
Paying for CO₂ compensation when buying plane tickets: the perfect solution or a dangerous illusion?

*A study on the behavior of people in the Netherlands towards voluntary carbon
offset schemes*

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Abstract

Global warming is a serious issue. An increasing amount of airline companies provide their passengers with the option to offset their CO₂. In this study, a survey was conducted to answer the research question: 'What is the behavior of people in the Netherlands towards voluntary carbon offset schemes in relation to their perception about environmental damages caused by the aviation industry?' Literature research is carried out on voluntary carbon offset involving afforestation, reforestation, and forest preservation projects. In general, there is a lack of trustworthiness and transparency in these kinds of schemes. It is not clear to what extent the schemes truly compensate. People seem to be aware of the existence of these schemes and are most willing to engage with them, whilst a substantial part of the people seems to be skeptical. More than a quarter of the people would be willing to fly more if they could compensate for their CO₂. This means that the provision of such an option, combined with the lack of transparency of these kinds of schemes, could create more environmental issues caused by the aviation industry. This would, however, only be the case if these schemes, which at this moment are thus not transparent enough, lack in efficiency in the fight against global warming. Creating more transparency and conducting more research regarding the efficiency of these schemes is therefore essential.

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1. Introduction

1.1 Background

In Earth's history, the climate has always fluctuated (Wong, 2015). However, due to human activity, this is happening on a faster stride. Half a century ago, the temperature was only rising half as fast as it is nowadays. At the 2015 United Nations Climate Change Conference in Paris, it was agreed upon that the global average temperature should not exceed a rise of 2 °C (Schmidt *et al.*, 2018). The main cause of global warming is most likely the greenhouse effect, caused by an increase in the emissions of greenhouse gasses (IPCC, 2014). Heat is trapped by greenhouse gasses in the atmosphere, causing the Earth to warm up. The most abundant greenhouse gas emitted by humans (>80%) is carbon dioxide (CO₂), which is released into the air by burning fossil fuels (such as coal and gas) for energy and transportation purposes (EPA,2020). Maintaining the average global temperature rise below 2 °C means the need to reduce the emission of greenhouse gas (GHG) across all sectors (Schmidt *et al.*, 2018). Companies are continually selling carbon offset services to their clients, in addition to programs that promote environmental management within their area of influence. These programs provide alternatives to reducing carbon dioxide emissions generated by the customer's decision, such as reforestation projects, projects that substitute fossil fuels with renewable energy sources, or carbon capture and storage (Gössling *et al.*, 2007).

One of the fastest-growing sources of carbon emissions is tourist- and business-related air travel. Air travel is extremely important within the subject of carbon emissions caused by the transportation industry (Gössling *et al.*, 2007). Air travel emissions are released in the upper troposphere and lower stratosphere, where the effect on cloudiness and ozone generation is higher (Sausen *et al.*, 2005). This means that in terms of global warming, pollution from airplanes can be between 1.9 and 5.1 times more damaging than carbon emitted from the ground (Gössling *et al.*, 2007). Considering that the amount of airline passengers is predicted to double in the next 20 years and the developments of technologies in the aviation industry are not going fast enough, it is anticipated that the aviation industry will outstrip the targeted efficiency gains (Schmidt *et al.*, 2018). Therefore, a growing number of airline companies provide their customers with the option to offset their carbon by paying a fee on their plane tickets. This is mostly done by afforestation, reforestation, and

preserving forests. An example is KLM's 'CO₂ZERO compensation service', for which the company invests in tree preservation in Panama (KLM, 2021). Forests are a high contributor when it comes to climate regulation. Trees can capture carbon dioxide through photosynthesis. According to Bastin *et al.* (2019), forest restoration is one of the most effective ways to tackle the issue of climate change. Therefore, in the aviation industry, voluntary carbon offsets have the potential to play a critical role in addressing climate change (Günther *et al.*, 2020). However, voluntary carbon offsetting schemes have been heavily criticized due to lack of transparency, variability of schemes, and their complexity (Mair, 2011).

1.2 Research problem

According to (Smith, 2007), carbon offsets offer a false sense of credibility to some of the most potentially unhealthy services on the market, among which the aviation industry. Furthermore, offsets have an incentive for airlines to 'greenwash' their unsustainable operations, and the risks of this buyable authenticity are often shifted to the buyer, who ends up footing the bill for the greenwash. These businesses also profit from offset programs, which concentrate most of the focus on the environment. Additionally, offsets can create the illusion that a consumer's purchase has no negative impact on the environment, while thus allowing companies to gain green credentials. (Marley, 2014)

The main objective of this study is to research the possibilities and some of the potential risks of CO₂ compensation schemes. This will be done by investigating the perception of people towards the environmental impacts caused by the aviation industry, and the different behavior towards the provision of voluntary carbon offset schemes. Prior to this, research on the efficiency and risks of these schemes is carried out. This way, the potential and risks of these schemes can be analyzed from a social perspective. To narrow down the research area, the investigation focuses only on inhabitants of the Netherlands. Furthermore, since most airlines invest in forestry projects, the focus of this research is on afforestation, reforestation, and forest preservation. Afforestation meaning planting trees on abandoned grounds (Pires *et al.*, 2019), reforestation meaning planting trees on grounds where they were cut or burned down (Grebner *et al.*, 2013).

The research aims to investigate whether the perception of people towards these schemes corresponds with the reality and whether people have any interest in

these sorts of schemes. This way, there can be shed some light on the potential and risks of voluntary carbon offset schemes in the aviation industry. Despite people's awareness about climate change, the provision of the option to compensate for emissions when buying a plane ticket could get people out of their guilt feeling, and even encourage people to keep traveling by plane rather than using another means of transportation. It is interesting to compare different groups of people since this can provide information about what influences people's behavior towards voluntary offset schemes and the environment. Such research can assist to set up policies regarding CO₂ compensation, create awareness about the efficiency of these compensation schemes, and reveal potential risks of providing them as an option to customers. For this research, the following research question is established:

'What is the behavior of people in the Netherlands towards voluntary carbon offset schemes in relation to their perception about environmental damages caused by the aviation industry?'

Additionally, literature research on the efficiency of voluntary carbon offset schemes is carried out. To guide the research, some sub-questions were established: For the literature research:

- *What does the concept of carbon offset when buying a plane ticket entail?*
- *What is known about the efficiency of voluntary carbon offset schemes?*
- *What is known about the behavior and perceptions of people towards voluntary carbon offset schemes?*

For the quantitative research:

- *What is the perception of people in the Netherlands towards environmental damages caused by the aviation industry?*
- *What is the behavior of people in the Netherlands towards voluntary carbon offset schemes?*
- *To what extent is the perception towards voluntary carbon offset influenced by age and sex?*

2. Literature review

2.1 Voluntary carbon offset efficiency and risks

The concept of forest carbon offset was first presented at the Bali climate change conference in 2007 (Gifford, 2020). Carbon offsetting is a method to compensate for CO₂ emissions, caused by multiple factors, for instance, air travel (Kerner & Brudermann, 2021). An increasing number of airline companies provide their customers with the opportunity to compensate for their share of emitted CO₂ when they travel by plane, allowing the action to be called ‘carbon neutral’ (Zheng *et al.*, 2019). The passengers pay a fee over their flight ticket, for which they are promised that the contribution of their travel to climate change is compensated for, or offset, by avoiding or decreasing a comparable quantity of emissions somewhere else on the world (Gössling *et al.*, 2007). The fees go to a so-called ‘carbon offsetting organization’, which includes projects for afforestation, reforestation, and forest preservation (Kerner & Brudermann, 2021). The price to offset differs per flight; according to the calculation of FlyGreen (2021), a single flight from Amsterdam to Berlin would add approximately €2.20 to the price of the flight ticket, whilst a flight from Amsterdam to New York would add around €12.50.

Although it may seem like a simple and functional way to minimize environmental damages caused by the aviation industry, there are still a lot of doubts and uncertainties associated with carbon offset schemes (Gifford, 2020). Gössling *et al.* (2007) state that carbon offsets are environmentally risky and not a way to directly minimize pollution from aviation.

It is debatable who puts a price on carbon. Calculating the precise individual contribution to climate change of a passenger is a complicated estimation procedure, influenced by many factors such as the kind of plane, the route, weather conditions, and more. As a result of these disparities, the effectiveness and legitimacy of voluntary carbon offsets are questionable (Gössling *et al.*, 2007). Therefore, according to Gifford (2020), standardization is essential to the evolution of voluntary carbon offsets.

Deforestation and degradation of forests already counted for 20% of global greenhouse gases in 2007 (IPPC, 2007). Tropical forests are being cut down at a speed of 15.8 million hectares per year. Offsetting may seem like an excuse for airline

companies to keep emitting instead of finding ways to reduce overall greenhouse gas emissions (Weisse & Goldman, 2018).

According to Anderson *et al.* (2017), offsets by forests could play a role in making climate change less severe, but they can also make it more difficult, by causing a distraction from the need for overall pollution reductions. Additionally, when a passenger decides to fly carbon neutral, it does not mean that their CO₂ is directly compensated for. It takes years before a tree can absorb CO₂ at its full capacity (Fuss *et al.*, 2018). In addition to that, situations can occur that cause stored CO₂ to be released into the atmosphere again, such as wildfires and pest infestations (Gifford, 2020).

Despite these risks, companies can, by providing compensation as an option to their customers, create a green image and improve service differentiation, sales, and employee loyalty by highlighting examples of their sustainability initiatives (Bansal & Roth, 2017). Forest management can therefore be used as a tool for smart marketing and provides a good impression towards investors and consumers (Gifford, 2020). Gifford (2020) also states that offset projects are primarily seen as a good source of revenue by property owners of the project locations, although they do not care much for the concept of combatting climate change.

During a study conducted on carbon offset schemes in the Amazon in Brazil by West *et al.* (2020), it was discovered that projects systematically exaggerated their pollution reductions. In their study, they claim that the methodologies were not rigorous, and there is room for projects to give out credits that do not effect the environment in any way. Additionally, according to a 2016 report by the European Commission, 85% of the EU's offset projects failed to cut emissions at all.

Whilst many news articles are referring to the dangers of voluntary carbon offset schemes, there is a scarcity in academic research conducted on the efficiency of these schemes.

2.2 People's behavior towards voluntary carbon offset schemes

Demographics alone are not a strong indicator of pro-environmental conduct (Mair, 2011). However, a study conducted by Gally and Clifton (2004), found that it is mostly older females with higher education levels that are willing to cooperate in climate change mitigation strategies.

Offset schemes are necessary, since at this moment, despite the environmental issues caused by the aviation industry, people are not changing their flying behavior on a big scale. Gössling *et al.* (2007) and Becken (2007) state that people do not have enough knowledge about the damage their travels cause to the environment. Therefore, they would be unwilling or not motivated to change their flying behavior (Randles & Mander, 2009). This suggests that knowledge about environmental damages caused by the aviation industry could trigger people to change their flying behavior.

There have been multiple studies carried out on people's behavior towards voluntary carbon offset when buying a plane ticket. Mckercher *et al.* (2010) state that there is not much interest from tourists in opportunities to reduce their emissions when buying a plane ticket. However, according to Kollmus and Bowell (2007), voluntary carbon offset schemes may seem like an easy way for tourists to contribute to the fight against global warming. Therefore, people might not feel further pressure to reduce their emissions. This could be an explanation to the findings of Mair and Wong (2010). According to them, people that are more environmentally aware are less willing to pay for their offsets.

Mair (2011) researched the behavior of people towards voluntary carbon offsetting and found that approximately 10% of the people were willing to compensate. This is, however, in contrast with a study conducted by Tartaglia and Grosbois (2009), in which only one out of 52 respondents had purchased compensation. Additionally, in research conducted by Gössling *et al.* (2009), only 2% of the respondents had ever chosen to compensate for their travels.

Passengers' skepticism about the carbon travel tax having any meaningful effect, according to a 2008 survey, is the most significant explanation for their failure to choose to compensate for their travels (Brouwer *et al.*, 2008). Additionally, lack of transparency and knowledge on carbon offset schemes can also be reasons for people to not engage with carbon offset schemes (Becken, 2007). A study, already conducted in 1999 by O'connor *et al.* (1999), in contrast to Mair and Wong (2010), showed that having more knowledge about environmental issues is the most important driver for taking action. Moreover, Lee and Moscardo (2005) stated that consumers that are more environmentally conscious are more likely to engage in climate change mitigation strategies than other consumers. In a more recent study, published in 2021, it was discovered that an individual's understanding of the

relation of air transport to climate change has an important impact on willingness to compensate (Birgelen *et al.*, 2011). Polonsky and Garma (2008) found that people, in general, have more knowledge about environmental concerns than about carbon offsets. They also concluded that people that do not know a lot about carbon offsets schemes, engage with these at a higher rate than people that do know a lot about these schemes.

2.3 Conceptual model

In figure 1, a conceptual model is presented. Environmental damages are caused by emissions from flights.

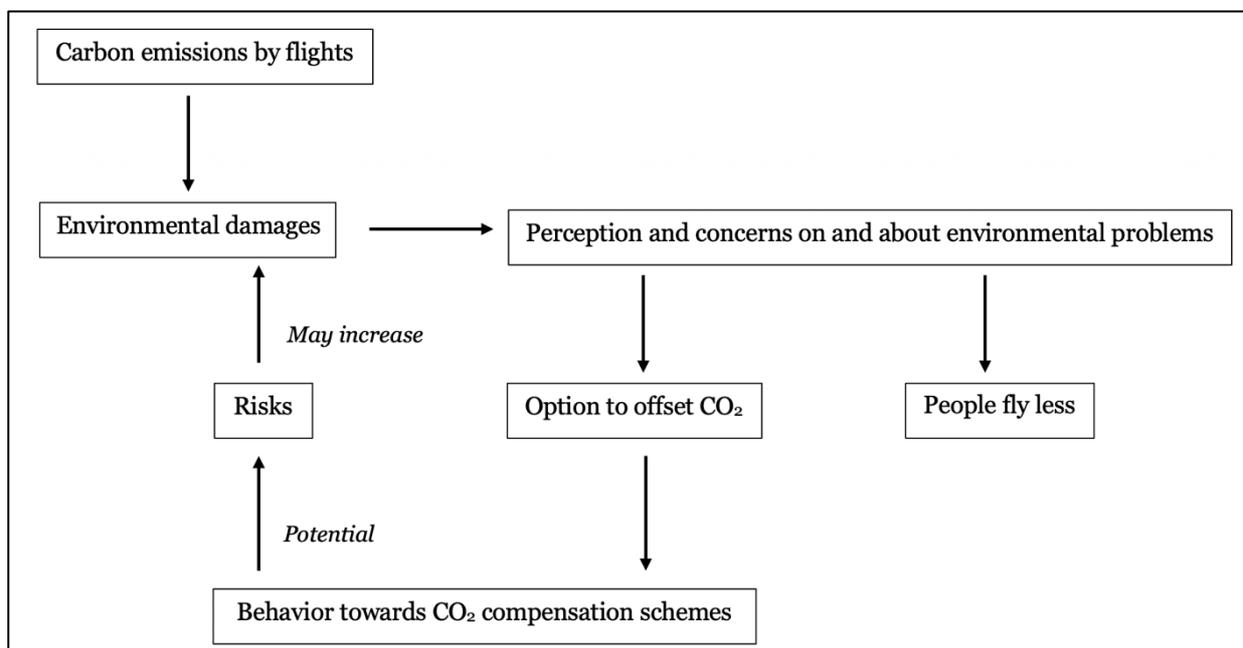


Figure 1: Conceptual model

Depending on the perception and concerns of people towards these damages, customers may choose the option to offset their CO₂, or fly less. The behavior of people towards these schemes includes risks, that involve the possibility of increasing environmental damages.

3. Methodology

3.1 Research method & data collection

To address the research question, a survey is conducted. To get a broader understanding of the behavior of people in the Netherlands towards carbon offset schemes, relationships between variables are researched. Therefore, a quantitative research strategy is used. This way, the dataset can get as big as possible, and therefore have the most chance of being representative for people living in the Netherlands. The survey is created using Qualtrics and is spread out on primarily social media platforms such as Instagram, Facebook, and Snapchat, and via personal connections. The data only consist of people that are living in the Netherlands, since the research is only focusing on inhabitants of the Netherlands. The data is analyzed mostly by comparing questions to each other, whereafter they are presented in a graph or a table. Statistical tests are performed where necessary. These include a chi-square test and a one-way ANOVA. The details of these tests can be found in Appendix C.

The survey consists out of 15 questions (appendix A), taking a total of approximately five minutes to fill in. It is divided into three different pages and is provided in English and Dutch. Respondents are asked for their gender, their age, which is divided into subcategories, their highest completed degree, and their primary occupation. After that, they are asked about their flying behavior and their knowledge and perception about and on the environment and CO₂ compensation. All the questions are asked as simple as possible, causing that as little as people possible fail to fill it in.

3.2 Quality of the data

It should be taken into account that the sample primarily consists out of students aged 19-30 years, which might have an impact on the results. Especially people aged under 18 and above 75 are not much represented in the sample. The survey is distributed through personal networks, which possibly creates a sampling bias. Furthermore, the survey asks people about their knowledge about different subjects. This is an indication that a person gives for themselves and can therefore not be verified. Furthermore, the questions ask if people would be willing to compensate, meaning that this does not automatically mean that they would choose the option in reality if it was provided.

The research ethics are taken into consideration by guaranteeing anonymity when taking the survey. The survey is completely voluntary and can be stopped at any moment. The data are confidential, handled with care, and will be destroyed after finishing this research.

4. Results

4.1 Overview of cases & variables

The survey conducted 437 respondents, of which 406 met the inclusion criteria of the research. Two respondents were excluded, following the criteria of living in the Netherlands. Twenty-nine respondents were excluded for not filling in the survey completely. The different variables with their measurement scales can be found in the appendix (appendix B). Question one was intentionally left out in the data analysis. This is only a control question and is not relevant for the research anymore, since people not living in the Netherlands were already excluded.

4.2 Sample distribution

In figure 2, the distribution of the sample based on age and gender is presented. The sample consists mostly out of females (57%). Out of 406 respondents, 55% are aged between 19 and 30. This can be explained by the fact that the survey is spread over social media platforms and personal connections, causing a possible sampling bias. This also explains why the primary occupation of most respondents in the sample (39%) was filled in as student. A total of 25% of the respondents filled in that they are employed part-time (<36 hours), whilst 19% of the respondents filled in that they are employed full-time (≥36 hours). Thirteen percent of the respondents are retired, and the remaining respondents (4%) are unemployed, a trainee, or 'other'. The highest completed degree for most of the respondents is university (30%), or university of applied sciences (25%). Ten percent of the respondents selected secondary vocational education as their highest completed degree, and 25% of the respondents selected pre-university education.

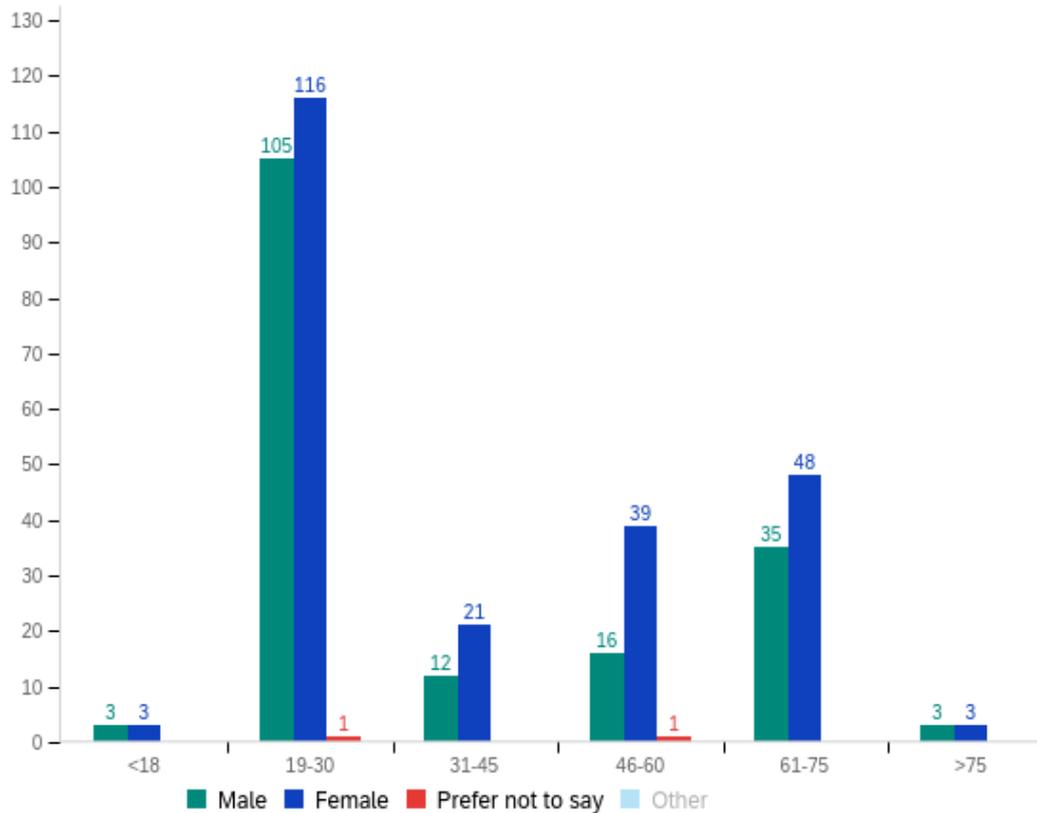


Figure 2: Sample distribution based on gender and age

4.3 Knowledge and concerns about environmental issues and the aviation industry

Respondents were asked about their usual flying behavior (question 6) (without taking the COVID-19 crisis into account). A return flight equals two times, as was indicated in the survey. In the sample, 170 people (42%) fly less than 1 time per year. The number of respondents that indicated to fly approximately 1-2 times per year, was 185 (46%). Forty-three of the respondents (11%) fly approximately 3-5 times a year, and only 8 respondents (2%) filed in that they fly more than 5 times a year. The questions following question 6 (question 7 and 8), asked the respondents about their knowledge on environmental damages caused by the aviation industry (figure 3), and whether they were concerned about these issues (figure 4). Most of the respondents indicated to believe that they have some knowledge on the matter (279), whilst only 29 (7%) respondents stated that they have no knowledge about it. An amount of 98 (24%) respondents reported that they know a lot about the environmental damages caused by the aviation industry. This is in contrast with Gössling *et al.* (2007) and Becken (2007), stating that people do not have a lot of knowledge about the damages caused by the aviation industry. However, it should be

noted that in this research, respondents had to estimate their knowledge themselves. This caused the possibility of respondents reporting to have more knowledge than they have in reality.

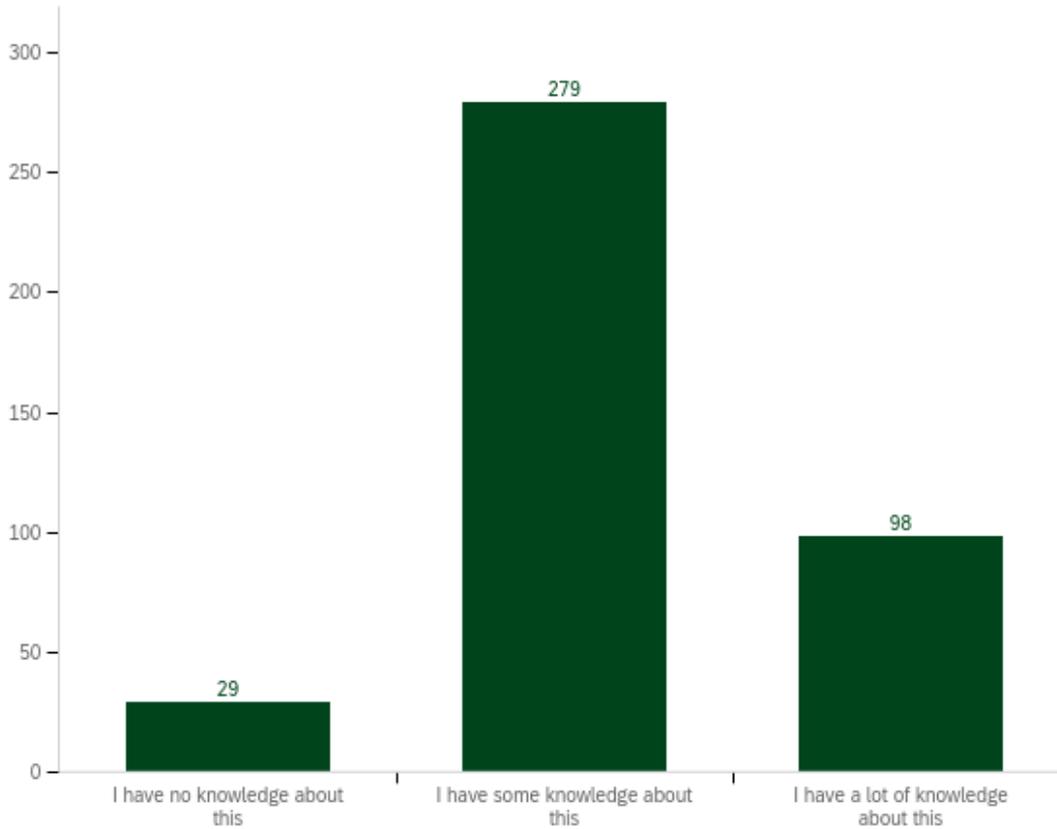


Figure 3: Results of question 7: 'How would you describe your knowledge about environmental damages caused by the aviation industry?'

In figure 4, the answers to question 8: 'Consider this statement: I am concerned about environmental issues caused by the aviation industry' are presented. Most people are concerned about environmental issues caused by the aviation industry. This can be explained by comparing questions 7 and 8 with each other since it seems that people that have a lot of knowledge, are also more concerned about the matter (figure 5).

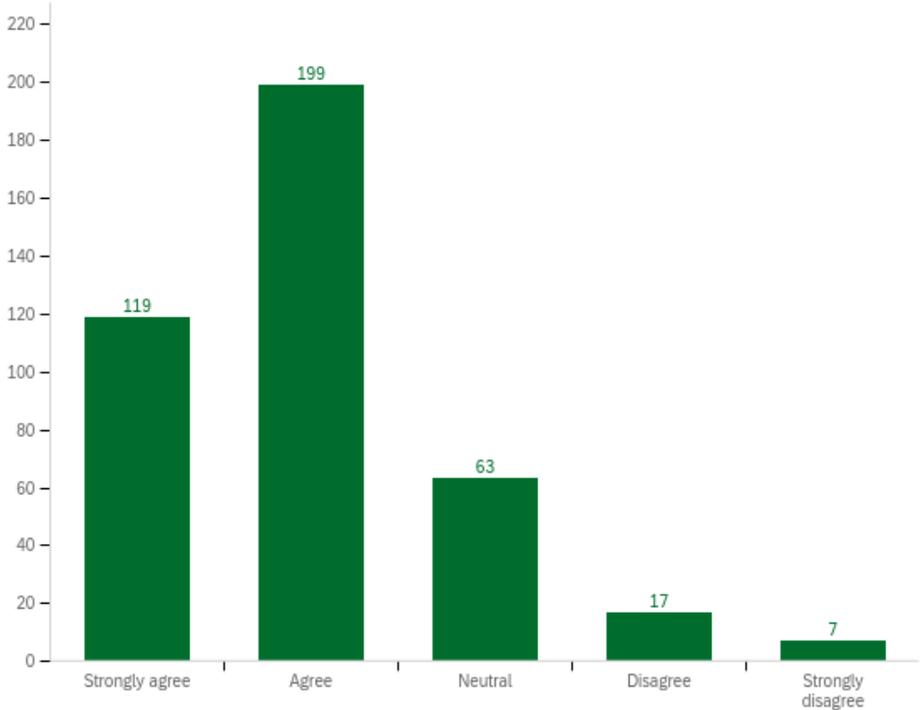


Figure 4: Results of question 8: ‘Consider this statement: I am concerned about environmental issues caused by the aviation industry’

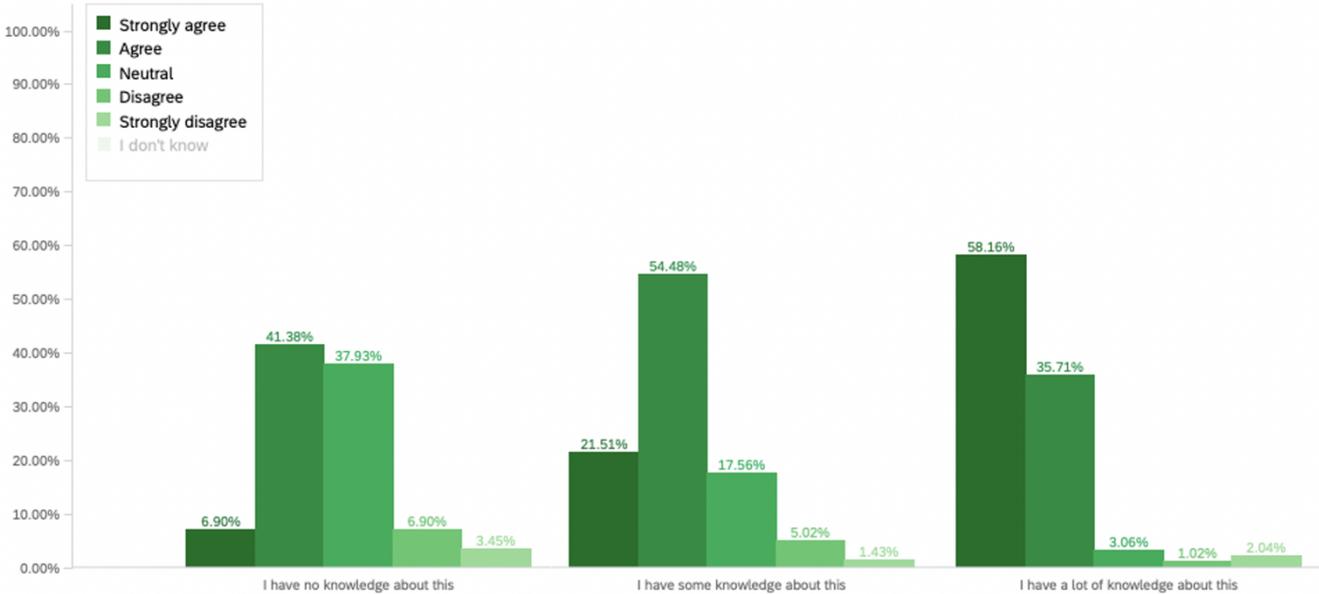


Figure 5: Results of question 7: ‘How would you describe your knowledge about environmental damages caused by the aviation industry?’ and question 8: ‘Consider this statement: I am concerned about environmental issues caused by the aviation industry’

4.4 Environmental issues and travel behavior

Question 9 asked respondents about whether the environmental issues caused by the aviation industry make people less willing to travel by plane (figure 6). The number of respondents that agree or strongly agree with this statement, is 235 (58%). However, there is still a big part, 87 of the respondents (21%), that does not agree with the statement.

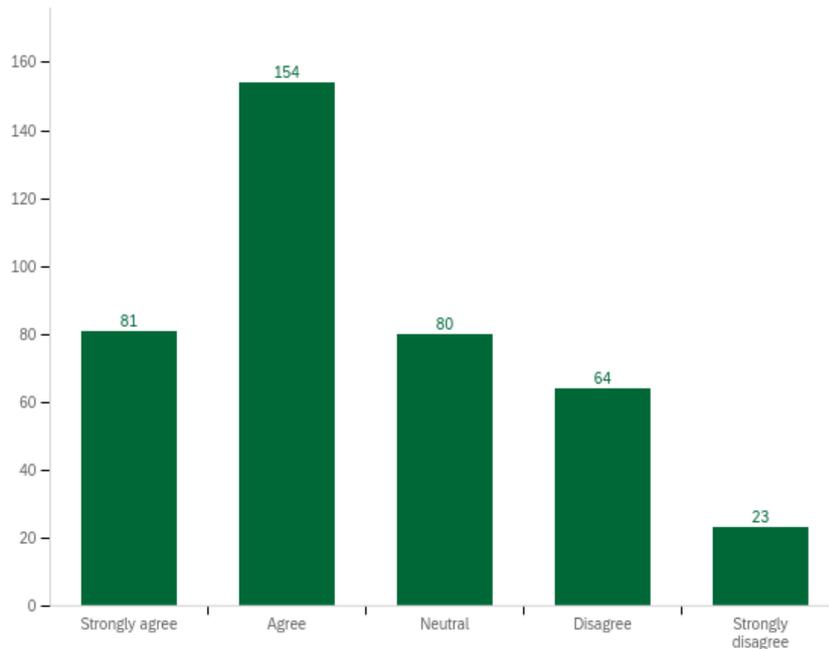


Figure 6: Results of question 9; 'Consider this statement: The environmental issues caused by the aviation industry make me less willing to travel by plane'

The results for question 7: 'How would you describe your knowledge about environmental damages caused by the CO₂ emissions from the aviation industry?' and question 9: 'Consider this statement: The environmental issues caused by the aviation industry make me less willing to travel by plane', are presented in figure 7. According to Randles & Mander (2009), people are unwilling to change their flying behavior due to having insufficient knowledge of the damages caused by the aviation industry. This would mean that people that have a lot of knowledge about these damages are willing to change their flying behavior. The data support this, since almost 86% of the respondents that state that they have a lot of knowledge about environmental damages caused by the aviation industry is less willing to travel by plane due to these issues. The data show that out of the people that think they have

some or a lot of knowledge about environmental damages caused by the aviation industry, more than half are less willing to travel by plane (51%).

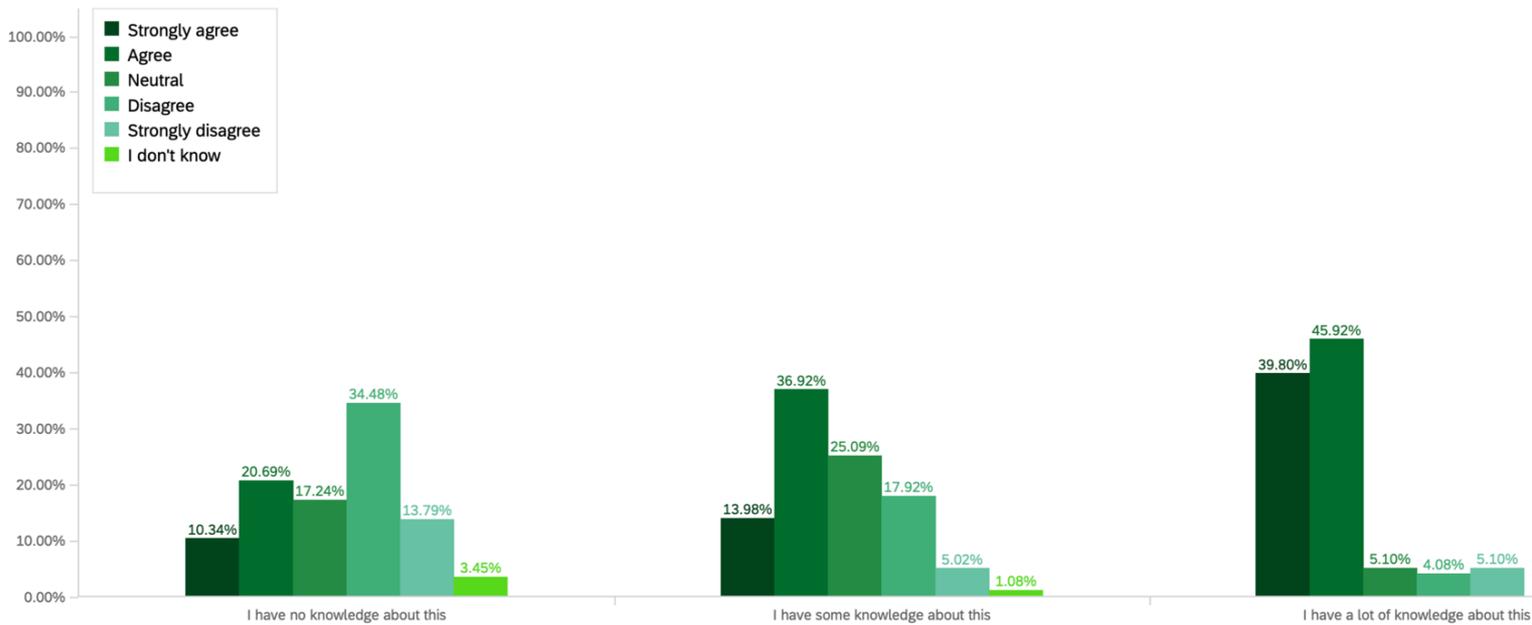


Figure 7: Results of question 7: ‘How would you describe your knowledge about environmental damages caused by the CO₂ emissions from the aviation industry?’ and question 9: ‘Consider this statement: The environmental issues caused by the aviation industry make me less willing to travel by plane’

4.5 Comparison of knowledge on environmental issues and knowledge on voluntary carbon offsets

The respondents were asked to what extent they are familiar with the concept of compensating for their CO₂ when buying a plane ticket. It seems that most people, 351 of the respondents (87%) are familiar with the concept, meaning that they have come across it or heard about the concept. This means that 55 respondents filled in that they have never heard about it (13%).

Question 7 asked the respondents about their knowledge of environmental damages caused by the aviation industry, whilst question 11 asked them about their knowledge of CO₂ compensation when buying a plane ticket. Polonsky & Garma (2009) found that people, in general, have more knowledge about environmental issues than about carbon offsets. This is in line with the data, which are presented in figure 8. An explanation for this can be that environmental problems are a much broader concept than CO₂ compensation schemes. Moreover, CO₂ compensation is relatively new, whilst the problem of climate change is known worldwide for decades already.

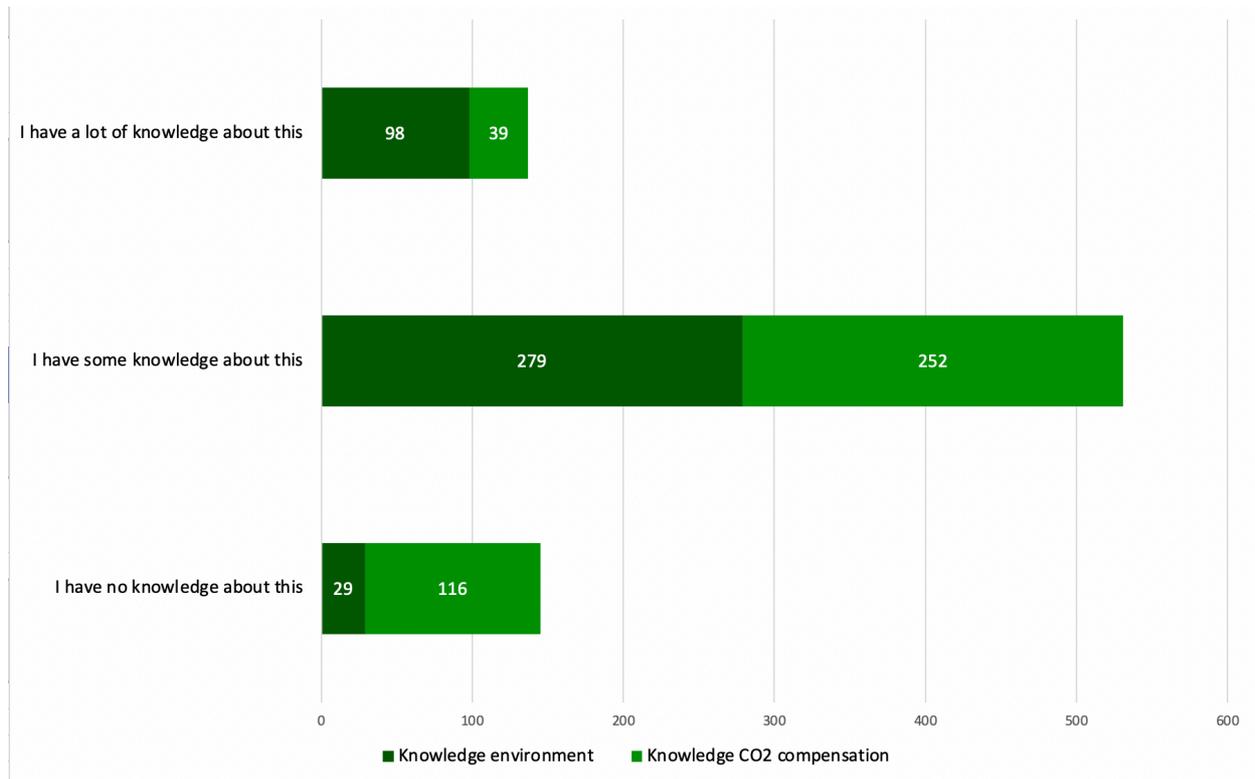


Figure 8: Comparison between question 7: ‘How would you describe your knowledge about environmental damages caused by the CO2 emissions from the aviation industry?’ and question 11: ‘How would you rate your knowledge on compensating for CO2 when buying a plane ticket?’

4.6 Willingness to pay for offset

Question 12 asked the respondents if they would be willing to pay more for their flight tickets to compensate for their CO₂. The results are presented in figure 9.

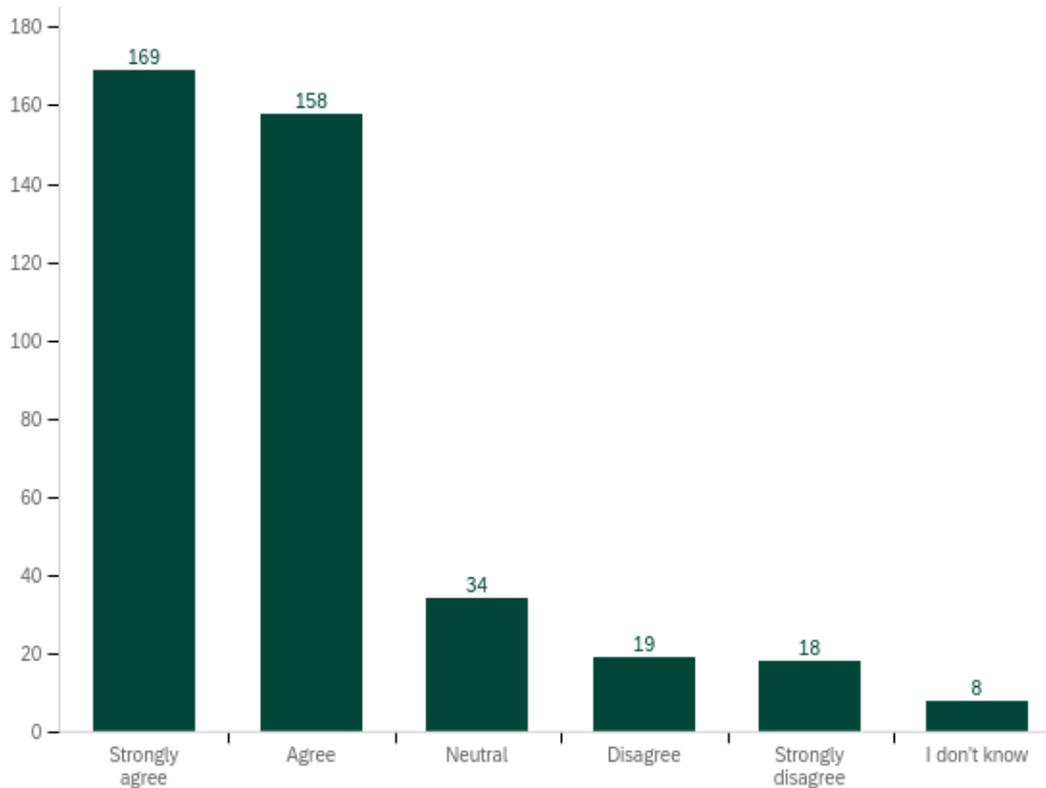


Figure 9: Results of question 12: Consider this statement: I am willing to pay more for my flight ticket to compensate for my CO₂

A total of 327 respondents out of 406 agrees (39%) or even strongly agrees (42%) with the statement. Only 37 respondents (9%) do not agree with the statement. According to Mair (2011), only 10% of people would be willing to compensate, and according to Tartaglia & Grosbois (2009) and Gössling (2009), this number is supposed to be even less. The data show that for this sample, this is not the case, since almost 81% would be willing to pay more for their flight ticket to compensate for their CO₂. This can be explained by the difference in the time of when the research was conducted. This research is conducted in 2021, whilst the research of Tartaglia & Grosbois (2009) and Gössling (2009) was conducted more than ten years ago.

4.7 Influence of knowledge on environmental issues on offset behavior

According to Mair and Wong (2010), people who are more aware of the environmental issues caused by the aviation industry are less willing to pay for their offsets. However, figure 10 shows that the data do not substantiate this. The data do, however, substantiate O’connor *et al.* (1999), who stated that more environmental awareness is the most important driver for taking action. As previously mentioned, it seems that people are more concerned about the environmental issues caused by the aviation industry when they have more knowledge. Concern about the environment can be an important driver for people to be willing to pay to compensate for their CO₂ emissions. Since most respondents indicated to be concerned about environmental issues caused by the aviation industry (figure 4), this can be an explanation why the outcomes of this data analysis differ from the research conducted by Mair and Wong (2010).

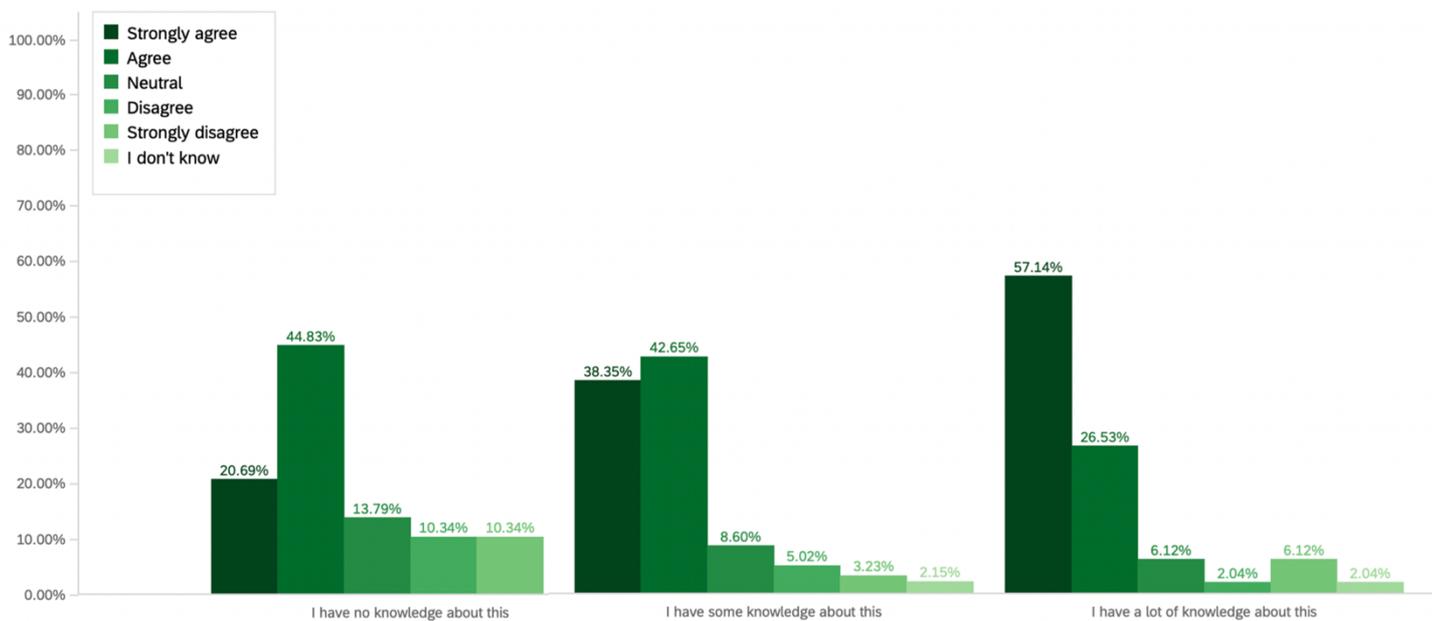


Figure 10: Results of question 7: ‘How would you rate your knowledge on environmental issues caused by the aviation industry?’ & 12: Consider this statement: I am willing to pay more for my flight ticket to compensate for my CO₂’

4.8 Influence of knowledge on offset schemes on offset behavior

The results of question 11: ‘How would you rate your knowledge on compensating for CO₂ when buying a plane ticket?’ are presented together with question 12: ‘Consider this statement: I am willing to pay more for my flight ticket to compensate for my CO₂’ in figure 11.

By looking at the comparison between questions 11 and 12, it seems that people with a lot of knowledge are more willing to pay to offset their flights. This was already stated by Birgelen *et al.* (2021). It is, however, in contrast with the conclusion of Polonsky and Garma (2009), who stated that people that do not know a lot about carbon offset schemes engage with them at a higher rate than people that do know a lot about these schemes.

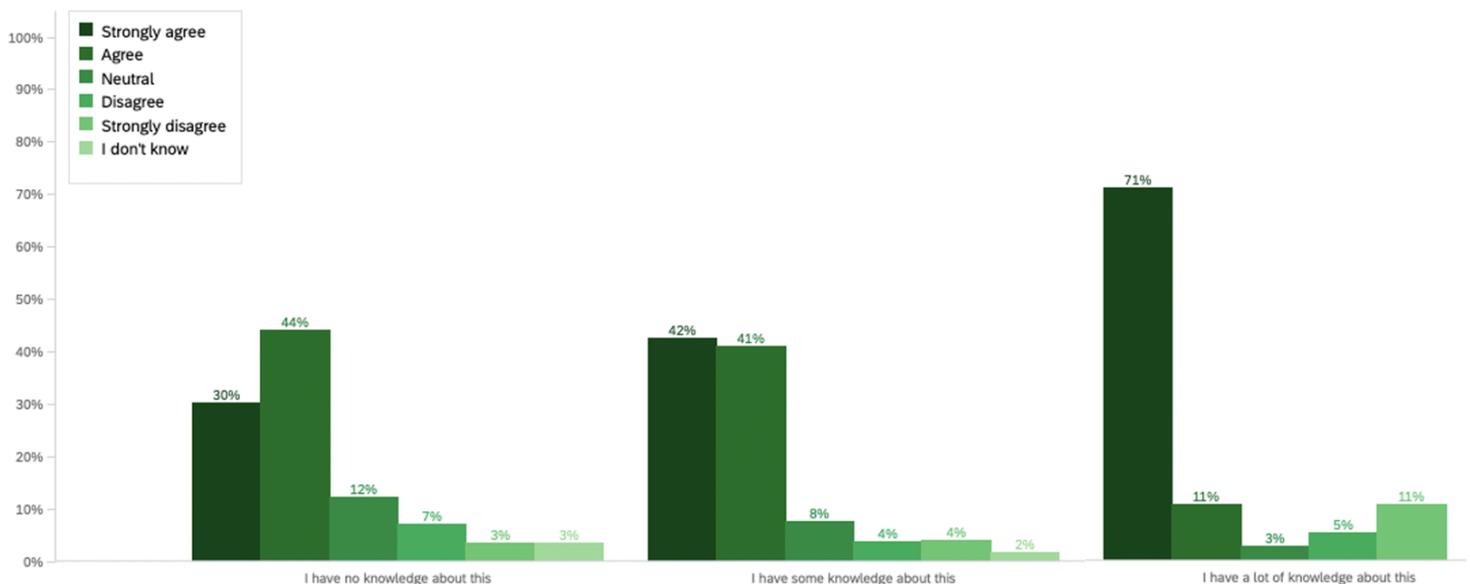


Figure 11: Results of question 11: ‘How would you rate your knowledge on compensating for CO₂ when buying a plane ticket?’ & 12: Consider this statement: I am willing to pay more for my flight ticket to compensate for my CO₂’

4.9 Influence of voluntary carbon offset on travel behavior

Whether the respondents would be willing to travel by plane more if the option to compensate was provided (question 13), is presented in figure 12. The answers are distributed; while most respondents selected the answer 'neutral', still more than a quarter of the participants (27.34%) agree or even strongly agree with the statement, causing the potential risk of creating more environmental damages by providing CO₂ compensation as an option to customers. Since the data give the impression that respondents are rather confused about the matter, this can be an explanation for the answer 'neutral' being the most selected. People are not sure, since it is not clear to what extent CO₂ compensation contributes to the reduction of environmental damages caused by the aviation industry.

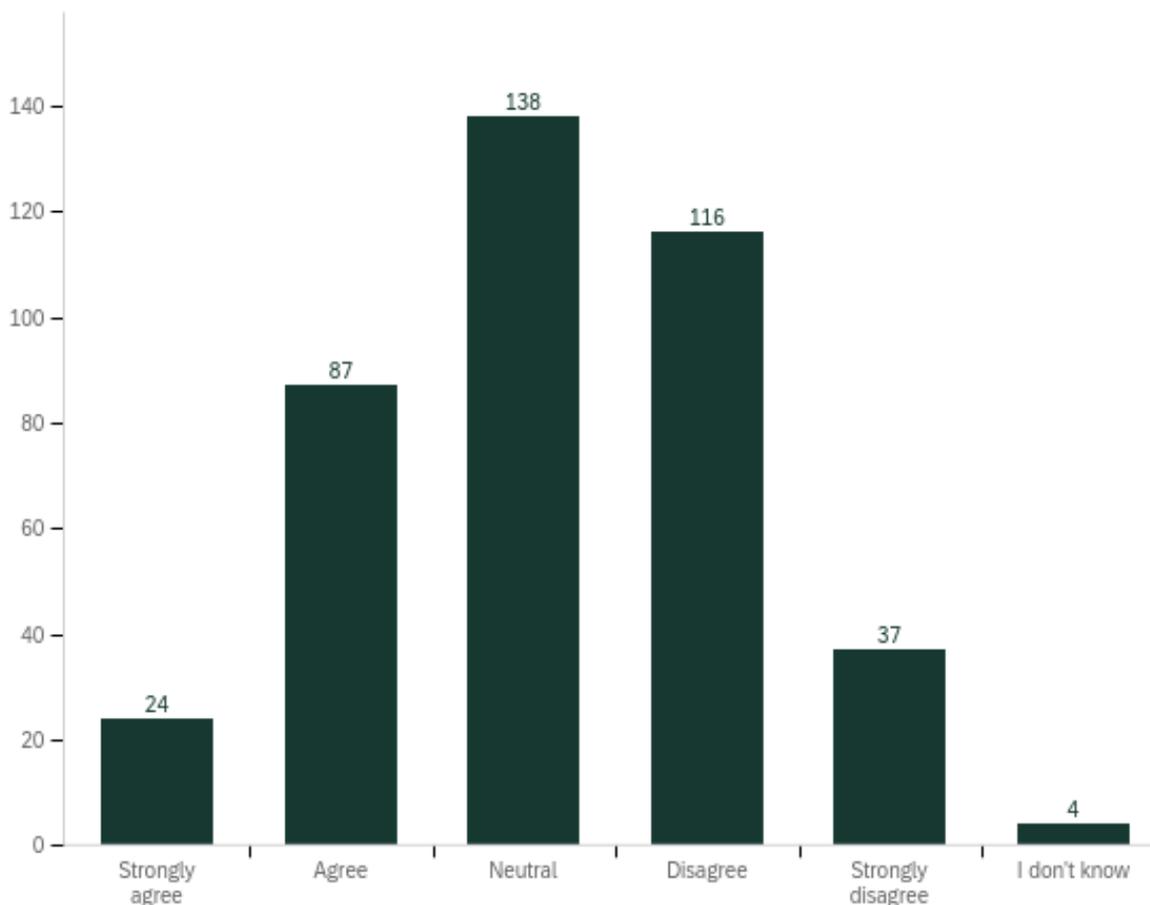


Figure 12: Results of question 13: Consider this statement: If the option to compensate for my CO₂ was provided, I would be willing to travel by plane more

An amount of 130 respondents (32%) filled in 'I don't know' as an answer to the last question (question 15): 'To what extent do you think that providing such an option could influence people's flying behavior?' (Figure 13). Most of the respondents don't think it influences people's flying behavior (49%). However, it should not be overlooked that there is still a certain amount (19%) that thinks that it would make people willing to fly more. This is remarkable since at question 13 (figure 12), more than 25% of the respondents stated that they would be willing to travel by plane more if the option to compensate was provided. This implies that respondents are possibly confused and unsure about the matter.

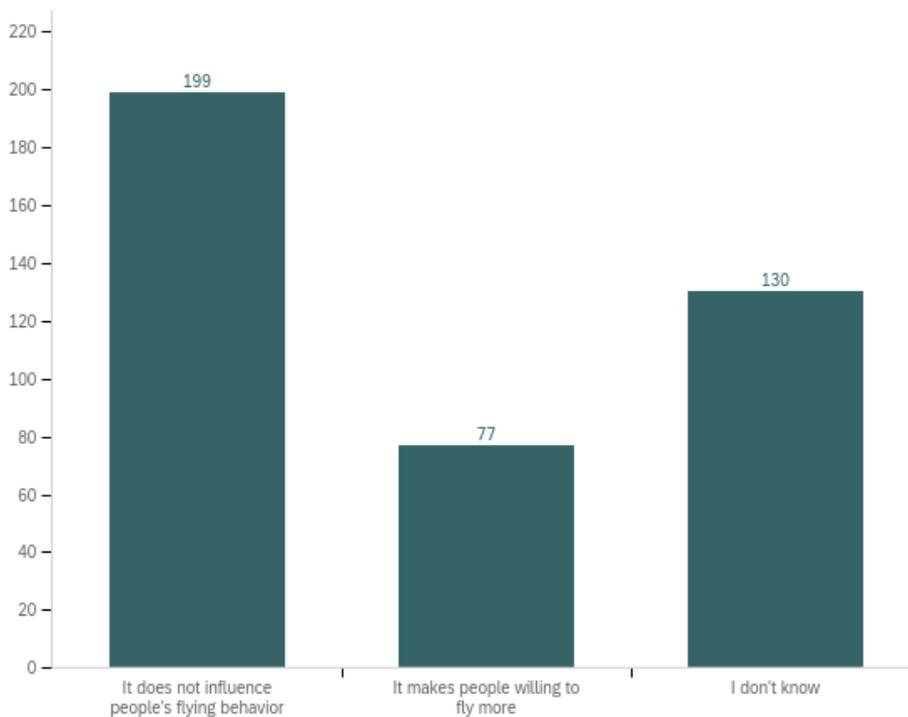


Figure 13: Results of question 15: 'To what extent do you think that providing such an option could influence people's flying behavior?'

4.10 Influence of skepticism on voluntary carbon offset

The results of question 14 provide the impression that respondents are mostly skeptical about carbon offset schemes, which according to Brouwer *et al.* (2008), is the most significant explanation of why people would not be willing to compensate for their travels. The respondents were asked: 'To what extent do you think that the provision of the option to compensate for your CO₂ when buying a plane ticket truly compensates for your part of the flight's emissions?' Using a digital pointer, respondents could select a number between 0 and 100. The mean for this question comes down to 29.95, meaning that the respondents do, on average, not think it compensates even for half of their emissions. Only 75 out of 406 respondents (19%) think it would compensate for over 50%, of whom only 17 (4%) think it compensates for over 75% of the emissions. In table 1, the results can be seen for when question 14 is compared to question 11: 'How would you rate your knowledge on compensating for CO₂ when buying a plane ticket?'

The figure shows that there is no big difference between people that state they have a lot of knowledge and people that state that they have some knowledge on compensating for CO₂. According to Becken (2007), lack of transparency and knowledge on carbon offset schemes are reasons to not engage with them. However, according to the obtained data, people that state that they have a lot of knowledge, seem to be, on average, less skeptical about CO₂ compensation.

Table 1: Results of Question 14: ‘To what extent do you think that the provision of the option to compensate for your CO₂ when buying a plane ticket truly compensates for your part of the flight’s emissions?’ combined with question 11: ‘How would you rate your knowledge on compensating for CO₂ when buying a plane ticket?’.

Answer Q14 ⇒ ↓ Answer Q11	Minimum	Maximum	Mean	Std Deviation	Count
I have no knowledge about this	0.00	86.00	29.46	21.48	116
I have some knowledge about this	0.00	100.00	28.99	21.99	252
I have a lot of knowledge about this	0.00	100.00	39.76	31.58	38

Following these data, a One-way ANOVA statistical test was carried out on question 11 and question 14, with question 14 being the dependent variable (Table 2). This test resulted in a significant difference between ‘I have some knowledge about this’ and ‘I have a lot of knowledge about this’ on a 5% confidence interval. The test supports the claim that people that state that they have a lot of knowledge, seem to be, on average, less skeptical about CO₂ compensation. No significant difference between ‘I have no knowledge about this’ and ‘I have a lot of knowledge about this’ is observed at a 5% confidence interval. However, at a 10% confidence interval, this difference is significant.

Table 2: SPSS output One-way ANOVA on question 14 and 11

Q11	Q11	Mean Difference	Std. Error	Sig.
I have no knowledge about this	Some knowledge	.762	2.581	.957
	A lot of knowledge	-10.306	4.300	.058*
I have some knowledge about this	No knowledge	-.762	2.581	.957
	A lot of knowledge	-11.069	4.003	.023**
I have a lot of knowledge about this	No knowledge	10.306	4.300	.058*
	Some knowledge about this	11.069	4.003	.023**

Note: *Significant at a confidence interval of 10%; ** Significant at a confidence interval of 5%

According to Brouwer *et al.* (2008), skepticism about the meaningful effect of carbon travel tax is the most important reason for people to not compensate for their CO₂. In figure 14, the results of question 12: ‘Consider this statement: I am willing to pay more for my flight ticket to compensate for my CO₂’ and question 14: ‘To what extent do you think that the provision of the option to compensate for your CO₂ when buying a plane ticket truly compensates for your part of the flight’s emissions?’ are presented. In the data, the mean of question 14 is higher for respondents that would choose to compensate and gradually lower for people who are neutral in this statement and are not willing to compensate. The data show thus that the more skeptical people are, the less willing they are to compensate (σ is approximately the same for all categories). This corresponds with the statement of Brouwer *et al.* (2008); skepticism about the meaningful effect of carbon travel tax is the most important reason for people to not compensate for their CO₂.

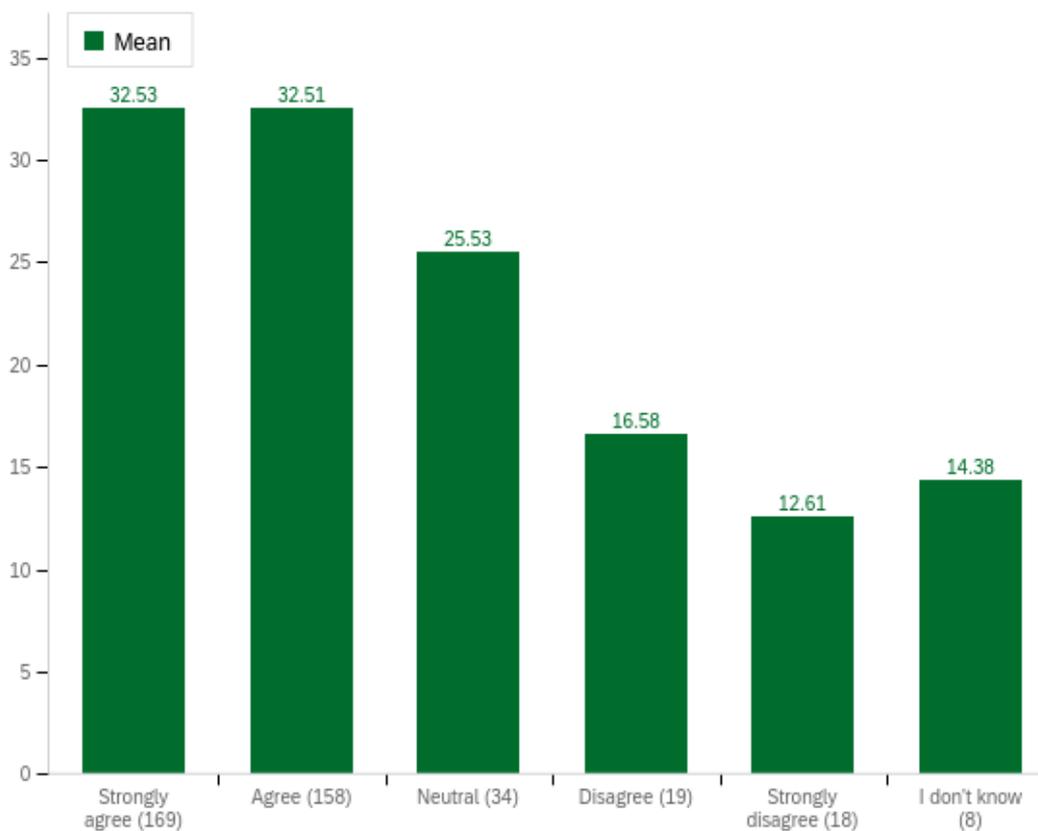


Figure 14: Results of Question 12: ‘Consider this statement: I am willing to pay more for my flight ticket to compensate for my CO₂’ combined with question 14: ‘To what extent do you think that the provision of the option to compensate for your CO₂ when buying a plane ticket truly compensates for your part of the flight’s emissions?’ combined with question

4.11 behavior towards voluntary carbon offset in relation to gender and age

In figure 15, willingness to pay to offset CO₂ (question 12) is divided into gender. Approximately 72% of the male respondents agree with the statement, against 87% of the female respondents. Therefore, it seems that females would be more willing to pay to compensate for their flight than men. This corresponds to a certain extent to the study conducted by Clifton (2004), who stated that it is mostly older, higher educated females who are willing to cooperate in climate change mitigation strategies. A chi-square test shows that there is indeed a significant relationship between gender and willingness to pay for CO₂ compensation when buying a plane ticket (table 3).

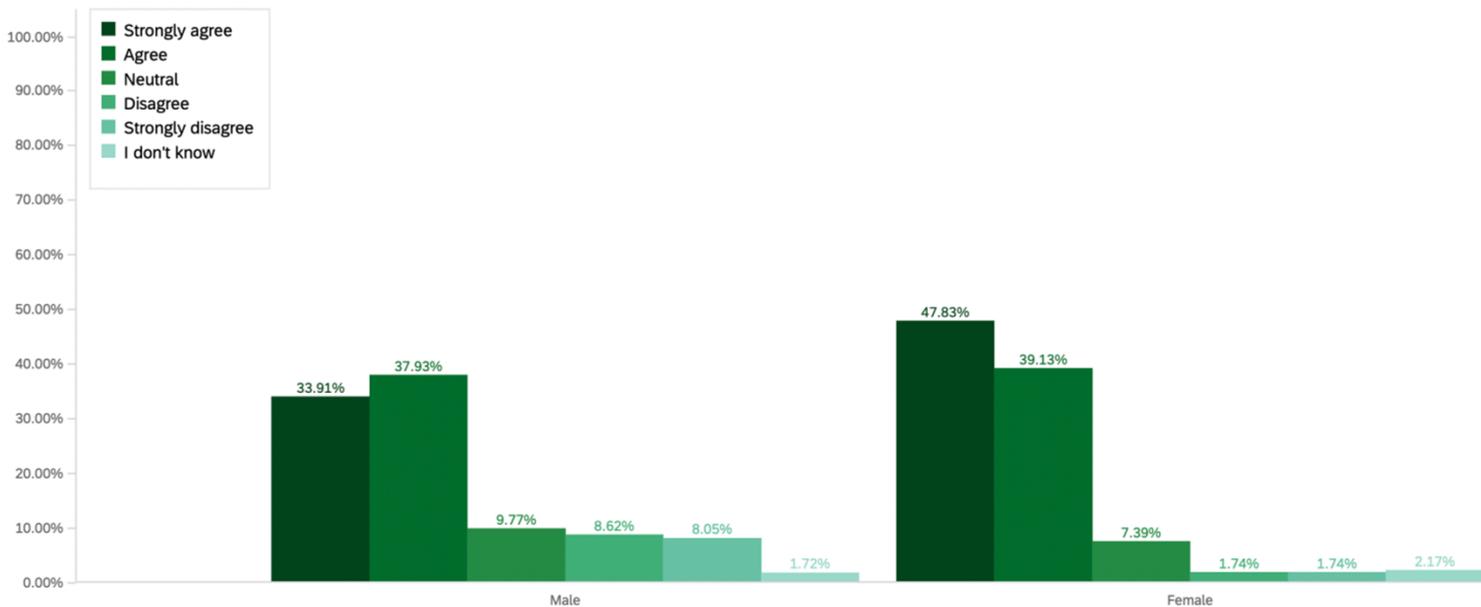


Figure 15: Results of question 12: Consider this statement: I am willing to pay more for my flight ticket to compensate for my CO₂' compared to gender

Table 3: Output of Chi-square test on age and willingness to pay to offset

	Value	Df	Sig.
Pearson Chi-Square	24.210	5	.000
Likelihood Ratio	24.725	5	.000
Linear-by-linear Association	24.056	1	.000
N of valid cases	404		

In figure 16, the results of question 12 are compared to age. Responses of under 18 and above 75 years were both intentionally left out of the visualization since both involved only 6 respondents. The data do not show big differences between age groups. This can be explained by looking at figure 9, in which can be observed that there only 37 respondents disagreed with the statement: 'I am willing to pay more for my flight ticket to compensate for my CO₂'. These answers should, given the number of respondents, be concentrated at one age to create a big difference between age groups, which is thus not the case.

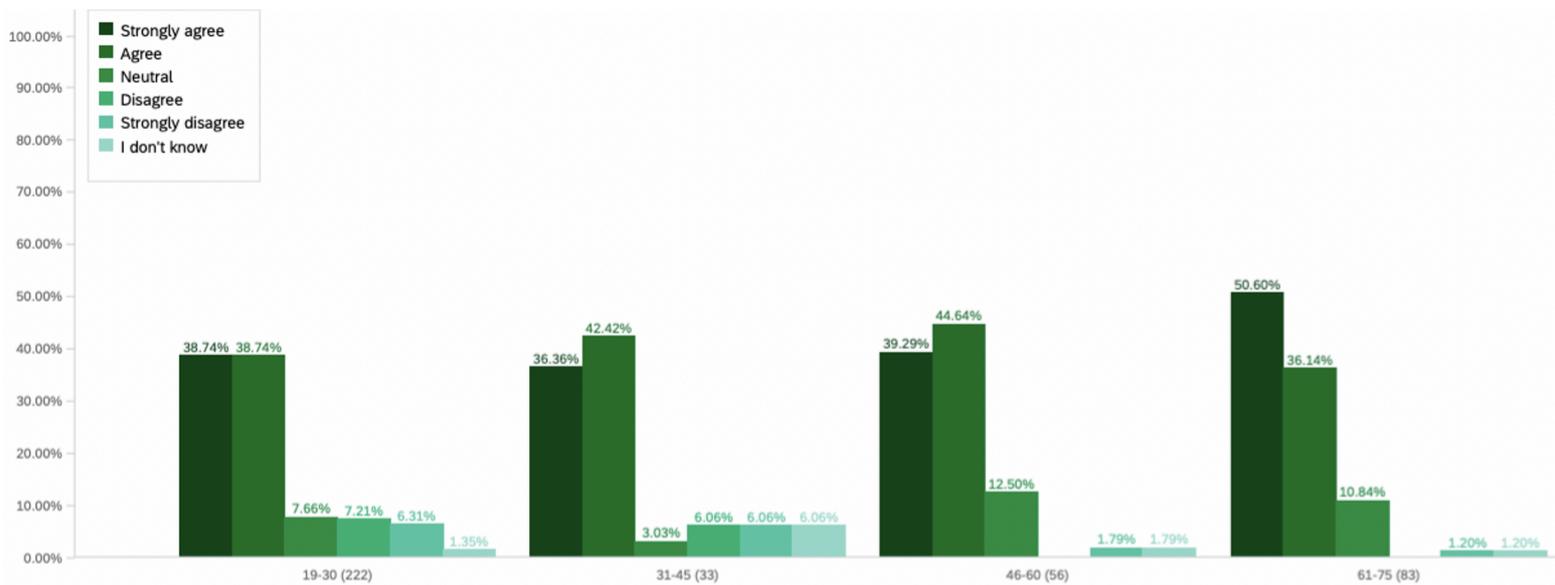


Figure 16: Results of question 12: Consider this statement: I am willing to pay more for my flight ticket to compensate for my CO₂' compared to age

5. Conclusions

For this research, literature on the efficiency of CO₂ compensation was conducted, as well as on previous research about the behavior of people on carbon offset schemes. From the literature review can be concluded that CO₂ compensation in the aviation industry is a very complex concept. The academic literature on the efficiency of carbon offset schemes is scarce, therefore there should be more research done on the matter. At this moment, even though the concept of carbon offset was introduced already in 2007, it lacks transparency, and the efficiency can therefore not be determined. The research question of this study is as follows: *‘What is the behavior of people in the Netherlands towards voluntary carbon offset schemes in relation to their perception about environmental damages caused by the aviation industry?’*

The research has shown that respondents have different perceptions of environmental damages caused by the aviation industry. People seem to be concerned about these issues and are less willing to travel by plane due to these environmental issues. Most people have come across or heard about voluntary carbon offset when buying a plane ticket. However, fewer people seem to have knowledge on voluntary carbon offset than on environmental damages caused by the aviation industry. Despite confusion, many people are willing to compensate for their CO₂. This number is higher under people that state that they have a lot of knowledge about environmental issues and CO₂ compensation. Furthermore, women seem to be more willing to offset their CO₂ than men. It is interesting that people that say they know a lot about CO₂ compensation, also seem to be less skeptical about the concept. People that are more skeptical about the concept of voluntary carbon offset, also seem to be less willing to pay more for their flight to compensate.

What should be noted, is that more than a quarter of the people would be willing to travel by plane more if they could compensate for their CO₂. Considering the uncertainties that come with voluntary carbon offset, the risk of voluntary carbon offset schemes being even more damaging to the environment is undeniable. The behavior of people in the Netherlands towards carbon offset schemes is that most are willing to engage with them, even though they are skeptical about the matter. The danger in these schemes is that more than half of the people are willing to fly more when they can offset their CO₂. Therefore, it is important to conduct future research on the efficiency, or more importantly, create transparency on carbon offset in the aviation industry by forestry projects. At this moment, voluntary carbon offset is not

trustworthy, and it can certainly not be ruled out that CO₂ compensation schemes can be, instead of helping to combat climate change, damaging to the environment.

According to this research, paying for CO₂ compensation when buying plane tickets does not seem like the perfect solution, but more like a dangerous illusion.

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Appendix A: Survey

CO2 compensation

Start of Block: Blz. 1

Thank you very much for your willingness to fill in this questionnaire. This research is part of my graduation thesis for the Bachelor 'Human Geography & Planning' from the faculty of Spatial Sciences at the University of Groningen.

You will be asked some questions regarding your perception towards compensating for your CO2 emissions when buying a plane ticket. The questionnaire is totally anonymous, and you will not be asked for your personal information. No answers can be used to identify you as a person. The questionnaire will take you about 5/10 minutes to fill in. Please take your time to read the questions thoroughly.

1. Are you an inhabitant of the Netherlands?

- Yes (1)
 - No (2)
-

2. What is your gender?

- Male (1)
 - Female (2)
 - Other (3)
 - Prefer not to say (4)
-

3. What is your age?

- <18 (1)
 - 19-30 (2)
 - 31-45 (3)
 - 46-60 (4)
 - 61-75 (5)
 - >75 (6)
-

4. What is your highest completed degree?

- None (1)
 - Primary education (2)
 - Pre-vocational secondary education (3)
 - Senior general education (4)
 - Pre-university education (5)
 - Secondary vocational education (6)
 - University of Applied Sciences (7)
 - University (8)
 - Other: (9)
-
-

5. Select your primary occupation

- Unemployed (1)
 - Employed (Parttime: <36 hours) (2)
 - Employed (Fulltime: >36 hours) (3)
 - Trainee (7)
 - Student (4)
 - Retired (5)
 - Other: (6)
-

End of Block: Blz. 1

Start of Block: Blz. 2

6. How many times per year do you approximately travel by plane?* (Apart from during the COVID-19 pandemic)

**return flight = 2 times*

- Less than 1 time per year (1)
 - 1-2 times per year (2)
 - 3-5 times per year (3)
 - More than five times per year (4)
-

7. How would you describe your knowledge about environmental damages caused by the CO₂ emissions from the aviation industry?

- I have no knowledge about this (1)
 - I have some knowledge about this (2)
 - I have a lot of knowledge about this (3)
-

8. Consider this statement: I am concerned about environmental issues caused by the aviation industry

- Strongly agree (1)
 - Agree (2)
 - Neutral (3)
 - Disagree (4)
 - Strongly disagree (5)
 - I don't know (6)
-

9. Consider this statement: The environmental issues caused by the aviation industry make me less willing to travel by plane

- Strongly agree (1)
 - Agree (2)
 - Neutral (3)
 - Disagree (4)
 - Strongly disagree (5)
 - I don't know (6)
-

10. To what extent are you familiar with the concept of compensating for your CO₂ when buying a plane ticket?

- I have never heard of this (before starting this questionnaire) (1)
- I have heard about it, but never come across it (2)
- I have come across it when buying a plane ticket (3)

End of Block: Blz. 2

Start of Block: Blz. 3

11. How would you rate your knowledge on compensating for CO₂ when buying a plane ticket?

- I have no knowledge about this (1)
 - I have some knowledge about this (2)
 - I have a lot of knowledge about this (3)
-

12. Consider this statement: I am willing to pay more for my flight ticket to compensate for my CO₂

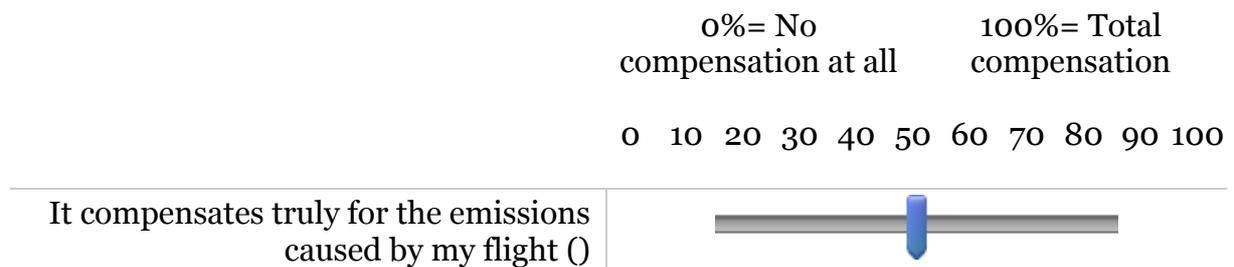
Imagine that compensation for a ticket from Amsterdam to Berlin will cost you around 2,50 euros. Compensating for a trip from Amsterdam to New York will cost you around 12 euros.

- Strongly agree (1)
 - Agree (2)
 - Neutral (3)
 - Disagree (4)
 - Strongly disagree (5)
 - I don't know (6)
-

13. Consider this statement: If the option to compensate for my CO₂ was provided, I would be willing to travel by plane more

- Strongly agree (1)
 - Agree (2)
 - Neutral (3)
 - Disagree (4)
 - Strongly disagree (5)
 - I don't know (6)
-

14. To what extent do you think that the provision of the option to compensate for your CO₂ when buying a plane ticket truly compensates for your part of the flight's emissions?



15. To what extent do you think that providing such an option could influence people's flying behavior?

- It does not influence people's flying behavior (1)
- It makes people willing to fly more (2)
- I don't know (3)

End of Block: Blz. 3

Appendix B: Overview of variables

Variable	Label	Measurement scale
Gender	2. What is your gender?	Nominal
Age	3. What is your age?	Ratio/Interval
Education	4. What is your highest completed degree?	Ratio/Interval
Occupation	5. Select your primary occupation	Ratio/Interval
Flying_behavior	6. How many times per year do you approximately travel by plane? (Apart from during the COVID-19 pandemic)	Ratio/Interval
Environment_knowledge	7. How would you describe your knowledge about environmental damages caused by the CO ₂ emissions from the aviation industry?	Nominal
Environment_concern	8. Consider this statement: I am concerned about environmental issues caused by the aviation industry	Ordinal
Travel_willingness	9. Consider this statement: The environmental issues caused by the aviation industry make me less willing to travel by plane	Ordinal
Familiar_compensation	10. To what extent are you familiar with the concept of compensating for your CO ₂ when buying a plane ticket?	Nominal
Knowledge_compensation	11. How would you rate your knowledge on compensating for CO ₂ when buying a plane ticket?	Nominal
Pay_willingness	12. Consider this statement: I am willing to pay more for my flight ticket to compensate for my CO ₂	Ordinal
Compensation_travel	13. Consider this statement: If the option to compensate for my CO ₂ was provided, I would be willing to travel by plane more	Ordinal
Extent_think_comp	14. To what extent do you think that the provision of the option to compensate for your CO ₂ when buying a plane ticket truly compensates for your part of the flight's emissions?	Nominal
Influence_behavior	15. To what extent do you think that providing such an option could influence people's flying behavior?	Nominal

Appendix C: Syntax SPSS

* Encoding: UTF-8.

DATASET ACTIVATE DataSet1.

CROSSTABS

/TABLES=Q2 BY Q12

/FORMAT=AVALUE TABLES

/STATISTICS=CHISQ

/CELLS=COUNT

/COUNT ROUND CELL

/METHOD=EXACT TIMER(0).

ONEWAY Q14 BY Q11

/MISSING ANALYSIS

/POSTHOC=SCHEFFE ALPHA(0.05).