

Assignment 7

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Course Number: MKTG 584 B

Course Name: Dynamic Structural Models

1 Overview

In this Assignment, you will apply all your knowledge on dynamic discrete choice models to a behavioral economics setting, where users have *present bias*. The goal here is to encourage you to apply everything we have learnt in class to a new setting, in an end-to-end fashion, i.e., going from model specification, to coding and estimation, to identification.

2 Background Readings

Read the following three papers:

- O’Donoghue, Ted, and Matthew Rabin. “Doing it now or later.” *American Economic Review* (1999), 103-124.
- Harris, Christopher, and David Laibson. “Dynamic choices of hyperbolic consumers.” *Econometrica* 69.4 (2001), 935-957.
- Fang, Hanming, and Yang Wang. “Estimating dynamic discrete choice models with hyperbolic discounting, with an application to mammography decisions.” *International Economic Review* 56.2 (2015), 565-596.

You can also read more materials on hyperbolic discounting if you are interested.

3 Application

Apply the Fang and Wang (2015) model to our bus engine problem with infinite horizon. (Note that the paper used a finite horizon setting). Appendix H of their paper has the model details.

4 Assumptions

- Assume all three discount factors, β , δ , and $\tilde{\beta}$ (the level of sophistication) are known.
- As usual, assume we have one state variable mileage that transitions deterministically and a fixed cost of replacement.

5 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 β

6 Submission and Evaluation

1. Code 1 A data generation program that takes as input all three discount factors, maximum mileage, number of time periods, and generates choice data.
2. Code 2 A program that takes as input the three discount factors and generates parameter estimates and standard errors.
3. A PDF detailed report that gives:
 - A step-by-step estimator (like in our class lecture notes) for the general problem of a structural model with hyperbolic discounting and sophistication.
 - Generate data for a representative set of primitives using code 1, and estimate them using code 2, and discuss the estimates (the mean, standard error using boot strap etc., like you did in your previous assignment reports).
 - Discuss what happens if you ignore hyperbolic discounting and/or naivete in your estimation.
 - Provide a formal proof of identification for how to identify all three discount factors using exclusion restrictions. Discuss what kinds of variables and data (give examples) would help you identify the different discount factors.

If you need to make assumptions anywhere, explicitly state them and number.