Empirical Industrial Organization & Consumer Choice

2b Analysing Choice of Heating Systems with Individual Choice Data

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The problems correspond to a problem set of Kenneth Train.

1. Load the dataset Heating in the R package mlogit and estimate a logit model with installation cost and operating cost as the only explanatory variables. Evaluate the estimation results:

(a) Do the estimated coefficients have the expected signs?

(b) Are both coefficients significantly different from zero?

(c) How closely do the predicted shares match the actual shares of houses with each heating system?

(d) The ratio of coefficients usually provides economically meaningful information. The willingness to pay (wtp) through higher installation cost for a one-dollar reduction in operating costs is the ratio of the operating cost coefficient to the installation cost coefficient. What is the estimated wtp from this model? Is it reasonable in magnitude?

(e) We can use the estimated wtp to obtain an estimate of the discount rate that is implied by the model of choice of operating system. The present value of the future operating costs is the discounted sum of operating costs over the life of the system: $PV = \sum_{t=1}^{L}(1+r)^{-t}OC$ where r is the discount rate and L being the life time of the system. As L rises, the PV approaches $(1/r)\,OC$. Therefore, for a

system with a sufficiently long life (which we will assume these systems have), a one-dollar reduction in OC reduces the present value of future operating costs by $1/r$ Dollars. This means that if the person choosing the system were incurring the installation costs and the operating costs over the life of the system, and rationally traded-off the two at a discount rate of r, the decisionmaker's wtp for operating cost reductions would be $1/r$. Given this, what value of the discount rate r is implied by the estimated wtp that you calculated in part d)? Is this a reasonable discount rate?

2. Estimate a model that imposes the constraint that r=0.12 (such that wtp=8.33). Test the hypothesis that r=0.12. To do this, you will need to create a new variable, estimate a restricted model using this variable and then run a liklihood ratio test (package lmtest)

3. Estimate the model with alternative-specific constants.

(a) How well do the estimated probabilities match the shares of customers choosing each alternative? Note that they match exactly: alternative-specific constants in a logit model insure that the average probabilities equal the observed shares.

(b) Calculate the wtp and discount rate r that is implied by the estimates. Are these reasonable?

(c) Suppose you had included constants for alternatives 1,3,4, and 5, with the constant for alternative 2 normalized to zero. What would be the estimated coefficient of the constant for alternative 1? Figure this out logically rather than actually estimating the model.

4. Now try a model with sociodemographic variables entering. Add alternative-specific income effects. What do the estimates imply about the impact of income on the choice of central systems versus room system? Do these income terms enter significantly?

5. The California Energy Commission (CEC) is considering whether to offer rebates on heat pumps. The CEC wants to predict the effect of the rebates on the heating system choices of customers in California. The rebates will be set at 10% of the installation cost.

a) First estimate again a model with installation costs, operating costs, and alternative specific constants.

b) Using your estimated model, make a prediction by how many percent and by how many percentage points the 10% rebates on heat-pumps raise the share of houses with heat pumps.