanpool, 4 if bus, 5 if other.
7	Primary route (work-to-home): 1 if I-90, 2 if I-5, 3 if SR-520, 4 if I-405, 5 if other
8	Do you generally encounter traffic congestion on you work-to-home trip? 1 if yes, 0 if no
9	Commuter age in years: 1 if less than 25, 2 if 26 to 30, 3 if 31 to 35, 4 if 26 to 40, 5 if 41 to 45, 6 if 46 to 50, 7 if greater than 50
10	Gender: 1if male, 0 if female
11	Number of cars in household
12	Number of children in household
13	Annual household income (U.S. dollars): 1 if less than 20,000, 2 if 20,000 to 29,999, 3 if 30,000 to 39,999, 4 if 40,000 to 49,999, 5 if 50,000 to 59,999, 6 if greater than 60000
14	Do you have flexible work hours? 1 if yes, 0 if no
15	Distance from work to home (in kilometers)
16	Commuter faces Level of Service D or worse? 1 if yes, 0 if no
17	Ratio of actual travel time to free-flow travel time
18	Population of work zone
19	Retail employment in work zone
20	Service employment in work zone
21	Size of work zone (in acres)

TABLE 2
Truncated Poisson Regression of the Number of Departure-Time Changes per Week

Variable Description	Estimated Parameter	*t* statistic	Marginal Effect
Constant	–0.931	–2.37	
State Route 520 indicator (1 if primary work-to-home route includes SR-520, 0 otherwise)	–0.567	–2.18	–0.874
Interstate 5 indicator (1 if primary work-to-home route includes I-5, 0 otherwise)	–0.377	–1.99	–0.582
Number of cars in household	–0.124	–1.47	–0.191
Flexible work hours indicator (1 if commuter has flexible work hours, 0 otherwise)	–0.397	–2.22	–0.613
Distance from work to home (in kilometers)	–0.0142	–1.20	–0.022
Car indicator (1 if commuter uses a car, 0 otherwise)	0.279	1.42	0.430
Young commuter indicator (1 if the commuter is less than 31 years old, 0 otherwise)	0.291	1.70	0.448
Number of observations		96	
Log likelihood at zero		–187.24	
Log likelihood at convergence		–149.02	
ρ^2		0.204	

APPENDIX

Cut and paste Limdep output here