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VOLUNTARY CARBON OFFSETS

ESTIMATING MEAN WILLINGNESS TO PAY AND EXPLORING BEHAVIORAL RATIONALE BEHIND VOLUNTARY CONTRIBUTIONS TO CARBON OFFSETTING PROGRAMS IN SWEDEN

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Abstract

The negative effect of carbon dioxide emissions on the environment is a fact. Measures have to be taken in order to preserve the world for coming generations. The aviation sector is a main contributor to these emissions. Voluntary carbon offsets are investment vehicles through which air travellers can financially compensate for their flight's carbon emissions. The thesis argues that macro-level indicators of sustainability are strongly and predictably affected by behavioral processes at the micro-level. The thesis aims at estimating the willingness to pay for voluntary carbon offsets and exploring the determinants behind air traveller's voluntary contributions to environmental preservation. A contingent valuation survey has been conducted among 320 Swedish air travellers. Three hypotheses have been derived from theories in behavioral economics (social image, relative culpability, conditional cooperation) and tested empirically. The study reports willingness to pay estimates of 679 SEK in a parametric framework. Adjusting for the level of certainty in the response yields a lower estimate, 185 SEK in line with expectations. A similar effect is reported using a nonparametric framework. The thesis concludes that allowing respondent to state an uncertain response in contingent valuation surveys yields more accurate willingness to pay estimates. Social image is the only hypothesis that has a statistically significant effect on respondents purchasing behavior. The thesis concludes that organizations providing voluntary carbon offsets as well as policy makers should take this into account in order to spread pro-environmental behavior.

Keywords*: voluntary carbon offsets; willingness to pay; social image and dichotomous choice contingent valuation***.**

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1 Introduction

"Each and every one of us can make changes in the way we live our lives and become part of the solution [to climate change]"

Al Gore in "An Inconvenient Truth" (2006)

The subject of climate change is widely debated all over the world. Increased temperatures, rising sea levels and natural catastrophes are daily discussed in media. Greenhouse gases' negative impact on the environment is an undeniable fact and there is a consensus that measures must be taken to preserve the world for coming generations. As a result of this, people in general are getting more concerned about the environment and individuals' contributions to the preservation of nature, such as recycling; waste separation and clean vehicles are becoming increasingly common.

The aviation sector is a large contributor to the emissions of greenhouse gases and hence a lot of attention is paid to this sector, its negative impact on the environment and the measures taken to reduce this impact. Among these measures are technological development of aircrafts, new types of fuel and different types of taxes (Peeters *et al.*, 2006). However, demand for air transport has been growing more rapidly than the effects of the efficiency improvements and measures, causing the greenhouse gas emissions from aviation to increase in absolute terms (IEA 2008b).

Like Al Gore maintains in his movie "An Inconvenient Truth" (2006), people must make changes in their everyday life to live in a more sustainable way. One way to do this, in terms of aviation consumption, is to start flying less or forego flying entirely. However, research has shown that for convenience reasons people are not willing to do this (Gössling *et al* 2009) and as a response to this, other alternatives have evolved in order to enable people to fly - but still act pro-environmentally.

An example of this is so called *voluntary carbon offsets* that people buy in order to neutralize their carbon emissions from flying. The traveler pays a certain amount, on top of the ticket price, that will be invested in a project aimed at reducing carbon emissions elsewhere. This project can for example be reforestation, renewable energy and energy efficiency projects (Brouwer *et al* 2008). Hence, the traveler has compensated for, or "neutralized", the emissions caused by the flight.

2 Purpose

The study aims at determining the willingness to pay for carbon offset among Swedish air travellers and understanding what drives them to voluntarily offset their carbon emissions from flying. Three hypotheses based on general theory on economic behavior have been developed and will be tested and at the same time Swedish air travelers' willingness to pay for voluntary carbon offsets will be determined.

Estimation of passenger mean willingness to pay for voluntary carbon offsets can possibly help Swedish and international policy makers create financial instruments that aim to decrease non-sustainable travelling and generate funds for the measures directed at mitigating emissions.

Hereby follows the three hypotheses tested in the study:

People's propensity to purchase voluntary carbon offsets is positively influenced by the degree to which other co-passengers choose to purchase voluntary carbon offsets.

Awareness about the relative extra amount of carbon dioxide emissions in the atmosphere that a person is responsible for comparing to peers positively influences the willingness to purchase voluntary carbon offsets.

The possibility to distinguish who has purchased a voluntary carbon offset will have a positive effect on people's willingness to purchase voluntary carbon offsets.

The paper proceeds in the following way. First the reader is introduced to the general problem with carbon emissions. Thereafter, a theoretical framework gives an overview of the tools at hand for researchers to elicit how people value the environment. Theories looking at the behavioral rationale behind the propensity to contribute to environmental preservation are then presented. Three theories are then introduced, which are thought to influence consumer valuation of environmental preservation; conditional cooperation, relative culpability and social image. The method used to conduct the study and the results are then presented in turn. Finally, the authors discuss the implications of the study findings in a broader context.

3 Background: the problem with carbon emissions

The background section consists of four parts. The first part briefly explains the greenhouse gas effect and its consequences for the environment. The second part reviews the contribution of the transport sector, and more specifically the aviation sector, to the emissions of greenhouse gases. The third part looks at what is being done in general to reduce the greenhouse gas

emissions from the aviation sector internationally and finally the fourth part gives a brief background to voluntary carbon offsets and the behavioral rationale behind these.

3.1 Greenhouse gases and the greenhouse effect

Greenhouse gases allow sunlight to enter the atmosphere and warm the Earth trapping heat in the lower atmosphere, the so-called greenhouse effect. This is a natural process and without it the average temperature on Earth would be approximately -15° Celsius and life would probably not exist on the planet (Pidwirny *et al*, 2010). However, the atmospheric concentration of the three main human-made greenhouse gases – carbon dioxide, methane and nitrous oxide – has rapidly increased since the beginning of the industrial revolution in the 18th century (Pidwirny *et al*, 2010). This has raised the discussions of global warming, as observations are made of glaciers melting, plants and animals being forced from their habitats, and the number of severe storms and droughts increases (Al Gore, An Inconvenient Truth). Of the anthropogenic greenhouse gases, carbon dioxide is the most important contributor to the increased greenhouse effect and about 63 % of the change in the intensity of the greenhouse effect, and hence global warming, can be accounted for by carbon dioxide (Pidwirny *et al*). The primary reasons for the increased amount of carbon dioxide in the atmosphere is due to the increased combustion of fossil fuels, deforestation, intensified agriculture and the rapidly expanding global population (Pidwirny *et al*). One large contributor to greenhouse gas emissions is the transportation sector.

3.2 Greenhouse gases and the aviation sector

The contribution of the transport sector to world's greenhouse gas emissions is considerable. In 2007, the sector's contribution was about 23% of the total emissions according to Kahn Ribeiro *et al* (2007). Within the transport sector, aviation contributes to a substantial proportion of greenhouse gas emissions and is experiencing the fastest emission growth, together with maritime transports. According to Gössling *et al* (2009), passenger aviation accounts for about 2% of worlds total carbon dioxide emissions. Also, the emissions from airplanes are especially harmful as they are released in the upper troposphere and lower stratosphere where their impact on ozone generation and cloudiness is much greater (Gössling *et al* 2007). The environmental harm in terms of global warming from air travel is between 1.9 to 5.1 times greater than emissions from traffic on the surface (Sausen *et al* 2005). When taking this into account the aviation sector's contribution to global warming in 2006 may have been up to 9% (T&E, 2006).

Aviation includes passenger transport, freight and military flights. Passenger transport accounts for the largest proportion, about 68 %, of all emissions associated with aviation (Gössling *et al*

2009). The global demand for passenger aviation grew at an annual rate of 3.8% between 2000-2006 (Boeing 2008) and is forecasted to grow at the rate 5.3% per year over the next 20 years (Boeing 2010-2029). The demand for cargo traffic is growing even faster with a forecasted growth rate of about 5.9% yearly for the period 2010-2029 (Boeing 2010-2029). Increasing economic growth, globalization, and international trade largely drives the increased demand (Boeing 2008). If aviation continues business as usual the carbon dioxide emissions are estimated at 3.1% per year, resulting in a 300-400% (PEW Aviation fact sheet) increase by 2050 (PEW Aviation and Marine report). Sweden's emissions from tourism-related aviation are higher than the global average; about 200 kg carbon dioxide per capita, compared to the global average of 80 kg per capita (UNWTO-UNEP-WMO, 2008).

3.3 Mitigation of greenhouse gas emissions from aviation

Currently, various measures for reducing greenhouse gas emissions from the transport and aviation sector are being discussed. Among these are governmental command-and-control measures (such as emission trading schemes, emission taxes, fuel taxes, value-added taxes), structural changes (such as changing flight altitudes and flight corridors, air traffic management, restructuring of public transport, switching to alternative modes of transport) and technological change (such as fuel efficiency, alternative fuels, low-speed aircrafts, improved aerodynamics) (Peeters *et al*). Combining all available mitigation strategies could reduce greenhouse gas emission with 53% below the estimated business-as-usual figures for 2050, to about twice the current levels (PEW Aviation and Marine Report, 2009).

There are however many obstacles to the full implementation of these measures, such as lack of governmental regulations, lack of international coordination and the high level of risk in these projects (Gössling *et al* 2008). The policies that are actually being implemented are more or less outpaced by the growing air travel sector. For these policies to be effective they must be well coordinated internationally (PEW Aviation fact sheet), but despite this and despite the sector's impact on global warming, international aviation is not included in the Kyoto protocol (Gössling *et al* 2008). No paradigm exists assigning the emissions for international flights to the greenhouse gas accounts of individual countries (PEW Aviation fact sheet). However, the European Union (EU) has decided that from 2012 and on, aviation will be included in the EU Emissions Trading Scheme. The scheme will apply to all airlines that fly in and out of the EU and will require aircraft operators to buy allowances equal to the CO_2 emissions of each flight. It is predicted that this extra cost for the airlines will be directly transferred to the ticket prices for their customers.

To limit the rapid growth in aviation emissions, the total number of emission allowances available will be capped at the average emissions level in 2004-2006.

The potential for voluntary carbon offsets is still big and they can be combined with the EU Emission Trading Scheme for aviation. Even though the ticket prices may increase as a result of the EU Emission Trading Scheme, people will still be offered to voluntarily compensate for their emissions. As will be discussed in more details later in this paper, when policies to preserve the environment are to be implemented it has been shown more efficient to induce people to contribute on a voluntary basis rather than introducing government intervention. Furthermore, if the emissions of greenhouse gases are to be controlled for, it is also relevant to increase people's attitudes towards and awareness of environmental issues. Hence, even if government intervention programs such as the EU Emission Trading Scheme do take care of the immediate problem with increasing carbon emissions, they do not change people's behaviour towards flying or towards acting more environmentally friendly – even though they may actually make people fly less due to the increased ticket prices. Hence, the take-off point of this thesis is that a well-functioning market for voluntary carbon offset programs is an important complement to government programs and that the efficiency and popularity of voluntary programs can be greatly increased through further research in the field.

3.4 Voluntary carbon offset programs and criticism of them

The demand in the aviation sector is growing and, as has been mentioned, 68% of the emissions from aviation can be derived from passenger traffic. In the recent years an increasing number of companies, both non-for-profit and for-profit ones, have started to offer flight passengers the possibility to voluntarily compensate for their emissions. A voluntary carbon offset is a certified emissions reduction that can be purchased by an individual or a company to neutralize their carbon emissions. The voluntary carbon offset balances the emission from one activity with reductions in emissions in another activity. These activities can, among other things, be reforestation, renewable energy, and energy efficiency projects (Brouwer *et al* 2008). Voluntary carbon offsets are purchased by passengers that are environmentally concerned but cannot or do not want to avoid flying. Programs focusing on aviation emissions are increasing - there are at least 41 voluntary offset providers worldwide (Gössling *et al* 2007). It is not clear exactly how much is being offset this way but one estimated figure is that 200 000 tons carbon dioxide are being compensated for through these programs. This is however a small proportion of the global tourism-related emissions from aviation, estimated to 515 megatons in 2005 (UNWTO-UNEP-WMO, 2008).

In order to understand how a voluntary carbon offset works, the principle of additionality is of importance. For a voluntary carbon offset to be effective, it must ensure that the emission reduction is additional and would not have occurred without the financial support from the purchaser. An example made by Gössling *et al* (2007) is the building of a wind farm, where emission reductions only can be counted if the wind farm would not have been built without the financial support from the voluntary carbon offset schemes and given that an equal quantity of electricity would no longer be produced from non-renewable fossil fuels.

Voluntary carbon offset are commonly discussed and criticized in media. Among others is the "pay-and-play" argument, where voluntary carbon offset supports the illusion that there are simple solutions to unsustainable lifestyles and that people do not have to change their way of life – they can just compensate for it financially (Gössling *et al*, 2007). Another criticism taken up by Gössling *et al* (2007) is the fact that the voluntary carbon offset providers often use their own subjective standards for validation and verification. There are many different kinds of voluntary carbon offsets offered on the market and it has thus become hard for customers to distinguish between them and to evaluate their credibility.

Despite this criticism, purchases of voluntary carbon offsets are becoming increasingly common and studies have shown that voluntary carbon offsets have the potential to contribute to meet greenhouse gas emission targets and reduce global warming (MacKerron *et al*, 2009). Voluntary carbon offsets also have an awareness-raising potential as it enables people to quantify how much they contribute to global warming when they fly and hence makes them consider their emissions. In 2007, the forecasted value of the entire voluntary carbon offsetting market in 2010 was 4 billion USD (Harvey and Corre, 2007).

4 Theory

The problem of voluntary carbon offsetting programs is also the object of more theoretical studies. This section presents the theory behind estimating willingness to pay for public goods as well as different theories from the field of behavioral economics explored in the study by means of hypothesis testing.

4.1 Valuing public goods

Haveman (1973) refers to the environment, or the clean air, as a public good (non-excludable, non-rivalrous). This thesis aims to study why people choose to pay to offset their carbon emissions from flying, and hence choose to contribute to a public (or common) good. As is stated by Brekke *et al* (2001), contribution to public goods is a part of everyday life (recycling of

waste, sending money to charity, vote to preserve democracy etc.) but nevertheless this voluntary behavior is hard to explain with neo-classical theory of economic behavior which is based on the assumption of purely rational and selfish actors in the market.

As Sugden points out in the book "Valuing Environmental Preferences", the intrinsic problem with public goods is that if its supply is left to the market, economic theory predicts that the public good will be undersupplied. Each individual buys the good (if they buy it at all) with a view to benefit herself; but each unit bought by the individual supplies benefits to all individuals. In his paper from 1984, Sugden further explains that welfare economics argue that public policy should aim at achieving Pareto efficiency in the supply of public goods. The problem is then to find a procedure for discovering enough about individuals' preferences to allow us to identify Pareto-efficient provisions for public goods.

According to Narbro and Sjöström (2000), the willingness to pay method is appealing because it is a measure of consumer preferences, which makes it possible to put monetary values on the perceived benefits from contributing to, for example, carbon offsetting programs, including the intangible benefits. Willingness to pay is derived from a theory on behaviour in markets, but in this context it is applied to a field where there is no market in the sense that supply and demand does not determine behaviour in a straightforward way. According to standard economic theory about supply and demand, the demand for any normal good should decrease as the price increases.

4.2 The limitations of neo-classical economic theory

According to a study by Jager, Janssen, De Vries, Greef and Vlek (2000) macro-level indicators of sustainability, such as pollution and fish-harvest, are strongly and predictably affected by behavioral processes at the micro-level. They conclude that the incorporation of a micro-level perspective on human behaviour within integrated models of the environment yields a better understanding and eventual management of the processes involved in environmental degradation. In other words, it is of great interest for policy makers to get a better understanding of the micro level dynamics at work when people choose to voluntarily contribute to, for example, carbon offsetting schemes in order to develop sound environmental policies.

According to Anderson (2000), the neo-classical model of Homo Economicus has exclusively populated the theoretical world of economics for more than a century. This model of the rationally self-interested actor has also come to dominate substantial subfields of political science, sociology, law and philosophy. According to Gintis (2000), environmental policies are

also generally based on this model of the human actor from neoclassical economic theory. As Anderson (2000) points out, trying to explain social outcomes by assuming the characteristics of Homo Economicus has considerable appeal. The theory adheres to the principle of methodological rationalism, that economic behaviour should be explained by a rational before resorting to explanations that represent people's decision-making process as being irrational. The widespread normative call of the economic theory of rational choice therefore supports its use as the default theory for explaining human behaviour. The theory can also facilitate formal, quantitative modelling of human behaviour. Anderson (2000) further means that self-interest is one of our primary motives, and therefore, if a theory could explain all human behaviour without resort to other motivations it could lay a claim to great parsimony.

However, in many circumstances people's behaviour deviates considerably from pure rational and selfish behaviour. For example, the theory of Homo Economicus fails to fully explain why people choose to voluntarily contribute to carbon offsetting programs. As Fehr and Schmidt (2006) outline, experimental economists have gathered overwhelming evidence since the 1980th that systematically refutes the self-interest hypothesis. This evidence indicates that a substantial percentage of the people are strongly motivated by other-regarding preferences and that concerns for the well-being of others, for fairness and for reciprocity, cannot be ignored in social interactions. Hence, according to Fehr and Schmidt (2006), concerns for altruism, fairness, and reciprocity seem to strongly motivate people in contributing to the provision of public goods. This study therefore explores the explanatory power of these alternative theories to analyze what motivates people to buy voluntary carbon offsetting programs.

4.3 Looking beyond neo-classical economic theory

This section presents previous research on related topics and the general theories of economic behaviour that are usually referred to in order to explain voluntary contributions to public goods in various settings. Three discriminated theories are then introduced; conditional cooperation, social image and culpability. In particular, the development of each is described, the settings in which each theory has been used is outlined, and the three hypotheses, derived from each theory that is being tested in the study, are formulated.

4.3.1 Previous research

In order to determine the factors that drive people to voluntary offset their emissions and their willingness to pay for such programs, it is of importance to consider previous and similar research in relevant fields of study. Research in the specific field of why people buy voluntary

carbon offsets in the aviation sector is fairly limited but the research in the field of behavioral economics is extensive and several studies that explore the subject of individual voluntary contributions to other pro-environmental activities have been used. Rowlands, Scott and Parker (2003) examines the determinants of the demand for green energy by trying to identify different demographic, social and attitudinal characteristics that determine individual willingness to pay for green electricity. The study indicates that attitudinal factors best identify potential purchasers of green electricity. Brouwer, Brander and Van Beukering (2008) perform a study on the willingness to pay to offset CO_2 emissions in the air travel industry on an airport in Amsterdam. The findings of the study shows that the market for voluntary carbon offsets has great potential and that people are willing to pay a premium to offset their air travel CO_2 emissions. McKerron *et al* (2009) finnd that voluntary carbon offsets have the potential to contribute both to meeting greenhouse gas emissions targets and to deliver co-benefits. The authors examines the motives behind such voluntary contributions in the UK on the grounds of behavioral economics and found that market price for voluntary carbon offsets underestimates the willingness to pay for it and that the structure of the voluntary carbon offset projects (such as co-benefits) is an important factor that encourages the voluntary carbon offset uptake and willingness to pay.

As stated in the introduction, Gössling *et al.* (2007) find that despite the facts that voluntary carbon offsets are getting increasingly popular and the number of providers is growing, there are big differences in quality and credibility between the providers of such. Moreover, Gössling *et al.* (2009) find that the majority of air travellers do not seem to be aware of options to compensate for CO_2 emissions from flying. They also find that a considerable share of air travellers are in fact willing to avoid flights but that air travellers generally do not see themselves responsible for providing a solution, which negatively impacts their willingness to compensate CO_2 emissions. Hooper *et al* (2008, through Behrens, 2009) find that the willingness to participate in voluntary carbon offsetting is positively influenced by an individual's level of environmental concern, its knowledge and awareness of aviation's impact on the environment and the type of offsetting project.

Behrens (2009) applies to the intangible air travel industry theories of consumer behaviour that have proven explanatory in determining the demand for many tangible environmentally friendly products such as ecological milk and fair trade coffee. The study aims at investigating the explanatory power of consumer-related factors for pro-environmental behaviour in aviation with a focus on passenger transport. Five hypotheses based on attitudinal characteristics are tested and the thesis' findings support that importance, perception of severity and self-perception

influence adaptation of voluntary carbon offsetting schemes. The study also maintains that there is a significant relationship between willingness to compensate and likelihood to compensate. However, the study was conducted on a fairly small sample (128 persons).

4.3.2 General behavioral economic theories

The hypothesis that some people are altruistic has a long tradition in economics and has often been used to explain charitable donations and the voluntary provision of public goods. A person is altruistic if her utility increases with the wellbeing of other people.

However, according to Andreoni (1990), this "pure altruistic" model lacks predictive power and is not easily generalised. He therefore introduces an "impure altruistic" model that is shown to be more consistent with observed patterns of giving. Andreoni (1990) claims that if people were pure altruists they would for example not be influenced by the way a donation was funded, as long as the public good is supplied. Hence, every dollar spent by the government on a public good would crowd out dollar per dollar any private contribution to that same good. However, econometric studies using field data find little evidence of crowding out of private contributions by government expenditures as predicted by the pure altruism model (Ribar and Wilhelm, 2002). Andreoni (1990) states that people tend to prefer to contribute to public goods through voluntary means rather then through government taxation. He refers to that phenomenon as the "warm glow" effect. That is, that donors actually do not receive utility from other people's benefit from the public good, but rather receive utility from the act of giving in itself. The motivation for giving is then exclusively driven by self-interest and not altruism. According to Crumpler and Grossman (2008), considerable evidence suggests that people contribute to public goods for both altruistic and "warm glow" reasons.

Benabou and Tirole (2004) develop a model in which people have different degrees of altruism, but are also concerned about their social reputation and self-respect. Thus, people behave altruistically because they are genuinely altruistic, but also because they want to signal to other people (or to themselves) that they are generous. This model has a rich set of implications. In particular, it can explain why monetary incentives may crowd out altruistic behaviour. The reason is that the presence of monetary rewards spoils the reputational value of good deeds. These actions are no longer an unambiguous signal of altruism or generosity with explicit rewards (or punishments), however, because they may have been undertaken for the money at stake.

Fehr and Schmidt (2006), state that free-riding incentives are a pervasive phenomenon in social life, for example the prevention of negative environmental externalities or the exploitation of a common resource. In these cases the free-rider cannot be excluded from the benefits of the public good although he does not contribute. In view of the ubiquity of cooperation problems in modern societies it is crucial to understand the forces shaping people's cooperation. According to an experiment conducted by Gintis (2000), economic actors are not self-regarding, but rather in many circumstances are *strong reciprocators* who come to strategic interactions with a propensity to cooperate, respond to cooperative behaviour by maintaining or increasing cooperation, and respond to free-riders by retaliating against the 'offenders', even at a personal cost, and even when there is no reasonable expectation that future personal gains will flow from such retaliation.

In an experiment conducted by Fehr and Gächter (1998), they found that people playing the role of firms commonly offer wages considerably higher than the returns they could expect from the enforceable level of worker effort. People playing the role of workers respond to this generosity by making considerably higher efforts than the minimum required to obtain their promised wage. Aggregate effort levels are lower than what firms demand, indicating that self-interest plays some role in determining contractual compliance. But they are much higher than what self-interest alone would produce. Firms punish shirking and reward diligence when given the opportunity to do so, even when this is costly and there is no prospect of further interaction with their workers. These results show that people are willing to cooperate, reward cooperation, and punish uncooperative behaviour, even when it is not in their self-interest to do so, and that they correctly believe that others are willing to do the same. Fehr and Gächter explain their results by postulating that people respond not just to bare incentives but to their interpretation of the intentions others express toward them in offering incentives. Generous and fair-minded intentions elicit generous and fair-minded behaviour. Furthermore, trust appears to be a key factor behind the willingness to cooperate. The norm of trust tells people to act as if they believe others will reciprocate their own cooperation.

On the basis of this general theoretical framework presented and previous research in the field, three main theories have been considered of special relevance in conducting the present study; conditional cooperation, relative culpability and social image.

4.3.3 Conditional Cooperation

Conditional cooperation can be considered as a motivation in its own or be a consequence of some fairness preferences like 'altruism', 'warm-glow', 'inequity aversion' or 'reciprocity'. In the

recent literature, such 'non-standard' motivations have received a lot of attention as explanations for the observed contribution behaviour in public goods experiments.

The impact of other-regarding preferences on cooperation can be easily illustrated for the case of reciprocal individuals. First, reciprocal subjects are willing to cooperate if they are sure that the other people who are involved in the cooperation problem will also cooperate, i.e. reciprocal subjects are conditionally cooperative. Sugden (1984) introduced a theory of reciprocity in which people may not free, cheap or easy ride when others are contributing. Models of reciprocity predict a significant positive relationship between an individual's contribution to a public good and of his group. In Corson (2007) an empirical test has been conducted to test the reciprocity theory advocated by Sugden. The test finds support for the fact that people behave as though part of their objective is to match the contributions given by other donors. Conditional cooperators are hence willing to contribute more to a public good the more others contribute.

If it would be the case that people are influenced by conditional cooperation in the context of carbon offsetting programs, this would be interesting since it would imply that there are multiplicative effects of getting more and more people involved (self-sustaining strategy).

Hypothesis: *People's propensity to purchase voluntary carbon offsets is positively influenced by the degree to which other co-passengers choose to purchase voluntary carbon offsets.*

4.3.4 Relative Culpability

Notions of personal responsibility have started to play a role in psychological research on actual choices with respect to the environment. Building on the "Cialdini Effect", Schultz *et al.* (2007) and Ayers *et al.* (2009) demonstrates that providing individuals with information regarding their energy consumption relative to that of their neighbours could provide an incentive for above-average households to reduce their energy consumption. Bento *et al.* (2010) refer to this as a *within commodity* effect: impacts on purchases of good X are affected by information about peers' consumption of good X. Other recent research has explored a *cross commodity* effect of green purchases (X) on other behaviours (Y): for example, a study by Mazur and Zhong (2009) reports that allowing people to purchase green household goods instead of non-green household goods, makes them more likely to cheat on a test.

In a test of the "passenger pays principle", Akther *et al.* (2009) find that air travellers' perceived responsibility for climate change, awareness of the environmental impact of flying, and the frequency of flying were all positively correlated with willingness to pay for a per-flight carbon offset program. This notion of personal responsibility in creating public harm is an extension of

what Kahneman *et al.* (1993) refer to as an "outrage effect", in which people are willing to pay more to avoid an environmental problem if they think it is human-caused than if they think that it is an outcome of nature (Bulte *et al.*, 2003). Kahneman *et al.* (1993), amongst others, have demonstrated this "outrage effect" on contingent valuation responses.

Bento, *et al.* (2010) extend these ideas to explore how willingness to pay to prevent a public bad is affected by perceived personal culpability - defined as the amount of social damage resulting from an individual's actions - in a controlled set of experiments. The study finds support for the fact that information about perceived personal culpability does affect individual willingness to pay, however, only when the information is provided relative to the social damages caused by others. Specifically, telling a subject that they are more culpable than somebody else does increase willingness to pay, whereas manipulating a subject's sense of culpability in absence of information about others has mixed effects across experiments. These culpability effects are not only important from the perspective of better understanding psychological factors underlying actual contributions and contingent values, but also have practical policy import. The study was conducted amongst 420 UK residents, and since the experiment has not been applied on any other sample it is of interest to explore if the findings can be generalized to the population of Swedish air travellers as well.

Hypothesis: *Awareness about the relative extra amount of carbon dioxide emissions in the atmosphere that a person is responsible for comparing to peers positively influences the willingness to pay for carbon offsetting programs.*

4.3.5 Social Image

According to Becker (1974), charitable behavior such as giving to charity or contributing to public goods can be motivated by a desire to avoid the scorn of others or to receive social acclaim. The fact that people seek esteem is widely accepted by economists and social psychologists. Bénabou and Tirole (2005) mean that this fact is used by charitable and non-profit institutions. They use the donors desire to be perceived as generous and selfless by offering different kinds of signals, everything from lapel pins, charity walks, wrist bands and T-shirts to plaques in opera houses or hospitals and buildings named after large contributors (Bénabou and Tirole, 2005; Ariely *et al*, 2008). Another fact that confirms this view is that anonymous donations are generally considered the most admirable way to give. However, these only represent about 1% of total donations (Glazer and Konrad, 1996).

Ariely *et al* (2008) refer to this type of motivation as "image motivation" or "signaling motivation" and economically this can be explained by a capturing of the rule of opinion in utility, the desire to be appreciated as well as respected by others and by the self. Since people are looking for social approval in their behavior they should try to send signals that are defined as "good", based on social norms and values in the society where they are active. Hence, since being altruistic is often seen as "good" - compared to being greedy or selfish, the act of giving or contributing to a public good is a way to signal to others that one is "good". Furthermore, numerous studies have found that people will act more generously and pro-socially in public than in private settings (Ariely *et al*, 2008).

Hypothesis: *The possibility to distinguish who has purchased a voluntary carbon offset will have a positive effect on people's willingness to pay for carbon offsetting programs.*

4.4 Summary of theory and hypotheses

The theory section has reviewed the literature on contribution to public and common goods, the willingness to pay for it and the behavioral drivers behind this voluntary kind of behavior. Focus has been on three theories that may determine this kind of behavior; conditional cooperation, relative culpability and social image. As a product of these theories, three hypotheses have been developed that will be used to test the applicability of the literature on the case of Swedish air transport passengers and their behavior in terms of purchase of voluntary carbon offsets.

5 Methodology

The following section gives an overview of the method used to conduct the study.

5.1 General research approach

The research is based on a quantitative approach in order to estimate the willingness to pay for carbon offsetting programs and to investigate the behavioral rationale behind such voluntary contributions to environmental preservation activities. Three hypotheses about determinants for contributions to carbon offsetting programs have been derived from the general theoretical framework presented and findings from previous research conducted in the field. These hypotheses are tested empirically through a survey in the study. In order to formulate a well-designed survey instrument, qualitative research procedures have also been used. Among others key informant interviews with for example M. Johannesson, Professor at the Department of Economics at the Stockholm School of Economics, and focus group discussions with potential respondents and employees at Swediavia, company owning Arlanda Airport, were used. As in the

study on willingness to pay for watershed protection conducted by Amponin *et al* (2007), willingness to pay has in this study been computed using two different frameworks; a parametric (probabilistic technique) and a non-parametric (empirical approach). Using both frameworks allow for making relative comparison and identify the more conservative estimate. Haab and McConnel (2002), state that estimates of willingness to pay of the parametric technique are sensitive to the distribution of the functional form and that the non-parametric model constitute a less restricted approach.

5.2 The contingent valuation method

Ciriaci and Wantrup (1947) first introduced the contingent valuation method as a reliable way of tracing the demand curve for public goods such as the environment, which is not transacted in any market place. Mackerron *et al* (2009) present contingent valuation as a stated preference technique based on a survey that ask individuals to place a monetary value on a good presented in a hypothetical scenario. Green *et al.* (1998) go on explaining that in single-bounded dichotomous-choice contingent valuation studies, subjects are presented with a hypothetical offer that specifies a market on which a public good is supplied. Subjects are then asked to cast a simple yes/no vote for paying a specific amount of money for a hypothetical change in the level of provision of the good. The hypothetical price faced by each respondent is fixed. Therefore and as Cameron (1988) puts it, respondents merely decide whether to "take it or leave it". This way of formulating the offer eases the cognitive task that respondents face when presented a hypothetical offer and minimizes the number of non-responses (Bateman *et al.*, 2002; Mitchell and Carson, 1989). In order to provide a profile of the cumulative distribution function of willingness to pay, the payment is varied experimentally over a large sample.

Hanley *et al* (2001) state that contingent valuation is well rooted in welfare economics and that stated willingness to pay amounts are related to respondents' underlying preferences in a consistent manner. According to Green *et al.* (1998) the single bounded dichotomous choice contingent valuation protocol has gained widespread use in applications to valuation of natural resources. It has displaced older methods in which subjects were asked to state open-ended willingness to pay estimates for a good, or to reveal a willingness to pay range by responses to a sequence of bids or choices from a set of alternatives. Boccaletti and Nardella (2000) further argue that although several alternative economic methodologies to value nonmarket goods exist, researchers usually prefer contingent valuation due to the flexibility inherent in the method and its relatively low cost compared to other methods that try to replicate real purchasing situations.

5.3 Reliability of results

When Ciriaci and Wantrup (1947) presented the contingent valuation method they recognized that surveys are not infallible and that it requires careful design and implementation for a contingent valuation study to deliver reliable results. Hanemann (1994) nevertheless finds substantial evidence for the validity of contingent valuation survey responses. He points out that there are many refinements that can be done in order to increase the reliability of willingness to pay estimates using a contingent valuation method. Arrow *et al.* (1993) have published the most recognized recommendations to increase the validity of contingent valuation survey responses. The survey questions in this study have been designed to adhere as much as possible to those recommendations, although taking into consideration the restrictions in time and resources that define the scope of the study.

For example, The study has been carried out by meeting the respondents face to face, hence having the opportunity to clarify any ambiguities. The study also measures how much a person is willing to pay for a good and not the compensation demanded to sell a good. The contingent valuation questionnaire has been pre-tested on a small sample. The contingent valuation survey breaks down willingness to pay by different respondent characteristics such as income and attitudes. The survey gives respondents an accurate and detailed explanation of the program and what the money invested will go to, hence making the purchase look more like in the real market place and limiting the effects of asymmetric information amongst respondents. Overall the survey design and conduction complies with most of the NOAA panel guidelines (Arrow *et al.* 1993).

The question asking if the respondents where "probably" or "definitely" sure about their acceptance/rejection of the offer, also gave them the opportunity to state an uncertain answer. This way of formulating an "exit" option does reflect the spirit of what Arrow *et al.* (1993) recommend to enhance the validity of contingent valuation survey answers. According to Blumenschein *et al.* (1998) a way of limiting one of the main problems with contingent valuation surveys, known as hypothetical bias, is to ask respondents to confirm their "yes" or "no" answer by stating if they are "probably" or "definitively" sure of it. Hypothetical bias is the extent to which individuals might behave inconsistently, when they do not have to back up their choices with real commitments. People then tend to overestimate their willingness to pay for a public good and the problem is to evaluate if peoples' stated behavior deviates significantly from actual behavior, hence influencing the willingness to pay estimate inferred from the study. One way of limiting the effects of hypothetical bias is to inform respondents of the fact that hypothetical bias

exists and that they are subject to it. However, such cheap talk design would have made the survey in this study less straightforward and by having the contingent valuation survey respondents answering the question if they are "probably" or "definitely" sure about their "yes" or "no" answer, this study incorporates both the recommendations of Arrow *et al.* (1993) and controls for hypothetical bias. According to the feedback from the pre-test the "probably" or "definitely" sure option was easily understood.

5.4 Survey design

According to Bateman *et al.* (2002), the careful drafting and pre-testing of a contingent valuation survey is pivotal to be certain that it mimics the relevant features of the market place. In the present study, a pilot questionnaire was first conducted on a group of 20 people to test the acceptability of all questions being asked and also to evaluate if the variations in price levels were roughly in line with the pilot group's willingness to pay. The results from that shaped the design of the final survey. The survey was designed as to be as straight forward, easily understandable and quick to answer as possible (less than 10mn required to complete the survey). A number of questions were multiple choice ones. The survey has been printed (a single page) and handed out in person to the respondents (see appendix 1 for an example). The surveys were handed out by the authors of this paper. They were equally knowledgeable in the subject matter, answered any questions regarding how to fill in the survey that respondents may have had and used the same presentation when meeting new potential respondents who accepted to answer the survey. Participants received no information regarding the content of the survey prior to accepting to answer it in order to limit any selection bias effect. The actions between the authors were coordinated in order to minimize any personal influence on respondents' choices. The survey itself was divided into three main parts:

- On the survey front page, respondents were asked to imagine booking a flight over the internet departing from Stockholm to London. During the booking process they would then be given the opportunity to offset the carbon emissions from the flight. An offer taking the form of an advertisement would pop-up on their computer screens before proceeding to final payment. This add was replicated on the survey (screen shot) and included among others information regarding the contribution of the aviation sector to global climate change, details about how the carbon offsetting program works and the cost of accepting the offer. The price of accepting the offer would be added to the ticket price. After considering the offer the respondents were asked if whether or not they would be willing to pay to contribute to the carbon offset program. Respondents that

accepted the offer were then asked a follow up question where they had to confirm whether or not they were "probably" or "definitely" sure about their stated contribution.

- On the back of the survey, respondents were asked to fill in individual socio-economic information such as age, gender and income level.
- The survey ended with attitudinal questions that were thought as potentially influencing purchasing behaviour, such as level of environmental awareness or previous experience of voluntary offsetting programs.

The split survey design implies on the one hand that the price of the offer was varied at random using 5 different price levels (50Skr, 100Skr, 200Skr, 400Skr, 800Skr) across the sample. The formulation of the offer has also been varied across the sample in order to test three independent variables related to the hypotheses formulated. For example, some respondents were faced with an offer at a price of 100Skr stating that they would receive a green boarding card if they accepted the offer, other respondents faced an offer at the same price but instead of giving them a green boarding card, the offer would state that 75% of their co-travellers compensated for carbon dioxide emissions. Some respondents were presented with an offer stating both options. This way, there were a total 40 different types of offers that were distributed across the sample population. With a total of 320 collected surveys, 8 persons answered each survey type. Different surveys were distributed to potential respondents at random.

5.5 Data collection

The study was conducted at Arlanda Airport, outside Stockholm. It is Sweden's most visited airport, with the most widespread destinations, hence providing the study with a broad and varied sample which gives a good representation of the population of Swedish air travellers. The sample on which this study has been conducted is non-probabilistic. However, Arlanda Airport has conducted a large-scale study over the course of the year 2009, with 98 678 interviews, which has served as a comparative population to validate the sample used in this study (for statistics see appendix 2). The sample has an equal weight of men and women as the bigger population sample (55% men and 45% women) and the age distribution is very similar, although slightly fewer 12 – 19 year old were included in the present survey then what is seen in the Arlanda Airport study. The share of respondents travelling for leisure is slightly more important in this study then what has been observed in the bigger sample (39% vs 32% in the Arlanda Airport report). The most noticeable difference comparing the two studies, is that this study has been carried out on a sample which contains less frequent flyers then the Arlanda Airport study.

The survey was mainly handed out to people at Arlanda Airport at terminal 5 and Sky City. Reflecting the smaller fraction of travellers departing from other terminals, 10% of the total surveys were handed out at terminal 1, 2, 3 and 4 (equally distributed). In order to get as broad a sample as possible, a portion of the surveys (40%) were distributed on the shuttle busses to Arlanda, on Arlanda Express and at the taxi arrival. This was done in an attempt to capture people with different income levels, environmental concerns and travel purposes. One might expect that business travellers spend less time at the terminal, hence resulting in fewer frequent flyers taking part in the survey distributed at the terminals. To let people answer the survey in the calm of the bus or train trip also limited the problem experienced in many contingent valuation surveys, that due to stress respondents don't pay attention to the questions asked and tick through the questionnaire without thinking. Collecting responses on both the bus and the train leave respondents with ample time to think (approx. 30 minutes) about the questions asked in the survey and make an informed decision on whether or not to accept the offer. In the terminal we also approached people who weren't in a hurry and were sitting down so they would have time to read through and take into account the conditions of the offer stated in the survey. The survey was handed out during December, 3rd until 7th and from 07.00am until 09.00pm.

5.6 Reflections over the method

Ideally the sample size could have been bigger, but given the representativeness of the sample compared with the study performed by Arlanda Airport with nearly 100 000 respondents, it is fair to say that the study has relevance. In the best of worlds however, this study should be conducted on a probability sample which would make it easier to generalize the findings. Although a sample of 320 respondents is not very large, it is worse emphasizing that it is comparable with many published contingent valuation studies.

Fortunately, a comparison of the 320 respondents in our reduced sample with the more representative sample collected by Arlanda Airport reveal that they have essentially the same characteristics. However, on should note that the Arlanda Airport is not a probabilistic sample either. One problem inherent with the Arlanda Airport sample is that data has not taken into account if one person was counted several times in the study. Frequent flyers are therefore most likely to be overestimated in the sample. One could argue that the fact that the smaller sample used in this study contains a smaller fraction of frequent flyers might therefore be a more accurate reflection of constituents of the population of Swedish air travellers today. A strong recommendation for future research is to follow the recommendations presented by Arrow *et al.* (1993) in an even more precise manner. However, this study does try and implement most of

those recommendations which makes the risks to this survey broadly balanced. Especially since special attention has been taken to control for a test that the respondents really take good care reading the questions asked in the survey. The sampling procedure might be suspect of selective bias as respondents had the option not to answer the survey. However, these effects have been mitigated to the greatest extent possible given the scope of the study and is a problem inherent in any survey based method.

5.6.1 Dependent variables

The dependent variable in this study is defined by whether or not respondents choose to accept the carbon offsetting offer. The respondent has first to state if "yes" or "no" he would accept the offer. In order to control for hypothetical bias, the respondent is then asked again to confirm if he is "probably" or "definitely" sure about accepting the offer. The dependent variable from these responses has then been created by ordering the answer into three categories: "no", "probably" and "yes". Mean willingness to pay estimates are sensitive to the treatment of "undecided" responses. In this study, the treatment of "probably" responses is important since approximately 37% of the respondents reported they were uncertain about accepting the offer. "Undecided" responses can either be treated as a separate response category, be excluded, or treated as "no". Vossler *et al.* (2002) conducted an experimental study that showed support for the fact that treating the "undecided" responses as "no" yields the most accurate willingness to pay estimates and correspond best to what actual behaviour would be observed on the market place. However, leaving the "undecided" response as a separate category avoids the issue of hypothesizing the respondent's actual voting decision or deleting any observations, which is important when considering the relative small sample this study has been conducted on. In this study this latter option has therefore been judged to be the most appropriate one.

5.6.2 Independent variables

Four independent variables, which it was hypothesised a priori would influence willingness to pay, were integrated in the survey and included in the ordered logistic regression equation. Those independent variables were formulated in the carbon offsetting offer to test the stated hypothesises. A base-line scenario was also designed containing none of the formulations.

Price: The carbon offsetting program was offered to respondents at five different prices. The program did however compensate for the same amount of carbon emissions and acted in the same way regardless what price tag was set on it. This isolates the belief that a higher price could imply more or better compensation. The chosen price levels have been inferred from previous

studies in the field and are also consistent with prices offered for carbon offsetting programs in the real market place.

Conditional cooperation: In order to investigate whether people are subjective to other people's behaviour and to investigate if there could be any multiplicative effects and conditionally cooperative effects in the purchase of voluntary carbon offsets, the offer was also varied with respect to social norms. This independent variable was integrated by telling the respondent that either on average only 25% of the other passengers used to offset their carbon emissions, or that on average 75% of the other passengers used to do it. A dummy was then created with the 25% option being that no social norm applied, whereas the 75% option implied that there was an effect of wanting to copy the behaviour other passengers.

Relative culpability: To determine if relative culpability is driving people to compensate for their carbon emissions in air travel, a text was included in some of the surveys stating that the respondent was culpable of eight times more carbon emissions than someone who chose to travel the same distance by train. A dummy was then created with the culpability text implying that a culpability factor applied, whereas the option without this text implied that the culpability was no effect.

Social image: The survey included a section explaining to the respondent that if he accepted the offer he would receive a green boarding card with a carbon offsetting program logo on. This variable captures the degree to which the respondent cares about appearing to behave in an environmentally friendly way. This signals to co-passengers that you are environmentally friendly and since the boarding card is needed to get on the plane, it is not associated with any boasting attitude (such as stickers or t-shirts). A dummy was created with the option without green boarding card implying that social image had no effect, whereas the green boarding card option implied that there was an effect of social image.

5.6.3 Control variables

Demographic and socioeconomic variables have been included in the survey in order to control for factors that might be of importance for explaining contributions to public goods (gender, age, income, education). The survey also included a number of variables to validate that the respondents did read and understand the questions asked. Such control variables included for example environmental attitudes. Arguably, if a respondent does recycle at home his level of environmental concern should be higher than someone who do not recycle on a regular basis. Hence, since our results are consistent with the fact that a higher level of environmental

awareness is positively correlated with the probability of accepting the carbon offsetting program, the thesis concludes that the survey has been well understood and read by the respondents. The survey has also included a number of variables that allows evaluation of the representativeness of the sample population with the population of all air travellers flying from Arlanda Airport (for statistics see appendix 1).

5.7 Econometric model for discrete choice

In this study the outcome modeled takes the form of discrete choice ("yes" or "no" format). According to Greene (2002), when the dependent variable in a model is an indicator of a discrete choice, conventional regression methods (such as linear regression) are generally inappropriate to estimate the model. In the present study, the values taken by the dependent variable correspond to a coding for the qualitative outcomes "no", "probably sure" or "definitely sure" on accepting a carbon offsetting offer.

Greene (2002), state that this kind of data is better analyzed using formal probit or logit model which, among others, allows estimation of probabilities and marginal effects. The question of which distribution to use cannot be justified on theoretical grounds, rather the decision is a natural one. The logistic distribution is similar to the normal except that the tails are heavier. This model is therefore appropriate when the categories of the dependent variable are well spread. The probit model is on the contrary more appropriate when the middle categories have greater frequencies than the high and low tail categories. In this study the middle category of the dependent variable is not expected to present greater frequency and a logistic distribution is therefore assumed. It is important to keep in mind that the logistic model impose a symmetric logistic distribution on the data. In the logit model, the goal is to model a dependent variable in terms of one or more independent variables, basically the same goal as in ordinary least squares regression. However, ordinary least squares regression is used for continuous dependent variables. In this study the dependent variable is not continuous but categorical, the three categories being "no", "probably sure", "definitely sure". When the dependent variable is not continuous, using logit eliminates heteroskedasticity.

In this study, the three categories of the dependent variable are ordered (in the same way as, for example, the level of insurance coverage taken by a consumer: none, part, or full). Although the outcome is a discrete choice, using a multinomial logit model on the data collected would according to Greene (2002) fail to account for the ordinal nature of the dependent variable. Using ordinary regression analysis would err in the opposite direction. With the three levels of responses coded 0 ("no"), 1 ("probably sure") and 2 ("definitely sure") applying a linear

regression would treat the difference between a 0 and 1 the same as that between a 2 and 3, whereas in fact they are only a ranking. According to Greene (2002), the ordered logit models has come into fairly wide use as a framework for analyzing such responses. The model is built around a latent regression that can be expressed as:

$$y^* = x\beta + \varepsilon$$

where y^* is the exact but unobserved dependent variable; x is the vector of independent variables; and β is the vector of regression coefficients which we wish to estimate. Further suppose that while we cannot observe y^*, we can only observe the categories of response:

$$y \begin{cases} = 0 \; if \; y^* \leq 0 \\ = 1 \; if \; 0 \; < \; y^* \leq \mu_1 \\ = 2 \; if \mu_1 \; \leq y^* \end{cases}$$

The ordered logit technique will use the observations on y, which are a form of censored data on y^*, to fit the parameter vector β. When dealing with ordered logistic models, it is important to note that the parameters of the model are not necessarily the marginal effects we are accustomed to. This study has taken this into account and reported result that are in a form that eases the reader's cognitive task. According to Williams (2006), the ordered logit model is based on the parallel lines assumption, that the β's (but not the α's) are the same across categories. A Brant test has been conducted to test the assumption of parallel lines, and the results were significant and that the assumption was violated, indicating that the assumption was not be rejected and that an ordered logit model could be computed. The econometric software STATA 9.2 was used to estimate the ordered logit model.

5.8 Parametric estimation

According to Amponin *et al.* (2007), a parametric model describes the behavioral tendencies of respondents by incorporating respondent characteristics into the willingness to pay function. The authors explain that a parametric framework allow a bid function to be calculated. As in the study by Amponin *et al.* (2007), the random utility model is the basic theoretical framework used in this study. The bid function explains the variation in willingness to pay response due to changes in the characteristics of the non-market good, in prices of market goods and differences in socio economic characteristics of respondents. In the study by Amponin *et al.*, the random utility model is described as assuming that individuals select the alternative that maximizes their

utility subject to a budget constraint. As expressed in the study conducted by Amponin *et al.* (2007), there is therefore an indirect utility function given by *V(·)* which describes the maximum amount of utility a household can get from their income (*Y*) subject to the prices of the goods (*P*), and the level at which the non-market environmental good (*G*) will be provided. The possible effect of demographic and socio-economic factors *(D*) on this utility is also assumed. The utility function can therefore be given by:

$$V\ (Y, P, D, G)$$

The implications are that a change in one factor impacts the level of household utility. For example, an increase in the provision of the non market good represents an improvement resulting in higher utility. In this study this can be illustrated by an increase in the number of trees planted by carbon offset programs which could increase global air quality. In contingent valuation studies, Amponin *et al.* (2007) argue that respondent compare utilities in order to make a discrete choice of whether to contribute to the provision of the public good or not. In the mentioned example with improved air quality, the household would accept the proposal provided that his utility with the extra trees planted through the carbon offsetting program and the required payment is higher than without the improvement in air quality resulting from new tree plantations. For example, the probability of accepting the offer is given by:

$$\text{Prob (Yes)} = \text{Prob}\ [\text{V}\ (\text{Y} - \text{P}, \text{D}, G^1) + \varepsilon_1] > Prob\ [\text{V}(\text{Y}, \text{D}, G^0) + \varepsilon_0]$$

Where G^1 represents the level of provision of the non market good if the respondent chooses to contribute to the provision of the public good, and G^0 represents the opposite scenario. According to Amponin *et al.* (2007), the stochastic term ε is one that can not be determined, representing the part of the true indirect utility function that cannot be observed.

5.9 Non parametric estimation

Amponin *et al.* (2007), refers to the nonparametric approach as purely empirical since it does away with the assumption of a parametric distribution. The authors state that in contingent valuation surveys with a dichotomous choice design that uses a range of positive bid levels, respondents are presented with one of the bid prices for accepting a hypothetical offer. Respondents are asked to state whether or not they are willing to pay the given price. Respondents who do not accept the offer are assumed to have a zero willingness to pay.

5.10 Estimating mean willingness to pay

The estimate of mean willingness to pay for carbon offsetting programs using a parametric method has been computed using the formula presented by P.O Johansson (1995). The formula restricts willingness to pay to be nonnegative. In this study such an assumption is reasonable as willingness to pay estimates for environmental protection do not take negative values (Blumenschein *et al.*, 2008). Assuming a linear utility function and a logistic distribution, the formula for computing mean willingness to pay can be expressed as:

$$-\left(\frac{1}{\beta}\right) \times \ln(1 + e^{\alpha})$$

where β is the price coefficient in the logistic regression equation. In Johansson (1995), α is a constant resulting from a logistic regression equation (with the effect of all other covariates added to the constant). However, in this study the parametrical model is estimated using an ordered logit model. Running the model in the software program STATA 9, yields cut off points instead of constants. In order to use the formula presented in this section, the cut off points have to be converted into constants. According to Williams (2006), the cut off points produced in the ordered logit model equal the negatives of the α's. Therefore, when estimating mean willingness to pay using the parametric framework, the negatives of the cut off points produced by the ordered logit model have been used.

6 Results

The following section presents the result of conducting the study

6.1 Descriptive statistics

The analysis of the data was divided into two steps. The first step looks at the responses to the first question; "Do you accept the offer?". Here the respondents were divided into two groups; one "yes group" and one "no group". The responses to the second question; "Are you probably or definitely sure about accepting the offer?" divided the respondents into two new groups; one group who were definitely sure about accepting the offer, and one group of the ones who were only probably sure or said no to begin with.

6.1.1 Variation of the offer

Price. Almost 60% of the respondents accepted the offer to begin with and 22,5% of the total amount of respondents were definitely sure about accepting the offer. The share of the respondents that accepted the offer they received at the given price level is described in **figure 1** below. It shows that as the price increased, the share of respondents that accepted the offer decreased, both when looking at the responses on whether they wanted to accept the offer to begin with, and also when looking at whether they were definitely or probably sure about accepting the offer at the given price level.

Figure 1. Share of respondents that accepted the offer at each given price level

Conditional cooperation. How the variation of the characteristics of the offer itself is related to respondents' acceptance rates can be seen in **table 1** below. The conditional cooperation factor was a percentage (75% and 25%, respectively) saying, on average, how big share of the other passengers that purchase voluntary carbon offsets for the selected flight. This did to some extent have the pre-supposed positive effects on respondents' acceptance rates; 63% of the people that faced the fact that on average 75% of the people on their flight compensated for

their carbon emissions, accepted the offer to begin with. Among the respondents that read that on average only 25% of the people on their flight compensated for their carbon emissions, "only" 57% accepted the offer. However, when looking at whether they were definitely sure to really accept the offer, the figures do no longer confirm that this factor has the pre-supposed influence.

Relative culpability. Interestingly, the appearance of the culpability factor telling the respondent that the trip he/she were about to buy causes 8 times more carbon emissions than the same trip by train, did not seem to have the pre-supposed positive effect on acceptance rates.

Social image. Similar figures like the ones on conditional cooperation describe the results from the social image feature. Of the people that faced the offer that included a social image factor in the form of a green boarding card, 66% accepted the offer, compared to 54% of the ones that did not face the green boarding card option.

	DO YOU ACCEPT THE OFFER?			ARE YOU DEFINITELY SURE?		
	Yes	No	Obs	Definitely	Probably	Obs
Conditional cooperation 75%	62%	38%	160	31%	69%	100
Conditional cooperation 25%	57%	43%	160	45%	55%	91
Culpability included	58%	42%	160	41%	59%	92
Culpability not included	62%	38%	160	34%	66%	99
Green boarding card incl.	66%	34%	160	37%	63%	105
No green boarding card incl.	54%	46%	160	38%	62%	86

Table 1. Responses in variation of offer.

6.1.2 Control variables

In the following section some brief comments on some interesting figures and their implications are given.

Gender. Worth noting is that female acceptance rates are higher than male acceptance rates.

Age. The age group 45-64 years has the relatively highest acceptance rate.

Education. Respondents with the highest level of completed education; university, have the highest acceptance rates.

Income. Slightly surprising, when looking at the income variable we see that the group with the highest income have the lowest share of respondetns accepting the offer to begin with. Instead, the group with a monthly income of 25 001-40 000 SEK had the highest share of respondents accepting the offer.

Flyer frequency. The big group of less frequent flyers, which had used air transport less than nine times the last twelve months, had the highest acceptance rates and were "definitely sure" in more cases than in the other groups.

Environmental concern. A less susprising but still interesting feature of the data is that the acceptance rate among the people that separate their waste at source (whole 77,5% of the entire sample) was higher than among the people that did not separate their waste at source. Also worth noting is that almost 78% of the respondents had heard of climate compensation before, but only about 24% had actually climate compensated before.

		DO YOU ACCEPT THE OFFER?			ARE YOU DEFINITELY SURE?		
		YES	NO	OBS	YES	NO	OBS
Gender	Male	51%	49%	176	20%	80%	176
	Female	70%	30%	144	26%	74%	144
Age	< 25	53%	47%	40	15%	85%	40
	25 – 44	58%	42%	136	23%	77%	136
	45 - 64	70%	30%	114	25%	75%	114
	> 65	41%	59%	27	22%	78%	27
Education	Elementary	62%	38%	16	19%	81%	16
	Upper secondary	56%	44%	108	20%	80%	108
	University	63%	37%	190	25%	75%	190
Income	< 10 000	54%	46%	26	8%	92%	26
	10 001 – 25 000	51%	49%	73	16%	84%	73
	25 001 – 40 000	68%	32%	125	28%	72%	125
	40 001 – 60 000	65%	35%	62	29%	71%	62
	> 60 000	48%	52%	33	12%	88%	33
Flights yearly	< 9	64%	36%	216	25%	75%	216
	10-20	48%	52%	64	16%	85%	64
	> 21	53%	47%	40	20%	80%	40
Separate	Yes	63%	37%	248	24%	76%	248
	No	47%	53%	72	17%	83%	72
Heard of climate	Yes	62%	38%	249	25%	75%	249
compensation	No	51%	49%	67	12%	88%	67
Climate comp.	Yes	73%	27%	77	40%	60%	77
before	No	56%	44%	241	17%	83%	241

Table 2. Control variables and responses

6.2 Regression results

The results from the regression analyzes are reported in table 3 below. In the ologit regression with the dependent variable "acceptance of offer" the responses fall into three different categories; "no", "yes, probably" and "yes, definitely". The regressions are conducted with only price as an independent variable, then with all four features of the offer (price, conditional

cooperation, social image, culpability) as independent variables. In the final regression the control variables are added. In the last regression some missing data points result in a drop of 4 observations. Not surprisingly, the coefficient for price is negative and significant in all three regressions. The negative sign of the price coefficient can be interpreted as when the price goes up, the probability that the respondent will accept the offer goes down.

None of the coefficients for conditional cooperation and relative culpability are significant in any of the regressions. The social image factor, represented by a proxy in the form of a green boarding card, has a positive coefficient that is significant both when we include the control variables and when we do not. When looking at the control variables impact on the dependent variable, gender proves to be positive (woman=1, man=0) and significant. Another highly significant and positive coefficient is that for separation of waste at source.

	ORDERED LOGIT Price		ORDERED LOGIT Extended		ORDERED LOGIT Control variables	
	Coefficient	**P-value**	**Coefficient**	**P-value**	**Coefficient**	**P-value**
Price	-0,002	0,000*	-0,002	0,000*	-0,002	0,000*
Culpability			-0,077	0,717	-0,023	0,915
Social Image			0,450	0,034**	0,451	0,042**
Conditional Coop.			0,026	0,902	0,016	0,941
Gender					0,543	0,021**
Age					0,002	0,829
Educ. Upp. Second.					-0,439	0,392
Educ. University					-0,178	0,719
Income					0,000	0,307
Flyer Frequency					-0,303	0,082
Separation of waste					0,775	0,006**
Cut1	-1,008		-0,821		-0,361	
Cut2	0,714		0,921		1,503	
Observations	320		320		316	
Pseudo R2	0,034		0,041		0,074	
***Significant at 1%**						
****** **Significant at 5%**						

Table 3. Ologit regression results. Dependent variable: Acceptance of offer.

6.3 Estimates of willingness to pay

To estimate the mean willingness to pay for voluntary carbon offsets in the sample, two different methods were used. First, a parametric method was used based on the coefficients from the regressions. Those results will be presented first. Mean willingness to pay for voluntary carbon offsets has then been estimated using a non-parametric method. This latter estimation has been based on data extracted directly from the survey responses.

6.3.1 Willingness to pay using a parametric method

Mean willingness to pay among the people that accepted the offer to begin with - that is, before the question about whether they were probably or definitely sure was asked - is 679 SEK. Here, the two respondent categories are yes (both probably and definitely) versus no. When the question about whether the respondents were probably or definitely sure was asked, the willingness to pay was a lot lower; 185 SEK. Here, the two respondent categories changes to yes definitely versus yes probably and no. These two values are true when all independent variables are set at their average values. By altering the significant variables from their average values we can see how the willingness to pay changes as a result of this. The mean willingness to pay according to the parametric method is summarized in table 4.

For the group that accepted the offer to begin with, if there is no green boarding card involved in the offer the willingness to pay for the voluntary carbon offset decreases to 598 SEK. On the other hand, if there is a green boarding card involved in the offer, willingness to pay goes up to 766 SEK. For the group that is definitely sure about accepting the offer, the willingness to pay changes accordingly; up to 223 SEK for a green boarding card but down to 153 SEK without it.

The men in the sample have a lower willingness to pay than the women, 593 SEK and 796 SEK respectively. Hence, these women are willing to pay about 63 % than men for voluntary carbon offsets. In the group with the respondents that are definitely sure the willingness to pay goes from 151 SEK for the men to 237 SEK for the women.

The people that separate their waste at source have a higher willingness to pay than the people that do not; 746 SEK and 476 SEK respectively. Hence, the people that separate their waste at source are willing to pay 56 % more than the people that do not. For the definitely sure respondents the relation was similar; 214 SEK for the people that separate and 110 SEK for those who do not, an increase of almost 100 %.

		Willingness to pay
Do you accept the offer?	Average for all variables	679 SEK
	With green boarding card	766 SEK
	Without green boarding card	598 SEK
	Woman	796 SEK
	Man	593 SEK
	Separates	746 SEK
	Do not separate	476 SEK
Are you probably or definitely sure?	Average for all variables	185 SEK
	With green boarding card	223 SEK
	Without green boarding card	153 SEK
	Woman	237 SEK
	Man	151 SEK
	Separates	214 SEK
	Do not separate	110 SEK

Table 4. Parametric estimation of willingness to pay for voluntary carbon offsets.

6.3.2 Willingness to pay using a non-parametric method

In a non-parametric estimation of the mean willingness to pay for climate compensation we get results that are lower than in the parametric estimation. For the respondents that accept the offer to begin with, the mean willingness to pay is 431 SEK. For the respondents that are definitely sure about accepting the offer, the mean willingness to pay is a lot lower; 148 SEK. The estimation of the curve is shown in **figure 2**. An important assumption that has been made here is that 800 SEK is the highest amount anyone would ever be willing to pay. Hence, the demand curve has been cut at 800 SEK. This is however just an assumption that may not hold in reality, therefore the willingness to pay may to some extent be underestimated, which seems to consist with the fact that these estimations are lower than estimated using a parametric method.

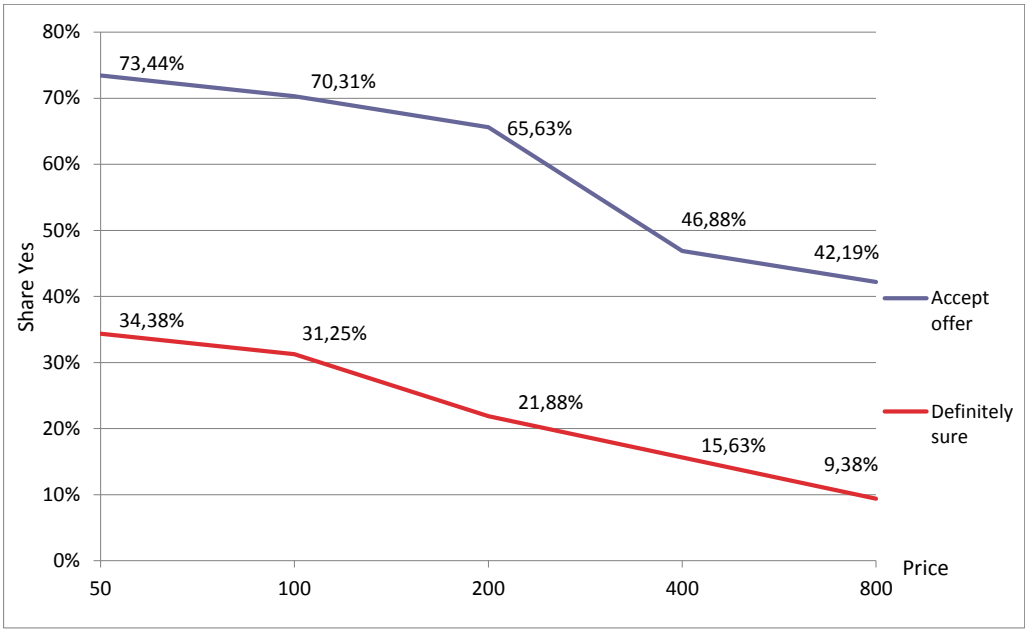

Figure 2. Non-parametric estimation of demand curve.

7 Discussion

The findings from the result section in comparison to the stated hypotheses are discussed below.

7.1 Willingness to pay

In order to estimate the willingness to pay for voluntary carbon offsets amongst Swedish air travellers, the price of the offer was varied across the sample. According to the parametric method, the mean willingness to pay for voluntary carbon offsets in Sweden is in the interval 185 SEK - 679 SEK when all the independent variables are at their average value. The higher value, 679 SEK, is given by the first part of the experiment; where the respondents were asked if they wanted to accept the offer at the given price. The lower value, 185 SEK, is given by the second part of the experiment; when the respondents were asked whether they were probably or definitely sure about accepting the offer at the given price. When the significant independent variables are changed from their average values, e.g. a green boarding card is included, the respondent is a woman or the respondent is a separator – the mean willingness to pay changes. Women and people that separate their waste at source tend to have a higher willingness to pay than men and people that do not separate their waste at source, respectively. The feature of a green boarding card in the offer also increases the willingness to pay for the offer. This shows that people aren't solely motivated by an urge to compensate for their carbon emissions, but that other factors may have an impact on their willingness to do so. This, in turn, points to the fact

that the participation rate for these kinds of program to some extent can be channelled and controlled trough well designed policies and marketing programs.

Interestingly, earlier research on mean willingness to pay for voluntary carbon offsets are within our interval. Brouwer *et al* (2008) find that passengers are willing to pay on average 26.6 Euros (about 236 SEK, 2011-01-27) per ton carbon dioxide. In our experiment the amount of carbon dioxide that was being offset was almost 1 ton (820 kg). Brouwer *et al* also find that the willingness to pay is often higher than the prices that are being offered on the market for voluntary carbon offsets. This is however more or less impossible to say today since there are many suppliers of voluntary carbon offsets and they all more or less have their own pricing system. MacKerron *et al.* find a similar mean willingness to pay in their sample of high educated, young brittish people. The mean willingness to pay for 1 ton carbon dioxide was 24 GBP (about 247 SEK, 2011-01-27) according to their study.

7.2 Conditional Cooperation

In the setting of this study, when people are informed that a large share of their co-travellers compensate for their carbon emissions, the participation rate changes. More specifically, when people were informed about the fact that on average 75% of the rest of the passengers compensated for carbon emissions, the rate of contributions to the carbon offset program increased. However, this increase was not significant in any of the performed regressions. Hence, the thesis does not find support for the conditional cooperation hypothesis that "*people's propensity to purchase carbon emission offsets is positively influenced by the degree to which other co-passengers choose to purchase carbon emission offsets."* The fact that the hypothesized trend was not observed can be due to the fact that people could think that if 75% of the rest of the passengers pay for offsetting their carbon emissions, it gives the respondent an opportunity to free-ride on others contribution. Similarly, if people faced an offer where only 25% of the rest of the passengers compensate for their carbon emissions, they may feel they have more of a duty to compensate for theirs. It is however not clear how the hypothesis could have been implemented in a more efficient way in order to decrease the risk of misunderstanding. Hence, from this thesis no assumption about the multiplicative effects of the participation rate in carbon offsetting program can be derived.

7.3 Relative culpability

Despite previous studies showing that relative culpability has an effect on contributions to public goods, no such effect was detected in this study. In fact, a larger share of the ones that did not

face this amendment of the offer decided to accept the offer than among the ones that actually did face the amendment. However, the results are not statistically significant and hence no conclusions can be drawn. There is therefore no support for the a priori hypothesis that "*awareness about the relative extra amount of carbon dioxide emissions to the atmosphere that a person is responsible for comparing to peers positively influences the willingness to purchase carbon emission offsets"*.

A reason for this unexpected outcome could possibly be that that the air travellers, which are being informed about their relative culpability level compared to people who choose to travel the same trip by train, might find the comparison a bit out of context. A part of this group would perhaps not consider doing the trip from Stockholm to Paris by train, and hence do not induce any feeling of shame or culpability as was intended.

Another possible reason could be that some people are so called "free-riders" that rather see the fact that on average 75% of the others on the plane offset their emissions as a reason not to offset.

7.4 Social Image

The study shows that when people know that they are going to be distinguished from the rest of the passengers if they compensate for their carbon emissions, they're willing to pay more for the same carbon offset program. Furthermore, we see that the participation rate increases when people who act environmentally friendly are discriminated from other passengers. This is in line with Ariely *et al*s (2008) theory of people wanting to signal to others that they are "good", in this case by their voluntary contribution to a cleaner environment. People seem motivated by a desire to appear generous and selfless just as stated by Bénabou and Tirole (2005). The fact that the green boarding card is designed as to have as little boasting effect as possible, it might make the green boarding card an attractive mean of signaling one's own good behaviour and gaining acceptance of the group. Even though the green boarding card does not make the contributor anonymous, neither does it require that he deliberately shows his act of "good". As Bénabou and Tirole (2005) points out, anonymous contributions are generally considered being the most admirable ways to give. For airline companies, an implementation of green boarding cards into their carbon offsetting programs should be seen as feasible and according to the findings of this study highly recommendable in order to increase purchases of voluntary carbon offsets. In the first of our regressions, on the ones that accepted the offer, the results of the thesis find significant support for the stated social image hypothesis that "the possibility to distinguish who has purchased a voluntary carbon offset will have a positive effect on people's willingness to purchase voluntary carbon offsets*"*.

7.5 Further findings

This thesis finds support for the fact that gender is a pivotal factor determining the propensity and the willingness to pay to contribute to carbon offsetting programs.

Environmental attitudes, estimated by the habit of separating waste, were also shown to have an impact on the willingness to pay to compensate for carbon emissions. People that separate their waste at source are willing to pay 56 % more than the people that do not. This is a sign of the validity of our study since it shows that people that are more environmentally engaged, and separation of waste is considered a good proxy of this, are more willing to pay to offset their carbon emissions. Hence, the answers that we got in our survey are in coherence with how people act in general from an environmental point of view.

7.6 Conclusions and suggestions for further research

This thesis aimed to estimate the willingness to pay for voluntary carbon offsets among Swedish air travelers. It also aimed to test the determinants behind this voluntary behavior by testing three hypotheses based on theories on voluntary contribution to public goods, namely those of social image, relative culpability and conditional cooperation. Some conclusions can now be drawn from the conducted study and the analysis of the collected data.

For the first part of the data, referred to as outcome 1, where the respondents were asked to accept or refuse the voluntary carbon offset offered, the willingness to pay was 694 SEK. For outcome 2, where the respondents were to decide if they were definitely or probably sure about accepting the offered voluntary carbon offset, the willingness to pay was a lot lower, only 177 SEK. Hence, when people are asked if they are definitely sure about accepting the offer, their willingness to pay decreases significantly.

For outcome 1 the study finds support for the hypothesis that social image is important and that the possibility to show that one has purchased a voluntary carbon offset has a positive and statistically significant correlation to the probability of acceptance. However, no statistically significant support can be found for the other two hypotheses, on relative culpability and on conditional cooperation. The positively statistically significant effect of social image may have some important policy implications since it implies that people are more willing to purchase voluntary carbon offsets if they can show to other people that they have done this.

These findings are in line with expectations. The inclusion of respondent's uncertainty in the design of contingent valuation studies decreases the willingness to pay percentage. Since

hypothetical bias and overestimation of willingness to pay estimates are at the heart of the criticism directed towards the use of contingent valuation methods, the findings of this thesis can be used to enhance the effectiveness and credibility of contingent valuation results as they yield more accurate willingness to pay estimates. As expressed in the introduction of the paper, environmental protection is becoming increasingly important. Finding new ways of analyzing or improving the current methods used to analyze the value people place on different public goods is therefore crucial. It is important for effective policy implementation and efficient fund allocation to preservation programs that yield the highest socio-economic benefit. In that respect, it is important that the relationship between how the inclusion of uncertainty influence willingness to pay estimates. The relationship should be investigated further.

Another finding is that gender was statistically significant in our econometric model. Women are more willing to purchase voluntary carbon offsets than men and their mean willingness to pay is 63% higher. Also, separation of waste was positively statistically significant too with a marginal effect of 0,834. These are interesting findings that had been interesting to investigate further.

A suggestion for future research would also be to focus on the social image factor and to test different kinds of features of the voluntary carbon offset to see which has the best effect on peoples' willingness to contribute and willingness to pay. The green boarding card feature presented in this study is rather easily implementable and it therefore presents considerable appeal for businesses who sell voluntary carbon offsets or airports that want to profile themselves as more environmentally friendly, like Arlanda Airport. Policy makers should also take the observed effect of social image on purchasing behavior into account since it can be used as a tool for spreading pro-environmental behavior and norms in society.

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Appendix 1: Survey example in Swedish

Tack för att du tar dig tid att svara på denna enkät!

Ditt deltagande är helt anonymt och dina svar behandlas konfidentiellt. Observera att du måste vara bosatt i Sverige för att kunna delta i denna enkät.

Studien görs på Handelshögskolan i Stockholm och resultaten kommer att analyseras i en magisteruppsats som del av en civilekonomexamen. Undersökningen utförs inte i samarbete med någon flygplats, flygbolag eller annat företag.

Var god läs igenom varje fråga noggrant och försök att svara så ärligt som möjligt. Vi ber dig också att vänligen vika ihop blanketten innan du överlämnar dina svar till oss.

Stort tack för din hjälp!

VERKLIG SITUATIONSBESKRIVNING

Föreställ dig att du ska flyga privat tur och retur från Stockholm till Paris med flygbolaget FLY Airlines. Du köper din biljett över internet och erbjuds följande tillval vid köpet av din biljett:

Läs igenom erbjudandet igen och tänk igenom villkoren innan du besvarar följande fråga.

Skulle du anta erbjudandet ovan?
☐ Ja ☐ Nej

Om du svarade ja till att anta erbjudandet: Är du troligen säker eller definitivt säker på att du skulle anta erbjudandet?
☐ Troligen säker ☐ Definitivt säker

Appendix 1

BAKGRUNDSFRÅGOR

1. Kön:
☐ Kvinna
☐ Man

2. Vänligen ange din ålder: ……

3. Vilken del av Sverige är du bosatt i?
☐ Norrland
☐ Götaland
☐ Svealand

4. Vilken är den högsta utbildning du har avklarat?
☐ Högstadium
☐ Gymnasium
☐ Universitet eller högre

6. Vilken är din personliga inkomst före skatt per månad?
☐ 0 – 10 000 SEK
☐ 10 001 - 25 000 SEK
☐ 25 001 - 40 000 SEK
☐ 40 001- 60 000 SEK
☐ Över 60 000 SEK

7. Vilket är det huvudsakliga syftet med din resa idag?
☐ Tjänst
☐ Privat

8. Vilken typ av biljett reser du med idag?
☐ Första klass/Business
☐ Ekonomi/Flygstol
☐ Charter
☐ Vet ej

9. Ska du flyga inrikes eller utrikes idag?
☐ Inrikes
☐ Utrikes

10. Hur många gånger har du flugit INRIKES (tur och retur) de senaste 12 månaderna?
☐ 1 gång eller mindre
☐ 2 - 5 gånger
☐ 6- 12 gånger
☐ 2 gånger i månaden eller mer

11. Hur många gånger har du flugit UTRIKES (tur och retur) de senaste 12 månaderna?
☐ 1 gång eller mindre
☐ 2 - 5 gånger
☐ 6- 12 gånger
☐ 2 gånger i månaden eller mer

12. Källsorterar du hemma?
☐ Ja
☐ Nej

13. Hade du hört talats om klimatkompensation innan du tog del av den här undersökningen?
☐ Ja
☐ Nej

14. Har du någonsin klimatkompenserat?
☐ Ja
☐ Nej

15. Om ja, hur många gånger har du klimatkompenserat senaste 12 månaderna? ……

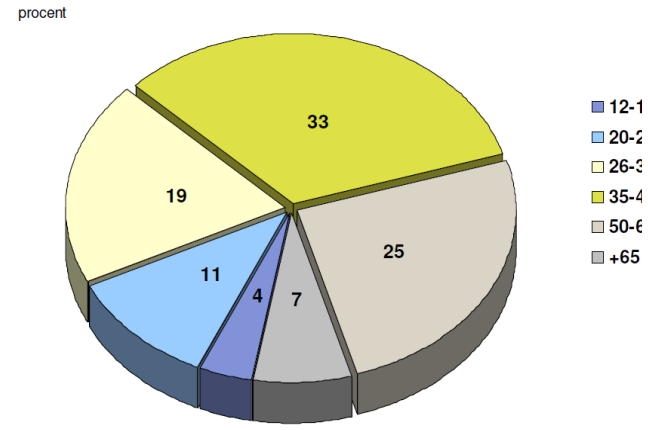
Tack för din medverkan!

Appendix 2: Arlanda Airport sample characteristics (%); Source LFV (2009)

Helår 2009 Procent			Kön		Ålder						Kategori			Biljettklass				Syfte med resa		Antal resor per år		
		Totalt	Man	Kvinna	12-19	20-25	26-34	35-49	50-64	+65	Inrikes	Utrikes charter	Utrikes linjefart	Ekonomiklass/ Flygstol	Förstaklass	Charter	Vet ej	Privat	Tjänst	1 resa/år	2-5 resor/år	+6 resor/år
Kön	Man	56			42	46	56	62	58	49	56	49	57	57	75	48	64	47	72	53	51	67
	Kvinna	44			58	54	44	38	42	51	44	51	43	43	25	52	36	53	28	47	49	33
Ålder	12-19	4	3	5							5	5	3	4	1	5	10	6	1	5	5	2
	20-25	11	9	14							12	11	11	12	3	9	8	15	4	14	12	7
	26-34	19	19	20							16	13	22	20	14	12	13	20	19	22	19	18
	35-49	33	36	29							32	31	34	33	45	30	44	26	46	30	30	40
	50-64	25	26	24							29	29	24	25	33	30	20	24	28	21	25	29
	+65	7	6	8							7	12	6	6	5	14	6	10	2	8	9	4
Kategori	Inrikes	25	25	25	29	27	20	24	28	24				28	6	2	22	22	30	12	23	38
	Utrikes charter	10	9	11	13	9	6	9	11	17				3	2	79	5	15	0	11	13	4
	Utrikes linjefart	65	67	64	58	64	73	67	61	59				70	92	19	73	63	70	77	63	58
Biljettklass	Ekonomiklass/Flygstol	89	89	88	88	92	93	89	86	80	99	23	95					84	96	87	86	94
	Förstaklass	2	2	1	0	0	1	2	2	1	0	0	2					1	3	2	1	2
	Charter	9	8	11	11	8	6	9	11	19	1	76	3					15	0	11	13	4
	Vet ej	0	0	0	1	0	0	0	0	0	0	0	0					0	0	0	0	0
Syfte med resa	Privat	64	53	77	95	87	64	49	59	91	56	98	61	61	25	99	40			75	75	38
	Tjänst	36	47	23	5	13	36	51	41	9	44	2	39	39	75	1	60			25	25	62
Antal resor per år	1 resa/år	28	26	30	34	36	32	26	23	31	14	33	33	28	28	32	27	33	19			
	2-5 resor/år	41	37	46	52	44	39	37	41	51	39	56	39	39	25	57	27	48	28			
	+6 resor/år	31	37	24	14	19	29	37	36	17	47	12	28	33	47	11	45	19	52			

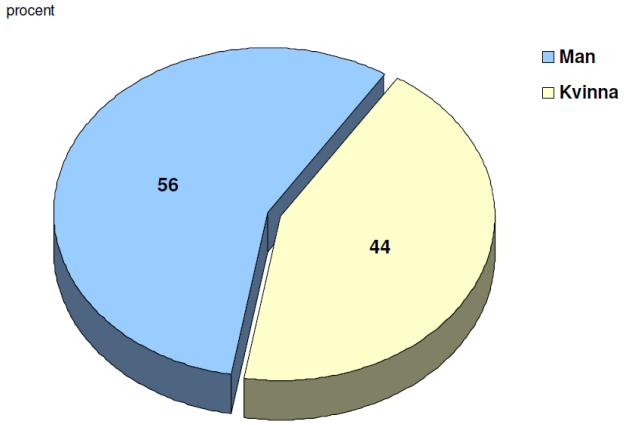
Appendix 2: Source LFV (2009)

Åldersfördelning



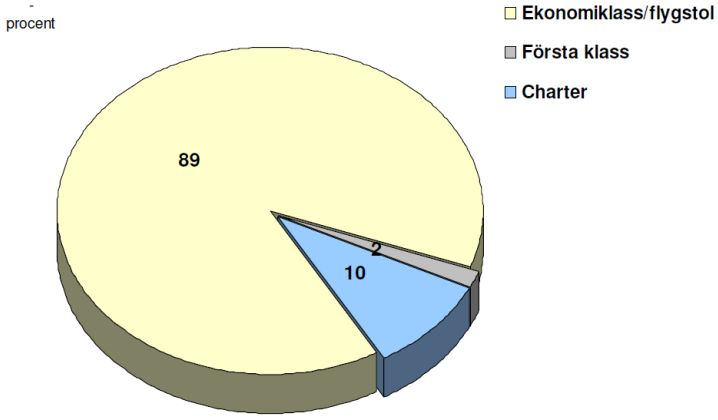
Age distribution %

Könsfördelning



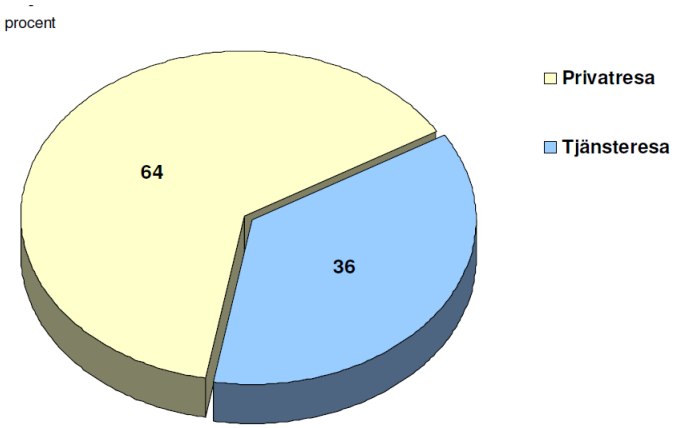
Gender distributiom % (men 56%)

Biljettyp



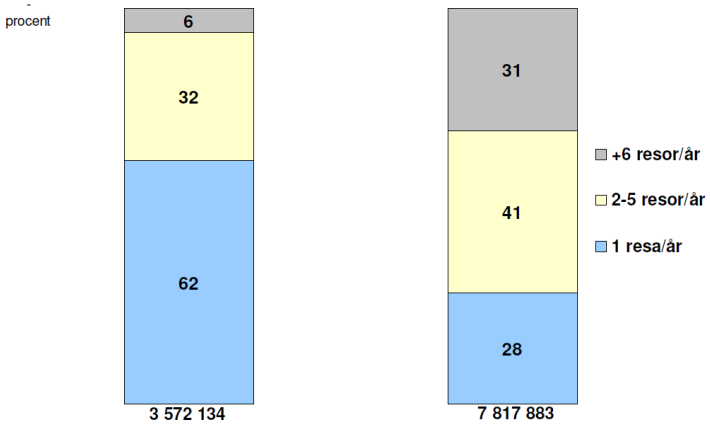
Ticket type (Economy89 %, First class 2%, Charter 10%)

Ärende



Travel purpose (private 64%, duty 36%)

Resfrekvens



Trvellers: 3 572 134
62 % = 1 travel/yr
32 % = 2 – 5 travels/yr

Travels: 7 817 883
28 % = 1 travel/yr
41 % = 2 – 5 travels/yr

Trevel frequency