Assignment 5

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Course Number: MKTG 584 B
Course Name: Dynamic Structural Models

1 Overview

In this Assignment, you will expand your estimation of the bus-engine problem to allow for persistent bus-specific unobservables. Here, you will implement the Arcidiacono & Jones algorithm, which involves an EM loop over the Rust nested fixed point.

2 Assumptions

- Assume the deterministic mileage transition process and utility specification given from Assignment 4.
- In your code, you don’t need to infer the state transition. Just assume it to be known.
- Assume there are two unobserved types of buses.

3 Inputs

Your code should take the following inputs:
- Data in following format (in columns) – BusNo., Timeperiod, DecisionNo. (0 if the line refers to continuation, 1 if it refers to replacement), Mileage, Chosen (0 if this line was chosen, 1 otherwise).
- Discount factor $\beta$

4 Outputs

For a given dataset and discount factor, the code should generate the following outputs:
- Parameters $\{\theta_1, \theta_2, \theta_3, \pi\}$ and the standard errors for each of them.
- Think about how you would get the standard errors $\pi$, and implement the algorithm so you can get these standard errors too.
5 Some suggestions

• Note that you cannot use Stata’s asclogit command to run the outer-loop of ML because your ML is specified at the bus-level, not at the bus-timeperiod level. So if you are using Stata for ML estimation, you will need to write an .ado code. At this stage, you don’t try to write the derivative/Hessian for the ML. Instead use numerical derivatives.

• Give the estimates from the last iteration of the EM as the starting values for the ML in the current iteration. That will speed up your algorithm significantly.

• EM algorithms tend to crawl towards the end. So be aware that it might take some time to converge. When you submit your code, specify the time it takes to run and the number of iterations to convergence, along with the convergence criterion.

• Run a simple Nested Fixed Point algorithm (as you did in Assignment 2) and report the bias in parameters from ignoring persistent unobservables.

6 Evaluation

I will evaluate the correctness of your code by giving you a .txt dataset in the format described above and a discount factor. Your code should produce the correct parameters for the data.