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Department of Economics

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- a survey based on companies flying via Bromma Stockholm Airport

Louise Goding

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Louise Goding

Supervisor: Carl Johan Lagerkvist, Swedish University of Agricultural Sciences, Department of Economics

Examiner: Sebastian Hess, Swedish University of Agricultural Sciences, Department of Economics

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Abstract

An important source of carbon dioxide emissions is the aviation industry, which accounts approximately for 2 percent globally. Therefore, reducing these emissions has become a major challenge for air travel authorities worldwide. One solution to the problem is the deployment of bio jet fuel, which is a green alternative to the traditional jet fuel and can result in an 80 percent reduction in carbon dioxide emissions. The production of bio jet fuel, however, is to date more expensive relative to the production of traditional jet fuel and leads, as a result, to a higher price of flight tickets. Consequently, this study investigates Swedish companies' willingness to pay for flying with 50 percent bio jet fuel by employing the contingent valuation method. The results obtained show that the average price premium is 11.5 percent, and that significant differences in the level of willingness to pay are found for different flight destinations; a result that provides valuable insights into pricing strategies for airlines operating on these destinations. The fact that companies employ certain booking policies have as well significant impacts on the estimated willingness to pay. Overall, the results of this study will increase airlines' awareness about the economic possibilities for them to begin the process of implementing the green alternative.

Acknowledgements

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I hope you will enjoy reading my study.

Uppsala, June 2016

Louise Goding

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Chapter one – Introductory Summary

1.1 Introduction

The climate change and global warming are accelerating and have become serious global threats. Only in March 2016, a new record was set; the global land and sea temperature was 1.28 degrees Celsius warmer in March than the average temperature for March during the period 1951-1980 (NASA, 2016). Scientists point to the fact that much can be explained by last century's human expansion of greenhouse gases, where carbon dioxide is included. The aviation industry worldwide is today, according to International Air Transport Association (IATA), responsible for 2 percent of global carbon dioxide emissions, but this level is about to change as the deployment of bio jet fuel is increasing and more commercial airlines are shifting to the green and sustainable alternative. The transition, however, is too slow and much can be explained by the currently higher costs of producing bio jet fuel relative to the traditional petroleum-based jet fuel. A situation that has direct consequence on the price of bio flight tickets, but can be solved through a large-scale production.

In Sweden, the market for bio jet fuel is still at the introduction phase and few air travelers are aware of its existence. At the same time, an increasing number of people and organizations are becoming more aware of the environment and have a positive attitude towards sustainable products and eco-services. This study therefore aims to investigate the willingness to pay of Swedish companies to fly with bio jet fuel by employing the contingent valuation technique. A total of 136 companies responded the survey.

The findings of this study show that there is a demand and willingness to pay a price premium for flying with bio jet fuel. 72 percent of the companies stated a positive willingness to pay for green business flights, and the average willingness to pay amounts to 11.5 percent of the base price of flight tickets. Furthermore, significant differences in the level of willingness to pay are found for different flight destinations. Companies traveling to Ronneby stated on average higher price premiums than companies traveling to Halmstad. Lastly, whether a company employs booking policies for business trips, such as to always fly at the lowest price possible or to choose the transportation mode with the least environmental impact, or not have significant impacts on the estimated willingness to pay. Companies that do employ the former policy has a negative effect on willingness to pay, whereas the latter policy has a positive effect.

The findings, however, should be interpreted with caution. The models used are limited because of the risk of bias that arise with the employment of the contingent valuation technique, but also because all potential explanatory variables related to companies' willingness to pay for bio jet fuel are not included in the analysis. On the contrary, the study shows that there is a demand for flying with the green alternative, but that more efforts from airlines, Swedish authorities and others are needed in order to allow a faster transition.

1.2 Background

1.2.1 Aviation and Bio Jet Fuel

Since the Wright brothers' fundamental breakthrough of the world's first successful airplane, modern day aviation has played a major role in the process of globalization and social and economic development. It facilitates world trade and enables people from all around the world to travel long distances over short time-spans. In their report, the Air Transport Action Group (ATAG) (2014) estimated that, only in Europe, the aviation industry in 2012 generated a total of 11.7 million jobs, where 2.6 million of these were directly generated. The same year the aviation industry contributed to

approximately 4 percent of GDP in Europe, and air travel forecasts show that these figures will only continue to rise.

Despite the many benefits with the aviation industry, air travel is a large contributor to environmental degradation through emissions of carbon dioxide. According to IATA (2014), air travel accounts for about 2 percent of global fossil carbon dioxide emissions, and as a way to combat these emission levels, IATA in 2009 set the target of reducing 2050 aviation emissions to 50 percent of 2005 levels. To meet this environmental target, one part of their four-pillar strategy is the deployment of low-carbon fuels, such as biofuels. Biofuels are produced from renewable biological resources and it has been discovered that, relative to fossil fuels, sustainably produced biofuels result in an 80 percent reduction in carbon dioxide emissions across their lifecycle (ATAG, 2009). Fortunately, previous investments in the development of biofuels have enabled the use of bio jet fuel, known as drop-in fuel, without aircraft replacement. Bio jet fuel is hence completely interchangeable and compatible with traditional jet fuel. Therefore, it is not a coincidence that actors in the aviation industry have recognized the benefits of bio jet fuel and gradually incorporates it in their strategies as an important milestone for sustainable growth.

1.2.2 Bromma Stockholm Airport

The decision of addressing the study towards companies flying domestically via Bromma Stockholm Airport is due to the fact that a majority of all flight passengers are business travelers. The airport's proximity to the city center of Stockholm, along with fast check-in and security check, make Bromma an attractive choice for many air travelers. An estimation recently made by Stockholm Chamber of Commerce (2014) shows that as many as 90 percent of all passengers flying via Bromma Stockholm Airport are business-related.

The future of Bromma Stockholm Airport has during last decades been intensively debated among politicians, environmentalists and experts. As a consequence, the Swedish government decided in 2014 to start an investigation whether to shut down the airport or not (Government Offices of Sweden, 2014). In December 2015, however, it was decided to close the investigation as the airport's impact on economic growth and job opportunities, particularly in the Stockholm region, would suffer. The decision to not shut down Bromma in the near future will hence contribute to new investments and projects, such as the implementation of bio jet fuel, managed by affected airlines and other relevant actors.

1.3 Problem Statement

The deployment of bio jet fuel in the aviation industry is, as mentioned above, one part of IATA's four-pillar strategy in order for modern day aviation to achieve the environmental target and long-term sustainability. Fortunately, previous investments in the development of renewable jet fuel have enabled the use of it without aircraft replacement, and in 2011 the first commercial flights with bio jet fuel were conducted. The flights were shown to be successful concerning flight safety and emission levels and have led to an increased amount of commercial flights using the green alternative. (Radich, 2015)

The airlines' demand for bio jet fuel, however, is to date still relatively low and much can be explained by the price of the green alternative relative to the price of fossil fuel. In 2013, batches of bio jet fuel were approximately three to four times more expensive than jet fuel derived from petroleum (Byman and Höglund, 2015); a ratio which can explain the airlines' slow transition process in an already price sensitive market. Fiskerud (2016) argues that the most effective way to decrease this price gap is by a large-scale production of bio jet fuel as a result of an increased demand from airlines and air travelers.

Since the production of bio jet fuel to date involves relatively higher costs, the price of flight tickets will increase if airlines would decide to implement the green alternative. With the hope of increasing airlines' awareness, and for them to begin the process of implementing the green alternative, it is of interest to examine Swedish companies and their interest and willingness to pay a price premium for flying with bio jet fuel. Therefore, the research question for this study is:

What are Swedish companies' willingness to pay for flights using 50 percent bio jet fuel?

The results obtained from this study will not only provide actors in the aviation industry, both from the demand side and the supply side, valuable information about air travelers' interest in flying with bio jet fuel, but it will also give strong indications of how high the mark-up price of bio flight tickets can be before Swedish companies would decide to not book these flights.

The answer to the research question will also generate other valuable information, therefore one sub-question has been developed:

- Which company characteristics strongly affect a company's willingness to pay a price premium?

Thus, the answer to the sub-question will provide airlines with valuable insights into pricing strategies.

1.4 Research Method

In order to provide answers to the research question and its sub-question, an Internet-based survey was sent out to Swedish companies flying domestically via Bromma Stockholm Airport. As the main purpose of this study is to examine the possibilities for actors within the Swedish aviation industry, such as airlines and airport owners, to shift to sustainable jet fuel the survey has the intention to gather relevant data about companies' demand and willingness to pay a price premium for flying with the green alternative. The elicitation method employed in the survey, namely the payment card method, means that a company representative responsible for the company's booking and travel procedures is presented with a series of ordered payment amounts, ranging from low to high, where she is asked to mark the maximum amount that the company would be willing to pay extra for flying with 50 percent bio jet fuel.

First of all, to fully understand the contingent valuation method and the market for bio jet fuel thorough research about the valuation technique, but also the environmental effects and technical possibilities of fueling existing airplanes with the green and sustainable alternative, was conducted. Secondly, a pilot test was carried out at Bromma Stockholm Airport with the intention to gain valuable information regarding Swedish business travelers' booking procedures, their willingness to pay for flying with 50 percent bio jet fuel to different destinations and how they experienced the listed price levels and price intervals. Thereafter, the main survey was sent out to 2 614 companies using the customer records of Braathens Regional Airlines and Stockholm Chamber of Commerce. As a last step, the collected data was analyzed using the statistical software programs, Stata and SPSS.

1.5 Social and Academic Relevance

The market for bio jet fuel is to date still at the introduction phase as the public's awareness of its existence is limited as well as there are few air travel around the world powered with bio jet fuel. For that reason, there are limited, if any, research on air travelers' willingness to pay for flying with the green alternative. Thus, this study will provide valuable information about the Swedish market's demand and it will thus contribute to the aviation industry's process of scaling up the production of the green and sustainable alternative.

This study can as well make important contributions to the current literature within the contingent valuation practice as there are few articles employing the payment card format for this subject. As far as the author knows, previous studies have only estimated individual flight passengers' willingness to pay for carbon offsets, where none of these are addressed towards Swedish air travelers nor are employing the payment card format. There have also been few studies that are addressed towards companies, whereby this study will also provide a theoretical contribution to understanding the determinants of Swedish companies' willingness to pay. Considering all the above factors, it makes this study the first one to employ the payment card method for flight passengers' willingness to pay for eco-services, both within and outside of Sweden.

1.6 Structure of Thesis

This thesis consists of seven chapters in total. Chapter *two* is designed to provide the reader with information about bio jet fuel's role in commercial air travel. In *chapter three,* an overview of previous academic literature on the topic of the contingent valuation technique is given. Focus will be placed on willingness to pay studies that either examine the aviation industry using other elicitation methods than the one employed in this study, or studies that examine other markets using the same elicitation method. In *chapter four,* the theoretical approach of the problem will be presented, where the reader will gain an increased understanding of the theory behind the contingent valuation method and its potentials. *Chapter five* is designed to provide the reader with information about the data collection process. *Chapter six,* in turn, reintroduces the analytical framework selected and presents the results. Lastly, *chapter seven* concludes and discusses the findings of this study and gives theoretical and practical recommendations for future research.

Chapter two – Bio Jet Fuel in Commercial Air Travel

One of the main challenges for the aviation industry is to preserve the social and economic benefits derived from modern air travel, while minimizing its environmental impact rising from high levels of carbon dioxide emissions. According to IATA (2015), air travel today accounts for only 2 percent of global fossil carbon dioxide emissions, but the aviation industry recognizes that it must set ambitious goals and develop new strategies in order to achieve long-term sustainability. Being the first industry in the world to manage its environmental impact, IATA in 2009 set the target of reducing 2050 aviation emissions to 50 percent of 2005 levels. To meet this environmental target, the industry has adopted a four-pillar strategy where improvements in operations and infrastructure, the use of one global market-based economic measure, improvements in technology as well as deployment of sustainable low-carbon fuels are included. (IATA, 2015) The four-pillar strategy and its specific impact on carbon dioxide emission can be seen in Figure 1 below.

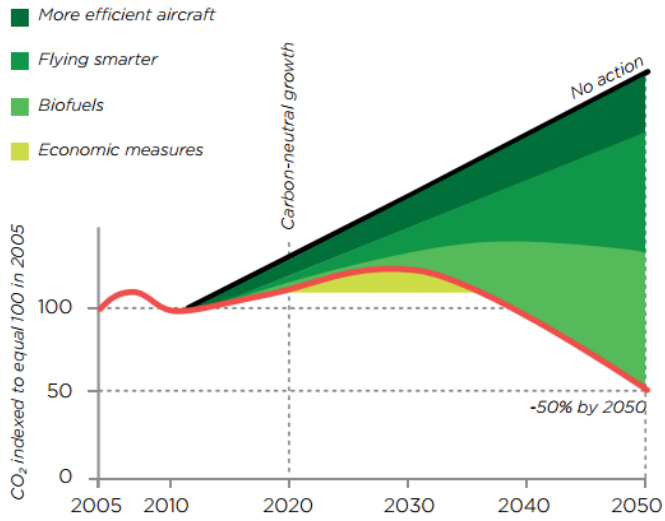

Figure 1 Common goals set by IATA for how the aviation industry can minimize carbon dioxide emissions
Source: IATA, 2015

One part of the four-pillar strategy that will have an important role for the aviation industry to achieve long-term sustainability is the deployment of bio jet fuel. Biofuels are produced from renewable biological resources, such as plant material, and has been discovered, relative to fossil fuels, to result in an 80 percent reduction in carbon dioxide emissions across their lifecycle (ATAG, 2014). There are both first-generation and second-generation biofuels, where the former is mainly used for road transportation, cooking and home heating. Second-generation biofuels, however, do not typically compete with the former as it is derived from other biological sources that are more suitable in aviation (ATAG, 2009). Thus, the main advantage of bio jet fuel is its flexibility as the production can be spread worldwide and across a number of different crops. A stable production, in turn, reduces airlines' exposure to the fuel cost volatility resulting from having a single source of energy, that is jet fuel derived from petroleum (Fiskerud, 2016). To date, bio jet fuel is completely interchangeable and compatible with traditional jet fuel, but only up to a mix of 50 percent (ATAG, 2009).

In 2011 the first commercial flights with bio jet fuel were conducted. These flights were shown to be successful concerning flight safety and emission levels and have led to an increased amount of commercial flights using bio jet fuel. To date, more than 1 500 passenger flights have taken place around the world and this number is expected to grow as the public becomes aware of its existence and hence

increases its demand. (Radich, 2015) On the other hand, the price of the renewable alternative relative to the price of fossil fuel was in 2013 estimated to be three times higher (ATAG, 2014); a ratio which can explain the airlines' slow transition process in an already price sensitive market. Furthermore, due to the fact of the recent year's falling price of fossil fuel, the relative price in 2016 has nearly doubled (Hörlin, 2016).

Another contributing factor to last decade's price gap between the two fuel sources is that there is no large-scale, continuous production of bio jet fuel. In Sweden, for example, where the market for bio jet fuel is still relatively small, each order is produced on demand (Byman and Höglund, 2015). But although the Swedish demand for bio jet fuel is relatively low, it is in the process of changing. Swedavia decided in 2016 to have green flights for all its official business travels; a decision that will have an important role in the process of increasing the Swedish market's demand for flying with bio jet fuel. (Swedavia, 2015)

Overall, the use of bio jet fuel has great potential in modern day aviation as it enables future air travel and at the same time reduces the risk of environmental degradation. To overcome the key barrier of the deployment of the green alternative, an increased demand from airlines and air travelers, which in turn will increase the incentives for bio jet fuel producers, is needed (Fiskerud, 2016).

Chapter three – Previous Literature

Determining the effects of a policy change, or the introduction of a product in a non-existing market, through the use of the contingent valuation method has been debated for decades. On the one hand, critics including Breidert et al. (2006) and Diamond et al. (1993) have all argued against the use of this direct valuation technique, on grounds of its' inability to truly reflect economic agents' purchase behavior in a real market. Others, such as Carson et al. (2001) and Blumenschein et al. (2008) argue instead that with a proper administration and implementation of the contingent valuation technique, the method can provide reliable and meaningful results from a hypothetical market setting.

Numbers of papers have attempted to overcome potential issues with incorrect estimates of individuals' preferences by comparing hypothetical willingness to pay to real willingness to pay in field experiments. Concerns regarding hypothetical bias in contingent valuation studies are often stressed by critics as the major issue when comparing the two. In their study of individuals' willingness to pay for a diabetes management program, Blumenschein et al. (2008) examined the effectiveness of cheap talk and certainty statements to eliminate hypothetical bias by comparing the outcomes of three groups treated either by real or hypothetical purchase offers. It was shown that certainty statements, but not cheap talk, was an effective method to eliminate the bias and thus provide accurate willingness to pay estimates. Brown et al. (2003), on the other hand, found evidence that the effectiveness of the cheap talk approach varied with the price level of the proposition to be voted on. At low price levels, there was a clear difference between hypothetical willingness to pay and real willingness to pay. Fix and Loomis (1997), in turn, investigate whether real market data and hypothetical market data differ in the estimation of the economic value of mountain biking, and found that the difference was not statistically significant.

Moving away from the debate about real market data and hypothetical market data, the literature investigating differences between contingent valuation methods, such as the payment card format and the dichotomous choice approach, is equally abundant, but less divided. Most have focused on the occurrence of varying willingness to pay estimates generated from the two methods. In their study of individuals' willingness to pay for environmental improvement through the purchase of wind-generated electricity, Champ and Bishop (2006) found evidence of larger estimates using the dichotomous choice approach. Similar findings were shown in the study by Ryan et al. (2004), where they investigate Scottish individuals' willingness to pay for different health care interventions. Consistent through the literature, the larger estimates from the dichotomous choice approach can be a result of yea-saying; a situation that arise when the respondent tends to agree with the statement when in doubt. Others, such as Kramer and Mercer (1997), found instead a slightly higher willingness to pay estimate generated by the payment card format when examining US residents' preferences for tropical rain forest preservation.

Literature concerning economic agents' preference of improved environmental quality through the use of bio jet fuel, however, is limited, if not non-existing. Brouwer et al. (2008) examined flight passengers traveling via Amsterdam Schiphol Airport and their willingness to pay to offset their carbon dioxide emissions generated from their air travel, i.e. the focus was put on climate compensation rather than climate reduction as in the case of bio jet fuel. MacKerron et al. (2009) conducted a similar study and investigated British young adults' willingness to pay for carbon offsets, only considering flight passengers flying between New York and London. Both studies employed the double-bounded and the single-bounded dichotomous approach respectively and estimated mean willingness to pay of €26.6 (≈ 240 SEK)[1] and £24.26 (≈ 330 SEK)[2].

[1] Exchange rate in 2006-12-01: 1 EUR = 9,011 SEK. www.xe.com
[2] Exchange rate in 2008-04-01: 1 GBP = 13,740 SEK. www.xe.com

To conclude the findings of previous literature, one can argue that the results are both speaking for and against the use of the contingent valuation technique. Although there is controversy over the use of the technique, new research is continuously being conducted to improve the practice and to increase the reliability and validity of the results. In Table 1 below, a summary of abovementioned studies is presented.

Table 1 Overview of previous literature

Study	**The Good**	**Main Findings**
Hypothetical vs. Real Willingness to Pay		
Blumenschein et al. (2008)	Groups divided into hypothetical with cheap talk, hypothetical with certainty statements, and real payment settings to estimate their willingness to pay for a diabetes management program.	Certainty statements remove the hypothetical bias and thus match a real market setting. The cheap talk approach has no significant impact on hypothetical bias.
Brown et al. (2003)	Groups divided into hypothetical, hypothetical with cheap talk script, and real payment settings to estimate their willingness to pay to provide scholarship aid to students in need.	Cheap talk script appears to increase in effectiveness as payment level, and correspondingly hypothetical bias, increase.
Fix and Loomis (1998)	Compares the economic value of mountain biking using real and hypothetical market data.	No statistical difference between real and hypothetical estimates.
Payment Card vs. Dichotomous Choice		
Champ and Bishop (2006)	Individuals' willingness to pay for wind power.	Lower willingness to pay estimates when employing the payment card format.
Ryan et al. (2004)	Scottish citizens' willingness to pay for different health care interventions.	Higher willingness to pay estimates when employing the dichotomous choice approach, most likely due to yea-saying.
Kramer and Mercer (1997)	US citizens' willingness to pay for tropical rain forest protection.	Slightly higher willingness to pay estimates using the payment card format.
Willingness to Pay for Carbon Offset in Air Travel		
Brouwer et al. (2008)	Schiphol flight passengers' willingness to pay for carbon offset using the dichotomous choice approach.	Mean willingness to pay amounted to approximately 240 SEK.
MacKerron et al. (2009)	British flight passengers' willingness to pay for carbon offset using the dichotomous choice approach.	Mean willingness to pay amounted to approximately 330 SEK.

Chapter four – Conceptual Framework

4.1 Welfare Economics

The economic theory associated with the contingent valuation method employed in this study is welfare economics (Bateman et al., 2002). Welfare economics seeks to define whether a potential change in an individual's or a company's utility resulting from a change in an economic variable, in this study improved environmental quality by reductions of carbon dioxide emission from air travel, is positive (Carson et al., 2001). The welfare implications resulting from this change are usually expressed in terms of a change in an index, such as a monetary amount, which would need to be taken from, or given to, a company to keep its overall level of utility constant (Mitchell and Carson, 1989). In order to keep the overall level of utility constant for a given company in this study, a monetary amount must be taken away from the company as the use of bio jet fuel has positive effects on climate and thus the company's utility. Consequently, it can be assumed that the company makes a trade-off decision between income and environmental quality, which can be seen in Figure 2 below. In its simplest form, a given company's utility (U) is an increasing function of income (I) and environmental quality (E), where the purchase of bio flight tickets will improve the environmental quality, E to E'. As the environmental quality increases, so does the company's utility, i.e. U to U'.

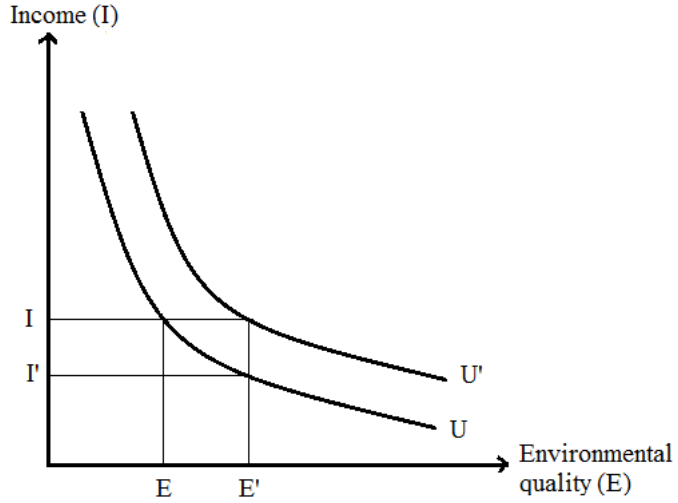

Figure 2 A company's trade-off decision between income and environmental quality
Source: Mensah, J., 2015

The above reasoning brings us to the concept of compensation variation which measures the amount of money that should be taken away from the company such that it has the same level of utility as before the policy change, U. The compensating variation is thus the maximum amount the company is willing to pay in order to have the environmental improvement happen, i.e. the difference between I and I' (Mensah, J., 2015).

Furthermore, the concept of compensating variation originates from the formal relationship between willingness to pay and a demand curve, where Mitchell and Carson (1989) argue that the Hicksian demand curve, rather than the Marshallian demand curve, best describes measures of benefits (consumer surplus) resulting from a policy. The reason is that the Marshallian demand curve does not hold the level of utility constant, but rather holds the level of income constant. In this study, the examined companies' income will not be held constant as the objective is to examine their willingness to pay for flying with bio jet fuel. Thus, it leads us to the conclusion that the Hicksian compensating measure will be used.

In Figure 3 below, companies' theoretical demand curve for improved environmental quality through the purchase of bio flight tickets is presented. Moving down the curve, points on the Hicksian demand curve show the additional price that companies would be willing to pay for different quantities of bio flight tickets. For a quantity increase of bio flight tickets from E to E', the Marshallian consumer surplus is the quantity associated with the area under the Marshallian demand curve, D^M, (that is a + b), whereas the Hicksian compensating surplus is the quantity associated with the area under the Hicksian demand curve, D^H, (that is a). (Mitchell and Carson, (1989) Area a shows accordingly an exact measurement of the company's willingness to pay while area a + b can be regarded as an approximation. It should be noted that the Hicksian compensating surplus is less than the Marshallian consumer surplus.

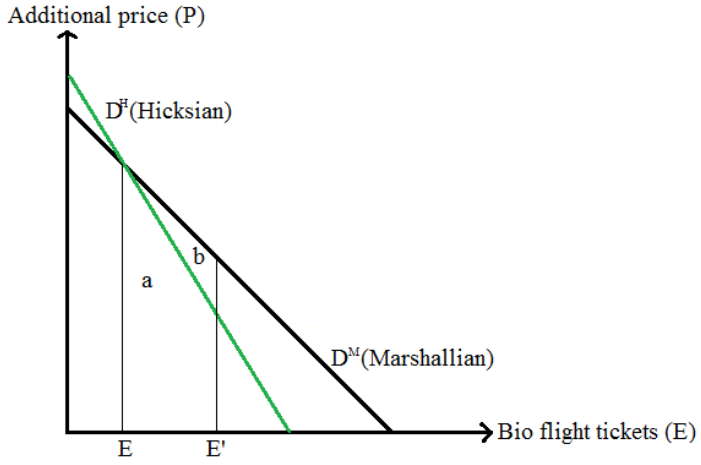

Figure 3 Companies' theoretical demand for bio flight tickets
Source: Mitchell and Carson, 1989

The principle used by welfare economics to evaluate a given policy, such as the deployment of aircrafts powered with bio jet fuel, is whether that policy is Pareto-improving. A Pareto-improving policy is one where resources are allocated in such way that there still exists possibilities of further gains of economic efficiency. Assuming that all companies maximize their benefits by acting according to its own preferences, economic efficiency in a competitive market will increase. (Mitchell and Carson, 1989) According to Boardman et al. (2011), the crucial point of a Pareto-improving policy is that "…if, and only if, the aggregate net benefits of the policy as measured by the WTP of all affected individuals are positive, then there exist sets of contributions and payments that would make the policy a Pareto improvement over the status quo." In accordance, the estimated willingness to pay in this study will give clear indications of Swedish companies' benefits with flying with bio jet fuel, which is a first step to see whether the deployment of bio jet fuel is Pareto-improving.

Rather than focusing on the aggregate net benefits of a policy it can be of interest to examine the distribution of individual benefits. In that way, the researcher or policy maker can gain valuable information about the percentage of respondents willing to pay various amounts for the environmental good in question, but also information about median willingness to pay and mean willingness to pay are gained which are essential in the decision whether to undertake the project and, if so, the method of financing it (Mitchell and Carson, 1989). According to economic theory, the percentage of respondents willing to pay a specific price should fall as the price they are asked to pay increases (Carson et al., 2001). This can be seen in Figure 4 below. As this phenomenon is almost universally observed in contingent valuation studies, the same is expected in this study.

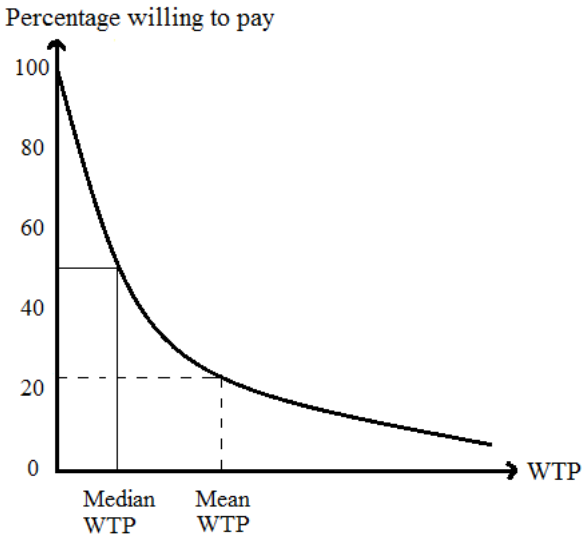

Figure 4 Percentage of companies willing to pay various amounts for bio flight tickets
Source: Mitchell and Carson, 1989

The most important implications of the theory for assessing economic impacts of a policy change by using the contingent valuation method have now been presented, and it can be concluded that the method stands on firm theoretical ground. In the section below, a comprehensive description of the valuation technique and its properties is given.

4.2 Contingent Valuation Method

Contingent valuation (CV) has become one of the most widely used non-market valuation techniques, especially in the area of environmental cost-benefit analysis. It was first introduced in the early 1960s by the economist Robert K. Davis and has ever since, owing to the development of several valuation techniques in recognition of its importance, been frequently used by economists worldwide. (Mitchell and Carson, 1989)

CV methods are one of the main categories of stated preferences methods. Stated preference methods are employed when there is no market for the product or service in question, but it is of interest to examine the hypothetical behavior of individuals and companies in that potential market. As the primary use of CV is to elicit individuals' or companies' willingness to pay for a hypothetical product or service, survey questions are employed. (Competition Commission, 2010)

Despite the fact that this direct approach to elicit economic agents' preferences is considered to be a flexible and useful valuation technique for researchers, it is subject to heavily criticism concerning the validity and reliability of the results. Breidert et al. (2006) among others argue that the hypothetical market setting makes it difficult for respondents to provide their true preference that corresponds to real economic choices, which therefore can cause invalid and non-reliable estimates of willingness to pay. Concerns regarding hypothetical bias, but also strategic behavior which arise when the respondent intends to influence the final outcome, are often stressed by CV critics as the major issues (Boardman et al., 2011) (Carson et al., 2001).

However, with a proper administration and implementation of the CV method, and with the implementation of several measures in order to eliminate or minimize potential biases, Venkatachalam (2004) and (Bateman et al. 2002) argue that CV is a promising method that can be used to derive valuable information about economic agents' preferences.

4.2.1 Elicitation Method

After have decided to employ the CV method, the next step for a researcher to take a position on is the choice of elicitation method, where the choice of which to use depends on the nature of the product and the type of welfare effects the study intends to measure. Extensive research on the choice of method has been carried out where researchers have arrived to the result that some methods are more statistically reliable than others. Furthermore, the choice has also shown to be of considerable importance as the different methods vary in their familiarity to respondents, in their ability to obtain the optimal amount of information and in their risk of producing biased willingness to pay estimates (Mitchell and Carson, 1989). Not only that, the researcher is also faced with a trade-off between above properties and the study's time and budget constraint (Breidert et al., 2006).

In the literature there are four major elicitation methods, namely the open-ended format, the bidding game, the payment card format and the dichotomous choice approach. The payment card format, which is used in this study, is the second oldest technique and was developed by Mitchell and Carson in the early 1980s (Mitchell and Carson, 1989). The format means that, after have been given a detailed and informative description about the effects of the specific policy change, the respondents are presented with a series of ordered payment amounts, ranging from low to high, where each respondent usually is asked to circle the maximum amount she would pay for the product or service in question. (Bateman et al., 2002) The format usually creates willingness to pay estimates in interval form, but there is a possibility to estimate a precise value using a follow-up question where the respondent is asked to state her exact willingness to pay amount within this interval.

The payment card format, but also the dichotomous choice approach, are according to Bateman et al. (2002) and Competition Commission (2010) the recommended methods to employ in a CV study. In contrast to the open-ended format and the bidding game, the two methods imply lower non-response rates and facilitate the respondent's valuation task. Furthermore, the open-ended format fails to elicit as reliable results as the other methods due to its simple design. When at last comparing the recommended methods, Mitchell and Carson (1989) argue that, in contrast to the payment card format, dichotomous choice approach imply statistical inefficiency.

Overall, given the properties of the four elicitation methods one can say that each one of them imply advantages and disadvantages of various degrees. Considering the nature of the product and the type of welfare effects that this study intends to measure, the payment card was reckoned to be the most appropriate.

4.2.2 Reliability and Validity of the Payment Card Format

As stated above, along with the employment of the payment card format follows different sorts of biases. For that reason, to ensure reliability and validity of a study, it is the researcher's responsibility to minimize these biases by various means. Table 2 below gives an overview of the benefits and potential biases that can arise when employing the payment card format. Solution to these biases are also presented.

Table 2 Summary of the main properties of the payment card format and solutions to minimize potential biases

Advantages	Disadvantages	Solution to bias
• Cost efficient	• Risk of range bias	♦ Use a sufficiently high upper limit
• Informative	• Risk of centering bias	♦ Provide an even number of listed payment amounts
• Provides a value context to the policy change	• Risk of influencing the respondent's valuation task	♦ Conduct a thorough market analysis
• Avoids starting bias		
• Reduces number of outliers		

Source: Bateman et al., 2002 and Mitchell and Carson, 1989

The fact that the respondent is presented with listed payment amounts, rather than being asked to state a value out of the air, provides a value context to the policy change and eliminates the risk of starting point bias. It also reduces the number of outliers relative to other elicitation methods as the respondent can only choose between the listed amounts. (Bateman et al., 2002) On the other hand, there are a few downsides to this format. First of all, assume a situation where the respondent is willing to pay an amount that is higher than the listed alternatives; a situation that can influence her valuation task and thus the final willingness to pay estimate. To minimize this range bias, Rowe et al. (1996) argue that there must be a sufficiently high upper limit such that the respondent does not feel restricted in her valuation. Secondly, the listed amounts can increase the risk of centering bias, a situation that arise when the respondent feels uncertain about her true preference and therefore, for simplicity, choose the middle option. In this case, Mitchell and Carson (1989) suggest the researcher to provide an even number of listed payment amounts such that there is no evident middle option. Lastly, there is a risk in general of influencing the respondent in the employment of the payment card format. This bias resembles the aforementioned situations and arises as the respondent becomes influenced by the listed amounts. By conducting a thorough market analysis of the likely costs of the product being evaluated in order to make the listed payment amounts as actual and real as possible, this type of biased can be minimized. (Bateman et al., 2002)

Overall, due to the fact of the researcher's potential to minimize biases by various means and that the format is one of the more cost efficient and informative elicitation methods, the payment card format is being extensively used in CV studies.

4.2.3 Survey Mode

In addition to the choice of elicitation method, the researcher has to take a position on the most appropriate survey mode to employ when collecting data. Which of the many modes to choose depends on several factors. In the literature there are four major technologies for administering surveys, namely face-to-face interviews, telephone interviews, mail surveys and Internet surveys, where each of them has its strengths and weaknesses. The former two, for example, are characterized by higher costs and time inefficiency, whereas the latter two have shown to be both less costly and more time efficient (Boardman et al., 2011). Moreover, face-to-face interviews enables the interviewer to clarify any ambiguity in the questions and to provide additional information to the respondent; courses of action that are not as possible in a mail survey. In an Internet survey, however, the risk of interviewer bias is minimized and it facilitates the provision of complex information. (Competition Commission, 2010)

Internet surveys, the survey mode employed in this study, are being extensively used in CV studies as the number of individuals and companies worldwide using the Internet are rapidly increasing. Lindhjem and Navrud (2011) examined the difference in willingness to pay estimates when using an Internet survey and face-to-face interviews, and found no evidence of survey mode effects. Marta-Pedroso et al. (2007), on the other hand, found a much lower response rate from the Internet survey when comparing the two survey modes. Depending on the policy change being evaluated, both authors eventually recommend Internet surveys as it can provide reliable and more cost efficient results.

As can be seen, each survey mode differs, for instance, in terms of cost, quality and quantity of data, response rate and the time necessary to collect data. Finally, what is important for the researcher to recognize is to choose the survey mode that ensures that the sample is representative of the target population.

4.3 Company Characteristics' Effect on Willingness to Pay

The sub-question of this study attempts to answer which company characteristics that affect a company's willingness to pay a price premium for flying with bio jet fuel. Identifying these company characteristics is important due to various reasons, such as to ensure that the sample is representative of the population from which it was drawn and to control the willingness to pay estimate for different company characteristics in the regression analysis (Bateman et al, 2002).

Research on this topic, but also on companies' purchase behavior of environmental friendly products, is limited whereas there exists extensive research on individual consumer behavior. However, when measuring European small and medium-sized companies' attitudes towards renewable energy and energy efficiency, Vazquez-Brust and Sarkis (2012) state that annual turnover, number of employees and environmental concern are strong determinants. Furthermore, in their study, Laroche et al. (2001) find that individual consumers with environmental concern are more likely to pay a price premium for green products. As these studies show and according to what is consistent with economic theory (Mitchell and Carson, 1989), an economic agent's income, but also her environmental concern, are strong, positive determinants of the estimated willingness to pay.

Whether a company is public-owned or private-owned, or depending on the line of business the company operates in, can also affect the stated willingness to pay. This is shown in the study by Wang and Lall (1999), where they estimate Chinese companies' willingness to pay for water use. The results show that state ownership had a negative significant impact on willingness to pay, whereas different line of businesses had significant mixed effects. In addition, Carlsson (1999) shows that main mode of transportation for company employees can also have an effect on the stated willingness to pay. He argues that rail passengers have higher price elasticity for air travel, while at the same time, business travelers are in general more sensitive to changes in travel time than changes in price. This suggests that, given that a company primarily travels by train, it could have a mixed effect on their stated willingness to pay. An overview of above factors is presented in Table 3 below.

Table 3 Possible determinants of willingness to pay and expected direction

Vector of company characteristics	Regression coefficient	Expected direction
♦ Public-owned company (PUBLIC)	♦ Dummy, $D_i = \begin{cases} 1\ if\ public \\ 0\ if\ otherwise \end{cases}$	Negative
♦ Number of employees (EMP)	♦ Dummy	Positive
♦ Annual turnover (AT)	♦ Dummy	Positive
♦ Booking policy (POL)	♦ Dummy	+/-
♦ Environmental concern (ENV)	♦ Dummy	Positive
♦ Line of business (LOB)	♦ Dummy	+/-
♦ Train as first choice (TRAIN)	♦ Dummy, $D_i = \begin{cases} 1\ if\ train \\ 0\ if\ otherwise \end{cases}$	+/-

One out of seven vectors presented in Table 3, namely booking policy, has not yet been mentioned in existing literature regarding company characteristics' effect on willingness to pay. However, this vector could lead to omitted variable bias if not included in the regression function. First of all, whether a company has a policy for business travels might not by itself effect their stated willingness to pay. However, depending on the type of policy it can be a significant determinant. If the booking policy urge employees at all times to choose the least expensive ticket, for example, one might expect that the company's willingness to pay a price premium for a green product amount to low values, or even to zero. On the other hand, if the booking policy instead urge employees to also consider the environmental effects of their travel, the opposite might occur. In the case of companies' booking policies, mixed effects on willingness to pay are expected.

The models used in this study to investigate Swedish companies' willingness to pay are two linear mixed-effects models, or more specifically one with a repeated measure design and one random intercepts model. A linear mixed-effects model is an extension of linear regression models for data that are collected and summarized in groups, and have as a key feature both fixed and random effects. (IBM, 2013) Fixed-effects terms are generally thought of as variables whose values of interest reflect the population average, whereas random-effects terms are associated with variables in which the set of potential outcomes can change. The fact that it allows for both effects enables the data to exhibit correlated and non-constant variability; a situation that is not possible in simpler models. The linear mixed-effects model is particularly useful in settings where repeated measures are made on the same sampling units, as in the case of panel data, or where measurements are made on clusters of related sampling units, as in the case of clustered data. Additionally, the ability to fit complex covariance and variance structures for panel data is another advantage of using the model. (NCSS, 2016)

The general form of the linear mixed-effects model is the following:

$$Y_{ij} = X_{ij}\beta + Z_{ij}\gamma + \varepsilon_{ij} \quad (1)$$

where

Y_{ij} is the observed dependent variable for company i, (WTP_i)
X_{ij} is the covariate vector for fixed effects
β is the fixed effects coefficient
Z_{ij} is the covariate vector for random effects
γ is the random effects coefficient
ε_{ij} is a multivariate normally distributed error term

The application of the linear mixed-effects model is preferable to other models by reason of the structure of the data set used in this study. The fact that respondent companies are asked two willingness to pay questions in total, where the first considers the destination that each specific company most frequently travels to, and where the second considers each specific company's top-2 destination, creates panel data. With a repeated measure design, correlated data within subjects that arise as a results of two willingness to pay measures for each company is allowed to be explicitly modeled. Furthermore, the use of a random intercept model enables individual differences between companies as it can be assumed that companies have different "baseline" willingness to pay. In order to solve this, a random effect for companies is added by assigning different intercept values for each one of them. The repeated measure design and the random intercepts model will highlight the reliability and validity of the model respectively.

Chapter five – Valuation Approach

5.1 Literature and Bio Jet Fuel Research

The market for bio jet fuel is to date still at the introduction phase as the public's awareness of its existence is limited as well as there are few air travel in Sweden powered with bio jet fuel (Fiskerud, 2016). For that reason, thorough research about the upcoming market and its potential consumers is necessary in order to obtain as reliable and valid results as possible.

Previous studies within this topic have estimated individual flight passengers' willingness to pay for carbon offsets, where none of these are addressed towards Swedish air travelers nor are employing the same elicitation method used in this study. Consequently, extensive research was performed to find academic literature on related topics, namely the themes of contingent valuation methods and how it can be employed within the market of green products and services.

Research and the development of biofuels in road transport is well ahead of the production and use of biofuels in the aviation industry. Therefore, to gain a deeper understanding of bio jet fuel, specifically its potential use and ensuing environmental effects, several state authorities, airlines and interest organizations with different objectives were contacted. The aim of contacting several actors was to ensure that a complete overview of bio jet fuel was given. Likewise, it was of great importance to hear these actors' view of probable future price of bio flight tickets; price information that was later used as a starting point in the pilot test and hence in the main survey.

5.2 Data Collection

In Figure 5 below, an overview of the main steps in the data collection process is presented, where the literature and bio jet fuel research have already been reviewed. Briefly described, quantitative data from the main survey was collected during four weeks in April 2016 and forms the basis for the final results.

Figure 5 Timeline for the data collection process

In the sections below, a more detailed description about each step is given.

5.2.1 Pilot Test

To ensure high levels of reliability and validity of this study, a pilot test was carried out during three days in February 2016 at Bromma Stockholm Airport, where the questionnaire was tested on business travelers waiting at the gate for departure. The questionnaire was constructed in Google Forms format and respondents answered the questions using a tablet. The main purpose of the pilot test was to identify and correct potential problems prior to the main survey, i.e. to gain valuable information regarding Swedish business travelers' booking procedures, their willingness to pay for flying with 50 percent bio jet fuel to different destinations and how they experienced the listed price levels and price intervals. A total of 51 business travelers responded the questionnaire.

To ensure that the questions asked were properly designed and to obtain as reliable and valid results as possible, several measures were implemented. Firstly, before carrying out the pilot test at Bromma Stockholm Airport it was pretested on partner companies, supervisor and fellow students. It was shown

to be an effective way in improving the quality of the questionnaire. Secondly, to ascertain the representativeness of the surveyed business travelers relative to the targeted population the pilot test took place on a Wednesday afternoon, a Thursday morning and a Friday morning during different weeks. Lastly, the surveyed respondents were randomly chosen by the author.

5.2.2 Main Survey

Before constructing the main survey an analysis of the pilot data was conducted. Information obtained from the analysis provided valuable insights of companies' (represented by an employee) willingness to pay for flights using 50 percent bio jet fuel and to what extent companies practice specific booking policies. The pilot test contributed to several improvements in the design and questions asked in the main survey.

In the beginning of April 2016, the main survey was sent out to 2 614 companies with operations located in different parts of Sweden. Of these 2 614 companies, the survey was sent out to 916 companies using the customer records of Braathens Regional Airlines and to 1 698 companies using the customer records of Stockholm Chamber of Commerce. The fact that the customer records of both Braathens Regional Airlines and Stockholm Chamber of Commerce are used enables a representative sample of the targeted population as there is a spread of companies with different characteristics, i.e. size, type of ownership and line of business etc. However, it also gave rise to a situation where some companies received duplicate mailings.

The main survey is Internet-based and was constructed in the survey platform, Netigate. The companies received the questionnaire from a link via e-mail sent from Braathens Regional Airlines and Stockholm Chamber of Commerce. With the purpose of maximizing the number of responses received, a total of two mailings and two reminders took place during a four-week period. In the first part of the survey, introductory questions regarding company characteristics, such as number of employees, annual turnover, environmental activities, booking policies and alternative transportation modes were asked. In the second part, the respondents were given information about bio jet fuel and what effects it has on carbon dioxide emissions, where they subsequently were asked to take a position on whether the company would be willing to pay a price premium or not. If positive, two willingness to pay questions were asked, where the first considered the destination that each specific company most frequently travels to, and where the second considered each specific company's top-two destination. All questions were asked in Swedish and the responses were recorded anonymously. (See Appendix C for the entire survey)

For the results of this study to be valid and relevant it is important that the company representative responding the survey has the authority to make decisions regarding the company's travel expenses. Otherwise, a respondent lacking this authority may base her answer on other non-relevant factors. To minimize the bias, information was given to the initial receiver of the survey to forward it to a company representative with the appropriate authority. In addition, to further ensure that the respondent is the correct one, questions regarding type of employment and whether she has authority were asked.

As this study is based on Swedish companies flying domestically via Bromma Stockholm Airport it is essential that the surveyed companies in fact travel via Bromma Stockholm Airport and thus can relate to the product in question, namely flying domestically with bio jet fuel. Therefore, information given prior to the survey urged only targeting companies to respond the questionnaire.

In the next chapter, the final analysis of the data collected in the main survey is presented.

Chapter six – Results

6.1 Preliminary Analysis

The survey resulted in 229 responses. Of these 229 responses, 139 are complete and 90 are incomplete. The high level of incomplete responses may be due to the fact that the survey was Internet-based, i.e. respondents could quit and leave the web-page at any time. The 90 incomplete questionnaires are considered as missing data and are thus not included in further analysis. Moreover, in order to ensure that the respondent has the authority to make decisions regarding the company's travel expenses, one Yes/No-question was asked. It resulted in that additional three responses were removed from the data. Finally, it can be concluded that a total of 136 responses can be used for further analysis.

6.1.1 Sample Characteristics

In Table 4 below, a summary of the respondents' background characteristics is presented. In short, 91.2 percent of the sampled companies are privately owned, 39 percent of all companies have more than 250 employees and 39.7 percent have an annual turnover of more than 500 million SEK. In this study, companies with number of employees less than 50 are considered to be small companies. The same definition is applied to companies with an annual turnover less than 100 million SEK. The explanatory variable "Environmental Concern" is based on answers from six questions about the sampled companies' environmental activities and sustainability classification, and serves as a measure of the companies' overall environmental concern. Companies with very high environmental concern amounts to 6.6 percent, whereas 15.4 percent have negligible environmental concern. (See Appendix B.2 for further description) Furthermore, questions regarding the companies' booking policies were asked, where 32.4 percent stated that business trips should be booked at the lowest price possible and 13.2 percent stated that employees must consider the environmental impact when choosing transportation mode. (See Appendix B.1 for detailed description of the background characteristics)

Table 4 Descriptive statistics of explanatory variables

Explanatory variables	Description	Frequency (N = 136)	Percent (%)
Sector	Binary variable = 1 if "Public"		
Public		12	8.8
Private		124	91.2
Employees	Binary variable = 1 if "1-9", "10-49"		
1-9		37	27.2
10-49		23	16.9
50-249		23	16.9
>250		53	39.0
Annual Turnover	Binary variable = 1 if "0-20", "20-100"		
0-20 mSEK		40	29.4
20-100 mSEK		16	11.8
100-500 mSEK		26	19.1
>500 mSEK		54	39.7
Environmental Concern	Categorical variable		
Negligible	0	21	15.4
Very Low	1	19	13.9
Low	2	27	19.9
Medium	3	25	18.4
Moderately High	4	22	16.2
High	5	13	9.6
Very High	6	9	6.6
Booking Policy			
Lowest Price Possible	Binary variable = 1 if "Yes"	44	32.4
Environmental Friendly	Binary variable = 1 if "Yes"	18	13.2

6.2 Willingness to Pay

The results of the data analysis of the willingness to pay of Swedish companies for flying with 50 percent bio jet fuel are presented in Table 5 below. As described earlier, the respondents were asked two willingness to pay questions in total, where the first considered the destination that each specific company most frequently travels to, and where the second considered each specific company's top-2 destination. Considering all 136 companies' stated willingness to pay, i.e. when the number of observations accordingly amount to 272, the mean willingness to pay for flying with 50 percent bio jet fuel is 11.50 percent of the base price of flight tickets. It should be mentioned, however, that nearly 28 percent of the companies are not willing to pay a price premium, a situation which clearly pushes down the estimated mean.

When examining top-1 destination and top-2 destination separately, i.e. when the number of observations are 136 each, the mean willingness to pay amounts to 11.95 percent and 11.06 percent of the base price of flight tickets. Again, the fact that nearly 28 percent stated a zero willingness to pay estimate pushes down the estimated mean.

The two destinations that the sampled companies stated that they fly to the most are Malmö and Gothenburg with 64 and 56 observations in total respectively. The results show that the mean willingness to pay for those companies that fly from Bromma Stockholm Airport to Malmö Airport with 50 percent bio jet fuel is 15.07 percent or 233 SEK, where the base price for a regular flight ticket is 1 542 SEK. Correspondingly, flying from Bromma Stockholm Airport to Gothenburg-Landvetter Airport gives a mean willingness to pay of 15.41 percent or 227 SEK, with a base price of 1 472 SEK.

Table 5 Swedish companies' mean willingness to pay for flying with 50 percent bio jet fuel

	Mean WTP	**Observations**
All	11.50 %	272
Top-1 Destination[a]	11.95 %	136
Top-2 Destination[a]	11.06 %	136
Malmö[a]	15.07 % (233 SEK)*	64
Gothenburg[a]	15.41 % (227 SEK)**	56

*Base price is 1 542 SEK excl. taxes and charges
**Base price is 1 472 SEK excl. taxes and charges
[a] See Appendix B.7-B.10 for regression analysis

In Figure 6 below, the distribution of the respondent companies' willingness to pay a price premium is shown. As in line with economic theory, the number of companies willing to pay a higher price premium for flying with bio jet fuel are less than the number of companies that are willing to pay a lower price premium. Thus, there is a negative relationship between willingness to pay and the number of companies. While the mean willingness to pay is 11.50 percent, the median willingness to pay amounts to 10.20 percent of the base price of flight tickets.

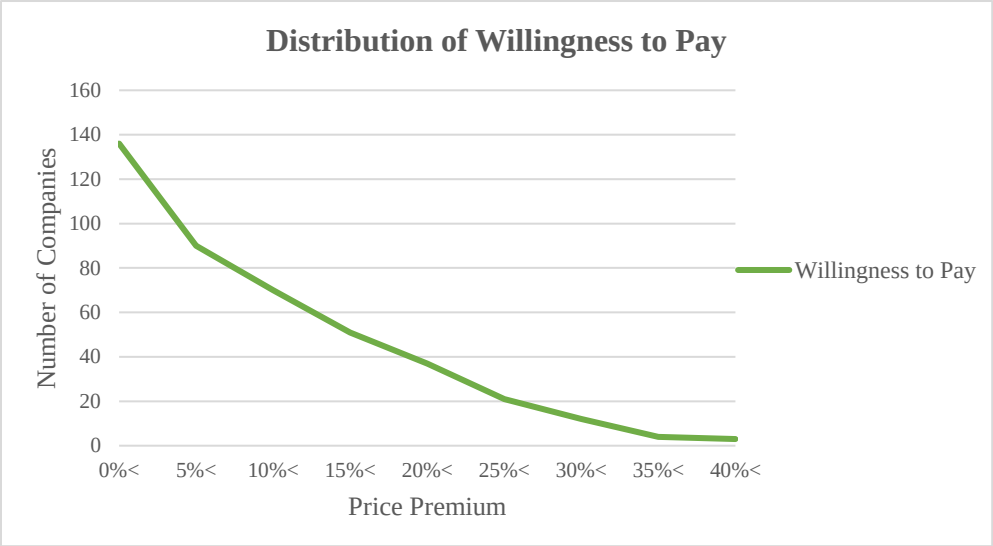

Figure 6 Distribution of Swedish companies' willingness to pay

6.2.1 Determinants of Willingness to Pay

Company characteristics' impact on the willingness to pay results presented in Table 6 below are analyzed in the statistical software SPSS through two linear mixed-effects models, where a repeated measure design and a random intercepts model are used respectively. As mentioned earlier, the benefit of using mixed models is that it enables both fixed and random effects in the same model, and thus allows a wide variety of correlation patterns to be explicitly modeled. In the two models, explanatory variables such as destinations and booking policies are fixed effects variables, whereas the intercept in the random intercept model is assumed to be different for each company and have thus a random effect.

The linear mixed-effects model using the repeated measure design demonstrates the reliability of having two willingness to pay estimates per company, i.e. one for each company's top-1 destination and one for their top-2 destination. Given the statistical significance of the Wald's test, it shows that the companies have, on average, stated differentiated willingness to pay estimates for their top destinations. The random intercept model, on the other hand, demonstrates the validity of the model, where it is assumed that the intercept varies across companies. The significance of the Wald's test shows that this the case. The Bayesian Information Criterion is estimated to -751 for both models, indicating equally adequate models (Heck et al., 2013).

Model 1, i.e. the mixed model using a repeated time design, in Table 6 shows that companies that employ a booking policy that urge employees to consider the environmental impact of their choice of transportation mode have, as expected, a positive effect on willingness to pay. These companies are on average willing to pay a price premium of 2.1 percentage points for flying with bio jet fuel. On the other hand, companies that instead urge employees at all times to choose the least expensive ticket decrease the estimated willingness to pay with 5.5 percentage points and is statistically significant at the 1 percent level.

The choice of destination for business trips have different positive impacts on companies' willingness to pay for flying with 50 percent bio jet fuel. Business trips to Gothenburg, for instance, increase the estimated willingness to pay with 16.0 percentage points, holding all other variables constant, whereas business trips to Kalmar increases the estimated willingness to pay with 7.8 percentage points; both estimates are statistically significant. Whether a company has a high level of environmental concern or not has remarkably no significant effect on the company's choice to pay a price premium for green

flights, nor has the size of company, in terms of number of employees or annual turnover, or ownership. (See Appendix B.6 for full model)

Table 6 Explanatory variables' effect on estimated willingness to pay using linear mixed-effects models with repeated time design and random intercepts, reduced model

Explanatory variables	**(1) Repeated Time**	**(2) Random Intercepts**
Policy_Eco	0.021**	0.033**
	(0.015)	(0.015)
Policy_Price	-0.055***	-0.055***
	(0.014)	(0.014)
[Göteborg]	0.160***	0.160***
	(0.015)	(0.015)
[Halmstad]	0.129***	0.129***
	(0.036)	(0.036)
[Kalmar]	0.078*	0.078*
	0.040)	(0.040)
[Malmö]	0.158***	0.158***
	(0.015)	(0.015)
[Ronneby]	0.193***	0.193***
	(0.028)	(0.028)
[Sundsvall]	0.181***	0.181***
	(0.019)	(0.019)
[Trollhättan]	0.181***	0.181***
	(0.028)	(0.028)
[Umeå]	0.136***	0.136***
	(0.016)	(0.016)
[Visby]	0.152***	0.152***
	(0.018)	(0.018)
[Växjö]	0.184***	0.184***
	(0.023)	(0.023)
[Åre/Östersund]	0.159***	0.159***
	(0.017)	(0.017)
[Ängelholm]	0.170***	0.170***
	(0.018)	(0.018)
[Destination WTP=0][b]	-	-
Intercept	0.021	0.021
	(0.014)	(0.014)
Observations	272	272
Wald Z (p-value)	8.513 (0.000)	7.573 (0.000)
Bayesian Information Criterion	-751	-751

*** p<0.01, ** p<0.05, * p<0.1

[b] This parameter is set to zero because it is redundant

If instead examining the mixed model allowing for random intercepts in Model 2, one can see that the estimates of the explanatory variables hardly change, and that the variables that are statistically significant in Model 1 remain significant in Model 2. Yet, the only parameter change can be examined in the explanatory variable regarding the environmental friendly booking policy, where the parameter now increases the willingness to pay with 3.3 percentage points and is statistically significant at the 5 percent level. The choice of flight destination for business trips in Model 2 has the same positive and varying impacts on companies' willingness to pay as in Model 1. Again, the level of environmental concern, company size, ownership or having train transportation as first choice have no significant effects on the company's willingness to pay a price premium for green flights.

6.2.2 Internal Validity

Internal validity in a study is essential in order to draw statistical conclusion about the causal effects for the population and setting being studied. However, in all statistical analysis there are several threats to the internal validity. In a linear mixed-effects model, the presence of multicollinearity would negatively influence the interval validity, as well as the violation of the specific model assumptions. The underlying assumptions for the model used in this study are 1) that the dependent variable is linearly related to the explanatory variables; 2) that the residual errors have constant variance; that the residual errors and the random effects vector are 3) independent from each other, and 4) are normally distributed (NCSS, 2016). Fortunately, the linear mixed-effects model is robust to violations of some of the assumptions.

The data used in this study show no indications of multicollinearity. It also does not show any signs of violations to assumptions 1) and 3). Tests show, however, that residual errors are not normally distributed and thus cause assumption 4) to be violated. Additionally, based on the White's test, it appears that heteroscedasticity. i.e. that the residual errors have non-constant variance, is present. On the other hand, the choice of running the model with a first-order autoregressive covariance structure should not cause any biased and inconsistent estimates as the variance is assumed to be heterogeneous (Shek and Ma, 2011). Assumption 2) should therefore not be violated. (See Appendix B.3 for all tests)

One issue facing the validity of the results is the presence of self-selection bias. Self-selection bias occurs when survey respondents decide by themselves whether to participate in the study or not; a situation that lead to a sample that do not accurately represent the studied population (Stock and Watson, 2014). For that reason, there is a risk that the surveyed companies in this study are characterized by a higher level of environmental activities as the product in question concerns green flights. Another issue facing the validity of this study is the risk of measurement errors. Measurement error is more common if the data are collected through a survey and occurs when the respondent mistakenly gives a wrong answer or misstate, for example, the correct annual turnover of the company (Stock and Watson, 2014). Alternatively, it could also be the case that the surveyed companies have an incentive to misstate their true willingness to pay if they believe that the results could be used against them. This strategic behavior and following downward bias is possible as the survey was sent out to business customers of Braathens Regional Airlines. On the other hand, the willingness to pay estimates may be upward biased due to the hypothetical setting. Companies might consider themselves more environmental friendly when responding the survey and thus state a higher willingness to pay, but would not actually pay in a real purchase setting. Lastly, there are few explanatory variables in the linear mixed-effects models that are statistically significant, which thus indicate that there must be other, non-included, factors that affect willingness to pay. A factor, such as a company's budget share of travel expenses, could be an example of an omitted variable that cause inconsistent and biased estimates.

Lastly, the fact that environmental concern, ownership and size of company in both linear mixed-effects models have no significant impact on companies' willingness to pay a price premium lead to results that run counter to economic theory and previous research. One explanation could be the relatively small sample size of 136 companies, which increases the uncertainty in the estimates and decreases the power to detect differences, such as ownership, between companies. The relatively small sample size also leads to few observations for the different destinations considered in this study; a situation that can cause invalid estimates.

Chapter seven – Discussion and Conclusion

7.1 Discussion

The fundamental aim of this study was to investigate the economic possibilities for primarily airlines to gradually incorporate bio jet fuel in their strategies as an important milestone for sustainable growth. The study also attempted to capture the main components to determine which company characteristic that affect willingness to pay for flying domestically with bio jet fuel. The results obtained provide airlines, mainly Braathens Regional Airlines as the survey is based on their flight routes, with valuable information about the economic potentials for speeding up the process towards the use of the green alternative. This is especially true since this study is among the first, if not the first, to examine Swedish air travelers' demand and willingness to pay for flying with the green alternative.

If comparing the results obtained in this study to results obtained in similar studies, where focus is put on climate compensation rather than climate reduction, the results in this study appear to be at the lower end of the scale. One might expect, however, that the willingness to pay for climate reduction operations would be higher than that for climate compensation operations as the negative environmental impact of the latter is larger. On the contrary, this study is addressed to companies rather than individuals, and can thus explain why the results appear to be at the lower end of scale. Companies are to a higher extent restricted by a tighter budget and do in general not feel equal personal responsibility for the environment as individuals do. Moreover, only three explanatory variables were shown to be significant determinants of willingness to pay; the two types of booking policies for business trips and the choice of flight destination. The booking policies' effects on willingness to pay were expected and do not need further interpretation. The differentiated effects of flight destinations, however, should be mentioned. First of all, there were few destinations where the subgroup sample size was large enough to draw statistical conclusions. This applies to destinations like Ronneby and Kalmar, where also the largest difference in willingness to pay estimates can be found. Secondly, this study does not consider differences in flight time and distance between Bromma Stockholm Airport and the specific destinations, which is something that could explain the various estimates in willingness to pay.

The results of this study should be interpreted with caution since it does not give concrete answers on all relevant matters. The fundamental question is whether the contingent valuation technique was able to estimate Swedish companies' true preferences for flying with bio jet fuel, and whether the derived estimates are valid even though there is a risk of self-selection bias and strategic bias to mention a few. As mentioned earlier, the sample size of 136 companies, the potential presence of omitted variable bias and other biases, and the fact that assumption 4) is violated can all cause invalid estimates. In order to minimize the risk of invalid estimates caused by of above elements, several measure were implemented, but it is impossible to eliminate all.

A question that arose during the study is the implications of the results on airlines' choice to shift to bio jet fuel. Considering the ethical aspect of replacing traditional jet fuel with bio jet fuel and the following effects it might have on societies and the environment worldwide, it is difficult to question that the deployment of the green alternative would lead to unethical consequences. Bio jet fuel have, for instance, less detrimental effects on the environment compared to traditional jet fuel, and its production can be spread worldwide and across a number of different crops. In addition, the production does not compete with food production. Finally, the fact that the survey was sent to companies using the partner companies' customer records requires that the process is carried out under ethically acceptable forms. The surveyed companies are, for example, entitled to receive full information about the project and what participation means. To ensure this, an information letter was given to the companies and the responses were recorded anonymously.

7.2 Conclusion

Bio jet fuel is a green and sustainable alternative to the traditional jet fuel, but with a considerably more limited market. Therefore, the contingent valuation method was used to examine Swedish companies' willingness to pay a price premium for flying with 50 percent bio jet fuel. An Internet-based survey built on the payment card format was sent out to companies using the customer records of Braathens Regional Airlines and Stockholm Chamber of Commerce. The analysis of this study concludes that Swedish companies are on average willing to pay a price premium of 11.5 percent for flying with 50 percent bio jet fuel. Significant differences in the level of willingness to pay are found for different flight destinations, where green business flights to Gothenburg and Malmö increase the willingness to pay estimate with approximately 16 percentage points. Moreover, companies that employ booking policies for business trips, such as to always fly at the lowest price possible or to choose the transportation mode with the least environmental impact, have a negative effect and a positive effect respectively on the estimated willingness to pay. Parts of the findings of this study, however, do not supplement the existing economic literature regarding company characteristics' effect on willingness to pay. Whether a company has a high level of environmental concern or not has remarkably no significant effect. Nor has the size of company, in terms of number of employees or annual turnover, ownership or main mode of transportation.

Overall, it can be concluded that 72 percent of the companies stated a positive willingness to pay for green business flights; a result that may induce airlines, Swedish authorities and others to devote more efforts in order to allow a faster transition towards the green and sustainable alternative.

7.3 Recommendations and Future Research

This study is one of the first to examine Swedish companies' willingness to pay for flying with bio jet fuel. It gives a comprehensive view of their current demand, but more information from other air travelers is needed in order for the aviation industry to take the final step and fully shift to bio jet fuel. Consequently, rather than focusing the study on companies, a different approach for future research could be to examine Swedish individual air travelers' willingness to pay for flying with the green alternative. Another approach could also be to focus on Swedish air travelers flying to international destinations, and see whether significant differences between flight destinations can be found there as well.

Theoretically, it would be of interest to employ a different elicitation method with the intention of examine the reliability of the results from using the payment card format. As mentioned earlier, previous literature has shown the occurrence of varying willingness to pay estimates generated from the different methods. Results from using another method for the same research question would therefore supplement the existing literature regarding these differences in estimates.

The survey resulted in 136 complete questionnaires, a sample size that can be too small with the number of explanatory variables and subgroups that were first considered in the models. Given the low response rate, which is a result of using an Internet-based survey and the choice of addressing the study towards companies, it is recommended to increase the number of companies that receive the survey in first place. This is a necessary step in order to decreases the uncertainty in the estimates and to increase the power to detect differences between subgroups.

Finally, an extension of this study could be the examination of other potential determinants of willingness to pay that were not included in the models applied here. This action would significantly improve the model.

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Appendix A

A.1 Introduction of Partner Companies

Swedavia

Swedavia is a state-owned company that owns, operates and develops a network of ten Swedish airports where Stockholm Arlanda Airport, Göteborg Landvetter and Bromma Stockholm Airport are the three largest airports in terms of flight passengers. In 2014, Swedavia set a passenger record with 35.7 million flight passengers traveling via the company's ten airports, a record that was hit the year after. Moreover, the role of Swedavia is to create the access Sweden needs to facilitate travel, business and meetings. (Swedavia, 2015)

Swedavia is an international role model in developing climate-smart airports as they since 2006 have been a climate-neutral company. One important sustainability initiative, which makes Swedavia a front-runner, is the one regarding bio jet fuel. As the first company in the world, Swedavia in 2016 decided to have green flights for all its official business travels. Therefore, it is also in Swedavia's interest to gain an understanding about Swedish companies' willingness to pay for flying with bio jet fuel, especially as the company is in a position where it can influence the deployment of bio jet fuel.

Braathens Regional Airlines

Braathens Regional Airlines is a subsidiary company of Braathens Aviation and is a new airline that was founded in February 2016. The company is a merger of Malmö Aviation and Sverigeflyg that until recently operated flight services to 13 domestic destinations within Sweden. The merge means that Braathens Regional Airlines continues these flight operating services with the vision to get even closer to its customer and to enhance the travel conditions for the flight passengers. Braathens Regional Airlines' operating hub is Bromma Stockholm Airport and the airport serves as an integral part of the company's business concept to save travelers' time. There are in total 2.2 million flight passengers per year traveling with the airline.

Braathens Regional Airlines has made several undertakings concerning its sustainability work and effects on the environment, e.g. the company has set the target to halve the carbon dioxide emissions of each flight passenger between 2015 and 2025. In addition, the new aircrafts, which will be delivered in 2018, are estimated to reduce carbon dioxide emissions by up to 40 percent and nitrogen oxide emissions by half. As the company has clear objectives to reduce carbon dioxide emissions related to its operations, it is in Braathens Regional Airlines' interest to gain knowledge about their business travelers' willingness to pay for flights using 50 percent bio jet fuel.

Stockholm Chamber of Commerce

Stockholm Chamber of Commerce is a business organization that works towards strengthen the Stockholm region's competitiveness in the global market by promoting business-friendly policies and supporting companies within the region.

One of Stockholm Chamber of Commerce's most important topics is the future of Bromma Stockholm Airport, where they point to the fact that a closure of the airport could jeopardize job creation, growth and development not only in Stockholm, but throughout Sweden. As they also have clear objectives that resources must be devoted to make flights green, rather than reduce the number of flights, it is of Stockholm Chamber of Commerce's interest to contribute to the development of flights using bio jet fuel.

Fly Green Fund

Fly Green Fund is a non-profit organization that was founded in June 2015 by SkyNRG, Karlstad Airport and Nordic Initiative Sustainable Aviation. The organization's main goal is to develop the Nordics into a pioneering bio jet fuel region by leading the efforts for increasing the demand for bio jet fuel. In that way, increasing the volume will lead to that the price gap between bio jet fuel and jet fuel derived from petroleum will decrease. Companies such as Swedavia and European Flight Service have connected to Fly Green Fund as partners. Fly Green Fund's vision is to enable organizations and individuals to fly more sustainably on bio jet fuel, and because of that it is as well in their interest to gain knowledge in Swedish companies' willingness to pay for flying with 50 percent bio jet fuel.

Appendix B

B.1 Descriptive Statistics

Table 7 Destination frequency including top-1 and top-2 destinations

Destination	Frequency
Gothenburg	56
Malmö	64
Ängelholm	12
Växjö	4
Åre/Östersund	14
Visby	10
Kalmar	1
Trollhättan	2
Sundsvall	7
Umeå	18
Ronneby	2
Halmstad	1

Table 8 Additional information about background characteristics

Explanatory variables	Frequency (N = 136)	Percent (%)
Line of Business		
Accommodation and food service activities	5	3.7
Arts, entertainment and recreation	3	2.2
Construction	4	2.9
Education	3	2.2
Electricity, gas, steam and air conditioning supply	3	2.2
Financial and insurance activities	17	12.5
Human health and social work activities	8	5.9
Information and communication	23	16.9
Manufacturing	10	7.4
Mining and quarrying	1	0.7
Other service activities	14	10.3
Professional, scientific and technical activities	14	10.3
Public administration and defence; compulsory social security	1	0.7
Real estate activities	5	3.7
Transportation and storage	10	7.4
Water supply; sewerage, waste management and remediation activities	1	0.7
Wholesale and retail	14	10.3
Environmental Policy		
Yes	107	78.7
No	29	21.3
Sustainability Manager		
Yes	79	58.1
No	57	41.9
Environmental Management (ISO 14001)		
Yes	41	30.2
No	95	69.8

B.2 The Explanatory Variable "Environmental Concern"

This variable is based on six questions on the sampled companies' environmental activities (see question 12-17 in Appendix C), where three of these questions are answered using a Likert scale and the remaining three are answered with Yes/No. To check whether these six questions on environmental concern measures the same construct, the Cronbach's Alpha has been estimated in Stata. The rule of thumb for the Cronbach's Alpha is that a value of 0.7 or higher is acceptable and indicates that the questions measure the same construct. The value of the Cronbach's Alpha in this study is 0.7523, which indicates a high internal consistency. Furthermore, the Kaiser-Meyer-Olkin measure of sampling adequacy gives a value of 0.8045, which indicates that the partial correlations are small and that a factor analysis can be useful for the environmental activities considered. On the other hand, a factor analysis shows that there is only one factor that has an eigenvalue higher than 1, and accounts for 50.2 percent of the variance.

As a result, another variable was created, where Yes-answers is coded 1 and where 4-5 on the Likert scale is coded 1, indicating an upper bound of environmental concern. Remaining answers are given a value of 0. The new variable takes the sum of the six questions and thus serves as a measure of the companies' overall environmental concern.

Table 9 Cronbach's alpha test

```
Test scale = mean(unstandardized items)
```

Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
eco_pol	136	+	0.5779	0.4980	.3716721	0.7403
eco_mgr	136	+	0.6581	0.5730	.3460512	0.7232
Eco_Info	136	+	0.7934	0.6314	.2350708	0.6731
Eco_Comp	136	+	0.7205	0.5305	.2679956	0.7065
Eco_Use	136	+	0.8779	0.7081	.1735948	0.6658
eco_cert	136	+	0.4786	0.3760	.3824346	0.7514
Test scale					.2961365	0.7523

B.3 Testing the Assumptions: linear mixed-effects model

Multicollinearity:

In Figure 7 below, the explanatory variables show no indication of multicollinearity as their correlations are relatively low. The categories of destinations are, as expected, related but cause no multicollinearity.

Correlation Matrix for Estimates of Fixed Effects[a]

Parameter	Intercept	Pol_Eco	Pol_Price	[Destination=1]	[Destination=2]	[Destination=3]	[Destination=4]	[Destination=5]	[Destination=6]	[Destination=7]	[Destination=8]	[Destination=9]	[Destination=10]	[Destination=11]	[Destination=12]	[Destination=13]
Intercept	1	-,048	-,418	-,699	-,703	-,583	-,458	-,612	-,599	-,277	-,377	-,547	-,638	-,377	-,277	.[b]
Pol_Eco	-,048	1	-,369	-,103	-,101	-,089	-,064	-,094	-,065	-,032	-,065	-,064	-,114	-,043	-,063	.[b]
Pol_Price	-,418	-,369	1	-,004	-,006	-,025	,024	,003	,006	,027	,004	-,010	,004	-,004	-,009	.[b]
[Destination=1]	-,699	-,103	-,004	1	,940	,787	,593	,806	,783	,337	,508	,716	,854	,503	,375	.[b]
[Destination=2]	-,703	-,101	-,006	,940	1	,796	,582	,809	,788	,332	,508	,741	,856	,489	,397	.[b]
[Destination=3]	-,583	-,089	-,025	,787	,796	1	,480	,662	,643	,274	,415	,598	,700	,405	,318	.[b]
[Destination=4]	-,458	-,064	,024	,593	,582	,480	1	,491	,478	,545	,309	,441	,520	,303	,232	.[b]
[Destination=5]	-,612	-,094	,003	,806	,809	,662	,491	1	,685	,281	,424	,647	,750	,423	,323	.[b]
[Destination=6]	-,599	-,065	,006	,783	,788	,643	,478	,685	1	,273	,412	,597	,697	,403	,313	.[b]
[Destination=7]	-,277	-,032	,027	,337	,332	,274	,545	,281	,273	1	,176	,252	,297	,173	,132	.[b]
[Destination=8]	-,377	-,065	,004	,508	,508	,415	,309	,424	,412	,176	1	,382	,449	,260	,203	.[b]
[Destination=9]	-,547	-,064	-,010	,716	,741	,598	,441	,647	,597	,252	,382	1	,649	,372	,295	.[b]
[Destination=10]	-,638	-,114	,004	,854	,856	,700	,520	,750	,697	,297	,449	,649	1	,503	,342	.[b]
[Destination=11]	-,377	-,043	-,004	,503	,489	,405	,303	,423	,403	,173	,260	,372	,503	1	,195	.[b]
[Destination=12]	-,277	-,063	-,009	,375	,397	,318	,232	,323	,313	,132	,203	,295	,342	,195	1	.[b]
[Destination=13]	.[b]	.[b]	.[b]	.[b]	.[b]	.[b]	.[b]	.[b]	.[b]	.[b]	.[b]	.[b]	.[b]	.[b]	.[b]	.[b]

a. Dependent Variable: WTP.

b. The correlation is system missing because it is associated with a redundant parameter.

Figure 7 Testing for multicollinearity

Heteroscedasticity:

Examining Figure 8, one can see that the spread of residuals gets narrower as the predicted value increases. This in an indication that heteroscedasticity may be present. To further examine if this is the case, explicitly test using a statistical measure is usually performed. Table 10 below show that the significant value of 0.001 confirms the hypothesis that heteroscedasticity is present.

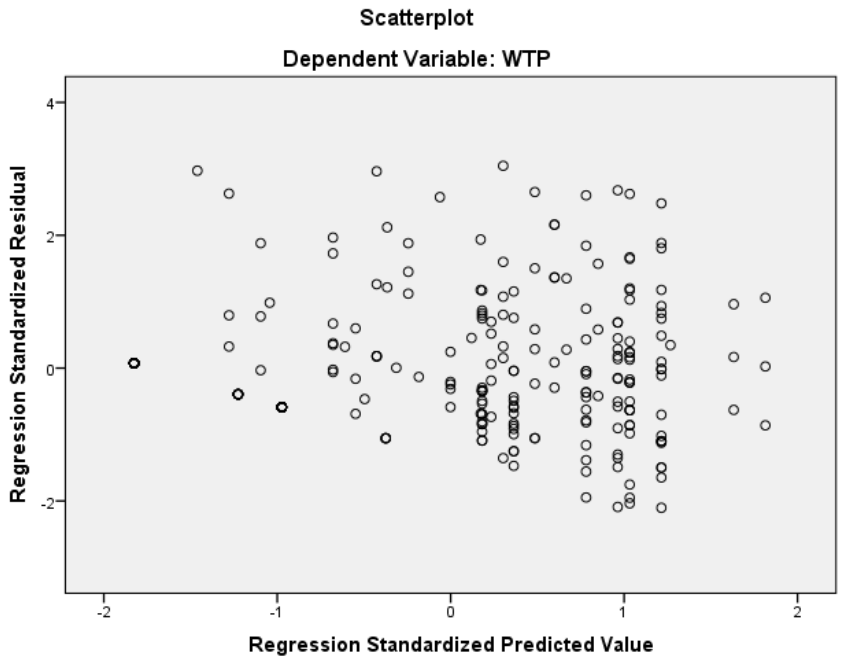


Figure 8 Scatterplot testing for heteroscedasticity

Table 10 White's test of heteroscedasticity

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,002	2	,001	6,727	,001[b]
	Residual	,037	269	,000		
	Total	,038	271			

a. Dependent Variable: RES_12 (RES_12 = Residuals Squared)

b. Predictors: (Constant), PRE_12, Unstandardized Predicted Value (PRE_12 = Predicted Values Squared)

Linear relationship between dependent and explanatory variables:

The fact that the regression analysis using the linear mixed-effects models only contains dummy variables and a categorical variable creates a situation where traditional linearity tests are limited.

Normality of residuals:

The results from Table 11 and Figure 9 suggest that the residuals are not normally distributed, i.e. the significance of the Shapiro-Wilk test and the abnormality of residuals in the Q-Q plot. Furthermore, the Skewness and Kurtosis are not significant. The assumption of normally distributed residuals is therefore violated.

Table 11 Shapiro-Wilk test checking for normally distributed explanatory variables

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Predicted Values	,146	272	,000	,903	272	,000
Residuals	,295	272	,000	,630	272	,000

a. Lilliefors Significance Correction

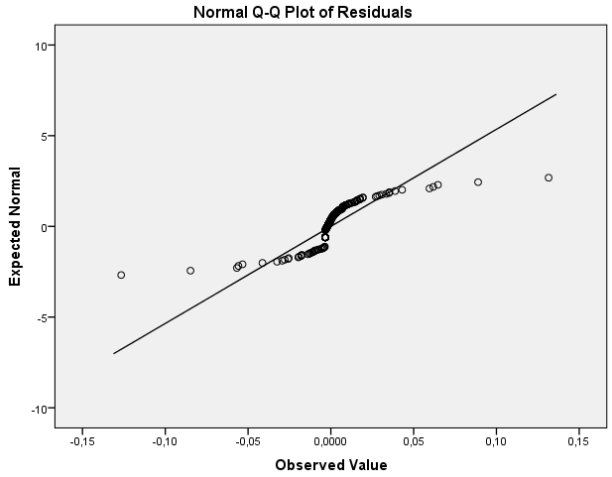


Figure 9 Testing for normally distributed residuals

Normally distributed explanatory variables:

In Table 12 below, the Shapiro-Wilk test is conducted in order to check the normality of the explanatory variables. The significance of the test shows that the variables are not normally distributed.

Table 12 Shapiro-Wilk test checking for normally distributed explanatory variables

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pol_Eco	,446	272	,000	,572	272	,000
Pol_Price	,360	272	,000	,635	272	,000
Destination	,247	272	,000	,779	272	,000

a. Lilliefors Significance Correction

B.4 Testing the Assumptions: multiple linear regression model with OLS estimation

The assumptions for multiple linear regression models are similar to the assumptions in linear mixed-effects models. The presence of multicollinearity will in both models cause an inconvenient situation in which it is impossible to obtain valid estimates. Given the results in Table 6 above and the results of an additional test including all explanatory variables, there are no indications that multicollinearity is present. Another assumption states that large outliers are unlikely. By reason of the chosen elicitation method, namely the payment card method, there is no risk for such occurrence. The third assumption highlights the fact that the data are collected by simple random sampling. In this study, there is a risk of violation to that assumption as the companies that received the survey, and actually responded the survey, might not accurately represent the population of interest. Lastly, the fourth assumption states that the error term has an expected value of zero given any values of the explanatory variables. This is related to omitted variable bias. Likewise, this assumption is likely to be violated as there are few explanatory variables in the multiple regression models below that are statistically significant, which thus indicate that there must be other, non-included, factors that affect willingness to pay. A factor, such as a company's budget share of travel expenses, could be an example of an omitted variables that cause inconsistent and biased estimates.

B.5 Share of Companies Willing to Pay a Price Premium

The results show that 27.94 percent of all responding companies are not willing to pay a price premium for flying with 50 percent bio jet fuel after have been given information about the environmental effects of biofuels. (See question 19 in Appendix C)

Table 13 Share of companies willing to pay a price premium

WTP	**Frequency (N = 136)**	**Percent (%)**
Yes	98	72.06
No	38	27.94

B.6 Linear Mixed Models: full models, and fixed-effects model

Table 14 Explanatory variables' effect on estimated willingness to pay using linear mixed-effects models with repeated time design and random intercepts, full model, and fixed-effects model

Explanatory variables	(1) Repeated Time	(2) Random Intercepts	(3) Fixed Effects
Public	0.024	0.025	0.024
	(0.024)	(0.024)	(0.018)
Emp <50	0.002	0.003	0.007
	(0.029)	(0.029)	(0.022)
AT <100	0.004	0.004	-0.000
	(0.028)	(0.029)	(0.021)
Policy_Eco	0.028	0.028	0.026**
	(0.017)	(0.017)	(0.013)
Policy_Price	-0.056***	-0.056***	-0.054***
	(0.020)	(0.015)	(0.011)
Env_Concern	0.003	0.003	0.002
	(0.005)	(0.005)	(0.004)
Train	0.014	0.014	0.016
	(0.018)	(0.018)	(0.013)
[Göteborg]	0.159***	0.160***	0.158***
	(0.015)	(0.015)	(0.014)
[Halmstad]	0.127***	0.124***	0.137*
	(0.037)	(0.037)	(0.079)
[Kalmar]	0.074*	0.072*	0.122
	0.040)	(0.040)	(0.081)
[Malmö]	0.157***	0.157***	0.151***
	(0.015)	(0.015)	(0.013)
[Ronneby]	0.191***	0.187***	0.197***
	(0.028)	(0.028)	(0.056)
[Sundsvall]	0.179***	0.177***	0.151***
	(0.019)	(0.019)	(0.031)
[Trollhättan]	0.179***	0.177***	0.199***
	(0.028)	(0.028)	(0.057)
[Umeå]	0.134***	0.133***	0.140***
	(0.017)	(0.017)	(0.021)
[Visby]	0.150***	0.151***	0.159***
	(0.018)	(0.018)	(0.026)
[Växjö]	0.182***	0.184***	0.180***
	(0.024)	(0.024)	(0.041)
[Åre/Östersund]	0.157***	0.156***	0.166***
	(0.017)	(0.017)	(0.023)
[Ängelholm]	0.169***	0.168***	0.199***
	(0.018)	(0.018)	(0.023)
[Destination WTP=0][b]	-	-	-
Time	-	0.004	-
		(0.003)	
Intercept	0.011	0.005	0.009
	(0.022)	(0.022)	(0.016)
Observations	272	272	272
Wald Z (p-value)	8.344 (0.000)	7.543 (0.000)	11.225 (0.000)
Bayesian Information Criterion	-720	-712	-511

*** p<0.01, ** p<0.05, * p<0.1

[b] This parameter is set to zero because it is redundant

In Table 14 above, the regressions of two linear mixed-effects model and one fixed-effects model are presented. Comparing the three models, one can examine that the repeated time design and random intercepts models are similar in terms of statistical significance, parameter estimates and the value of the Bayesian information criteria. The fixed-effects model, however, differs noticeably in terms of these measures. Traveling to Kalmar from Bromma Stockholm Airport does no longer have a significant impact on willingness to pay a price premium, whereas having an environmental friendly booking policy does. Furthermore, the higher value of the Bayesian information criterion amounting to -511 indicates that the fixed-effects model has a relatively lower quality than the other models; the model with the smallest value is namely preferable.

The fixed-effects model is, for other reasons than a higher value of the Bayesian information criterion, a weaker model than the two linear mixed-effects model. The main difference is that the fixed-effects model lacks random effects and can thus not assume that companies have different "baseline" willingness to pay. For this data set, one can expect that such differences occur which further speaks against the use of the fixed-effects model. In addition, for a fixed-effects model to be preferred, variability within the companies in the variables across time is necessary since too little variability can lead to too large standard errors.

B.7 Willingness to Pay a Price Premium: top-1 destination

Companies that stated that they would be willing to pay a price premium were asked two follow-up questions, one about which of 12 destinations that each specific company most frequently travels to, and the other where they stated their top-2 destination. In the regression output below, results from companies' top-1 destination is presented. A multiple linear regression model with OLS estimation and robust standard errors in Stata was used.

Table 15 Regression analysis for companies' estimated willingness to pay for top-1 destination

	(1)	(2)
Explanatory variables	**WTP_Dest1_Percent**	**WTP_Dest1_Percent**
Public	0.058**	0.057**
	(0.029)	(0.029)
Emp <50	0.002	0.002
	(0.046)	(0.048)
AT <100	-0.001	-0.001
	(0.049)	(0.048)
Policy_Eco	0.045**	0.044*
	(0.021)	(0.024)
Policy_Price	-0.059***	-0.059***
	(0.020)	(0.021)
Env_Concern		0.000
		(0.007)
Observations	136	136
Adjusted R-squared	0.057	0.050

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Examining regression function 1, being a public-owned company increases the estimated willingness to pay for top-1 destination with 5.8 percentage points and is statistically significant at the 5 percent level. Furthermore, a company with booking policies regarding price of ticket and the environmental impacts of transportation mode have statistically significant impacts on willingness to pay. As expected, booking policies that urge employees at all times to choose the least expensive ticket decrease the willingness to

pay with 5.9 percentage points, whereas booking policies that instead urge employees to consider the environmental effects of their travel increases the estimated willingness to pay with 4.5 percentage points. Being a small company, i.e. with number of employees lower than 50 or an annual turnover less than 100 million SEK, have no statistically significant impact on willingness to pay.

When adding the explanatory variable "Environmental Concern" in regression function 2, there are no significant changes in the remaining variables, indicating no omitted variable bias in regression function 1 if omitting "Environmental Concern". However, it should be noticed that the value of adjusted R-squared is low in both models, which means that the models explain little of the response variability. On the other hand, the statistically significant explanatory variables can still be interpreted as having an impact on estimated willingness to pay.

B.8 Willingness to Pay a Price Premium: top-2 destination

In the regression output below, results from companies' top-2 destination is presented. A multiple linear regression model with OLS estimation and robust standard errors in Stata was used.

Table 16 Regression analysis for companies' estimated willingness to pay for top-2 destination

Explanatory variables	**(1)** **WTP_Dest2_Percent**	**(2)** **WTP_Dest2_Percent**
Public	0.042	0.041
	(0.026)	(0.025)
Emp <50	0.001	0.003
	(0.044)	(0.046)
AT <100	0.002	0.003
	(0.046)	(0.046)
Policy_Eco	0.041**	0.039*
	(0.020)	(0.023)
Policy_Price	-0.046**	-0.047**
	(0.018)	(0.019)
Env_Concern		0.002
		(0.007)
Observations	136	136
Adjusted R-squared	0.035	0.028

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Examining regression function 1, being a public-owned company has no statistically significant impact on estimated willingness to pay for top-2 destination. However, as in the case of top-1 destination, booking policies that urge employees at all times to choose the least expensive ticket decrease the willingness to pay with 4.6 percentage points, whereas booking policies that instead urge employees to consider the environmental effects of their travel increases the estimate with 4.1 percentage points. Both estimates are statistically significant at the 5 percent level. Being a small company, i.e. with number of employees lower than 50 or an annual turnover less than 100 million SEK, have no statistically significant impact on willingness to pay.

When adding the explanatory variable "Environmental Concern" in regression function 2, there are no significant changes in the remaining variables, indicating no omitted variable bias in regression function 1 if omitting "Environmental Concern". However, again it should be noticed that the value of adjusted R-squared is low in both models, which means that the models explain little of the response variability. On the other hand, the statistically significant explanatory variables can still be interpreted as having an impact on estimated willingness to pay.

B.9 Willingness to Pay a Price Premium: Bromma Stockholm Airport - Malmö Airport

64 companies stated that one of their most frequently visited destinations for business trips are Malmö. In the regression output below, results from companies flying to Malmö Airport is presented. A multiple linear regression model with OLS estimation and robust standard errors in Stata was used.

Table 17 Regression analysis for companies' estimated willingness to pay for flying to Malmö Airport

Explanatory variables	**(1)** **WTP_MMX_Percent**	**(2)** **WTP_MMX_Percent**
Public	-0.004	-0.005
	(0.027)	(0.027)
Emp <50	0.063**	0.065**
	(0.025)	(0.027)
AT <100	-0.076**	-0.075**
	(0.029)	(0.029)
Policy_Eco	0.049*	0.047
	(0.025)	(0.031)
Policy_Price	-0.091***	-0.091***
	(0.018)	(0.018)
Env_Concern		0.001
		(0.008)
Observations	64	64
Adjusted R-squared	0.174	0.160

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Examining regression function 1, being a small company with less than 50 employees increases the willingness to pay with 6.5 percentage points and is statistically significant at the 5 percent level. In addition, a company with an annual turnover less than 100 million SEK increases the estimate with 7.6 percentage points and is, as well, statistically significant at the 5 percent level. Once again, both booking policies are statistically significant on the 10 percent and 1 percent respectively and have expected effects on estimated willingness to pay. Whether a company is public-owned or not has no significant impact on willingness to pay.

When adding the explanatory variable "Environmental Concern" in regression function 2, there are no noteworthy changes in the remaining variables, indicating no omitted variable bias in regression function 1 if omitting "Environmental Concern". However, again it should be noticed that the value of adjusted R-squared is low in both models, which means that the models explain little of the response variability. On the other hand, the statistically significant explanatory variables can still be interpreted as having an impact on estimated willingness to pay.

B.10 Willingness to Pay a Price Premium: Bromma Stockholm Airport - Gothenburg-Landvetter Airport

56 companies stated that one of their most frequently visited destinations for business trips are Gothenburg. In the regression output below, results from companies flying to Gothenburg-Landvetter Airport is presented. A multiple linear regression model with OLS estimation and robust standard errors in Stata was used.

Table 18 Regression analysis for companies' estimated willingness to pay for flying to Gothenburg-Landvetter Airport

Explanatory variables	**(1)** **WTP_GOT_Percent**	**(2)** **WTP_GOT_Percent**
Public	0.084***	0.094**
	(0.030)	(0.035)
Emp <50	0.035	0.052
	(0.038)	(0.042)
AT <100	-0.024	-0.030
	(0.040)	(0.038)
Policy_Eco	0.034	0.024
	(0.028)	(0.034)
Policy_Price	-0.077***	-0.081***
	(0.027)	(0.029)
Env_Concern		0.008
		(0.011)
Observations	56	56
Adjusted R-squared	0.056	0.048

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Examining regression function 1, being a public-owned company increases the estimated willingness to pay with 8.4 percentage points and is statistically significant at the 1 percent level. In contrast to previous regression outputs, only booking policies regarding price is significant and have, as expected, a negative impact on the willingness to pay.

When adding the explanatory variable "Environmental Concern" in regression function 2, there are some significant changes in the remaining variables, indicating that there could be omitted variable bias in regression function 1 where "Environmental Concern" is not included. Again, it should be noticed that the value of adjusted R-squared is low in both models, which means that the models explain little of the response variability. On the other hand, the statistically significant explanatory variables can still be interpreted as having an impact on estimated willingness to pay.

Appendix C

C.1 Survey

Introductory information

Hej!

Denna studie görs på uppdrag av Stockholms Handelskammare, Swedavia, Braathens Regional Airlines och Fly Green Fund med syftet att undersöka svenska företags intresse av att flyga med biobränsle. Studien är en del av ett masteruppsatsarbete och jag skulle därför uppskatta om er organisation vill hjälpa mig genom att besvara ett antal frågor.

Det är **mycket viktigt** att den person som besvarar enkäten har hand om organisationens resepolicy, alternativt svarar på uppdrag åt den person som har det. Vänligen hjälp mig att nå rätt person i organisationen då er organisations svar inte kan ersättas av en annan.

Det är även **mycket viktigt** att er organisation har rest med inrikesflyg via Bromma Stockholm Airport.

Ur de resultat som uppstår kommer man inte kunna utläsa vad er organisation har svarat. Studien tar cirka **5 minuter** att besvara.

På förhand vill jag tacka för er medverkan i studien.

Vänliga hälsningar,

Louise Goding
Masterstudent i Nationalekonomi inriktning Miljö
Sveriges Lantbruksuniversitet, Uppsala

Question 1

Vilken är din nuvarande position i den organisation där du är anställd?

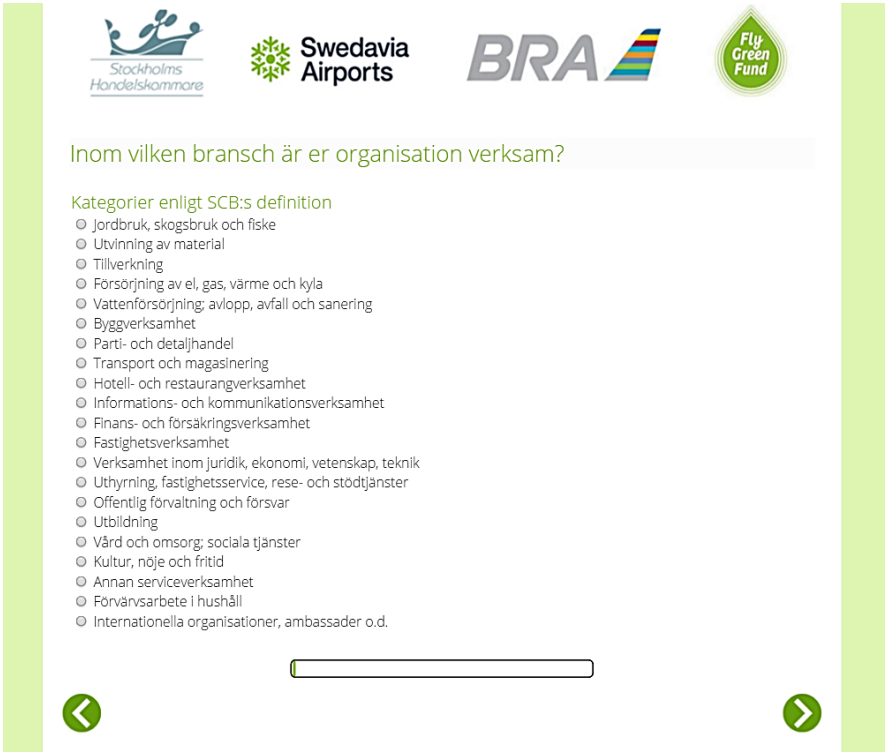
- VD/GD
- Ekonomichef
- Inköpschef/Upphandlingschef
- HR-chef
- Annan position

Om Annan position:

Question 2

Question 3

Question 4



Question 5

Question 6

Question 7

Question 8

Question 9 – If respondent answers "Ja" in Question 8

Question 10 – Follow-up question to Question 9

Question 11 – for everyone

Question 12

Question 13

Question 14

Question 15

Question 16

Question 17

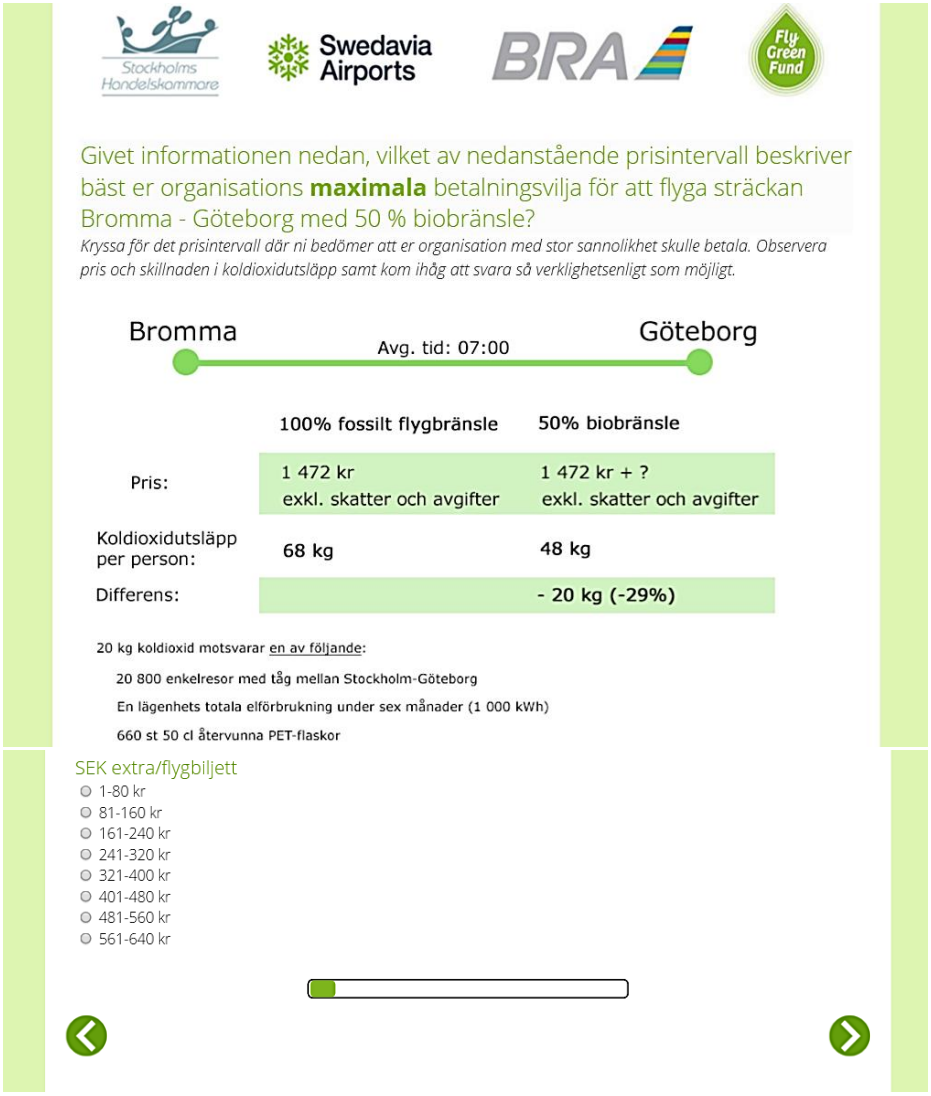
Question 18


Stockholms Handelskammare
Swedavia Airports
BRA
Fly Green Fund
Vid bokning av tjänsteresor används alltid tåg som ett förstahandsalternativ
Instämmer ej
Instämmer helt
0

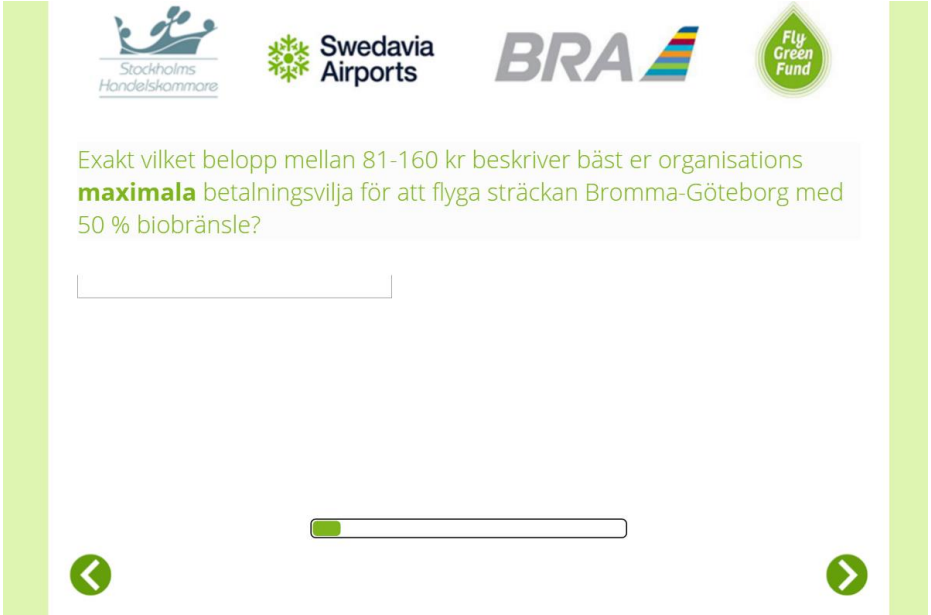
Question 19

Question 20 – If respondent answers “Ja” in Question 19

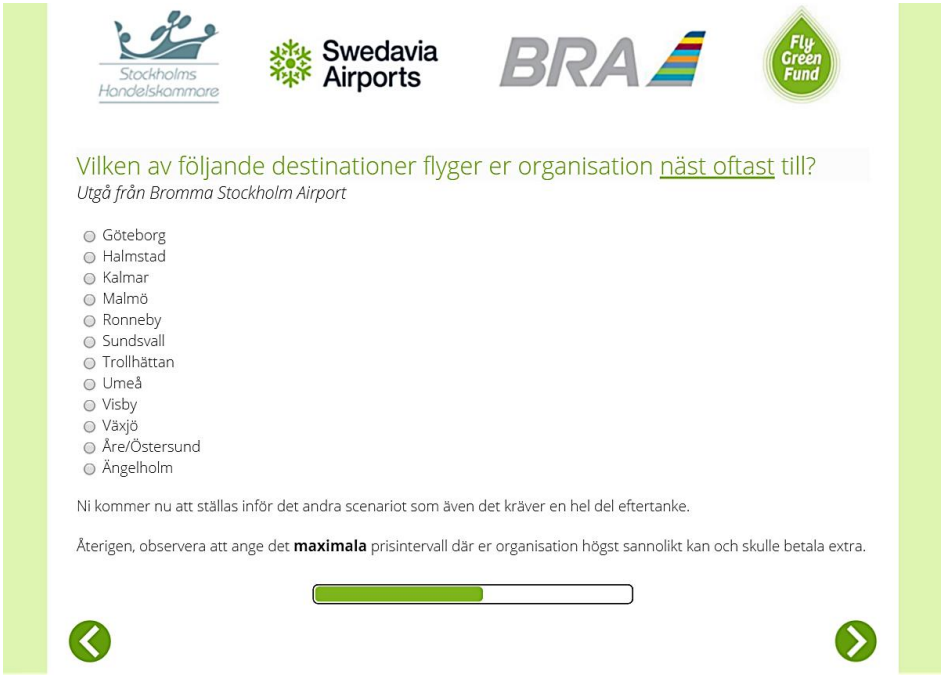
Question 21 – If respondent answers “Göteborg” in Question 20



Question 22 – If respondent answers “81-160 kr” in Question 21

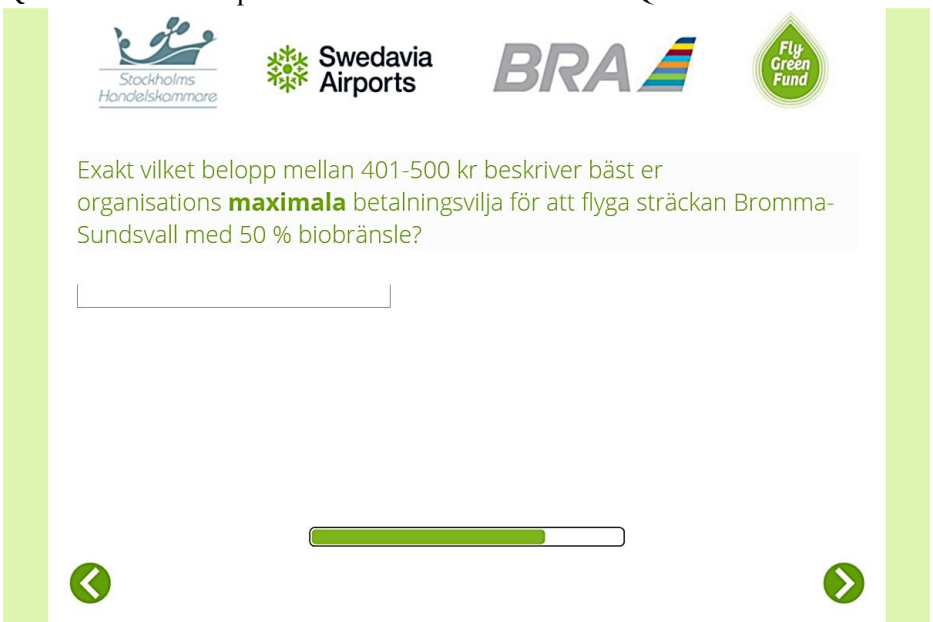


Question 23


Stockholms Handelskammare
Swedavia Airports
BRA
Fly Green Fund
Vilken av följande destinationer flyger er organisation näst oftast till?
Utgå från Bromma Stockholm Airport
Göteborg
Halmstad
Kalmar
Malmö
Ronneby
Sundsvall
Trollhättan
Umeå
Visby
Växjö
Åre/Östersund
Ängelholm
Ni kommer nu att ställas inför det andra scenariot som även det kräver en hel del eftertanke.
Återigen, observera att ange det maximala prisintervall där er organisation högst sannolikt kan och skulle betala extra.

Question 24 – If respondent answers “Sundsvall” in Question 23

Question 25 – If respondent answers “401-500 kr” in Question 24



Question 26 – for everyone