

Assignment 4

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Course Number: MKTG 584 A

Course Name: Dynamic Structural Models

1 Overview

The goal of this assignment is to generate data for a single agent dynamic model with persistent unobservables. This assignment is very similar to Assignment 1, except now there is a bus-specific brand that persists over time. As before, we have a simple specification of the Rust bus engine problem with Type 1 extreme value i.i.d errors.

2 Model specifications

- One time-varying observed state variable x_t , which denotes mileage
- One time-invariant state variable s , which can take two values $s = \{0, 1\}$. This is treated as an observable when generating the data.
- Assume a deterministic state transition for x_t such that:

$$\begin{aligned}x_t &= x_{t-1} + 1 \text{ if } x_{t-1} < M \\x_t &= x_{t-1} \text{ if } x_{t-1} = M\end{aligned}\tag{1}$$

The state transition is not a function of s .

- Assume the per period maintenance cost to be $\theta_1 \cdot x_t$
- Assume replacement cost to be $\theta_2 + \theta_3 s$

3 Inputs

Your code should take the following inputs:

- Number of buses N
- Number of periods per bus, T
- Maximum mileage M
- Population distribution of the unobserved type $s = 0$, which is defined as π

- Discount factor β
- Parameters $\{\theta_1, \theta_2, \theta_3\}$

4 Outputs

For a given set of input parameters (described above), the code should generate an output dataset that has the following fields: BusNo., Type ($s = 0$ or $s = 1$), Timeperiod, DecisionNo. (0 – continue, 1 – replace), Mileage, ExpChoiceSpecificValuefunction, Chosen (0 – this option was not chosen, 1 – this option was chosen).

As with Assignment 1, I will test the correctness of your code by asking you to generate data for a set of parameters and then importing the data into Stata and recovering the parameters. So you should make sure that your dataset does not have strings or other types of bugs, and is importing into Stata without any difficulty.

5 Submission materials

Please submit the following:

1. The code
2. A dataset generated for the following parameters – Number of buses = 100, Number of time periods = 100, Maximum mileage = 200, $\theta_1 = 1$, $\theta_2 = 9$, $\theta_3 = 4.5$, $\pi = 0.4$, and $\beta = 0.95$.
 - Data should be called data4.txt. Please do not use any other name.
 - Do not use a header line with variable titles