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A survey on factors influencing people in the Netherlands in the decision to travel by train for leisure

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Abstract

The transport sector is a big contributor to climate change, especially air travel generates a big share of the greenhouse gas emissions. A sustainable substitute for travelling by plane is travelling by train. However, still the largest group of people that travel for leisure in the Netherlands, travel by plane. The aim of this paper is to investigate factors that influence the decision of people in the Netherlands to choose the plane or train as a transport mode for travelling for leisure in Europe. A survey was set up with multiple scenarios, where people had to choose their preferred transport mode, the plane or the train. Besides, 50 percent of all respondents received extra information about the influence of travelling on climate change. For the analyses, logistic models were used. The results indicate that giving respondents extra information, results in respondents choosing the train more often as the preferred transport mode. Besides, education and occupation had a significant impact on the choice of rail travel.

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1. Introduction

The plane has become a popular transport mode. In 2019 the average Dutch person travelled 1.3 times a year by plane. Despite the decrease in flights by plane during the Covid-19 pandemic, the number of travellers by plane increased again in 2021 compared to 2020 (CBS, 2022c). However, the transport sector is an increasing source of air pollution. This also includes air travel, as it contributes to the increase of greenhouse gas emissions, which is the driving force of climate change. Climate change has been a problem for many years, and a decrease in travel by plane could help in the battle with climate change. A substitute for travelling by plane could be travelling by train. When looking at travelling within Europe, many places have become more accessible by train. Travelling by train is more environmentally friendly than travelling by plane (Böhler, 2006). However, travelling by train is often more expensive and time-intensive (Álvarez, 2010).

In 2019 almost fifteen percent of all passenger kilometers, within the Netherlands, were by public transport. The train was a more popular transport mode than the bus, metro, and tram, and accounted for 11.3 percent of all passenger kilometers in the Netherlands (CBS, 2021a). For travelling by train within the Netherlands, work and education were the most important travel goals. Among students, the amount of public transport users is relatively high. Besides, on average men travel as much as women by train (CBS, 2021b). Also, international travelling by train has become more popular. This year (2022) 17 percent of all Dutch vacationers are planning on going on a holiday by train. A couple of years ago this was only 2.5 percent of Dutch vacationers (Parool, 2022).

In a study by Zijlstra & Olga (2018), it was shown that there is also a large group of Dutch people that didn't travel by plane for more than a year. The reasons they gave for not travelling by plane were mostly the costs, health, and fear of flying. Environmental considerations seemed to be less important when deciding to not use a plane as a transport mode.

This raises the question, of how to make people choose to travel by train more. Mainly, as research shows that many travellers choose their transport mode based on financial reasons or based on minimizing travel time. However, we saw before that travelling by train is often more expensive and time-consuming. Besides, other aspects of flexibility, convenience, and comfort were found as important factors when choosing a transport mode (Hares et al., 2010).

Public information campaigns can, when used appropriately, be an effective way for the government to communicate to a larger number of citizens (Weiss & Tschirhart, 1994). These campaigns are also used to encourage citizens to live more sustainably. (Wheeler, 2008) (Owens & Drifill, 2008) Also, in the Netherlands multiple campaigns are active or have been active this year, regarding sustainability, to encourage citizens to live in a more sustainable way. One of these campaigns is called ‘Iedereen doet wat’¹. The government started the campaign in cooperation with businesses and organizations to encourage people to make more sustainable choices (Rijksoverheid, 2019). Another campaign that started this year is the campaign ‘Zet ook de knop om’². The campaign encourages citizens to save energy to, among others, fight climate change (Rijksoverheid, 2022).

The government could also make use of campaigns to encourage citizens to travel in a more sustainable way. It is crucial that policies target the right individuals (Van Acker et al., 2019). Besides, it is relevant for the government to look at possible groups of people in the Netherlands that already favour travelling by train. Moreover, it is important for the government to understand if educating people about the impact of travel on climate change, would make a significant positive change on people’s transport mode choices.

The aim of this paper is to investigate whether informing people about the impact of travelling on climate change, will make them choose a more sustainable transport mode when travelling for leisure in Europe. This paper examines whether there is a correlation between informing people about climate changes and transport mode preferences while controlling for other factors such as gender, age, education, occupation, and household yearly gross income. To gather data, a survey was set up. The method implicated in this research helps answer the main research question and the sub-questions. First, the influence of educating people about sustainable transport on transport mode preferences is researched. Secondly, the influence of factors like age, gender, education, occupation and household yearly gross income on transport mode choices are examined. Lastly, the correlation between transport mode choices and the price and distance of travelling is researched. At the end, all results of the sub-questions are combined to be able to answer the main research question:

1. The translation of ‘Iedereen doet wat’ is ‘Everyone does something’
2. The translation of ‘Zet ook de knop om’ is ‘Turn de switch’.

What influences the decision of people in the Netherlands to choose the plane or train as a transport mode for travelling for leisure in Europe?

The remaining sections of this paper are organized as follows. The second section describes the relevant literature. A detailed description of the applied methodology and the models used is then provided in section 3. Section 4 presents the data and used sample and elaborates the different variables used in the model. Moreover, section 5 discusses the results and section 6 shows the conclusion and discussion.

2. Literature review

The following chapter gives an overview of the literature on the 7th of August 2022. This paper examines the factors influencing people in the Netherlands to travel by train and plane for leisure in Europe. Therefore, an overview of the literature on air travel and rail travel is presented below. Besides, the concept of nudging is elaborated and literature on nudging in the transport sector is discussed. Lastly, existing literature on the influence of social-economic factors on transport mode choices is reviewed.

Recently published research shows that the tourism sector accounts for approximately 8-11 percent of all greenhouse gas emissions. The aviation sector accounts for around 17 percent of travel carbon emissions and an increase in pollution from the tourism transport sector is expected in the coming years. By 2030 emissions related to transport from tourism are expected to account for 5.3 percent of all carbon emissions worldwide. Many tourism-related companies signed the Glasgow Declaration on Climate Action in Tourism during the last Conference of the Parties (COP) in Glasgow (National Geographic, 2022). The goal of the declaration is to reduce pollution from the tourism sector. To battle climate change, a reduction in carbon emissions from the tourism sector is needed (Simpson et al., 2008). Moreover, the concept of 'green growth' seems to be a goal in the tourist sector. Green growth is the situation wherein economic growth is reached and at the same time a more sustainable environment is created. However, at this moment green growth seems to be more of a fantasy than reality as the tourist sector is still a big contributor to climate change. Many changes are needed in the sector to achieve this concept (Hall, 2014).

Also, other literature shows the influence of air travel on climate change. An example is an article by Gühnemann, Kurzweil & Mailer (2021), where the relationship between tourism travel and climate change was researched. The study focussed on the situation in Austria, where the number of tourists arriving by plane is expected to increase in the coming years. The paper showed that faster modes of transport, such as air travel, encourage people to travel long distances. The transport sector is one of the biggest contributors to the greenhouse gas emission balance in Austria. There are strong incentives needed to reduce the impact of tourism-related transport on climate change and greenhouse gas emissions. The paper claims that, among others, a shift from road and air transport to rail and public transport is needed to reduce travel-related greenhouse gas emissions significantly.

Also, according to Dällenbach (2020) the majority of travellers consider rail travel as an alternative to air travel. The paper uses two samples to examine factors influencing the choice of travelling by train and travelling by plane. The results from both samples illustrate differences between the perception of travel time for travellers by train and travellers by plane. Travellers who travel by plane value minimizing their travel time more than travellers who by train. However, rail travellers find it more important to spend their travel time productively, whereas this was not the case for travellers by plane. The travel time is thus a crucial factor for travellers when making their transport mode choice. Travellers who find travel time less important are more likely to travel by train instead of the plane.

However, the costs of travelling are seen as the most important factor when choosing a transport mode. In a study by Hergesell & Dickinger (2012) the plane was selected as the number one option among students when travelling in Europe. Besides, the train and the car were popular transport modes when travelling in Europe. Nonetheless, the paper shows that an increase in the price of air travel only results in a shift from air travel to rail travel when air travel is significantly more expensive than traveling by train. The paper illustrates that travellers are prepared to switch from air travel to rail travel, however the willingness to make this shift decreases for longer trips. Besides, travellers that are familiar with train travel, also choose the train more often as the transport mode for international trips. Moreover, the paper concludes that travellers' view of the environment has an influence on their holiday transport mode choice. This would suggest that campaigns explaining the environmental friendliness of rail travel could result in more travellers choosing a more sustainable transport mode.

As Hegeseel & Dickinger (2012) conclude that campaigns could result in people choosing a more sustainable transport mode. Research also indicates that many travellers do not consider the environment when choosing their holiday transport mode. For instance, in a paper by Hares et al. (2010) the awareness among citizens of the impact of travelling on climate change is examined. The paper looked into the role of climate change in holiday travel decisions. The paper shows that many people do not consider climate change when choosing their holiday destination. In combination with a barrier to changing behaviour, changing people's holiday into more sustainable holidays is a big challenge.

However, this could also be the result of consumers not being able to identify possible behaviour changes that are worth doing. Thogersen (2021) indicates that climate change is a complex matter and the relationship between climate change and consumer behaviour is

difficult. The paper illustrates that environmentally friendly behaviour should be made the easy behaviour. Possible implications are carbon labelling, reflecting the carbon footprint in prices, and introducing climate-friendly products that are able to compete with unfriendly climate products.

Besides, other studies examine the result of encouraging people to travel more sustainably. The literature recognizes that current attempts to encourage people to travel more sustainably have been insufficient (Higham et al, 2016) (Morten, Gartersleben & Jessop; 2018). A paper by Higham et al. (2016) reviews different types of approaches when trying to influence people. Besides, the paper examines how citizens from four western countries, the United Kingdom, Australia, Germany, and Norway, react to different approaches. The paper looks at soft approaches such as social marketing and nudging, but also looks at harder approaches such as government regulations. The paper concludes that among the four western nations, the willingness to accept certain approaches varied. Besides, the paper states that voluntarily approaches to encourage people to travel more sustainably are not enough to make a sufficient change. Therefore, also policy measures are needed, and only then it will result in an acceptable change. However, the best interventions differ per country.

Behaviour change interventions are used to change individuals' behaviour in a certain direction. However, often the maintenance of behaviour change is complex. Still, also changing people's behaviour in the short term can be a challenge. There are many different ways individuals' behaviour can be influenced. An example of a way of changing people's behaviour is nudging.

In this paper, the influence of nudging on holiday transport mode choices is researched. Nudges are interventions that point people in a certain direction, but also allow them to choose their own path. Nudges are used to change people's behaviour and can be used in a lot of contexts. A requirement of a nudge is that it doesn't result in significant incentives. Some nudges include informing people, while other nudges make choices less difficult. Reminders and warnings are examples of nudges (Sunstein, 2015).

However, nudging has proponents and opponents. In an overview of the ethics of nudging, the advantages and disadvantages of nudging are discussed (Schmidt & Engelen, 2020). An argument in favour of nudging is that is a cost-effective way for policymakers to promote certain outcomes. Besides, nudging is relatively easy and cheap to implement. Furthermore, nudging respect peoples' choice as they allow people to choose their own way. However,

proponents of nudging question if nudging really respects freedom of choice. Besides, they argue that nudges are manipulative.

A study that illustrates the impact of nudging on sustainable behaviour, is a paper by Lehner, Mont, and Heiskanen (2016). The paper recognises nudging to be a useful tool for policymakers to encourage people to live in a more sustainable way. However, the paper also states that nudging should be an addition to laws and regulations and that nudging alone is not a sufficient tool for making people behave more sustainably. Other implications are needed to make people travel more sustainably.

Furthermore, most attempts on encouraging people to travel more sustainably included educating people on the influence of air travel on climate change. However, Cohan, and Kantanbacher (2018) state that also the influence of travelling by plane on personal health should be emphasized. The paper illustrates that highlighting the impact of travelling by train on health would help in the reduction of unsustainable aero mobility.

In this paper not only the influence of nudging on holiday transport mode choices is researched, but also the influence of socio-economic factors on holiday transport mode choices are researched. The sections below show the existing literature of socio-economic factors on holiday transport mode choices.

In the literature factors influencing transport mode choices are researched. For example, in a study by Van Acker, Mully & Ho (2019), the impact of travel attitudes and neighbourhoods' perceptions on travel behaviour are researched. The study also looks at the influence of someone's background on travel behaviour, where it looks at travel experience and childhood residential. The study used a survey to obtain information on the respondents' childhood, travel experiences, and current residence. The results show the largest significant positive impact of current travel attitudes on current travel behaviour. Besides, the study shows a positive effect between travel experience and childhood residential on travel behaviour. Besides, the study also looked at social-economic and geographic factors and their influence on travel behaviour. It shows that younger generations have a stronger anti-travel attitude compared to the older generation. Besides, younger generations have a more negative view of cars.

Also, in other studies age was found as a determinant of modal choice. (De Witte et al., 2013). Besides, gender was in some studies found as a determinant of modal choice. (Brown et al., 2003). While in other studies the interdependency between gender and factors, like employment

status and household consumption, appeared to be more of a determinant for modal choice than gender itself. The same accounts for education, where the interdependency between education and other factors, like household size and occupation, was classified as a determinant of modal choice, rather than education itself (De Witte et al., 2013). However, in a study by Pickery (2005) results showed that higher educated people have a preference for travelling by car. This is in contrast to what was found by Limtanakool et al. (2006), as they stated that higher educated people prefer travelling by public transport over travelling by car.

Also, according to De Witte et al. (2013) income is one of the most important determinants of modal choice. They state that income has a positive relationship with car ownership. Besides, the study shows that household consumption also has an impact on modal choice.

3. Methodology

In the following section, the models used in this study are elaborated. The models are used to answer the main research question and the sub-questions.

A logit model, also known as a logistic regression model, will be used to examine the research question, with the choice of train travel as the dependent variable. The formula for the logit model is expressed as the probability of the dependent variable being equal to 1. The equation is shown below:

$$P(Y = 1) = \frac{1}{1 + e^{-\text{logit}(p)}} = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n)}}$$

The logit model can be defined in a linear shape. The logit model is then written as the natural log of the odds. That is shown in the equation below:

$$\ln(\text{odds}) = \text{logit}(p) = \ln\left[\frac{p}{(1-p)}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

A logit model will be used because it is most appropriate for a binary dependent variable with categorical or numeric predictor variables. With this model, an estimation can be made of the probability of someone travelling by train. The logit model is used to overcome the problem of violating the assumption of linearity.

However, the coefficients in a logit model are more difficult to interpret, therefore the odds ratios are used for the interpretation of the model. The odds ratio can be interpreted as follows; the odds of an occasion, in this model whether a person chooses the train as a transport mode, is the probability that a person chooses the train divided by the probability that a person doesn't choose the train as the preferred transport mode.

The coefficients and the odds ratio have a direct relationship. Therefore, the odds ratios can be derived after estimating the β coefficients of the logit model. The exponentiation of the β is equal to the odds ratio.

First the influence of informing people about the impact of travelling on climate change on transport mode choices is researched. A model is set up to calculate the probability of someone travelling by train.

To address the first sub-question, an equation is set up. The expression of the first model is:

$$\ln\left[\frac{p(\text{train}=1)}{(1-p)(\text{train}=1)}\right] = \beta_0 + \beta_1\text{Info} + \beta_2\text{Gender} + \beta_3\text{Age} + \beta_4\text{Education} + \beta_5\text{Occupation} + \beta_6\text{Housholdincome} + \beta_7\text{Distance} + \beta_8\text{Price}$$

The equation can be estimated and the values of the predictor variables can be filled in. The value of the coefficients is between 0 and 1, demonstrating the probability that a person travels by train. The nearer the value comes to 1, the higher the probability that a person travels by train. The model can be used to estimate whether informing people about climate change has a significant effect on their transport mode choices.

Besides, calculating the socio-economics characteristics of people is an important part of this paper. Besides, the influence of distance and price are researched. Therefore, to address the second sub-question an equation is set up to calculate the correlation between the socio-economic factors (age, education, occupation, household income), costs and distance and travelling by train.

The second model can be expressed as:

$$\ln\left[\frac{p(\text{train}=1)}{(1-p)(\text{train}=1)}\right] = \beta_0 + \beta_1\text{Gender} + \beta_2\text{Age} + \beta_3\text{Education} + \beta_4\text{Occupation} + \beta_5\text{Housholdincome} + \beta_6\text{Distance} + \beta_7\text{Price}$$

Also for this equation, it can be estimated and the values of the predictor variables can be filled in. This will show the results for the effect of gender, age, education, occupation, household income on transport mode choice. Moreover, the models will be estimated by using the statistical program StataMP17.

4. Data

The following section discusses the data used in this study.

The data used in this study were collected through a survey on sustainable behaviour and transport mode choices, build on Qualtrics. The survey consisted of two parts: one about personal socio-economic characteristics such as gender, age, education, household yearly gross income, and occupation. The second part of the survey consists of questions about travel behaviour. Respondents were presented scenarios to different destinations in Europe. For each of these scenarios, respondents had to choose whether they would prefer to travel by plane or by train. The destinations in Europe were Paris, London, Hamburg, Prague, Berlin, Vienna and Milan. Besides, half of the respondents got extra information regarding the influence of travelling by plane on climate change. A graph was shown to the respondents that showed that travelling by plane is 20 times more polluting than travelling by train. Besides, the respondents got some extra information about the consequences of climate change. Qualtrics randomly assigned 50 percent of the respondents to the extra information (see Appendix B for the extra information). The target group for the survey is adults (18+) from the Netherlands.

The survey was shared on multiple social media. Platforms used to gather enough respondents were Facebook, LinkedIn, and WhatsApp. Websites like Survey Swap and Survey Circle were used to reach respondents outside of the social circle of the writer of the paper.

The survey could be filled in by respondents from the 10th of June 2022 to the 28th of June 2022. In total 221 respondents filled in the survey. Some respondents didn't fill in the whole survey or filled in unrealistic responses and thus these respondents were deleted from the sample. Therefore, in total 198 respondents were taken into account in the sample. The respondents were asked about seven scenarios in the survey. To increase the variation of the data, every response to the survey was split up in seven parts. This way seven times more, 1386, observations were taken into account in the analyses. The survey was used to research the main question and the sub-questions.

4.1 Survey Design

In the next part, the survey design will be discussed. As said before, the survey consists of two parts. The survey was in Dutch, as the target audience was adults from the Netherlands.

First respondents got an introduction where they got an explanation about the survey and some information about the writer of the thesis. Then, the respondents got some personal questions. This part of the survey consists of socio-economic questions to answer the following sub-question:

Do socio-economic characteristics of people in the Netherlands have an influence on the decision about travelling by train or plane for leisure in Europe?

The respondents got questions about their age, gender, education, occupation, and household yearly gross income. (All survey questions can be found in Appendix A)

In the next part of the survey, a random group of respondents got information about the influence of travelling by plane on the environment. Besides, the respondents got informed about the fact that travelling by train is much less polluting than travelling by plane. Not all respondents got this information and therefore, this part of the survey was used to answer the following sub-question:

When made aware of the differences of polluting transport modes, do people in the Netherlands make different transport decisions regarding travelling for leisure in Europe?

Now, all respondents get the same seven scenarios. With these scenarios, the respondents had to make a decision between travelling to a certain destination in Europe by plane or by train. The destination, travel time, and price of the journey were given. (All survey questions can be found in Appendix A)

The price and travel time of the scenarios were chosen as realistic as possible, as the price and travel time for all destinations were compared to the prices and travel times given on the Dutch websites Nsinternational, Omio, Skyscanner and Cheaptickets. The website Nsinternational offers train tickets to destinations all over Europe. Omio offers both train tickets and flight tickets and Skyscanner and cheaptickets offer flight tickets. When looking at the prices of the tickets, the average price for the month of June was calculated, as the survey was active in June. The destinations in the survey were chosen since the scenarios include trips with various travel times and prices in Europe.

4.2 Specification of the variables

Dependent variable:

Train

The dependent variable in the model is the choice of train travel. To investigate what factors influence people to travel in a more sustainable way respondents were asked about their transport mode preferences. In the survey respondents are asked to choose a transport mode in multiple scenarios. The two available transport modes in the questions are the train and the plane. The variable train is therefore a binary variable with a value 1 if the respondent chose the train, and 0 if the respondent chose the plane as the preferred transport mode. In the model, other variables are used to examine their influence on their decision regarding transport mode.

Independent variables:

Information

As mentioned before, the impact of this variable on the dependent variable, train, is the main focus of this paper. This variable is used to investigate whether educating or informing people about the influence of travelling on climate change, has an influence on their travel decisions. Fifty percent of the respondents got randomly selected and received information about the impact of travelling on climate change. This variable is therefore a dummy variable with a value 1 if the respondent got the information and with a value 0 if the respondent didn't get the extra information.

Age

As mentioned before, existing literature shows that age has an impact on modal choices. Besides, research demonstrates that younger generations are more environmentally conscious (CBS, 2021d). Therefore, age was put in the model to investigate whether age has an effect on people choosing a more environmentally friendly transport mode. The respondents were asked to fill in their age. All responses with a value below 18 for age, were deleted from the sample as this paper only looks into adults in the Netherlands. Furthermore, unrealistic values were also deleted from the sample.

Gender

Besides, gender was implemented in the model. Also, for the variable gender, research shows mixed results regarding the influence of gender on transport mode choices. However, research shows that on average, women find the environment more important than men (CBS, 2021d).

For that reason, gender was implemented in the model. Respondents were asked how they identify themselves. Gender is therefore a dummy variable with a value 1 when the respondent identifies themselves as a female and a value 0 when the respondent identifies themselves as male. Respondents were not obligated to tell their gender and could fill in, that they preferred not to tell how they identified themselves. These were reported as missing values.

Education

Furthermore, education was added to the model. Research shows that education can have a significant effect on someone's transport mode preferences (De Witte et al., 2013). In the survey respondents were asked about the highest level of education that they followed or completed. To make comparison easier, in the analyses two dummy variables were created. The dummy variables are Degree and Nodegree. The respondents that follow or followed education at university level belong to the Degree group. Others belong to the Nodegree group.

Occupation

Moreover, research shows that occupation can have an effect on transport mode choices. Therefore, occupation was added to the model. Respondents were asked to fill in their occupation. Three dummy variables were created namely, Work, Retired, and Student, with Work as the reference group.

Household yearly gross income

According to de Witte et al. (2013) income is one of the most important determinants of modal choice. That is why household yearly gross income was implemented in the model. Respondents were asked about their income. In the survey the respondents could choose between five categories. The first category was household yearly gross income under 20.000 euros and the second category was household yearly gross income between 20.000 and 40.000 euros. Besides, the third category was household yearly gross income between 40.000 and 70.000 euros and the fourth category was household yearly gross income between 70.000 and 100.000 euros. Lastly, the fifth category represented household yearly gross income from 100.000 euros and upwards. Respondents were not obligated to fill in their household yearly gross income and therefore all 'prefer not to tell' responses were reported as missing values.

To make comparison easier, the first three categories were combined into the dummy variable LowIncome. The last two categories were also put together into the dummy variable

HighIncome. The average household yearly gross income in 2018 in the Netherlands was 68.500 euros. Therefore, with the new two dummy variables, a comparison can be made between household yearly gross income below average and household yearly gross income above average in the Netherlands.

Costs & Distance

The cost and distance of a journey are seen as two of the biggest determinants for people to travel somewhere (Hares et al., 2010). The control variables Costs and Distance are therefore implemented in the model.

For the cost three dummy variables are created. The first dummy variable is Cheap, the second dummy is Expensive and the third one is indifferent. The scenarios are split up into these three dummies. The cheapest transport mode was added to the dummy variable cheap and the expensive transport mode was added to the dummy variable expensive. For example, in the scenario Paris, the costs for travelling by plane were 93 euros and the costs for travelling by train were 125 euros. Therefore, the option plane was added to the cheap dummy and the option train was added to the expensive variable. In the scenario with Prague as destination, the costs for travelling by plane and train were equal. Therefore, the scenario Prague was added to the Indifferent variable.

For Distance, three dummy variables are created. The dummy variables are Short, Medium, and Far, with Short as the reference group. The shortest destinations, based on the distance in kilometers, were added to the dummy variable Short. The destinations that were furthest away, were added to the dummy variable Far. The destinations between Far and Short were added to the dummy variable Medium. The scenarios Hamburg, Paris, and London were added to the dummy Short. The scenarios Prague and Berlin were added to dummy Medium. Lastly, the scenarios Milan and Vienna were added to the dummy Far.

5. Results

5.1 Descriptive statistics

Table 1 shows the descriptive statistics for the independent and dependent variables used in the models. The descriptive statistics are shown for the variables age, gender, education, occupation, income, and sustainability information.

Table 1. Descriptive statistics

Variable	Mean	Frequenties	Standard Deviation	n
Sustainability Info	0.490	49.0%	0.500	97
Age	35.706	100%	15.131	179
Female	0.551	55.1%	0.500	109
Male	0.439	43.9%	0.500	87
WO	0.298	29.8%	0.459	59
HBO	0.414	41.4%	0.494	82
MBO	0.207	20.7%	0.406	41
High School	0.076	7.6%	0.265	15
Other education	0.005	0.5%	0.071	1
Full-time	0.364	36.4%	0.482	72
Part-time	0.227	22.7%	0.420	45
Student	0.328	32.8%	0.471	65
Stagiaire	0.040	4.0%	0.197	8
Other occupation	0.010	1.0%	0.100	2
Less 20.000 euros	0.253	25.3%	0.436	50
20.000 – 40.000 euros	0.177	17.7%	0.382	35
40.000 – 70.000 euros	0.207	20.7%	0.406	41
70.000 – 100.000 euros	0.141	14.1%	0.349	28
100.000 euros or more	0.091	9.1%	0.288	18

We can derive from Table 1 that 55.1 percent of the respondents identify themselves as female. Furthermore, we can see that 36.4 percent of the respondents have a full-time job. The standard

deviation and the mean of all variables are also given in Table 1. For instance, we can observe that the average age of the respondents is equal to 35.706. We can also derive from Table 1 that 49.0 percent of all respondents got extra information about the influence of travelling on climate change. Besides, the frequency of all variables is presented in Table 1. For example, 55.1 percent of all respondents identified themselves as female.

Table 2 is a frequency table and shows how often respondents chose a destination with the different transport modes. The percentages shown in Table 2 show the percentage of respondents that chose the train or plane for one particular destination. For example, when respondents got the scenario where they had to choose between travelling to Prague by train or plane, 145 respondents chose the airplane and 53 respondents chose the train as a transport mode. Thus, 73.23 percent of respondents chose the airplane and 26.77 percent of the respondents chose the train. Table 2 also illustrates how often respondents chose the train and plane calculated over all destinations.

Table 2. Frequency table

Route	Train %	Train n	Plane %	Plane n
Ams¹ – Hamburg	88.89	176	11.11	22
Ams – Paris	75.25	149	24.75	49
Ams – London	32.32	64	67.68	134
Ams – Berlin	79.20	158	20.20	40
Ams - Prague	26.77	53	73.23	145
Rtd² - Milan	16.67	33	83.33	165
Ams – Vienna	45.96	91	54.04	107
Overall	52.24	724	47.76	662
destinations				

1. Ams is short for Amsterdam

2. Rtd is short for Rotterdam

Table 2 is organized by distance. First, the table presents the short destinations. Secondly, the medium destinations and lastly the far destinations. Besides, Table 2 shows that in the scenarios Prague, Milan, Vienna, and London respondents chose the plane more often as the preferred transport mode. While, in the scenarios Berlin, Hamburg, and Paris respondents chose the train more often as the preferred transport mode. Thus, except for London and Prague, the train was

mostly chosen in the medium and short destinations. We can also derive from the table that overall, the train was chosen more often as the preferred transport mode than the plane.

5.2 Regression results – survey logit models

The following tables show the results from the performed regressions. Table 3 shows the results for model 1 and Table 4 shows the result for model 2. The tables show the odds ratio, standard error, significance level, and the regression coefficients. Model 1 indicates that seven out of eleven variables in the model are significant, employing a criterion of 0.05 statistical significance. Model 2 indicates that six out of ten variables are significant.

Table 3. Logit model 1

Train	Odds Ratio	Standard Error	P-Value	Beta
Sustainability Info	1.304	0.160	0.030	0.266
Age	1.006	0.005	0.245	0.006
Gender Female	0.962	0.135	0.782	-0.039
Degree	1.574	0.230	0.002	0.453
Student	0.980	0.156	0.897	-0.020
Retired	15.518	10.111	0.000	2.742
HighIncome	1.112	0.174	0.499	0.105
Medium destination	2.192	0.440	0.000	0.785
Far destination	0.228	0.033	0.000	-1.478
Expensive	1.334	0.184	0.036	0.288
Indifferent	0.091	0.022	0.000	-2.394
Constant	1.023	0.311	0.941	0.023

Table 3 illustrates the influence of nudging on transport mode choices, thus addressing Sub-question 1. It shows that Sustainability Info is a significant predictor of the choice of train. The number of observations in the model is equal to 1,379. The log likelihood of the model is -810.734. The pseudo R2 of the model is 0.1505. The LR chi2 of the model is equal to 287.17.

Information (Table 3)

The dummy variable Sustainability Info illustrates whether respondents got extra information about the influence of travelling on climate change. According to the results, respondents who

received the extra information were 30.4 percent more likely to choose the train option than respondents who didn't get the extra information, controlling for age, gender, education, occupation, and income. This result is significant on the 0.05 significance level.

Table 4. Logit model 2

Train	Odds Ratio	Standard Error	P-Value	Beta
Age	1.007	0.005	0.193	0.007
Gender Female	0.992	0.138	0.954	-0.080
Degree	1.525	0.162	0.004	0.422
Student	1.026	0.162	0.869	-0.026
Retired	15.375	10.011	0.000	2.732
HighIncome	1.086	0.169	0.596	0.083
Medium destination	2.186	0.438	0.000	0.782
Far destination	0.229	0.033	0.000	-1.472
Expensive	1.326	0.182	0.040	0.283
Indifferent	0.092	0.022	0.000	-2.387
Constant	1.097	0.311	0.759	0.093

Table 3 illustrates the influence of socio-economic factors, costs and destination on transport mode choices, thus addressing Sub-question 2. It shows that Degree, Retired, Destinations and Prices are significant predictors of the choice of train. The number of observations in the model is equal to 1,379. The log likelihood of the model is -813.092. The pseudo R2 of the model is 0.1480. The LR chi2 of the model is equal to 282.45.

Education (Table 4)

Table 4 shows that the odds ratio for the dummy variable degree is 1.525. This means that respondents with a degree were 52.5 percent more likely to pick the train option, than respondents who didn't have a degree. The relationship between having a degree and travelling by train is statistically significant, with a 0.05 significance level. This means that it can be concluded that, respondents who have a degree seem to be more likely to travel by train.

Occupation (Table 4)

For occupation, three dummy variables were created. The three dummy variables are Working, Retired and Student, with Working as the reference group. The results in Table 4 show that

Students are 2.6 percent more likely to choose the train option than people who work full-time or part-time. Besides, retirees are 15.4 times more likely to choose the train option, than people who work full time or part-time. However, only the relationship with Retired is statistically significant. So, the variable student does not seem to have a relevant effect on the chance of someone travelling by train.

Distance (Table 4)

For the variable distance, three dummy variables were created. The three dummy variables are Short, Medium, and Far destinations, with Short destinations as the reference group. The results in Table 4 show that when respondents chose a transport mode for the destinations that belong to the group Medium destinations, the chance the respondent chose the train is 2.186 times higher than for Short destinations. Besides, the results indicate that for destinations that belong to the Far group, respondents are 77.1 percent less likely to choose the train option, compared to the Short destinations. Thus, the distance seems to have a significant relationship with the dependent variable Train.

Price (Table 4)

For price, also three dummy variables were created. The three dummy variables are Cheap, Expensive, and indifferent. The results illustrate that if a destination belongs to the Expensive group, the chance that the preferred transport mode to the destination is train, is 32.6 percent higher compared to when the destination belongs to the group Cheap. For the Indifferent destinations, the chance that the preferred transport mode to the destination is train, is 90,2 percent lower than for destinations that belong to the Cheap group. The described relationships are statistically significant.

Other variables tested in the model that don't have a significant effect on the choice of train are age, gender and household yearly gross income.

6. Conclusion and discussion

Climate change has been a big problem for a long period of time. A big contributor to climate change is the transport sector, as the transport sector generates a lot of greenhouse gas emissions. A big part of those greenhouse gas emissions come from travelling by plane for leisure. A substitute for travelling by plane is travelling by train. Travelling by train is much less polluting than travelling by plane. However, a large group of people from the Netherlands still travel by plane. Often price and travel time are given as determiners for travelling by plane for leisure instead of travelling by train. In this paper factors that influence transport mode preferences are researched. Therefore, the main question in this paper is:

What influences the decision of people in the Netherlands to choose the plane or train as a transport mode for travelling for leisure in Europe?

Logit models are used to answer the main question. The results show that informing or educating people about the influence of travelling on climate change, could increase the probability that a person decides to travel by train for leisure. A possible explanation is that people are not aware of how badly the environment is impacted by travelling by plane compared to travelling by train. Therefore, when respondents received the sustainability information, they chose the train as the preferred transport mode.

However, there may have been response bias, specifically a social desirability bias. The respondents could have answered in a way that they defined as morally or socially correct. Instead of answering the questions truthfully, the respondents answered what they thought was socially acceptable, namely travelling by train. The respondents could have been induced to choose the train option.

Furthermore, results from the analyses showed that education, occupation, destination, and price also have a significant effect on transport mode choices. The results indicated that for education, having a degree increases the chance of people travelling by train for leisure, compared to people without a degree. A possible explanation could be that higher educated people are better informed about climate change. Besides, they might be more aware of the differences in pollution between travelling by plane and travelling by train. This could result in higher educated people choosing the train more often as the preferred transport mode.

For occupation, retirees seem to have a higher chance of choosing the train as the preferred transport mode than people who work part-time or full-time. A possible explanation is that retirees have more time, as they don't work (anymore) and therefore are less unwilling to travel with longer travel times. However, just three percent of our sample was a retiree. This is not representative of adults in the Netherlands and therefore, the odds ratio of 15.375 might not be representative of retirees.

Besides, the destination also seems to have a significant effect on someone's transport mode preference when travelling for leisure in Europe. The results showed that when a destination belonged to the group Far destinations, the probability of someone travelling by train decreased significantly, compared to Short destinations. A possible reason for this could be, that for Far destinations the travel time for both the train and plane increases. However, due to the waiting time for travelling by plane being a constant, the difference between waiting times increases. Furthermore, an increase in distance results in an increase in the absolute difference between waiting times also without the waiting time at the airport. Therefore, travelling by train gets less attractive for Far destinations due to the travel time.

Yet, the chance of someone travelling by train is higher for Medium destinations, compared to Short destinations. This is quite remarkable as you would expect that the probability of someone travelling by train decreases in this scenario, as the travel time increases.

Besides, looking at the results for the dummy variables Expensive and Indifferent, we can observe that it is more likely, that when people chose an Expensive destination, that they chose the train as the transport mode. This could indicate that people are willing to pay more for travelling by train than for travelling by plane.

There was no statistically significant relationship found between travelling by train for leisure in Europe and the variables age, gender, and household yearly gross income. This is in contrast to what was found in earlier research. Earlier research showed that age has a significant impact on travel behaviour (De Witte et al., 2013). Besides, gender also seemed to have an influence on travel decisions (Brown et al., 2003). Furthermore, De Witte et al. (2013) indicated that income has a big influence on travel behaviour. The results from our analyses are thus in contrast to what was found in other studies before.

Nonetheless, the results of the survey might have been influenced by chaos on airports in the Netherlands in the last months. Due to a staff shortage, massive problems accrued on Schiphol. Many travellers missed their flight due to the long queues, resulting in many negative

experiences for travellers. This could have resulted in people choosing the train more often as the preferred transport mode.

Besides, there are also some limitations to our research. The main limitations of our research are due to the validity of the variables and data used in this paper. Regarding the data, questions are raised regarding the representativeness of the data. For example, the group retirees in our data is much smaller than in reality. Whereas, the student group is much larger than in reality. Therefore, the data is not representative for adults in the Netherlands. Besides, as the survey was mostly filled in by family, friends, and acquaintances of the writer of this paper, the sample is most likely not representative of society in the Netherlands.

Besides, the number of control variables in our model might be considered too little. The R-squared for model one is 0.1505 and the R-squared for model two is 0.1480. These values are way too low. So, this would indicate that there are probably other variables that also explain the choice of travelling by train. By adding more variables, the variation in the model can be predicted more precisely.

In conclusion, further research is needed, regarding travelling for leisure in Europe. First of all, more control variables are needed when doing further research. Besides, a suggestion for further research is researching different ways of educating people on the impact of travelling on climate change. Harder approaches, such as laws, can be investigated. Such investigation could help with the goal of minimizing climate change and reducing greenhouse gas emissions. Besides, further research could also look into other forms of sustainable transportation, such as public transport or the introduction of electric, sustainable airplanes.

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8. Appendix A




This appendix includes the survey questions.




1. What is your age?
2. How do you identify yourself?
 - Male
 - Female
 - Non-binary
 - Prefer not to say
3. What is the highest level of education you followed?
 - Primary education
 - Secondary education
 - MBO
 - HBO
 - University
 - Other
4. What is your current occupation?
 - Working full-time
 - Working part-time
 - Job seeker
 - Student
 - Stagiaire
 - Retired
 - Other
5. What is your household's yearly gross income?
 - Less than 20.000 euros
 - 20.000 - 40.000 euros
 - 40.000 - 70.000 euros
 - 70.000 - 100.000 euros

- More than 100.000 euros




- Prefer not to say




6. Imagine travelling in Europe for leisure or visiting family. Which trip do you prefer?

-  Flight from Amsterdam to Prague
-  1,5 hour + 3 hours wating time on the airport
-  100 euros




-  Train journey from Amsterdam to Prague
-  12 hours
-  100 euros




7. Imagine travelling in Europe for leisure or visiting family. Which trip do you prefer?

-  Flight from Rotterdam to Milan
-  2 hours+ 3 hours wating time on the airport
-  110 euros







-  Train journey from Rotterdam to Milan
-  12 hours
-  160 euros

8. Imagine travelling in Europe for leisure or visiting family. Which trip do you prefer?







-  Flight from Amsterdam to Berlin
-  1,5 hour + 3 hours wating time on the airport
-  80 euros

-  Train journey from Amsterdam to Berlin
-  6 hours
-  50 euros




9. Imagine travelling in Europe for leisure or visiting family. Which trip do you prefer?




-  Flight from Amsterdam to London
-  1,25 hour + 3 hours wating time on the airport
-  93 euros
-  Train journey from Amsterdam to London
-  5 hours
-  180 euros

10. Imagine travelling in Europe for leisure or visiting family. Which trip do you prefer?







-  Flight from Amsterdam to Paris
-  1,5 hour + 3 hours wating time on the airport
-  90 euros
-  Train journey from Amsterdam to Paris
-  3,5 hours
-  125 euros

11. Imagine travelling in Europe for leisure or visiting family. Which trip do you prefer?

-  Flight from Amsterdam to Vienna
-  2 hours + 3 hours wating time on the airport
-  160 euros

-  Train journey from Amsterdam to Vienna
 -  13 hours
 -  70 euros

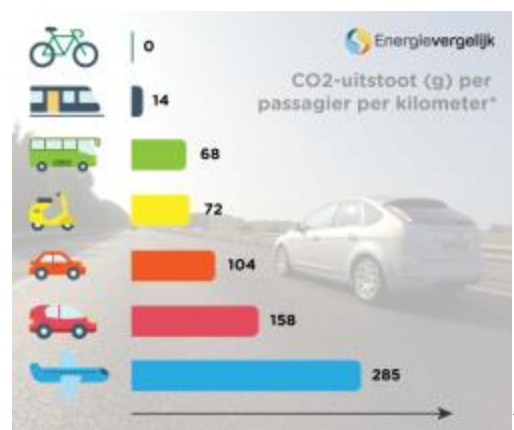
12. Imagine travelling in Europe for leisure or visiting family. Which trip do you prefer?

-  Flight from Amsterdam to Hamburg
 -  1 hour + 3 hours waiting time on the airport
 -  80 euros
-  Train journey from Amsterdam to Hamburg
 -  5 hours
 -  40 euros

9. Appendix B

Appendix B shows the extra information that was randomly assigned to half of the respondents.

In 2020, the Dutch transport sector generated 22 billion kilograms of CO₂ equivalents of greenhouse gases. The largest contributor is the air travel sector with 35%. Greenhouse gases cause the global temperature to rise. If greenhouse gas emissions continue at the same rate, the planet will become even warmer and warmer. With major consequences for people, nature and the environment.



The CO₂ emissions per passenger per kilometre for traveling by plane are 20 times greater than for traveling by train.

*The translation of the text next to the graph is: CO₂ emission per passenger per kilometre.