

Weekly assignment 2

This week's assignment is about the expected impact of flight taxes on travel choice behavior and the willingness to voluntarily compensate CO₂ emissions. Specifically, the topic is about people's willingness to accept a particular city trip offer given information about travel conditions and flight taxation. The data is available in the file *FlightTaxation.csv* on Canvas. Following is some background and a specification of the task.¹ Always motivate your answers. The solution to this exercise needs to be submitted as pdf (!) via Canvas. [Expected length is about four pages.]

Flight taxation and choice behavior

Many governments have implemented, or are considering to implement, a national flight tax or similar measures. In the Netherlands, the main motivation for this measure was the need to stimulate sustainable mode choice behavior by travellers. Currently, traveling by car, train or bus is taxed, while international flights are not taxed.

Experiment

Early 2020, an online quasi-experiment was held among students of the Rotterdam School of Management, exploring individual preferences for the use of traveling by airplane or by train to a European city and the willingness to voluntarily compensate CO₂ emissions. Additionally, questions were asked about personality traits and individual characteristics. A description of the available data is in table 1.

The online experiment had a so-called $3 \times 2 \times 3$ *between subjects* design, in which respondents were asked to indicate their likelihood to travel by airplane and to travel by train to a particular destination. The precise offer varied with respect to: (i) destination (London, Berlin and Marseille); (ii) presence of travel information (about tariffs and trip duration); and (iii) flight tariffs (regular flight tariff, regular tariff plus low tax, regular tariff plus high tax). The combination of these $3 \times 2 \times 3$ conditions led to eighteen different travel options. An example of a particular travel offer is in box 1. Participants were randomly assigned to one of these travel offers.

¹Basically, this assignment serves two purposes: (i) to practice the material of the corresponding session, and (ii) to provide an example of an online experiment to collect data. The latter explains why the assignment contains an extensive explanation of the experimental setup before presenting detailed questions.

A holiday destination will be shown with different travel modes. You will be asked to indicate the likelihood to use a particular travel mode on a scale of 0 (= no chance, practically no chance) to 100 (= certain, practically certain). Please note that the likelihoods of these travel options should be indicated independently; scores need not add to 100. Also, there are no 'right' or 'wrong' answers; it is highly desirable to answer truthfully.

Imagine you would like to book a holiday/city trip to London. For this trip, you can either choose to travel by train or by airplane. Ticket prices for this trip are shown in the table below; prices are representative for a trip to London.

Travel mode	Price	Travel time [‡]
Train	€99	4h 45min
Airplane	€48	2h 10min

[‡] The travel time is from Amsterdam central station or Schiphol Airport to London Victoria station – train station in the city centre.

> Indicate the likelihood that you would choose to travel by train to London

> Indicate the likelihood that you would choose to travel by airplane to London

> Please give an indication of the attractiveness of your destination London

Box 1: Example of a travel scenario with destination London, for a regular flight tariff, and with travel information provided

Interest of the study

Apart from the precise definition and relevant indicators of the likelihood to travel by airplane or by train, interest is in the causes of variation in these likelihoods. Some may attribute this variation to different personality traits or individual characteristics. Research-wise, however, the main interest is in the influence of the experimental controls, i.e., the distinct features of the travel offer. Note that the likelihood to travel by airplane and the likelihood to travel by train have been measured separately (and do not need to add up to 100).

Before continuing with the questions of this assignment, set up a suitable environment on your computer (if not already done so before), download datafile *FlightTaxation.csv* from Canvas and store it in subfolder *Data* (without opening it in Excel or Numbers!). In R, import the data into dataframe *dsFlightTax* with the following instruction:²

```
dsFlightTax <-  
  read.csv2(file=paste0(dirData, "FlightTaxation.csv"),  
            stringsAsFactors=FALSE)  
  
head(dsFlightTax)
```

Function `head` has been added to have a first check of the imported data.

Question 1: Assumed causal model

Set up a causal relationships scheme that summarizes your explanations of the likelihood to travel by airplane for the offered travel scenario. Make use of the background information, your own creativity and the variable descriptions in table 1. **Apart from the dependent variable, the scheme should contain two Likert-type quantities, three experimental manipulations, *ManipTax*, *ManipInfo* and *ManipDest*, and at least one qualitative variable with three or more outcomes.** So, seven ($= 1 + 2 + 3 + 1$) quantities in total. [0.5 - 1 page]

Question 2: Scale analysis of multi-item indicators

Determine the scale reliability and perform a scale analysis of the two Likert quantities in the model. Add the constructed Likert-indicators to the dataframe. Discuss relevant results. [0.5 - 1 page]

Question 3: Descriptive analysis based on graphics

Use function `ggplot` to visualize the distributions of the variables included in your causal scheme. All, except the three graphics for the experimental manipulations should be included in the paper. Discuss the main takeaways from these

²This has been practiced in this week's tutorial. Character variable *dirData* contains the name of the path of subfolder *Data*, which contains datafile *FlightTaxation.csv*.

graphics. Explain in one sentence why it does make sense to examine the distributions of the experimental manipulations, but it does not really make sense to include them in a paper (or your solution to this assignment in particular). [1 - 1.5 page]

Question 4: Descriptive analysis based on summary statistics

Univariate descriptive analysis of the variables in your model is continued based on summary statistics. Use function `stargazer` to make a table with descriptive statistics of the quantitative variables in your model. The table must be appropriately formatted and meet academic layout requirements.³ Discuss the main takeaways from the table. [about 1 page]

Make frequency tables for the qualitative variables in your causal relationships scheme. Discuss relevant insights from this table in text; the tables themselves need not be included. [0.5 page]

Question 5: Univariate inference

Statistical inference is about the use of sample information to infer, i.e., make probability statements, about population parameters. It comes in the form of estimation and hypothesis testing. (i) Use function `t.test` to determine a 98% confidence interval estimate for the mean likelihood that people travel by airplane *rateAirplane*. Present outcomes, but also the intermediate steps of calculating the interval estimate. (ii) Test the assumption that the proportion of students living with parents is equal to at least 0.45 against the alternative that this proportion is lower than 0.45, at a significance level of 6%. Present a 7-steps scheme as well as the significance value (*p*-value) to motivate your answer. [0.5 - 1 page]

³An explanation of APA style tables can be found, for instance, at <https://apastyle.apa.org/style-grammar-guidelines/tables-figures/tables>. Generally, academic layout means that tables have limited horizontal lines (at the top and the bottom, and a separator line between header and table body), and no vertical lines; text is left aligned, integer numbers are right aligned, real numbers are dot aligned. Tables have a title (at the top), which should be informative about the table content. Additional explanations can be given in table notes. Tables made with function `stargazer` are close to meeting this requirement, but may require limited adjustments.

Table 1: Description of information about flight tax and voluntary CO₂ compensation

<i>Variable</i>	<i>Description</i>
<i>Travel options</i>	
<i>rateTrain</i>	Likelihood that respondent will travel by train (from 0 = ‘not attractive at all’ to 100 = ‘absolutely attractive’);
<i>rateAirplane</i>	Likelihood that respondent will travel by airplane (from 0 = ‘not attractive at all’ to 100 = ‘absolutely attractive’);
<i>Experimental manipulations</i>	
<i>ManipTax</i>	Extra tax on flight ticket (1 = ‘only price flight ticket’, 2 = ‘price flight ticket including low tax’, 3 = ‘price including high tax’);
<i>ManipInfo</i>	Information on travel time of train and airplane (1 = ‘no information on travel time’, 2 = ‘information on travel time’);
<i>ManipDest</i>	Holiday destination in Europe (1 = ‘London’, 2 = ‘Berlin’, 3 = ‘Marseille’);
<i>Experimental manipulation checks</i>	
<i>CheckDest</i>	What was the destination of your holiday? (1 = ‘London’, 2 = ‘Berlin’, 3 = ‘Marseille’);
<i>CheckInfo</i>	Was there any information about the travel time of the train or airplane? (1 = ‘Yes’, 2 = ‘No’);
<i>CheckTax</i>	Was there any information about a tax on flight tickets? (1 = ‘No’, 2 = ‘Yes, a tax of €7.50’, 3 = ‘Yes, a tax of €15’);
<i>Attractiveness of the destination</i>	
<i>Attractiveness</i>	Attractiveness of city (London, Berlin or Marseille) for a holiday (from 0 = ‘not attractive at all’ to 100 = ‘absolutely attractive’);
<i>Personal traveling</i>	
<i>PreferTrain</i>	I would rather travel by train than airplane (scale from 0 = ‘strongly disagree’ to 100 = ‘strongly agree’);
<i>PreferAirplane</i>	I would rather travel by airplane than train (scale from 0 = ‘strongly disagree’ to 100 = ‘strongly agree’);
<i>ImportPrice</i>	Price is the most important element for deciding which form of transport to use for my holiday (scale from 0 = ‘strongly disagree’ to 100 = ‘strongly agree’);
<i>ImportTime</i>	Time is the most important element for deciding which form of transport to use for my holiday (scale from 0 = ‘strongly disagree’ to 100 = ‘strongly agree’);
<i>ImportComfort</i>	Comfort is the most important element (scale from 0 = ‘strongly disagree’ to 100 = ‘strongly agree’);
<i>SchipholTrain</i>	Traveling time to Schiphol by train (1 = ‘< 30min’, 2 = ‘30–45min’, 3 = ‘45–60min’, 4 = ‘> 60min’);
<i>SchipholCar</i>	Traveling time to Schiphol by car (1 = ‘< 30min’, 2 = ‘30–45min’, 3 = ‘45–60min’, 4 = ‘> 60min’, 5 = ‘I do not have the option to go by car’);

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table 1 continued

Variable	Description
<i>Willingness to pay for CO₂ compensation</i>	
CO2Comp	Willing to pay a voluntary CO ₂ compensation? ^c ;
CO2Comp5E	Willing to pay a voluntary CO ₂ compensation of €5, knowing that return flight emits 0.20 tonnes of CO ₂ ? ^c ;
CO2Comp7E	Willing to pay a voluntary CO ₂ compensation of €7, knowing that return flight emits 0.20 tonnes of CO ₂ ? ^c ;
CO2CompMax	Maximum amount to voluntarily pay for CO ₂ compensation (in €);
<i>New Environmental Paradigm/Environmental beliefs^a</i>	
Nep01	The earth is like a spaceship with very limited room and resources;
Nep02	Humans were meant to rule over the rest of nature ;
Nep03	The balance of nature is strong enough to cope with the impacts of modern industrial nations;
Nep04	Humans will eventually learn enough about how nature works to be able to control it;
Nep05	If things continue on their present course, we will soon experience a major ecological catastrophe;
<i>Behavioral identification form</i>	
Bif01	Painting a room (1='Applying brush strokes', 2='Making the room look fresh' ^d);
Bif02	Paying the rent (1='Maintaining a place to live' ^d , 2='Writing a check');
Bif03	Tooth brushing (1='Preventing tooth decay' ^d , 2='Moving a brush around in one's mouth');
Bif04	Eating (1='Getting nutrition' ^d , 2='Chewing and swallowing');
Bif05	Having a cavity filled (1='Protecting your teeth' ^d , 2='Going to the dentist');
Bif06	Measuring a room for carpeting (1='Getting ready to remodel' ^d , 2='Using a yard stick');
Bif07	Climbing a tree (1='Getting a good view' ^d , 2='Holding on to branches');
<i>Guilt feelings^b</i>	
Guilt01	I feel ashamed of driving an automobile;
Guilt02	People whose health is affected by air pollution make me feel guilty;
Guilt03	Even though I contribute to air pollution by driving an automobile, I do not experience any feelings of guilt;
Guilt04	News about air pollution does not make me feel guilty;
Guilt05	I certainly do not feel ashamed driving a car;

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table 1 continued

Variable	Description
<i>Personality^b</i>	
Big01	I see myself as someone who is reserved;
Big02	I see myself as someone who is generally trusting;
Big03	I see myself as someone who tends to be lazy;
Big04	I see myself as someone who is relaxed, handles stress well;
Big05	I see myself as someone who has few artistic interests;
Big06	I see myself as someone who is outgoing, sociable;
Big07	I see myself as someone who tends to find fault with others;
Big08	I see myself as someone who does a thorough job;
Big09	I see myself as someone who gets nervous easily;
Big10	I see myself as someone who has an active imagination;
<i>Demographic characteristics</i>	
dGender	Gender (1 = 'Male', 2 = 'Female', 3 = 'Prefer not to disclose');
YrBirth	Year of birth;
dIBA	Participation in the BA or IBA program? (1 = 'BA', 2 = 'IBA');
SatFac	Satisfaction with the study (score from 0 to 100);
HrPWork	Hours per week performing paid work (hours per week);
HrVWork	Hours per week performing voluntary work (hours per week);
HrClass	Hours per week normally spent on attending classes (hours per week);
HrStud	Hours per week normally spent on studying (other than attending classes) (hours per week);
cLiving	Living condition that best conforms with respondent's situation (1 = 'Rented room from student housing', 2 = 'Privately rented room', 3 = 'Living with parents', 4 = 'House of one's own', 5 = 'Other');
cLocate	Description that best fits home town (1 = 'City area', 2 = 'Suburban area of a city', 3 = 'Larger town', 4 = 'Smaller village', 5 = 'Rural area');
dPreMas	Participation in the pre-master or in the regular program (1 = 'Pre-master', 2 = 'Regular');
dSports	Member of a sports club ^c ;
dFraternity	Member of a student fraternity, such as RSC, Laurentius, SSR, et cetera ^c ;
dAssoc	Active member of a study association, such as STAR, EFR, et cetera ^c ;
dAbroad	Studied or worked abroad ^c .

^a Likert-scale with seven answer categories: 1 = 'Strongly disagree', ..., 7 = 'Strongly agree'.

^b Likert-scale with five answer categories: 1 = 'Disagree strongly', ..., 5 = 'Agree strongly'.

^c Answer scale with two options: 1 = 'Yes', 2 = 'No'.

^d 'Abstract' answer of the *behavioral identification form* (Bif).