blueskies PROJECT

Is the Sky Falling for Airline Profits in the European Union?

The Consequences for Airlines from the Inclusion of Aviation in the EU Emissions Trading System

By Samuel Grausz and Nigel Purvis with Rebecca Lefton

February 2012

About the Blue Skies project

The Blue Skies project is a collaborative research initiative that works to help make aviation safe, affordable, secure, and clean. The project provides in depth legal, political, and economic research on issues that vitally affect the aviation sector. Through this research and outreach to key stakeholders, the project seeks to build consensus and positive collaboration.

Our first report, a collaboration between Climate Advisers and the Center for American Progress, seeks to create common understanding of the economic consequences of one of the most controversial aviation emissions policies currently under consideration, the inclusion of aviation in the European Union Emissions Trading System. This report is analytical and does not attempt to advocate for a specific policy or set of policies.

For more information on the Blue Skies project or this report, please contact Samuel Grausz of Climate Advisers by phone at (206-851-6156) or by email at grausz@climateadvisers.com, and Rebecca Lefton of the Center for American Progress by phone at (202-478-5323) or by email at rlefton@americanprogress.org.

blueskies PROJECT

Is the Sky Falling for Airline Profits in the European Union?

The Consequences for Airlines from the Inclusion of Aviation in the E.U. Emissions Trading System

By Samuel Grausz and Nigel Purvis with Rebecca Lefton
February 2012

Climate Advisers

Center for American Progress

Contents

Introduction and summary

The European Union's decision to include the aviation sector in its Emissions Trading System as of January 1, 2012, sparked considerable ire across the world. The new policy, an expansion of the European Union's existing greenhouse gas cap-and-trade system, seeks to reduce greenhouse gas emissions from one of the fastest-growing sources of emissions—the aviation industry. The new policy will require airlines to obtain permits for each ton of greenhouse gas emissions produced by all of their flights departing from or arriving in the European Union and other participating states.

Most controversially, the policy includes all airlines—not just EU airlines—and all emissions over the entire flight path, including outside EU airspace. Airlines based inside and outside of the European Union, as well as some countries where these non-EU airlines are based, allege that the policy is illegal and will result in substantial increases in costs and ticket prices, resulting in a decline in demand for air travel. The European Union counters that the policy is well within its rights and will have minimal adverse impacts on the aviation sector.

Scholars around the world have attempted to weigh in on these questions, but until now no consensus has emerged among the experts. This report attempts to clarify the economic impacts of the European Union's actions by synthesizing and summarizing available economic studies. Altogether, we looked at 37 studies to produce this report. Our review shows that the existing literature makes the following findings:

- In the near term, the EU aviation policy will increase airline profits because carriers are likely to be overcompensated by aspects of the policy designed to reduce the cost for airlines of complying with the new rules.

- EU airlines will profit more than non-EU airlines because EU airlines have more flights covered by the new policy, even though the policy itself is not overtly protectionist.

- Traditional so-called "network" airlines—those that use a traditional hub-and-spoke system for scheduling flights—will receive a larger increase in profits than low-cost airlines that operate mostly within the European Union because network airlines have more operations covered by the policy and because the demand for network airline flights is less responsive to changes in price.

- Some airlines may continue to oppose the EU aviation policy for other reasons, enumerated toward the end of this report.

The findings presented here necessarily rely most heavily on a limited number of studies (16 of the 37 papers reviewed) that model policies similar to the actual EU emissions policy being implemented and that provide sufficiently detailed results with respect to profits and other key metrics. In the interest of improving certainty about the consequences of this policy, the report describes how future studies could provide more clear and useful results.

Glossary of terms

European Union Emissions Trading System, or EU ETS. The greenhouse gas cap-and-trade program established by the European Union in 2005 that covers emissions from electricity generation, industry, and aviation. For more information, see http://ec.europa.eu/clima/policies/ets/index_en.htm.

Clean Development Mechanism, or CDM. A system initiated by the Kyoto Protocol whereby countries identified as Annex I—generally developed countries—can invest in emissions reduction projects in countries identified as non-Annex I—generally developing countries—countries and receive Certified Emissions Reduction, or CER, credits for use in international offset markets. The European Union Emissions Trading System accepts CER credits. For more information, see http://cdm.unfccc.int/.

Cap-and-trade program. An emissions control policy under which a regulator specifies an upper limit on emissions by covered entities (the "cap") but allows covered entities to trade permits ("allowances") that entitle those entities to emit. The market for the allowances generates a price for emissions comparable to a tax on emissions. For more information, see http://www.epa.gov/captrade/.

Greenhouse gases, or GHG. A set of gases that, when emitted, cause additional heat to be trapped by the Earth's atmosphere, raising the surface temperature of the Earth. The most common is carbon dioxide, or CO2. Others include methane, or CH4, and nitrous oxide, or N2O. For more information, see http://epa.gov/climatechange/emissions/index.html.

Allowances. The permits traded by covered entities under a cap-and-trade program that entitle those entities to emit a certain quantity of emissions. In the case of the European Union Emissions Trading System, one allowance entitles an entity to emit greenhouse gases equivalent in global warming impact to one metric ton of CO2.

Free allocation. The allowances given for free by the regulator to covered entities under a cap-and-trade program. In the case of the European Union Emissions Trading System, free allocation is given out based on historical flight volume.

Network airlines. Airlines that use a traditional hub-and-spoke system for scheduling flights. These airlines tend to be older and larger than low-cost airlines.

Low-cost airlines. Airlines that offer flights at lower prices by following a generally recognized business model that may include a single passenger class of service, standardized aircraft utilization, limited in-flight services, use of smaller and less expensive airports, and lower employee wages and benefits.

Soot. A general term that refers to a black, carbonaceous substance resulting from the incomplete combustion of coal, wood, oil, or other hydrocarbons.

NOx. A general term that refers to the mono-nitrogen oxides NO and NO2, which are produced by the reaction of nitrogen and oxygen gases in the air during combustion. Not to be confused with N2O.

SOx. A general term that refers to various mono-sulfur oxides, which are produced by the reaction of sulfur in coal and petroleum and oxygen in the air during combustion.

Black carbon. A general name for a set of specific components of soot with climate forcing attributes.

Allowance auctions. The regular sales of allowances by the regulator of a cap-and-trade program. Under the European Union Emissions Trading System, the European Union auctions 15 percent of allowances to the aviation sector, with the other 85 percent given out for free to the airlines.

Out-of-pocket costs. A general term that, in the context of this paper, refers to the costs faced by the airlines. It is calculated as the emissions cost minus value of free allocation. Out-of-pocket costs do not take into account the changes in revenues and costs that result from the policy and thus are not a good measure of the policy's economic impact on the airlines.

Emissions costs. A general term that, in the context of this paper, refers to the costs of all emissions from the airlines not taking into account the free allocation. When the free allocation is granted based on historical metrics, economic theory predicts that airlines will seek to pass through the full emissions cost.

Pass through. An economic term that refers to the ability of an entity that faces an increase in costs to defray the increase in costs by increasing prices. In the aviation context this refers to the rates at which airlines are able to pass through the cost of emissions into ticket prices. This is most easily calculated as the ratio of the change in ticket prices to the costs per ticket that the airlines are attempting to pass through.

Air Passenger Duty, or APD, and Air Passenger Tax, or APT. A type of policy that places a tax on each passenger on a qualified flight leaving a given country. These policies exist in many countries. Particularly prominent examples of such policies include the United Kingdom's APD and Germany's APT.

Elasticity. An economic term that refers to the percent change in one metric resulting from a percent change in another metric. In the context of cap-and-trade policies, two elasticities are particularly important. The price elasticity of supply refers to the percent change in quantity supplied resulting from a percent change in price. The price elasticity of demand refers to the percent change in quantity demanded resulting from a percent change in price. These two metrics—along with various other metrics described in the main report—jointly determine the pass-through rate in the aviation context.

EU aviation policy context

The European Union decided to include the aviation industry within its Emissions Trading System because it is one of the fastest-growing sources of greenhouse gas emissions, currently representing 3 percent of global CO2 emissions,[1] and potentially increasing by 290 percent to 667 percent by 2050.[2] Airplanes also emit water vapor, soot, NOx, SOx, and black carbon. (See Glossary on page 3 for precise definitions of the terms used in this report.) Airplanes emit all of these greenhouse gases directly into the upper atmosphere, potentially doubling the overall climate impact of aviation emissions.[3]

Further, international aviation emissions are specifically excluded from the Kyoto Protocol, which directs governments to work through the International Civil Aviation Organization, or ICAO, to develop a global mechanism to reduce aviation emissions. The European Union decided to move ahead of the ongoing ICAO process as it felt that process was proceeding too slowly.

The EU aviation policy itself is as follows: Starting in 2012 airlines will be required to obtain permits, also known as "allowances," for each ton of emissions produced by all of their flights departing from or arriving in the European Union and other participating states.[4] The allowances are not like traditional air pollution permits, specifying complicated limitations and exact actions that the polluting entity must follow. Instead they are more like a form of currency, entitling the entity to emit one metric ton of CO2. Most controversially the policy includes all airlines, not just EU airlines, and all emissions throughout the entire flight path, including outside the EU airspace.

Covered airlines can acquire allowances through a number of sources. The largest source will be the allowances issued to the airlines for free by the European Union, which will add up to 85 percent of all the allowances the European Union will create for airlines.[5] The free allowances are divided between airlines based on each airline's share of past operations.[6] Airlines can also "borrow" allowances from future years to meet obligations in a given year.

Outside of free allowances airlines can purchase the allowances through official EU allowance auctions. These auctions will sell off the remaining 15 percent of the allowances created by the European Union. Further, airlines can buy the allowances from other airlines or companies in other sectors covered by the EU Emissions Trading System such as electricity generators and many industries in the European Union. This is the "trade" part of "cap and trade."

Finally, airlines can obtain allowances by participating in the Kyoto Protocol's Clean Development Mechanism, which allows regulated entities to obtain allowances by demonstrating they have helped reduce emissions in developing countries. Once they acquire these allowances, airlines can choose to use the allowances to meet their obligations in the current year or to hold the allowances to meet their obligations in future years, a practice known as "banking" in cap-and-trade circles. The policy reduces total CO2 emissions by only issuing enough allowances to cover a portion of airline emissions. This upper limit on total emissions is known as the "cap." The cap will immediately force airlines to either reduce emissions or buy additional allowances from other nonaviation sources, forcing their emissions to decrease. This limit will only reduce more emissions over time as the aviation sector grows.[7]

Research approach

Even before the European Union officially proposed the inclusion of aviation in the Emissions Trading System in 2005, reports were released estimating the economic impact of the potential policy. In this study we summarize all these reports without respect to their source and without delving extensively into their assumptions or methodology.[8]

We reviewed a large number of studies but present the results for only the studies that estimate impacts on the overall airline sector or specific airline or flight subgroups.[9] All the studies reviewed, broken down by which are and which are not included in the data tables, are detailed in Appendix B on page 30. We excluded results that were developed prior to the finalization of the policy and do not model a policy similar to the final EU emissions policy. Major methodological decisions are discussed in Appendix D on page 34.

One major challenge we faced is that studies often present results in dissimilar ways. As an example, a number of studies estimate out-of-pocket costs while others estimate only out-of-pocket costs per passenger. Without making these costs comparable, we would not have been able to include the results of all of the studies within a single range.

Fortunately the International Air Transport Association, or IATA, did a 2007 study on the issue, Financial Impacts of Extending the EU ETS to Airlines, which provides estimates using a wide variety of metrics. (In this report we will use parenthetical citations for the 37 studies we examine. They are all listed in full in Appendix A of this report on page 27.) As such, we often used IATA (2007) to extrapolate the results of other studies into other metrics, such as translating costs into cost per passenger. All the numbers that were extrapolated are identified in the Appendix C tables on page 31.

In presenting the results we look first at impacts on all flights covered by the policy and second at specific subgroups, such as EU versus non-EU airlines and low-cost versus traditional network carriers. Within each of these groups, we focus on five key metrics:

- Cost
- Ticket prices
- Demand
- Profits
- Competitiveness

In the main report, we present the range of available estimates. The results for each study included in the range are presented in Appendix C.

Overall impacts

The right and wrong way to measure impacts

Many studies measure the impacts of the EU aviation policy by estimating out-of-pocket costs for airlines. They calculate these costs as the emissions costs (emissions multiplied by the emissions price) minus the value of the free allowances provided to the airlines. This is the wrong way to measure the impact on airlines as airlines pass through much of the emissions cost to consumers in the form of higher ticket prices, generating a reduction in demand that affects both costs and revenues.

The correct way to measure impacts is to calculate the effect of the EU policy on airline profits. This calculation requires at a minimum determining the emissions cost, how much of that cost is passed through to consumers, how demand will respond to the increase in ticket prices, and what effects these changes have on revenues and costs. Only three studies we reviewed made this calculation for all covered airlines (IATA, 2007; Boon et al., 2007; Ernst & Young, 2007).

In the end the change in profit in broad terms is equal to the sum of the emissions cost, the increase in revenue from the increase in ticket prices, the decrease in revenues and costs from the decrease in demand, and the value of the free allocation.[10] Existing studies ultimately find that the emissions cost, revenue from increased ticket prices, and revenues and costs from the decrease in demand approximately cancel each other out, and the value of the free allocation results in the EU policy generating positive profits.

Out-of-pocket costs

We start by considering the estimates of out-of-pocket costs as that is what most studies estimate. Existing studies predict that the EU policy will not result in very significant out-of-pocket costs. The studies found that out-of-pocket costs would be between $316 million and $8 billion per year or between $0.70 and $17.90 per passenger. This is a very wide spectrum but most of the estimates are closer to the lower end—with all but four of the studies estimating costs below $4 billion per year.

These costs are modest compared to existing operating costs. The cost of EU aviation policy translates into roughly 0.2 percent to 4.4 percent of forecasted total annual costs in 2012 for flights covered by the policy.[11] Further, the out-of-pocket costs from the new policy are small relative to other variable cost changes recently faced by the airline industry, especially fuel cost. According to the International Air Transport Association, prices for jet kerosene grew to $126.70 per barrel from $29.10 per barrel from 2002 to 2008, largely causing fuel cost for airlines covered by the policy to increase to $38.5 billion from $8.8 billion.[12] This $29.7 billion increase in fuel costs dwarfs the increase in costs projected to be caused by the EU policy.

Compared to other regulatory burdens, the out-of-pocket costs are also small. According to one study the new policy will cost approximately 1.4 percent of the annual cost of the U.K.'s Air Passenger Duty and 5 percent of the German Airline Passenger Tax (Bloomberg, 2011).

As these comparisons show, the out-of-pocket costs are not large relative to other costs. This comparison is helpful because it indicates that the relative effect of the EU aviation policy will not be large compared to other policies that have and continue to impose costs on the industry. This comparison does not, however, completely measure the impacts of the EU aviation policy, as it does not consider the effects of the policy on ticket prices, demand, and, ultimately, profits.

Emissions costs and changes in ticket prices

The first step in determining the effect on profits is to calculate emissions costs. The difference between out-of-pocket costs and emissions costs is, by definition, the total value of all allowances. The European Union plans to create 212 million allowances in 2012 and 208 million allowances every year thereafter for aviation.[13] This translates, at emissions price of $15 and $33 per metric ton CO2 (the prices assumed by IATA 2007) into $2.7 to $5.8 billion dollars for all airlines.

Only two studies (IATA, 2007; SEC, 2006) estimate the emissions costs explicitly. They calculate full costs as between $1.1 billion and $11.8 billion or between $2.40 and $25 per passenger.[14] Extrapolating from IATA (2007), the emissions cost implied by the range of out-of-pocket costs from all studies described above is between $1.1 billion and $25.6 billion or between $2.40 to $63 per passenger.[15]

As existing studies found that emissions costs are not relatively large, and as airlines can only pass through a portion of emissions costs, existing studies unsurprisingly found relatively small changes in ticket prices. The studies reviewed estimated changes in ticket prices of between $0.50 and $39.[16] This translates into a percent change in price of between 0.1 percent and 6.5 percent. Assuming that airlines will pass through the costs of the EU aviation policy costs in the same way they have passed through the other similar taxes and fuel price changes, the changes in ticket prices resulting from the inclusion of aviation in the EU Emissions Trading System will pale in comparison to the other government taxes on aviation (such as the United Kingdom's Air Passenger Duty and Germany's Airline Passenger Tax) and the decade-long increase in fuel prices.

Leaving aside the effect of the changes in ticket prices on demand, which we will discuss in the next section, the increase in ticket prices drives a substantial increase in revenues. Unfortunately only one study (IATA, 2007) explicitly estimates the change in revenue resulting from the change in ticket price. This study finds that an increase in average ticket prices of between $8.90 and $19.00—near the mean of estimates by other studies—causes an increase in revenue of between $4.2 billion and $8.9 billion. Extrapolating from this study and the changes in ticket prices estimated by other studies shows that the $0.53 to $39 increase in ticket prices found for all studies results in an increase in revenue of between $248 million and $18 billion.

The ticket price changes described above require some explanation. First, not all studies that estimate emissions costs also calculate changes in ticket prices and vice versa. As a result the range of emissions costs is not directly comparable to the range of ticket price changes. Looking only at the two studies that estimate both emissions costs and changes in ticket prices, the range for emissions costs is between $2.40 and $25.30 per passenger, and the range in changes in ticket prices is between $2.40 and $19.

Second, different studies assume very different rates at which airlines will pass through costs to consumers. The study by Ernst & Young (2007) assumes a pass-through rate of 29 percent to 35 percent, depending on the type of airline and the year, while IATA (2007) assumes a pass-through rate of 75 percent, and Boon et al. (2007) assumes a pass-through rate of 100 percent.

The extent to which airlines pass through to consumers their emissions costs depend on a number of factors on both the supply and demand side.[17] Most studies consider a subset of these issues when determining pass-through rates. At most they discuss two key parameters: the elasticities of demand and supply. These refer to the aggregate willingness of consumers to continue to purchase tickets despite facing higher costs and the willingness of airlines to offer flights at lower prices. Our study does not attempt to delve into these elasticities or the resulting pass-through rates.

Changes in demand

The changes in ticket prices in turn could drive a reduction in demand for airline tickets. The potential reduction in demand is determined by the size of the change in ticket prices and the elasticity of demand for airline travel, with a more elastic demand causing a larger decrease in ticket prices. As existing studies found small changes in ticket prices, it is unsurprising that they also showed small changes in demand. Only three studies out of the 37 reviewed estimated total change in demand. Those studies found demand reductions of between 180,000 and 18.1 million tickets, which translate into a reduction in demand of between 0.04 percent and 3.9 percent.

These reductions in demand drive decreases in both revenues and costs. Revenues decrease because fewer passengers buy tickets, and costs decrease because airlines have to pay for fuel and services for fewer passengers. Only one study (IATA, 2007) explicitly estimates these changes in revenues and costs. They find that a reduction in demand of between 1.8 percent and 3.9 percent results in reductions in revenues of between $4.4 billion and $9.5 billion, and reductions in costs of $2.5 billion to $5.3 billion.

In the near-term, the EU aviation policy will increase airline profits because carries are likely to be overcompensated by aspects of the policy designed to reduce the cost of complying with the new rules for airlines.

Extrapolating these results to the other two studies that estimate changes in demand implies that the reduction in demand for all studies of between 0.04 percent and 3.9 percent results in reductions in revenues of $93 million to $9.5 billion, and reductions in costs of $52 million to $5.3 billion. Note that these reductions in revenue and costs should not be construed as the full changes in revenues and costs caused by the policy as they do not include the emissions costs, the revenues from increased ticket prices, and the value of allowances.

As with changes in ticket prices, not every study that estimates changes in ticket prices also estimates changes in demand and vice versa. Only one study (IATA, 2007) estimates changes in both metrics. This study finds changes in ticket prices of between $8.90 and $19 or between 1.5 percent and 3.2 percent, and reductions in demand of between 8.5 million and 18.1 million tickets or between 1.8 percent and 3.9 percent.

Changes in profits

The change in profits—the final metric that theoretically is the most important for airlines—is the sum of the emissions costs, the value of free allowances, the increase in revenue from the increase in ticket prices, and the decrease in revenue and costs from reduced demand. Only three studies (Boon et al., 2007; Ernst & Young, 2007; IATA, 2007) estimate a final change in profits for all affected airlines, and none of those studies model the exact final EU policy, as they all assume that the European Union will auction a different share of allowances than the final policy requires.

Of these three studies IATA (2007) models a version of the policy closest to the actual final EU policy.[18] IATA (2007) also assumes a pass-through rate that falls between the more extreme assumptions of Boon et al. (2007) and Ernst & Young (2007), as described above, though this is not a primary concern of this study as we do not focus on the validity of modeling assumptions.[19] As such we look primarily at the results of IATA (2007), though refer to Boon et al., Ernst & Young, and other studies to check the IATA (2007) results.

IATA (2007) finds that profits for covered flights will increase by between $590 million and $1.4 billion, which represents a 31 percent to 76 percent increase in total profits for covered flights. The positive change in profits results because the net negative change in profit resulting from the compliance costs, increase in ticket prices, and reduction in demand is more than offset by the value of the free allocation. Specifically, IATA (2007) finds that the net negative change in profits will be $2.5 to $5.4 billion and the value of the free allocation will be $2.9 to $6.5 billion dollars, depending on the allowance price.

Written in a different way, this increase in profits represents an increase in the overall profit margin of covered airlines of between 0.2 percent and 0.5 percent.[20] This is a substantial increase in profits, especially given the highly competitive airline industry. The ranges of profits for IATA (2007) are shown in Table 1 on page 16, and the results for all of the studies are provided in Appendix C.

As IATA (2007) assumes too much free allocation, this profit change estimate is likely an overestimate of the actual profit change increases. A back-of-the envelope calculation using the data provided by IATA (2007), however, indicates that their modeling would find profit changes under the actual final allocation scheme of between $380 and $570 million. This translates into between a 20 percent and 30 percent increase in profits and an increase in margins of 0.13 percent and 0.20 percent.

Two additional studies also provide results that suggest that the final profit changes for all airlines will be positive. Vivid Economics (2008) estimates changes in profits without free allocation for a number of different flights. They find that airlines are likely to lose profits equal to between 20 percent and 40 percent of emissions costs before free allocation. As airlines are likely to receive free allocation equal to much more than 20 percent to 40 percent of their emissions cost, namely 65 percent of emissions costs according to Bloomberg (2011), the Vivid Economics analysis implies that airlines may make significant positive profits.

More clearly, Malina et al. (MIT, 2012) model the actual EU policy and estimate the change in profits for U.S. airlines only. They find that U.S. airlines will gain $116 million in profits per year, which translates into an increase in overall profit margins of 0.15 percent. This result, though not covering non-U.S. airlines, suggests that at least airlines flying extra-EU routes will likely gain profits as a result of the EU policy.

The nature of these additional profits deserves explanation. First, these additional profits are not a one-time transfer. The European Union grants free allowances to airlines every year until they revise the law. As such, the increase in profit margins will persist year after year as long as the free allocation is granted. Second, if as the years go on, airlines continue to grow faster than they can improve the energy efficiency of their airplanes, then they will need to buy more and more allowances from other sectors in the EU's Emissions Trading System and other eligible international emissions and offset markets. As a result the airlines will have to pay more for allowances relative to their allocation of free allowances, increasing costs and reducing profits. Thus, if growth outpaces efficiency, airlines could at some point in the future, depending of course on the future price of allowances and credits in international carbon markets, begin to lose money as a result of the EU policy.

TABLE 1

Overall impacts of EU aviation policy on airlines

Category	Units	Range
Out-of-pocket-costs		
Total	Million USD	$316 to $8,352
Per passenger	USD	$0.68 to $17.89
Emissions costs		
Total	Million USD	$1,118 to $29,590
Per passenger	USD	$2.39 to $63.36
Change in ticket prices		
Total	USD	$0.53 to $38.54
Percent change	Percent	0.09 to 6.50
Change in demand		
Total	Million tickets	-0.18 to -18.10
Percent change	Percent	-0.04 to -3.90
Change in costs		
Out-of pocket	Million USD	$316 to $8,352
Effect of change in demand	Million USD	-$52 to -$5,305

Change in revenues		
Effect of change in ticket price	Million USD	$248 to $17,995
Effect of change in demand	Million USD	-$93 to -$9,506
Change in profits	Million USD	$591 to $1,447

Note: Out-of-pocket costs are the difference between emissions costs and the value of allowances.
Source: Various studies. See above text and Appendix C on page 30 for more details.

Subgroup results

Measuring subgroup impacts

Existing studies of the EU aviation policy find that the overall impacts of the policy on airline profits will be positive and significant relative to current profits. This is a positive sign for airlines. Not all airlines will gain the same amount from the policy, however, which raises concerns about competitiveness.

Before diving into a discussion of subgroups and effects on competitiveness, it is important to describe exactly what we mean by competitiveness and in what sense it matters to airlines. A good working definition of the effects of a policy on competitiveness could be the extent to which it helps or hurts one airline more than another. In general each airline seeks to maximize its own profits, so competitiveness really refers to the relative effect of the policy on each airline's profits.

There are two primary profit impacts that are likely to differ between airlines. First, airlines receive different amounts of free allocation depending on their historical emissions. If an airline receives relatively more allocation than another, the airline can be said to gain a competitive advantage. This type of competitive advantage, however, does not necessarily result in the advantaged airlines taking any market share from the disadvantaged airline.

Second, the changes in ticket prices caused by the program have a complex effect on costs, revenues, and profits. As described in detail in the previous section, the price on carbon will raise ticket prices, causing consumers to buy fewer airline tickets. The extent to which each airline increases its prices and each passenger reduces or shifts its demand depends on a number of factors, which interact in complex ways. The factors include the efficiency of the airline's current fleets, the ability of the airlines to reduce emissions cheaply, the competitiveness of the markets the airlines operate in, the characteristics of the passengers within each market, and the responsiveness of the passengers within each market to changes in ticket price.[21]

None of the studies we examined provided results at a level of detail to determine the causes of different changes in profits. Very few of the studies, in fact, even calculated changes in profits for subgroups. Carefully defining competitiveness and the mechanisms for differences in lost profits will help by enabling us to theorize why studies found different changes in profits for different subgroups and to draw some conclusions from the available results.

As we show in the next section, we expect EU airlines as a whole to gain significantly more profits than non-EU airlines as a result of the policy. This is largely because EU airlines have historically had a larger volume of operations covered by the policy, not because the EU policy is inherently discriminatory. In fact the EU aviation policy treats all airlines equally by requiring each airline, regardless of its national origin, to turn in one allowance for every ton of carbon emissions and by providing the same amount of free allocation for each ton of historical emissions.

Within EU airlines, the studies expect network airlines to outperform low-cost airlines, with low-cost airlines potentially losing profits. This is likely because network airlines have more of their operations in flights in and out of the European Union—so called extra-EU flights—and less in intra-EU flights than do low-cost airlines. In the future, this divergence of impacts likely will cause airlines, especially low-cost airlines, to switch more of their flights to extra-EU routes, though the available data do not indicate the size of this shift.

EU airlines will profit more than non-EU airlines because EU airlines have more flights covered by the new policy, even though the policy itself is not overtly protectionist.

Airline nationalities

The highly controversial nature of the new policy and the elevation of the debate on its efficacy to the level of national governments and international regulatory bodies make the relative effect of the EU aviation policy on airlines of different nationalities particularly important. Only one study (Boon et al., 2007) calculated changes in profits for airlines of different nationalities.[22] As noted above, Boon et al. (2007) assumes that the EU policy grants more free allocation than the final policy allows, causing Boon et al. (2007) to overestimate positive profit changes. Even with this inconsistency, however, the Boon et al. (2007) results still provide useful indications of the relevant impacts of the EU policy on airlines of different nationalities.

Boon et al. (2007) found that EU airlines would gain up to $9.2 billion in annual profits while non-EU airlines will gain up to $5.5 billion annually. Rephrased in terms of profit margins, the EU policy will cause the profit margins of EU airlines to increase by up to 2.3 percent and the profit margins of non-EU airlines to increase by up to 0.6 percent.[23]

In light of the general conclusion that airlines affected by the new policy will gain significant profits, these results make sense. EU airlines control more of the European aviation market and will have more of their operations covered by the EU policy, meaning that they will receive more free allocation and thus gain more profits and larger increases in their profit margins. Boon et al. (2007) does not provide enough additional data to say whether this larger increase in profits is also the result of EU airlines paying fewer costs due to a more efficient fleet or losing less demand as a result of having more flexible costs.

Two other studies (Schaefer et al., 2010; IATA, 2007) find that EU airlines will face significantly more out-of-pocket costs than non-EU airlines. As discussed in the section on overall results, the relative out-of-pocket costs say very little about the relative effect on profits. The results from all of these studies are shown in Table 2 as well as the tables in Appendix B.

As discussed above, these results do not necessarily imply that the EU aviation policy is discriminatory. The policy treats all airlines the same by requiring each airline to turn in one allowance for each metric ton of emissions and by providing the same free allocation for each ton of historical emissions. The remaining differences in effects on profits are the result of economic factors beyond the control of the policymakers.

TABLE 2
Policy impacts by airline nationality

Category	Units	EU airlines	US airlines	Non-EU airlines
Out-of-pocket costs				
Total				
Schaefer et al 2010	Million USD	$1,270 to $2,032		$258 to $413
IATA 2007	Million USD	$1,095 to $2,124	$172 to $334	$322 to $625
Change in profits				
Total				
Boon et al (Delft) 2007	Million USD	NA to $9,216		NA to $5,532
Malina et al (MIT) 2012	Million USD		$116	
Margin				
Boon et al (Delft) 2007	Percent	NA to 2.30		NA to 0.60
Malina et al (MIT) 2012	Percent		0.15	

Airline types

The airlines themselves are probably most concerned about the relative effects of the EU aviation policy on them and their competitors. Although traditional network airlines compete regularly against each other, they also increasingly compete against low-cost airlines for short- and medium-distance flights. This competition is particularly fierce in Europe, with the rise of low-cost airlines such as RyanAir, easyJet, and many others. Faced with this increased competition, both network and low-cost airlines are likely very concerned with the relative effects of the EU aviation policy.

Only one study (Ernst & Young, 2007) estimates the profit impacts of the EU aviation policy on different airline types. As noted before, this study does not model the actual EU policy but a version with significantly more of the allowances auctioned rather than given away for free. Due to this additional auctioning, airlines lose rather than gain profits in their modeling. Despite this, the relative effects shown in the Ernst & Young (2007) modeling provides some useful information.

The report finds that network airlines will lose significantly more profits than low-cost or cargo airlines. They calculate that network airlines will lose between $580 million and $2.6 billion while low-cost airlines will lose between $144 million and $565 million.[24] This is likely largely because network airlines have a much higher flight volume covered by the EU aviation policy than low-cost or cargo airlines. The higher flight volume is shown by the results of two other studies (Schaefer et al., 2010; IATA, 2007), both of which found that network airlines face much higher out-of-pocket costs than low-cost or cargo airlines.

The larger historical flight volume under the EU aviation policy might indicate that, under a modeling of the actual EU policy, network airlines would actually gain more profits than low-cost airlines. Lacking additional modeling, however, this result is tentative at best. Moreover, the next section on flight types potentially provides a clearer answer to this question.

Flight types

Another way of viewing the relative impacts on airlines of different nationalities and types is by the relative impact of the policy on different types of flights, specifically intra-EU and extra-EU flights. EU airlines are involved in both the intra-EU and extra-EU markets. Non-EU airlines likely do not have much of a presence in the intra-EU market. Similarly, network airlines have stakes in both the extra-EU and intra-EU markets, while low-cost airlines depend on the intra-EU market. Thus if the policy creates more profits for extra-EU flights than intra-EU flights, then it will benefit both EU and non-EU airlines. It will also benefit network airlines to a greater extent than low-cost airlines.

One study (IATA, 2007) finds that airlines will lose profits on intra-EU flights but gain profits on extra-EU flights. This report calculates that in total, intra-EU flights will lose between $70 million and $150 million per year while extra-EU flights will gain between $660 million and $1.6 billion per year. In terms of profit margins, intra-EU flights will lose approximately 0.1 percent of profit margin while extra-EU flights will gain 0.4 percent to 0.9 percent of profit margin.

These results generally make sense. Extra-EU flights create more emissions and thus airlines will receive more allowances for having undertaken them in the past. Passengers on extra-EU flights also have fewer alternative options to flying than those on intra-EU flights, meaning their demand will be less elastic and airlines will be able to pass through more of the cost and lose less of their sales. Intra-EU flights, in contrast, will draw fewer allowances, and their passengers have more alternatives to flying. As such, the airlines making these flights will gain less free allocation, pass through less cost, and lose more sales.

The IATA (2007) report does not address the relative fleet efficiency of low-cost versus network airlines. Commentators frequently point out that low-cost airlines have a newer, more efficient fleet of planes. If this is true, then low-cost airlines will incur fewer costs than network airlines, increasing the profits of low-cost airlines relative to network airlines. This might explain the continuing support of the low-cost airlines for the EU aviation policy. Lacking data, however, we cannot confirm this theory.

Based on the IATA (2007) results, we would expect both EU and non-EU network airlines to gain significant profits. We would also expect EU low-cost airlines to gain significantly fewer profits and potentially lose profits. Based on the above data, we cannot estimate the size of the disparity in profits. These results are particularly interesting in light of the ongoing support of the low-cost airlines for the EU aviation policy.

Much of the divergence in profits from these flights likely depends on the relative amounts of free allowances each of these flights provides to the operating airlines. These free allowances are allocated based on historical emissions, which means that they will have no impact on the ongoing relative profitability of intra- and extra-EU flights. Consumers of intra-EU flights have more elastic demand, and thus airlines cannot pass through as much of the carbon cost of these flights, meaning their profitability relative to extra-EU flights will fall. Thus airlines, especially low-cost airlines, may switch to more extra-EU flights in the future.

Comparison to airline views

Existing studies show fairly clearly that EU aviation policy will increase profits for many—if not all—airlines. These findings do not comport well with the strong, continuing opposition of some airlines to the policy. Why would the airlines oppose a policy that most studies expect will increase their profits?

There are a number of possible explanations. The airlines showing the strongest opposition, namely U.S. and other non-EU network carriers, might oppose the policy because they are concerned that their competitors, the EU network airlines, will gain a competitive advantage. U.S. and non-EU network airlines may also oppose the EU policy because it might open the door for future, less accommodating climate regulation in their own countries, creating a risk of lost profits.

Further, airlines in general may be concerned that the European Union will give less free allocation in future years, as the European Union has done for other covered sectors under the EU Emissions Trading System. Airlines may also be worried that increasing emissions will eventually overwhelm the value of the free allocation, decreasing profits in the long term. They may further be afraid that increasing ticket prices will in the long term threaten the growth of the aviation industry, with aviation demand being replaced by demand for less carbon-intensive ways of moving people and goods such as trains and ships, or ways of avoiding air travel such as video conferencing.[25] The existing studies do not evaluate these potential claims or provide any information suggesting whether they are reasonable or not.

Existing studies could go further in describing the basic impact of the EU aviation policy on profits. As explained above, only three studies we reviewed estimate profit impacts for all airlines, and only one of those studies modeled a policy that closely matches the actual EU policy. Future studies should certainly estimate profits and preferably would disaggregate those estimates to the level of individual airlines.

Additional research also needs to be done to explicitly answer more questions regarding competitiveness. Certain currently available results, such as the profit impacts for EU and non-EU airlines and network and low-cost airlines, give some indication about the comparative advantages conferred by these policies. They do not answer more specific questions such how much the policy will enable EU airlines to take passengers from U.S. airlines or network airlines to take passengers from low-cost airlines, or larger questions such as whether this policy will drive certain low-cost airlines out of business. These questions are very important from the perspective of industry and many governments, and provide important information for business, policy, and advocacy planning.

Future research also needs to delve into the causes of the differences in these studies. As this paper explicitly examines only the results of the studies and not the assumptions that drive those results, it is not a full meta-analysis. Such an analysis would also make clear other sources of disagreement between the studies, such as assumptions about price elasticities and the treatment of historical allocation of emission allowances. This would allow future scholars to more accurately model the impacts of the policy in the future and more promptly evaluate the results of others. In support of this type of analysis, future studies need to confront differences between their results and the results of other studies head on by discussing the reasons for the differences.

Appendix A

References

Abrell, Jan. 2011. "Private Transport and the European Emission Trading System: Revenue Recycling, Public Transport Subsidies, and Congestion Effects." Social Science Research Network eLibrary, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1844300.

Anger, Annela. 2010. "Including aviation in the European emissions trading scheme: Impacts on the industry, CO2 emissions and macroeconomic activity in the EU." Journal of Air Transport Management 16 (2): 100–105.

Anger, Annela, and others. 2008. "Air Transport in the European Union Emissions Trading Scheme." Omega. http://www.landecon.cam.ac.uk/research/eeprg/4cmr/pdf/OmegaStudy_finalreport.pdf.

Anger, Annela, and Jonathan Köhler. 2010. "Including aviation emissions in the EU ETS: Much ado about nothing? A review." Transport Policy 17 (1): 38–46.

Bloomberg. 2011. "Including Aviation in the EU ETS - The Burning Question." Bloomberg New Energy Finance, available at http://bnef.com/free-publications/white-papers/.

Boon, Bart, and others. 2007. "Allocation of Allowances for Aviation in the EU ETS." The Netherlands: CE Delft, available at http://www.cedelft.eu/publicatie/allocation_of_allowances_for_aviation_in_the_eu_ets/575?PHPSESSID=ad8353cb75ccfdf097561c2fc46a6f6a.

Cames, Martin, Odette Deuber, and Ulrike Rath. 2004. "Emissions Trading in International Civil Aviation." Berlin: Institute for Applied Ecology, available at http://www.umweltdaten.de/publikationen/fpdf-l/2605.pdf.

Dorbian, Christopher S., Philip J. Wolfe, and Ian A. Waitz. 2011. "Estimating the climate and air quality benefits of aviation fuel and emissions reductions." Atmospheric Environment 45 (16): 2750–2759.

Ernst & Young. 2007. "Analysis of the EC Proposal to Include Aviation Activities in the Emissions Trading System." Washington: Ernst & Young, available at http://www.obsa.org/Lists/Documentacion/Attachments/124/Analysis_EC_proposal_include_aviation_ETS_EN.pdf.

Ernst & Young. 2008. "Inclusion of Aviation in the EU ETS: Cases for Carbon Leakage." Washington: Ernst & Young, available at http://www.iaca.be/index.cfm?AFF5184E-BDBE-2776-0CC0-9E3D55BCA9FB.

European Commission. 2011. "Reducing Emissions from the Aviation Sector". Brussels, Belgium: European Commission, available at http://ec.europa.eu/clima/policies/transport/aviation/index_en.htm.

Faber, Jasper, and Linda Brinke. 2011. "The Inclusion of Aviation in the EU Emissions Trading System." Geneva, Switzerland: ICTSD Programme on Trade and Environment, available at http://ictsd.org/downloads/2011/09/faber_web2gp2.pdf.

Frontier Economics. 2006. "Economic Consideration of Extending the EU ETS to Include Aviation." London, available at http://www.elfaa.com/documents/FrontierEconomicsreportforELFAA-Economicconsideration.pdf.

Heymann, Eric, and Joachim Hartel. 2011. "Emissions trading in aviation." Frankfurt: Deutsche Bank Research, available at http://www.dbresearch.de/PROD/DBR_INTERNET_DE-PROD/PROD0000000000280535/Emissions+trading+in+aviation%3A+Moderate+burdens+for+the+time+being,+perceptible+competition+effects.pdf.

Hihara, Katsuya. 2011. "Analysis on bargaining about global climate change mitigation in international aviation sector" Transportation Research Part E: Logistics and Transportation Review 47 (3): 342–358.

IATA. 2007. "Financial Impacts of Extending the EU ETS to Airlines." Geneva: International Air Transport Association.

IATA. 2011. "Financial Forecast." Geneva: International Air Transport Association, available at http://www.iata.org/whatwedo/Documents/economics/Industry-Outlook-September2011.pdf.

ICF Consulting. 2006. "Including Aviation into the EU ETS: Impact on EU Allowance Prices." London, available at http://www.decc.gov.uk/assets/decc/what%20we%20do/global%20climate%20change%20and%20energy/tackling%20climate%20change/emissions%20trading/eu_ets/publications/including-aviation-icf.pdf.

Knight, Zoe, Celine Fernaro, and Samantha Gleave. 2008. "Aviation in EU ETS; an incentive for edfficiency." Merrill Lynch, available at http://www.ml.com/media/113530.pdf.

Macintosh, Andrew, and Lailey Wallace. 2009. "International aviation emissions to 2025: Can emissions be stabilised without restricting demand?" Energy Policy 37 (1): 264–273.

Malavolti, Estelle, and Julien Jenvrin. 2010. "Strategic Reaction of Airlines to the ETS," available at http://intranet.imet.gr/Portals/0/UsefulDocuments/documents/01654.pdf.

Malina, Robert, and others. 2012. "The impact of the European Union Emissions Trading Scheme on US aviation." Journal of Air Transport Management 19: 36–41.

Mayor, Karen, and Richard S. J. Tol. 2007. "The Impact Of The Uk Aviation Tax On Carbon Dioxide Emissions And Visitor Numbers." Working Papers. Hamburg, Germany: Research unit Sustainability and Global Change, available at http://ideas.repec.org/p/sgc/wpaper/131.html.

Mayor, Karen, and Richard S.J. Tol. 2010. "The impact of European climate change regulations on international tourist markets." Transportation Research Part D: Transport and Environment 15 (1): 26–36.

Mendes, Lucas M Z, and Georgina Santos. 2008. "Using economic instruments to address emissions from air transport in the European Union." Environment and Planning A 40 (1): 189–209.

Morrell, Peter. 2007. "An evaluation of possible EU air transport emissions trading scheme allocation methods." Energy Policy 35 (11): 5562–5570.

Morrell, Peter. 2010. "The Economics of Co2 Emissions Trading for Aviation." The Future for Interurban Passenger Transport, 459–481, available at http://www.oecd-ilibrary.org/transport/the-future-for-interurban-passenger-transport/the-economics-of-co2-emissions-trading-for-aviation_9789282102688-18-en;jsessionid=52d4gtbbolqab.epsilon?citeformat=ris.

OAG. 2012. "EU Emissions Trading Scheme Report." OAG Market Intelligence, available at http://www.oagaviation.com/Solutions/Reports-Guides/ETS/ETS?utm_source=pressrelease&utm_medium=ubmaviation&utm_campaign=ets.

Oxera. 2003. "Asssessment of the Financial Impact on Airlines of Integration into the EU Greenhouse Gas Emissions Trading Scheme." Oxford, England: Oxera, available at http://www.oxera.com/cmsDocuments/Reports/BAA%20Assessment%20of%20the%20financial%20impact%20on%20airlines.pdf.

Schaefer, Martin, and others. 2010. "The economic impact of the upcoming EU emissions trading system on airlines and EU Member States—an empirical estimation." European Transport Research Review 2: 189–200.

Scheelhaase, Janina D., and Wolfgang G. Grimme. 2007. "Emissions trading for international aviation—an estimation of the economic impact on selected European airlines." Journal of Air Transport Management 13 (5): 253–263.

Scheelhaase, Janina, Wolfgang Grimme, and Martin Schaefer. 2010. "The inclusion of aviation into the EU emission trading scheme – Impacts on competition between European and non-European network airlines." Transportation Research Part D: Transport and Environment 15 (1): 14–25.

SEC. 2006. "Impact Assessment of the Inclusion of Aviation Activities in the Scheme for Greenhouse Gas Emission Allowance Trading within the Community." Brussels: Commission of the European Communities.

Tol, Richard S. J. 2006. The Impact of a Carbon Tax on International Tourism. Dublin, Ireland: Economic and Social Research Institute (ESRI). http://ideas.repec.org/p/esr/wpaper/wp177.html.

Vespermann, Jan, and Andreas Wald. 2011. "Much Ado about Nothing? – An analysis of economic impacts and ecologic effects of the EU-emission trading scheme in the aviation industry." Transportation Research Part A: Policy and Practice 45: 1066–1076.

Vivid Economics. 2007. "A Study to Estimate Ticket Price Changes for Aviation in the EU Emission Trading Scheme." London. Available at http://www.vivideconomics.com/index.php/publications/a-study-to-estimate-ticket-price-changes-for-aviation-in-the-eu-ets.

Vivid Economics. 2008. "Impacts of Emissions Trading on Profits in Aviation". London. Available at http://www.vivideconomics.com/index.php/publications/impacts-of-emissions-trading-on-profits-in-aviation.

Wit, Ron, and others. 2005. Giving Wings to Emission Trading. The Netherlands: CE Delft, available at http://ec.europa.eu/clima/policies/transport/aviation/docs/aviation_et_study_en.pdf.

Appendix B

Studies reviewed and included or not included in this report

The following section lists all the studies reviewed, broken down by those included and not included in the aggregate tables (in Appendix C). As mentioned above, studies were reviewed but not included for a number of reasons. Most studies were excluded either because they did not model the actual EU aviation policy or because they did not provide results for either a subset of or the whole covered aviation sector.

Studies reviewed

Included	Not included
1 Wit et al (Delft) 2005	**1** Oxera 2003
2 SEC (European Commission) 2006	**2** Cames et al 2004
3 Boon et al (Delft) 2007	**3** Frontier Economics 2006
4 Ernst & Young 2007	**4** ICF Consulting 2006
5 IATA 2007	**5** Tol 2006
6 Anger et al 2008	**6** Morrell 2007
7 Ernst & Young 2008	**7** Scheelhaase and Grimme 2007
8 Knight et al (Merrill Lynch) 2008	**8** Mayor and Tol 2007
9 Schaefer et al 2010	**9** Vivid Economics 2007
10 Scheelhaase et al 2010	**10** Mendes and Santos 2008
11 Bloomberg 2011	**11** Vivid Economics 2008
12 Faber and Brinke (ICTSD) 2011	**12** Macintosh and Wallace 2009
13 Heyman and Hartel (Deutsche Bank) 2011	**13** Anger 2010
14 Vesperman and Wald 2011	**14** Anger and Kohler 2010
15 OAG 2012	**15** Malavolti and Jenvrin 2010
16 Malina et al (MIT) 2012	**16** Mayor and Tol 2010
	17 Morrell 2010
	18 Abrell 2011
	19 Dorbian et al 2011
	20 Hihara 2011
	21 Winchester et al 2011

Appendix C

Estimates in the reviewed studies

The following tables are broken out by individual study. In each table, cells marked with grey boxes are extrapolated from the available results. All extrapolations were calculated by multiplying the available metric (costs) by the average of the ratio between the two metrics (costs and cost per passenger) from IATA (2007)—the only study that consistently provides results in multiple metrics.

Estimates of costs by existing study

	Out-of-pocket costs		Emissions costs	
Estimates	**Million USD**	**USD per passenger**	**Million USD**	**USD per passenger**
Bloomberg 2011	$1,779 to $8,352	$3.79 to $17.89	$5,625 to $26,561	$12.05 to $56.88
Heyman and Hartel (Deutsche Bank) 2011	$1,463	$3.13	$4,652	$9.96
OAG 2012	$1,314	$2.81	$4,655	$9.97
Schaefer et al 2010	$1,528 to $2,445	$3.27 to $5.24	$4,859 to $7,774	$10.41 to $16.65
EU airlines	$1,270 to $2,032			
Non-EU airlines	$258 to $413			
Network	$1,329 to $2,126			
Low cost	$199 to $319			
Scheelhaase et al 2010				
EU airlines		$6.13 to $6.78		$16.81 to $17.81
US airlines		$1.44 to $3.01		$12.75 to $12.86
Vesperman and Wald 2011	$4,881	$10.45	$15,522	$33.24
Ernst & Young	$4,072 to $6,650	$8.72 to $14.24	$12,948 to $21,147	$27.73 to $45.28
Knight et all (Merrill Lynch) 2008	$3,966	$8.49	$12,611	$27.00
Ernst & Young*	$1,538 to $7,226	$3.29 to $15.47	$3,418 to $15,341	$7.32 to $32.85
IATA 2007	$1,619 to $3,224	$3.47 to $6.90	$5,528 to $11,832	$11.84 to $25.34
EU airlines	$1,095 to $2,124			
US airlines	$172 to $334			
Non-EU airlines	$322 to $625			
Network airlines	$911 to $1,768			
Low cost airlines	$184 to $356			

Intra-EU flights	$288 to $574			$4.63 to $9.94
Extra-EU flights	$930 to $1,849			$24.95 to $53.36
SEC (European Commission) 2006	$316 to $1,578	$0.68 to $3.38	$1,118 to $5,590	$2.39 to $11.97

* Not included in ranges in text due to its modeling of a policy significantly different from the final policy. See Appendix B for more details.

Estimates of ticket price changes by existing study

	Change in ticket price		Change in revenue
Estimates	**USD**	**Percent**	**Milion USD**
Faber and Brinke (ICTSD) 2001	$7.71 to $38.54	1.30 to 6.50	$3,599 to $17.995
Boon et al (Delft) 2007*	$5.99 to $17.96	1.01 to 3.03	$2,795 to $8,384
Ernst & Young 2007*	$0.19 to $2.79	0.03 to 0.47	$87 to $1,304
IATA 2007	$8.88 to $18.99	1.50 to 3.20	$4,147 to $8,871
Intra-EU flights	$3.47 to $7.45	1.10 to 2.30	$1,041 to $2,234
Economy passengers	$3.47 to $7.45	1.20 to 2.60	
Premium passengers	$3.47 to $7.45	0.40 to 0.90	
Extra-EU flights	$18.73 to $40.02	1.70 to 3.60	$3,106 to $6,637
Economy passengers	$18.73 to $40.02	2.20 to 4.60	
Premium passengers	$18.73 to $40.02	0.60 to 1.30	
SEC (European Commission) 2006	$2.39 to $11.97	0.40 to 2.02	$1,118 to $5,589
Wit et al (Delft) 2005	$0.53 to $1.73	0.09 to 0.29	$248 to $807

* Not included in ranges in text due to its modeling of a policy significantly different from the final policy. See Appendix B for more details.

Estimates of demand changes by existing study

	Change in demand		Change in revenue	Change in cost
Estimates	**Million tickets**	**Percent**	**Milion USD**	**Million USD**
Anger et al 2008	-0.18 to -4.56	-0.04 to -0.98	-$93 to -$2,391	-$52 to -$1,341
Boon et al (Delft) 2007*	NA to -9.40		NA to -$8,189	NA to -$4,635
EU airlines		NA to -3.30		
Non-EU airlines		NA to -0.90		
Intra-EU flights	NA to -2.21	NA to -2.50	NA to -$2,226	NA to -$1,145
Extra-EU flight	NA to -7.19	NA to -4.10	NA to -$5,963	NA to -$3,490
IATA 2007	-8.50 to -18.10	-1.80 to -3.90	-$4,442 to -$9,506	-$2,504 to -$5,305
Intra-EU flights	-5.20 to -11.10	-1.70 to -3.70	-$1,524 to -$3,270	-$797 to -$1,655
Economy passengers	-5.10 to -11.00	-1.80 to -3.80		
Premium passengers	-0.04 to -0.09	-0.30 to -0.70		

Extra-EU flights	-3.30 to -7.10	-2.00 to -4.30	-$2,918 to -$6,235	-$1,708 to -$3,650
Economy passengers	-3.30 to -7.00	-2.20 to -4.60		
Premium passengers	-0.03 to -0.06	-0.20 to -0.40		
Wit et al (Delft) 2005				
EU airlines		-0.70 to -2.10		
Non-EU airlines		-0.10 to -0.40		

* Not included in ranges in text due to its modeling of a policy significantly different from the final policy. See Appendix B for more details.

Estimates of profit changes by existing study

	Change in profits	
Estimates	**Million USD**	**Change in margin**
Malina et al (MIT) 2012		
US airlines	$116	0.15 percent
Boon et all (Delft) 2007*	NA to $14,748	NA to 1.09 percent
EU airlines	NA to $9,216	NA to 2.30 percent
Non-EU airlines	NA to $5,532	NA to 0.60 percent
Ernst & Young 2007*	-$1,053 to -$4,489	-0.36 to -1.54 percent
Network	-$576 to -$2,638	
Low cost	-$144 to -$565	
Cargo	-$333 to -$1,286	
IATA 2007	$591 to $1,447	0.20 to 0.50 percent
Intra-EU flights	-$68 to -$145	-0.10 to -0.10 percent
Extra-EU flights	$660 to $1,592	0.40 to 0.90 percent

* Not included in ranges in text due to its modeling of a policy significantly different from the final policy. See Appendix B for more details.

Appendix D

Notes on methodology

All costs converted from euros to U.S. dollars at an exchange rate of 1 EUR to 1.33 USD.

We translate total results to per passenger and vice versa by assuming that the policy will cover 467 million passenger tickets. This number is taken from IATA (2007).

In all cases, the lower and upper bound estimates in each range are the results associated with a low and high allowance price respectively.

In all cases where total results are presented for studies that calculate results for short-haul, medium-haul, and long-haul flights, only the results for medium-haul flights are presented. This applies to Wit et al. (2005), SEC (2006), Ernst & Young (2007), and Boon et al. (2007).

Boon et al. (2007) estimate economic impacts for versions of the EU policy with different allocation regimes. This study presents results for their Sub-Variant 1, 100 percent free allocation based on historical emissions, as this is the closest of their modeled scenarios to the actual EU policy. For their change in demand for EU and non-EU carriers, we present the percent change in RTK rather than the percent change in passengers, as they do not provide data on the later. As Boon et al. (2007) model a policy that is significantly different from the final EU policy, we do not include their results in the ranges in the text, though we do include their results in the appendix tables.

Ernst & Young (2007) find starkly different impacts from the other existing studies. These different results are largely because the study assumes that more allowances are auctioned than the actual policy requires. The additional increases costs, ticket price changes, demand reductions, and, as a result, profit loses. As this study does not actually model the policy, it is not included in the ranges for overall results presented in the main report. It is used, however, in the ranges for impacts on airline subgroups, as few other studies are available for these results, and we do not expect the auction percentage to drastically impact the distributional impacts of the policy. All the study's results are included in the appendix tables.

Also Ernst & Young (2007) do not explicitly calculate full costs. We extrapolate full costs from their results by dividing the cost of auctioning revenue by the auctioning percentage to get the value of all allowances and then adding the value of allowances purchased from other sectors.

IATA (2007) does not make any statements about historical versus updated allocation. They do, however, implicitly assume that free allowances are given based on historical emissions by assuming that the monetary value of the free allowances are not passed through into ticket prices.

About the authors

Samuel Grausz is an associate at Climate Advisers and manages its energy practice. Samuel also holds a research position at Resources for the Future, where he works with leading economic scholars on a broad set of energy and environment policy issues. Samuel previously worked at National Economic Research Associates, a leading economic consulting firm.

Nigel Purvis is the founder and president of Climate Advisers. Previously, Nigel directed U.S. environmental diplomacy, serving most recently as deputy assistant secretary of state for oceans, environment, and science. Later Nigel served as vice president for policy and external affairs at The Nature Conservancy. He holds senior research appointments at Resources for the Future, the German Marshall Fund of the United States, and the Brookings Institute. Early in his career Nigel worked as an international lawyer at the State Department, as a securities attorney at the law firm of Sullivan & Cromwell, and as a lecturer at Georgetown University.

Rebecca Lefton is a Policy Analyst focusing on international climate and energy policy at the Center for American Progress. Rebecca began her work with CAP in the ThinkProgress War Room. Prior to joining CAP she worked at the Pew Charitable Trusts Environment Group. She holds a master's degree in public policy from the Harris School of Public Policy at the University of Chicago. As a graduate student Rebecca worked with a coalition of cities in the United States and Canada to create sustainable urban environments and protect water resources with the Great Lakes and St. Lawrence Cities Initiative.

Acknowledgements

Special thanks to Annela Anger of the University of Cambridge, Dallas Burtraw and Ray Kopp of Resources for the Future, and Gernot Wagner and Ruiwen Lee of the Environmental Defense Fund for reviewing this paper and providing comments.

Endnotes

1 International Civil Aviation Organization. "ICAO Environmental Report 2010" (2010), available at http://www.icao.int/environmental-protection/Pages/EnvReport10.aspx.

2 Artur Runge-Metzger, "Aviation and Emissions Trading: ICAO Council Briefing," September 29, 2010, available at http://ec.europa.eu/clima/policies/transport/aviation/docs/presentation_icao_en.pdf. Percent change relative to a 2006 baseline.

3 International Civil Aviation Organization. "ICAO Environmental Report 2010."

4 Other participating states include Iceland, Lichtenstein, and Norway. Croatia, when it joins the European Union in 2013, will become part of the program. The policy does not include flights with a minimum take-off weight less than 5,700 kg, training and military flights, and flights to remote regions. For more, see: European Commission, "Reducing Emissions from the Aviation Sector" (Brussels: European Commission, 2011), available at http://ec.europa.eu/clima/policies/transport/aviation/index_en.htm.

5 In 2020, 85 percent of the allowances will be issued for free to existing airlines. Each year from 2013 to 2020, 82 percent of the allowances will be issued for free to existing airlines and 3 percent will be kept in reserve for fast-growing and new airlines.

6 Measured in tonne-kilometers in passengers and freight in 2010.

7 The European Union will create enough new allowances to cover 97 percent of average aviation emissions from 2004 to 2006 in 2012, and 95 percent in 2013 and thereafter.

8 Most importantly, we do not compare allowance price assumptions. These assumptions, more than anything else, are likely drive the variety of results.

9 This importantly leaves out a number of studies that estimate impacts on the European or global economy and studies that estimate impacts on specific airlines or specific flight patterns. In a few cases, we did include estimates for specific airlines when the results for those airlines are intended to represent an airline subgroup.

10 The value of the allowances is not factored into the changes in ticket prices and demand and is included as a source of profits because the EU policy allocates free allowances based on historical emissions. Economic theory suggests that this will occur because free allowances based on historical emissions do not affect the marginal cost of emissions and thus airlines will not pass through the value of the allowances to consumers and will instead keep the free allocation as profit. Economists have documented this effect empirically in a large number of studies. For good examples, see: Jos Sijm, S Hers, W Lise, and B Wetzelaer, "The impact of the EU ETS on electricity prices," Environmental Protection (2008); Jos Sijm, Karsten Neuhoff, and Yihsu Chen, "CO2 cost pass-through and windfall profits in the power sector," Climate Policy 6 (1) (2006): 49–72; Lans A. Bovenberg, and Lawrence H. Goulder, "Neutralizing the Adverse Industry Impacts of CO2 Abatement Policies: What Does it Cost?" NBER Working Papers, available at http://ideas.repec.org/p/nbr/nberwo/7654.html; Dallas Burtraw and Karen Palmer, "Compensation rules for climate policy in the electricity sector," Journal of Policy Analysis and Management 27 (4) (2008): 819–847.

11 No study estimates and presents total costs for all covered airlines. We approximate total covered costs as the costs for all European air travel, calculated using worldwide aviation costs and regional market shares from IATA. This approximation may be inaccurate to the extent that the costs of airlines differ between regions and to the extent that the IATA Europe region does not line up with the coverage of the EU policy. See: IATA, "Financial Forecast" (Geneva: International Air Transport Association, 2011), available at http://www.iata.org/whatwedo/Documents/economics/Industry-Outlook-September2011.pdf; IATA, "Air Transport Market Analysis" (Geneva: International Air Transport Association, 2011), available at http://www.iata.org/whatwedo/Documents/economics/MIS_Note_Sep11.pdf.

12 Similar to above, we approximate total fuel costs for covered airlines using the fuel costs for all European air travel, calculated using worldwide aviation costs and regional market shares from IATA. We use regional market shares for 2010 in all years, as IATA only makes data publicly available for that year.

13 European Commission, "Reducing Emissions from the Aviation Sector" (Brussels: European Commission, 2011), available at http://ec.europa.eu/clima/policies/transport/aviation/index_en.htm.

14 IATA (2007) does not explicitly show these numbers but they do provide full costs per passenger and total number of passengers.

15 The difference between the out-of-pocket and emission cost for IATA (2007) does not exactly match the value of free allocation calculated in the previous paragraph because IATA (2007) assumes a 10% auction rate rather than the 15% auction rate included in the final policy. We corrected for this in the extrapolation of the other studies. Also, we chose to extrapolate from IATA (2007) rather than just add the calculated value of free allowances to the out-of-pocket costs from each study because not every study identifies its assumed allowance price.

16 The changes in ticket prices described above represent the change in price for the average ticket, with respect to both distance and price. For those studies that estimated price changes for short-, medium-, and long-haul flights, we included changes in ticket prices for the medium-haul flight. Obviously the EU policy will result in different ticket price changes for flights of different lengths, as short- and long-haul flights use different amounts of fuel and have different base ticket prices.

17 On the supply side, pass through depends on the number of firms in a market, the concentration of market shares, whether the firms seek to maximize profits or other objectives, and the ability of other firms to enter and exit the market. On the demand side, pass through depends on the number of different types of passengers and the willingness of different passengers to pay higher prices for a given ticket. For economists these factors are manifested in the size of relevant market and the characterization of the supply and demand curve. Vivid Economics (2007 and 2008) provide more thorough examination of these issues.

18 This was determined by summing auction percentages over the relevant modeling horizons and comparing that to the sum of auction percentages for the actual policy.

Endnotes

19 IATA (2007) assumes a 75 percent pass-through rate, while Ernst & Young (2007) assumes 29 percent to 35 percent, and Boon et al. (2007) assumes 100 percent. As described previously the pass-through rate is the key determinant in a simple modeling framework of the extent to which the airlines can increase ticket prices in response to increases in costs. This plays a major role in setting changes in revenues, costs, and, thus, profits.

20 Baseline annual profits of covered flights approximated with 2010 profits and profit margins in Europe from IATA (2011). We use the 2010 estimate to avoid including the effects of the EU policy (which may or may not be included in the IATA forecast for 2012) and as 2012 is predicted to be a particularly bad year by IATA, meaning that it may not be a good estimate of average annual reference profits under the EU policy.

21 The back-of-the-envelope calculation involves reducing the amount of free allocation to reflect a switch from 10 percent to 15 percent auctioning. No other modifications are necessary as under the IATA (2007) modeling the amount of free allocation does not affect changes in ticket prices or demand. This calculation is uniquely possible with IATA (2007) as it disaggregates the components of changes in revenues and costs, specifically identifying the value of the free allocation.

22 Malina et al. (MIT, 2012) also estimate changes in profits, but only for U.S. airlines. As such their results cannot be used to compare the impact of the EU policy on airlines of different nationalities.

23 As noted before, the Boon et al. (2007) estimates of profit changes seem large, but the direction of the profit changes and distribution of the changes between EU and non-EU airlines make sense. Also these profit margins do not appear to be adjusted for coverage, meaning that the EU policy increases profits of non-EU airlines by 0.6 percent relative to the total profits of non-EU airlines.

24 Ernst & Young (2007) also calculate that cargo will lose $188 million to $727 million.

25 Obviously, these alternatives will only replace certain types of air travel. Ships, for example, might replace air cargo or passenger flights over short distances. They will probably not substitute for transatlantic flights due to time cost.

The Center for American Progress is a nonpartisan research and educational institute dedicated to promoting a strong, just, and free America that ensures opportunity for all. We believe that Americans are bound together by a common commitment to these values and we aspire to ensure that our national policies reflect these values. We work to find progressive and pragmatic solutions to significant domestic and international problems and develop policy proposals that foster a government that is "of the people, by the people, and for the people."

Center for American Progress

Climate Advisers is a consulting firm specializing in U.S. climate change policy, international climate cooperation, global carbon markets, and climate-related forest conservation. Climate Advisers is known for its vision, policy expertise, political acumen, and access to senior policymakers in the United States and around the world. Our clients include leading national governments, financial institutions, companies, think tanks, philanthropic foundations, conservation organizations and climate advocacy groups. Climate Advisers helps clients develop and advance environmentally effective, economically affordable and politically realistic climate change policies, strategies, and investments. In short, the firm is working with others to actively shape the low carbon economy.

Climate Advisers