You can work by group of 2 or alone. You must provide the code and a short report that explains the approach and presents the results in tables and/or figures. Please send those files by email to `isis.durrmeyer@tse-fr.eu` before November 30th.

Data

You have real data on the French automobile automobile market.[1] This dataset is in csv and contains string variables (car manufacturer, brand, and model names). Be careful, Matlab does not read string variables so you should drop these variables before loading the data in Matlab.

You observe the following variables:
year: between 2003 and 2008
manuf_name: provides the name of the manufacturer
num_manuf: provides a number for each manufacturer (1-21)
brand: the brand name (a manufacturer sells typically several brands)
num_brand: provides a number for each brand (1 - 40)
model_name: the model name, typically a brand sells different car models
price: in €10,000
cylinder: the cylinder capacity (in $1{,}000\text{cm}^3$)
weight: in 1,000 kg
horsepower: the fiscal horsepower
fuel_cost: in €/100 km
nb_households: total number of households (market potential)
sj: market share
i1b_poids_vide-i3b_euro_km: are the standard BLP instruments (sum of other product characteristics)

If working with a random coefficient model is too complicated, use a simple logit model without unobserved heterogeneity.

1 Estimation of the model

1) Estimate a random coefficient logit model with a random coefficient on the price. We assume the price coefficient is normally distributed. *(Note: to approximate the integral, use 100 normal draws and set the random number generator to "2020").* Specify the utility function as linear in all the car characteristics (intercept, price, cylinder, weight, horsepower and fuel cost). Use the standard BLP instruments that are already constructed. Interpret the coefficients. Do they have the expected signs?

2) Estimate the same random coefficient logit model with year fixed effects and brand fixed effects. Compare the estimated parameters. We will use these parameters for the counterfactual simulations.

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[1]This dataset is proprietary, you cannot use it for other purpose.

3) (*optional, bonus points*) Estimate the same random coefficient logit model (with year and brand fixed effects) with additional instruments, the differentiation IV's (the "local" ones) from Gandhi & Houde. Compare the parameter estimates.

2 Counterfactual simulation

For the counterfactual simulation part, you should use the year 2008 only and the parameters estimated in question 2). As a preliminary step, recover the vector of marginal costs for the year 2008 and compute the average mark up of the industry and the total industry profits.

Question 1: Merger and economies of scale

1) Simulate a merger between VOLKSWAGEN and BMW. What are the effects on the average price, mark up, profits of the merging parties, total profits of the industry and on the average consumer surplus?

2) Compute the minimum efficiency gain (cost reduction in %, applied to all the products of the merging parties) necessary for the merger to generate no decrease in the average consumer surplus. [*Hint: for a "brute force" approach, define a grid of possible cost efficiency values and solve for the market equilibrium and compute the corresponding consumer surplus for each value on the grid.*]

Question 2: Cross participation

Note: We start from the market equilibrium without the merger.

1) RENAULT decides to buy 30% shares of PSA. What are the effects on the average price and mark up, on the profits of RENAULT and PSA, on the total industry profits and on the average consumer surplus?

2) PSA hesitates to buy some shares of RENAULT in response. What is the maximal willingness to pay to buy 30% of RENAULT? Compute also the willingness to pay before RENAULT's acquisition of PSA's shares. Compare and explain the difference between the two willingness to pay.