AIRLINE CARBON OFFSET: PASSENGERS' WILLINGNESS TO PAY AND REASONS TO BUY

S. K. Jason CHANG, National Taiwan University, Taiwan, skchang@ntu.edu.tw

Joel Z.Y. SHON, Tainan University of Technology, Taiwan, joelshon@ms4.hinet.net

Tzuoo-Ding LIN, National Cheng Kung University, Taiwan tdlin@mail.ncku.edu.tw

ABSTRACT

In the past few years, GHG has become the hottest issues in the transportation sector. Most of the transportation modes are trying to go green via using hybrid technology, alternative fuel, or renewable energies. But for people who take airplanes, especially those cross-continent travellers, there is very limited alternative. As a result, some airlines are providing carbon offset program for travellers to buy back the carbon dioxide they emitted during their trip. Airlines collect the offsets to purchase equivalent certificates or to fund CDM projects to make their trips carbon neutral. The carbon offset program is now popular throughout the world, yet it is still a volunteer program. Only very little number of passengers are purchasing the offset. Hence we would like to find out the passengers' willingness to pay in this study. For those passengers who have the offset buying experiences, we would then examine the major reasons for them to buy. A cross-culture comparison would be analyzed to find out the different responses of passengers of various socio-economic variables.

Keywords :Carbon Offset, Air Transportation, Willingness to Pay Reason to Buy

INTRODUCTION

Global warming has become a global issue since late 1990s. Starting from Kyoto protocol of 1997, to most recent Copenhagen summit in 2009, the whole world is looking for some effective ways to reduce green house gas (GHG) emission, hoping to cool down the steadily increasing temperature on earth. Transportation sector usually accounted for less than 20% of total GHG emitted by all sectors. In comparison with other industrial sectors which GHG is emitted in some highly centralized production sites of heavy energy consumption departments, transportation industry is with much more mobility and end-users. This characteristic has increased the difficulties of not only tracing but also reducing GHG emissions in the transportation sector. As a result, a lot of policies and incentives needed to be introduced to meet the various travel demand of different travellers. Hence we can find

hybrid vehicles, alternative fuels, HOV and HO/T, road pricing, public transport promotion, and TDM policies for VMT reduction, even ITS technologies are now targeted to lower the carbon dioxide emitted by the transportation sector.

Among all transportation modes, air transportation itself accounted for almost 2% of total emissions. Not significantly high, but still considerable. Especially there is hardly any alternative for cross-continent travelling if such travelling can not be eliminated by internet related communication technologies. The GHG reduction policies and incentives of surface transportation are mostly not suitable in the air transportation sector. Even the alternative fuel for aviation is still in its early experimental stage. As a result, air transportation seems to be an evil activity even its fuel efficiency is much better than most surface transportation modes with engine combustion technology. In the past few years, a number of government bureaus of certain nations have noticed the problems of air transportation sector, so they started to make some new policies towards air transportation, hoping to force the airline reducing GHG emissions. European Union made a quick decision to include the aviation sector in its Emissions Trading Scheme (EU ETS). This decision has created a lot of debates and divided aviation industries into two different groups. However, the decision has successfully attracted the whole world's attention. A lot of related issues focusing on the effects of emissions trading in the air transportation sector have been discussed. Some airlines also introduced the volunteer trading scheme, or the carbon offset program as titled in this study, to test the market response of passengers and shippers. This study aims to find out the willingness to pay and reasons for passengers/shippers to buy the offset. It also discovers the current market acceptance of such an initiative of environmental protection.

LITERATURE REVIEWS

According to IATA's report, there are now over 30 airlines providing carbon offset programs. However, pick-up rates (where reported) have tended to be low and many passengers are sceptical about where their money is going. Major carriers with carbon offset program in EU, Asia, America, and Oceania are listed in Table 1.

Table 1 Major Carriers with Carbon Offset Programs

Regions	Airlines offered Carbon Offset Programs
East Asia	Cathay Pacific, Dragon Airlines
Indian Subcontinent	
Mideast and Central Asia	
Central Europe	
West Europe	Lufthansa, Swissair, Virgin Atlantic, TAP
North America	United, Continental, Delta
Central and South America	
Africa	
Oceania	Qantas

Table 2 Voluntary offset solution providers and major customers data source: travelpost

Name	Calculator	Cost /ton Co2	NYC to LA	12,000 Miles	For Profit ?	Offset Projects	Choose Project Option	3rd Party Certification	Partnerships with Travel Companies	Progress (in CO2 pounds)	Year Founded
Carbonfund .org	Air, Car, Home, Wedding, Individual	$5.50	$4.92	$17.74	No	Renewable energy (wind, solar); energy efficiency, reforestation	Yes	Green-e, Environmental Resources Trust, Chicago Climate Exchange, others	Orbitz	--	2003
Cleaner Climate	Air, Lifestyle, Business	$17	$23.34	$43.22	Yes	Energy efficient lightbulbs in South Africa	No	--		--	--
Climate Friendly	Air, Car, Home, Office	$18.80	$44.37	$44.71	Yes	Gold Standard renewable energy credits	No	GreenPower Services Pty Ltd		123 million pounds	2003
CO2Debt	Air, Car, Home, Business	$10	$5.00	$35.00	No	Reforestation, carbon sequestration, global warming research	No	--		--	2007
Conservation Fund Go Zero Project	Meta calculator	$9.32	$9.76	$5.40	No	Tree planting and carbon sequestration projects	No	Environmental Synergies Inc and Environmental Resources Trust	Travelocity, Delta	--	2000
DrivingGreen	Air, Car, Event, Corporate Fleet	$8.00	$32.00	$16.00	Yes	Farm equipment designed to convert animal waste to renewable energy; projects managed by AgCert International	No	SES-Inc		26.28 million	--
LiveNeutral	Air, Car	$7.50	$18.75	$28.00	No	Chicago Climate Exchange emmissions reduction credits	No	Chicago Climate Exchange		--	2005
Native Energy	Lifestyle, Travel, Car, Home	$12	$24.00	$48.00	Yes	Wind power, farm methane reduction projects	Yes	Independent certified public accountant		--	2000
NoCarbons 4U	Meta calculator	$5	$4.69	$16.64	Yes	Wind power, tree planting	No	--		--	--
Prairie Tree Project	Air, Car, Home, Business	$50	$25.00	$100	Yes	Tree planting and carbon sequestration in Colorado	No	--		--	2007
Sustainable Travel International	Air, Car, Home, Hotel/Lodging	$15.25	$27.27	$50.63	No	Renewable energy, energy efficiency, sustainable development	No	MyClimate certified	Continental Airlines	--	2002
TerraPass	Air, Car, Home, Dorm, Wedding	$9.95	$9.95	$39.95	Yes	Clean energy (wind, biodiesel); biomass (dairy farm methane); industrial efficiency	No	Green-e program from Center for Resource Solutions	Flexcar, Expedia	380 million	2004

In additional to airlines, some travel agencies as well as hotels are also launching carbon offset programs. Offset consultancies soon become one of the fast growing businesses around the globe. Some governments are also aware of the importance of airline carbon emissions. Japan has launched its trial carbon trading scheme and JAL has soon participated as a volunteer. Australian and US government have both promoted related regulations, though not yet legislated by parliament. In academic, voluntary carbon offset program is also a good topic since it deals with the role, obligation, and responsibility of polluters as well as the means of internalization of external cost. The price elasticity, the cost transferability, the trading scheme itself, the platform promoted by different parties, as well as the different carbon financial tools are all fast growing fields to different academic disciplines.

METHODOLOGY

To find out passengers' willingness to pay and reasons to buy the carbon offset offered by airlines, a questionnaire based on previous studies of purchasing behaviour and willingness to pay was first developed. These questionnaires were then brought to 2 airports in a same nation of the East Asia region. In order to diversify the samples of different nationalities, trip purposes, and travel patterns, the study selected 33 flights which were widely spread in four different markets on both weekdays and weekends. 33 passengers were randomly selected in the waiting lounge in front of the boarding gate before boarding of each selected flight. A total number of 1,089 questionnaires were successfully collected. Some 3% sampling error can be expected within these samples.

Table 3 Sampling flight distributions

	Intra-east Asia	Cross-Pacific	East Asia-Europe	East Asia - Oceania
Weekday flights	6	5	5	5
Weekend flights	3	3	3	3

RESEARCH FINDINGS

The first phase of the survey was done in the end of January 2010. According to the statistics, 15.79% of the respondents have heard airline voluntary carbon offset program. Among the aware respondents, a very few 8% respondents have the experiences of buying the offset. Only 1.38% of the respondents have purchased the carbon offset in this trip. However, even if they paid the offset, some of them still didn't know how may Kilograms of CO2 they were about to emit. 72.09% of the paid passengers failed to answer the correct number of emission volume within 15% tolerance. Of the 8% respondents with the experience of buying offsets, 58.14% of the respondents were buying for their believes of environment protection; while 19.77% were because of the green production requirement of their companies. For those 92% who have never participated any airline carbon offset program, the major reason is because they don't even know what the program is for. For those who were aware of the program, but never participated in such programs, the major reason is because they think airlines should pay for GHG emission, but not passengers. Under such circumstance, even if

the price of offset dropped to 10% of the price they need to pay by now, they are still less than 10% of the passengers have the willingness to pay.

Table 4 is the descriptive statistics of all sampling passengers. The study was designed to analyze the differences between respondents' different socio-economic variables. However, the percentage of respondents with purchasing experience was relatively low. The response in some clusters are always 0. In order to get better statistical test result, more samples with different background will be collected and analyzed in the future.

Table 4 Descriptive Statistics of Sampling Passengers

Trip Purpose	Business	Leisure	Both	Home from Business			Home from Leisure		
	21.40%	38.75%	27.64%	8.08%			4.13%		
Age	<20	20-29	30-39	40-49	50-59		>60		
	5.69%	25.90%	29.11%	22.68%	11.48%		5.14%		
Gender	Male	61.8%	Female	38.2%					
Residential Area	Asia	Mideast	India Sub.	Oceania	North America	Central & South America	Central Europe	West Europe	Africa
	62.35%	1.29%	6.98%	2.57%	15.89%	2.85%	2.20%	5.88%	0%
Annual Income	<10,000	10,000-19,999	20,000-29,999	30,000-39,999	40,000-49,999	>50,000			
	9.83%	11.75%	19.56%	21.95%	19.74%	17.17%			

CONCLUSION REMARKS AND POLICY SUGGESTIONS

Global warming has taught both consumers and marketers to be conscious of CSR. Some passengers and airlines care a great deal about environmental protection. However, environmental protection is not the only issue in CSR, as global warming is not the only issue in environmental protection. Long before Greenhouse Gases (GHGs) became a household name, aircraft noise had always been the focus of environmental organizations concerned about aviation activities and their impact on the environment. In the 1980s, concerns about SOx emitted from aircraft engines were widespread as this gas led to acid rain, which is harmful to plants and to human health. Since 2000, greenhouse gases and carbon dioxide appear to have become the main focus instead. Some airlines are moving fast, and have started to buy offsets or have started to fund CDM (Clean Development Mechanism) projects to neutralize the GHGs they emit. Introducing such green initiatives creates a positive corporate image of these airlines, even though most of the carbon offset funds come from voluntary contributions of passengers.

To realize the major responses of carbon offset program from airlines passengers, this study aimed to find out the willingness to pay and reasons to buy the volunteer offset. Some important findings listed in the previous section can be concluded as following:

1. There is only less than 1.4% passengers have the experiences of buying airline carbon offsets. The percentage is too low to have real effects in neutralizing the carbon dioxide emitted by air transportation activities.
2. The major reason for passengers to buy the offset is because these passengers believe they have to do something for the environment. In another word, these passengers are

more concerning the global warming issue than the average of all passengers. However, this is also the dilemma of these programs because only volunteers will participate.

3. The reason for majority passengers not to buy the offset is because they don't think they need to do it. Passengers believe the airlines should be the polluters to be blamed.
4. Under such circumstances, even if the price of carbon dioxide offered by the airline carbon offset program dropped to an unreasonable low level, there are still less than 10% of the passengers have the willingness to pay for the offsets.
5. In the future, passengers still have no intension to pay for the carbon offset.

From these important conclusions, two policy suggestions can be made as follows:

1. Public education is still necessary. Most passengers still don't know what carbon offset is and what it is for. Passengers also believe
2. To get acquainted with emission trading, government involvement should be introduced much earlier than EU ETS official launches in 2012.
3. Current voluntary offset program created by individual airline has very limited effects. Joint program by region, by alliance, even integrated global offset program should be encouraged to increase the creditability of the program.

There are, of course some research limitations of this study. First of all, the survey is based on two international airports of a same country only. Though there are passengers of different nationality, the samples of passengers were still highly restricted. Moreover, all the major carriers in this country do not offer carbon offset program. Although a lot of carriers operated in these two airports do provide such programs, the effects of promotion and the probability of finding a passenger with some purchasing experience can still be very different to those airports as the base airports of airlines with carbon offset programs. To fix the problem of insufficient samples, the sampling numbers should be at least 10 times higher in at least 8 more airports located in all other regions. Finally, the attitude of the government will also have certain impacts over the willingness to pay. Though not yet found in this study, It is not too far to expect that passengers from a country with a lot more regulations on GHG emission may have higher willingness to pay, and vice versa. Future studies will focus on the corrections of these research restrictions.

In fact, all the topics related to carbon trading are still on-going topics since the trading environmental are developing and the best practice are yet to find. EU ETS will soon launch in 2012. The scheme has also provided a system of credit transfer and mutual deduction. These technical arrangement and trading system design will certainly have some huge impacts on airlines' carbon offset programs. A continuous global study on this single issue should still be encouraged.

REFERENCE

Andrew Holden, 2009, "The environment-tourism nexus influence of market ethics" ,*Annals of Tourism Research*, Vol.36, No.3, pp.373–389.

Andrew Macintosh and Lailey Wallace, 2009, "International aviation emissions to 2025: Can emissions be stabilised without restricting demand?" ,*Energy Policy*, Vol.37, pp.264–273.

Anming Zhang, Sveinn Vidar Gudmundsson and Tae H. Oum, 2010, "Air transport, global warming and the environment" ,*Transportation Research Part D*, Vol.15, pp.1–4.

Annela Anger and Jonathan Kohler, 2010, " Including aviation emissions in the EU ETS: Much ado about nothing? A review" ,*Transport Policy*, Vol.17, pp.38–46.

Annela Anger, 2009, "Including aviation in the European emissions trading scheme: Impacts on the industry, CO_2 emissions and macroeconomic activity in the EU" ,*Journal of Air Transport Management*, pp.1–6.

Brian Graham and Jon Shaw, 2008, "Low-cost airlines in Europe: Reconciling liberalization and sustainability" ,*Geoforum*, Vol.39, pp.1439–1451.

C. Miyoshi and K.J. Mason, 2009, "The carbon emissions of selected airlines and aircraft types in three geographic markets" ,*Journal of Air Transport Management*, Vol.15, pp.138–147.

Charles A. Jones and David L. Levy, 2007, " North American business strategies towards climate change" ,*European Management Journal*, Vol.25, No.6, pp.428–440.

Christian Hofer, Martin E. Dresner and Robert J. Windle, 2010, "The environmental effects of airline carbon emissions taxation in the US" ,*Transportation Research Part D*, Vol.15, pp.37–45.

D.S. Lee, G. Pitari, V. Grewe, K. Gierens, J.E. Penner, A. Petzold, M.J. Prather, U. Schumann, A. Bais, T. Berntsen, D. Iachetti, L.L. Lim and R. Sausen, 2009,"Transport impacts on atmosphere and climate: Aviation" ,*Atmospheric Environment*, pp.1–57.

David S. Lee, David W. Fahey, Piers M. Forster, Peter J. Newton, Ron C.N. Wit, Ling L. Lim, Bethan Owen and Robert Sausen, 2009, "Aviation and global climate change in the 21st century" ,*Atmospheric Environment*, Vol.43, pp.3520–3537.

Francis M. Vanek, 2001, "Growth of exports from developing countries: Implications for freight trends and ecological impact" ,*Futures*, Vol.33, pp.393–406.

Fred Curtis, 2009, "Peak globalization: Climate change, oil depletion and global trade" ,*Ecological Economics*, Vol.69, pp.427–434.

George J. MacKerron, Catrin Egerton, Christopher Gaskell, Aimie Parpia and Susana Mourato, 2009, "Willingness to pay for carbon offset certification and co-benefits among(high-)flying young adults in the UK" ,*Energy Policy*, Vol.37, pp.1372–1381.

George Marsh, 2008, "Biofuels: aviation alternative?" ,*Renewable Energy Focus*, pp.48–51.

Ilyoung Oh, Walter Wehrmeyer and Yacob Mulugetta, 2010, "Decomposition analysis and mitigation strategies of CO_2 emissions from energy consumption in South Korea" ,*Energy Policy*, Vol.38, pp.364–377.

Inga J. Smith and Craig J. Rodger, 2009, "Carbon emission offsets for aviation-generated emissions due to international travel to and from New Zealand" ,*Energy Policy*, Vol.37, pp.3438–3447.

Jan C. Semenza, David E. Hall, Daniel J. Wilson, Brian D. Bontempo, David J. Sailor and Linda A. George, 2008, " Public perception of climate change voluntary mitigation and barriers to behavior change" ,*American Journal of Preventive Medicine*, Vol.35, pp.479–487.

Jonas Akerman, 2005, " Sustainable air transport—on track in 2050" ,*Transportation Research Part D*, Vol.10, pp.111–126.

Karen Mayor and Richard S.J. Tol, 2007, "The impact of the UK aviation tax on carbon dioxide emissions and visitor numbers" ,*Transport Policy*, Vol.14, pp.507–513.

Karen Mayor and Richard S.J. Tol, 2008, "The impact of the EU–US Open Skies agreement on international travel and carbon dioxide emissions" ,*Journal of Air Transport Management*, Vol.14, pp.1–7.

Karen Mayor and Richard S.J. Tol, 2009, "Aviation and the environment in the context of the EU–US Open Skies agreement" ,*Journal of Air Transport Management*, Vol.15, pp.90–95.

Karen Mayor and Richard S.J. Tol, 2010, "The impact of European climate change regulations on international tourist markets" ,*Transportation Research Part D*, Vol.15, pp.26–36.

Katie Southworth, 2009, "Corporate voluntary action: A valuable but incomplete solution to climate change and energy security challenges" ,*Policy and Society*, Vol.27, pp.329–350.

Katsuhiro Yamaguchi, 2010, "Voluntary CO_2 emissions reduction scheme: Analysis of airline voluntary plan in Japan" ,*Transportation Research Part D*, Vol.15, pp.46–50.

Kyung Ho Kang, Seoki Lee and Chang Huh, 2010, "Impacts of positive and negative corporate social responsibility activities on company performance in the hospitality industry" ,*International Journal of Hospitality Management*, Vol.29, pp.72–82.

Larry Lohmann, 2009, "Toward a different debate in environmental accounting: The cases of carbon and cost–benefit" ,*Accounting, Organizations and Society*, Vol.34, pp.499–534.

Lee Chapman, 2007, "Transport and climate change: a review" ,*Journal of Transport Geography*, Vol.15, pp.354–367.

Milan Janic, 1999, "Aviation and externalities: The accomplishments and problems" ,*Transportation Research Part D*, Vol.4, pp.159–180.

Patrick Moriarty and Damon Honnery, 2008, "Low-mobility: The future of transport" ,*Futures*, Vol.40, pp.865–872.

Paul Peeters, 2008, "Book review: Tourism and climate change mitigation. Methods, greenhouse gas reductions and policies" ,*Journal of Transport Geography*, Vol.16, pp.229–230.

Richard Butler, 2009, "Tourism in the future: Cycles, waves or wheels?" ,*Futures*, Vol.41, pp.346–352.

Richard S.J. Tol, 2007, "The impact of a carbon tax on international tourism" ,*Transportation Research Part D*, Vol.12, pp.129–142.

Roderick A. Smith, 2008, “Enabling technologies for demand management: Transport” ,*Energy Policy*, Vol.36, pp.4444 – 4448.

Sascha Albers, Jan-Andre Buhne and Heiko Peters, 2009, ”Will the EU-ETS instigate airline network reconfigurations?” ,*Journal of Air Transport Management*, Vol.15, pp.1–6.

Sonia Akter, Roy Brouwer, Luke Brander and Pieter van Beukering, 2009, ”Respondent uncertainty in a contingent market for carbon offsets” ,*Ecological Economics*, Vol.68, pp.1858–1863.

Victoria Williams and Robert B. Noland, 2006, ”Comparing the CO_2 emissions and contrail formation from short and long haul air traffic routes from London Heathrow” ,*Environmental Science & Policy*, Vol.9, pp.487 – 495.