Appendix A - Expert Panel Briefing Note

Expert panel on additional cross subsidisation

Considering arguments and providing expert opinion

Report

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1   Introduction

In the period end 2005 till September 2006 MVA London in cooperation with SEO Amsterdam was commissioned by the Dutch Ministry of Transport, DGTL to perform an analysis of the economic and competition effects of the different proposals from the European Commission to include aviation in the European Emission Trading System (ETS). Roughly at the same time CE Delft was commissioned to study the overall impacts of this inclusion for the European Commission.

Both studies considered the possibility that inclusion of aviation in the ETS could lead to the distortion of competition between airlines through cross-subsidisation[1].

The studies concluded differently on additional possibilities for cross-subsidisation. As a result, both parties have different views on the possible distortion of the competitive market on routes where EU-based carriers compete directly with carriers based outside the EU.

CE Delft (2005) concluded that 'none of the policy options considered in this study will significantly damage the competitive position of EU airlines relative to non-EU airlines'. In contrast, MVA and SEO (2006) concluded that 'effective cross-subsidisation by non-EU carriers in the Departing EU scope of the ETS appears to be more probable than cross-subsidisation by EU network carriers in the Intra-EU scope of the ETS'.

In July 2007, the Dutch Ministry of Transport, DGTL commissioned CE Delft, MVA and SEO to study the causes for their different opinions and to see whether a further investigation could shed more light on the likelihood of additional cross-subsidisation.

Formally, the aim of the work currently carried out is:
1 To determine whether it is possible to assess the impacts on the competitive market between EU based carriers and non-EU based carriers based on sound economic reasoning and analysis of empirical data.
2 If so, to determine whether the inclusion of aviation in ETS as proposed by the European Commission will offer non-EU airlines the opportunity to increase their market share on markets where they compete directly with EU based airlines by undercutting fares on these markets, subsidising potential losses on these markets by increased prices on routes at which they do not compete with EU airlines, and thus increase their total profits.

As part of the project, a panel of experts will be contacted to provide input to the study. This note elaborates the input that we ask for. But first, it provides an analytical background on the study.

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[1]   More strictly, cross-subsidisation additional to that already practised.

2 Assumptions and definitions

The basis for this study is the proposal of the European Commission to include aviation in the European system of emission trading EU ETS. This proposal has several aspects that are relevant for the expert panel:

- Airlines ('aircraft operators' is the phrase used in the directive) will be subject to EU ETS regardless of their nationality. So the principle of non-discrimination applies
- All flights arriving at or departing from EU airports will be subject to EU ETS.

This study focuses on *additional* cross-subsidisation, i.e. cross-subsidisation that is caused by the inclusion of aviation in the EU ETS and that is additional to any cross-subsidisation that may occur at present.

Within this study, additional cross-subsidisation is defined as:

Allocating the costs of ETS to flights outside the scope of ETS

By allocating the costs of the EU ETS to flights outside the scope of the EU ETS, airlines could possibly increase their profits in market segments outside the scope of the EU ETS, and use these profits to offset the cost increase in the ETS market segment.

This study furthermore defines that an airline has the *opportunity* to additionally cross-subsidise if that airline:

a Has operations within the scope of the ETS; and
b Has operations outside the scope of the ETS; and
c Has the possibility after the inclusion of aviation in the ETS (but not before) to increase profits on market segments outside the scope of the ETS.

If the first two conditions are not fulfilled simultaneously, either ETS costs are not incurred or ETS costs cannot be allocated to routes outside the scope of the EU ETS. If the third condition is not met, the airline does not have the means to reduce prices in the ETS market segment. This definition is in line with MVA (2006). Please note that an airline that has the opportunity to cross-subsidise may or may not find cross-subsidisation to be *desirable*, as defined below.

This study defines that airlines will find cross-subsidising *desirable* if it is in their interest, i.e. if cross-subsidising increases their current profits after the introduction of ETS (or, alternatively, the net present value of their current and future profits).

Please note that it is not contested that on some routes, the EU ETS may impact different airlines in different ways. For example:

1 On routes from an EU airport to an airport outside the EU that involve transfer at a hub, the route using a non-EU hub may become more attractive since the second leg of this route is outside the scope of ETS. This is not cross-subsidisation since this does not involve allocating ETS costs to a non-ETS flight[2].

2 Airlines that operate fuel efficient aircraft will have fewer ETS costs and may use this to their advantage. Again, this does not involve a re-allocation of costs and so does not constitute cross-subsidisation.

Furthermore, it is not contested that EU carriers will face higher ETS costs relative to their revenue, as a higher share of their flights will be included in the EU ETS. Neither is it contested that in theory, EU carriers will face slower growth in their home markets.

3   Brief analysis

This section contains a brief analysis of the opportunity and desirability of cross-subsidisation. This analysis is shared by MVA and CE Delft. We invite the experts to comment on the analysis.

To analyse the opportunity for and desirability of cross-subsidisation, it is helpful to define four market segments:

1 The market in the scope of the EU ETS, i.e. all flights arriving at and departing from EU airports.

2 The market outside the scope of the EU ETS where airlines that have operations under the EU ETS compete with airlines that do not have operations under the EU ETS.

3 The market outside the scope of the EU ETS where airlines that have operations under the EU ETS only compete with airlines that also have operations under the EU ETS.

4 The market outside the scope of the EU ETS where only airlines that have no operations under the EU ETS are active.

Airlines that operate solely in market segment 1, 2 or 4 do not have an opportunity to cross-subsidise (remember the definition of cross-subsidisation: allocating the costs of ETS to flights outside the scope of ETS). (By definition, airlines that operate solely in market segment 3 do not exist).

Airlines that operate both on market segment 1 and 2 will find that they have no opportunity to cross-subsidise. After all, if they would allocate ETS costs incurred on market segment 1 to market segment 2, they would reduce demand for their

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2   It remains to be seen whether the advantage of routes via non-EU hubs strengthens the competitive position of non EU carriers. Although it is clear that EU carriers predominantly use EU hubs in their own network, and non-EU carriers predominantly use non-EU hubs, the situation within the alliances may be different. Because of code-sharing arrangements and alliances, EU carriers have access to non-EU hubs and non-EU carriers to hubs in the EU. A flight from Vienna to Minneapolis, for example, may be carried out by NorthWest and involve a transfer at Amsterdam, or it may be carried out by Austrian Airlines and involve a transfer at Washington DC. it is not clear at this stage whether this example is an exception or common practice.

services in market segment 2. Assuming that they had maximised their profits in market segment 2 before the introduction of ETS, their profits would decrease after cross-subsidisation, since the costs of operating a flight in this segment would remain the same.

The validity of this rationale rests on the assumption that airlines are behaving as rational economic actors, whether that is in terms of short- or long-term profit maximising, maintaining market share, providing feed traffic to their long-haul operations, etc. Given that rationale, cross-subsidising routes to/from the EU by transferring ETS costs to routes wholly outside the EU will not be attractive to non-EU carriers unless market conditions on those routes are modified as a consequence of the ETS.

There can be no **general** presumption that market conditions on routes wholly outside the EU will be modified by the ETS. However, the situation may be different for airlines that operate both on market segment 1 and 3. In this case, all carriers in the market segments concerned may find that adjusting prices moves them to a new optimum. So cross-subsidisation may be both possible and desirable.

With regard to opportunity, at least the following conditions would have to apply:
1 No new entrants on segment 3 that do not operate in market segment 1. Since prices in market segment 3 will be higher than marginal costs, this segment is attractive to new entrants. This can be new entrants to the aviation industry, or new entrants to these market segments. Thus the opportunity for cross-subsidisation will be influenced by entry costs. The opportunity for cross-subsidisation will be higher if new entrants are deterred by regulatory barriers or shortage of slots.
2 No exit of airlines from market segment 1. If non-EU airlines were to retreat from market segment 1 and focus entirely on market segment 3, other non-EU airlines in that segment that retained their routes to/from the EU would find that it had become a segment of type 2.

The foregoing discussion suggests that, though non-EU airlines would have an opportunity to cross-subsidise that EU airlines would not have, the conditions in which non-EU airlines would find cross-subsidisation desirable are limited to those previously described. This could be described as a long-run "equilibrium" perspective, however. There is still the question of whether non-EU airlines might find cross-subsidisation an attractive market-domination strategy over a finite period.

In this case, non-EU airlines might choose to behave strategically with the objective of reducing competition from EU airlines on routes to/from the EU. An example of this could be maintaining prices on such routes that would be unsustainable for the EU airlines. While losses would probably be incurred by both EU and non-EU airlines, for the latter a much smaller proportion of their activity would be affected by this. If the effect were to create a differential in prices between EU and non-EU airlines, the advantage would further shift to non-EU carriers in that

they would gain market share. These processes could encourage – or force – EU carriers to leave the market.

4 Further steps by MVA, SEO and CE Delft

MVA and CE Delft agree on both the definitions in section 2 and the analysis in section 3. A number of issues are still unresolved. Some of these issues will be resolved by MVA, SEO and CE Delft, partly by executing empirical tests. For other issues, the experts are asked to provide input.

Issues to be resolved by SEO include:
- How large is market segment 3? This can probably be assessed using the OAG.
- How much does the share of operations in market segments 1 and 3 differ for different airlines? Again, the OAG can probably be used to answer this question.
- How large is the opportunity to cross-subsidise under varying scenarios of permit price, permit allocation and pass through of opportunity costs. This will be estimated through use of SEO's NetCost model.

MVA will analyse:
- The contestability of markets in market segment 3: are there regulatory or other barriers against new entrants?

CE Delft will analyse:
- Under which conditions would the introduction of aviation in the EU ETS create additional incentives for strategic pricing?

5 Questions to the expert panel

The previous sections describe the circumstances which – in principle – offer opportunity for non-EU airlines to cross-subsidise and would make it desirable for them to do so. But we are conscious of the gulf between principle and whether cross-subsidisation would be a plausible or likely strategy in practice. This is where we are seeking the additional insights of the experts. Though there may not be definitive answers, there may nonetheless be important considerations that the experts believe will influence practice towards or away from cross-subsidisation. It may be that the probability of cross-subsidisation is higher in some markets than others.

In this context, we would like to ask the experts the following particular questions:

1 Do you agree with the analysis presented in section 3? If not, please specify.
2 Key to the desirability of cross subsidisation is that the cross price elasticity between carriers is high. Do you believe this to be true? Could you give an estimate of the cross-elasticity?

3   The analysis in section 3 refers mainly to an equilibrium situation and rational, profit-maximising actors. In reality, the market may need some time to adjust to the new situation. During this transitional period, airlines may have extra incentives to cross-subsidise. Do you believe this to be true? How long would you expect this period to last?

4   In general, how much time would it take for airlines to adjust their capacity to reduced and/or growing demand. How would this depend on the pace of demand growth or reduction?

5   How likely do you consider the strategic behaviour of airlines to be, such as that is described at the end of section 3?

6   Apart from the issue of cross-subsidisation, the competitive position of EU carriers may be affected by the fact that routes via EU hubs will incur larger cost increases than routes via non-EU hubs (see footnote 2). Do you believe it is feasible that EU carriers could overcome this disadvantage by making use of non-EU hubs, e.g. through code sharing and alliances? If so how widespread do you think this would be?

CE Delft and MVA invite the experts to provide a written paper covering the questions above and any other issues that the experts may consider relevant. We would also like to invite to experts to point us to relevant literature that we may have overlooked.

Expert Panel on Additional Cross Subsidization with the Introduction of Emissions Trading in the EU

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October 30, 2007

Summary Statement

It is my view that non-EU airlines will have neither the opportunity nor the desire to cross-subsidize routes on which they compete with EU carriers under conditions where an ETS has been introduced into the EU. To have an opportunity to [cross] subsidize there must be a pool of capital from which the subsidy is drawn. If firms are profit maximizing and seeking to maximize shareholder value, no pool will exist because airlines will be profit maximizing in each market. To try to raise money in market 'A' to underprice in market 'B' will mean non-profit maximizing behaviour in both markets; that is, marginal revenue ≠marginal cost.

Cross subsidization is not desirable because cross-subsidization is never profitable. This conclusion also would seem to hold even if firms compete in a number of markets with different costs, unless these markets can somehow be linked (in which case, they may be able to be aggregated). I see no reason why airlines would want to cross subsidise routes to Europe after the introduction of the ETS, if they are not doing so already.

The relevant market is the city pair. Airlines competing in these markets will face approximately the same cost increase when the ETS is introduced; the amount of the cost increase will depend on segment length and type of aircraft/engines flown, among other things. Airlines faced with higher marginal costs will adjust their fares subject to this cost change and recognizing competitive conditions in the market. The airlines' ability to respond is also limited by the fact that many routes into Europe are capacity constrained, and many EU airports are also slot controlled (more on this below). If one makes any other assumption as to what airlines are maximizing, anything can happen. For example, if they are size maximisers, they might increase or decrease EU flights, depending on market conditions. If non European airlines gain free credits they may use these to keep fares low if they are not profit maximisers, and wish to gain market share. There is also the added complication that there are still a number of flag-carrying airlines that do not pursue profit-maximising strategies but are used as instruments of policies such as promoting tourism, etc and if capacity can be expanded by introducing bigger planes this may occur. Finally, there are still a number of bilaterals that have restrictions and these create market distortions.

It is also my view that the use of the term cross-subsidy is confusing. Cross subsidy to an economist means that a good or service is provided and priced in the marketplace below the full cost of production. If all costs are allocatable, as in for example a single product firm, it is relatively straight forward to determine whether a good or service is being cross-subsidized. However, in the case of multi-product firms, which airlines certainly are, not all costs are allocatable. There are common costs and some means must be found to allocate them. As an example, ETS costs are flight costs, they are common to all passengers. It is unlikely that air fares will increase by the same amount so the ETS charge per passenger is the same. Firms will generally use a Ramsey pricing concept to allocate these common costs which means price elasticities come into play. These firm specific price elasticities may well change as shown by Oum, Zhang and Zhang (1993) as well as Fu (2006) and it is likely optimal for the firm to re-allocate the ETS common flight costs in the same way the current yield management programs allocate other common costs among passengers. Therefore observing firms changing relative prices between markets may be quite rational and is not necessarily a sign of cross subsidy.

Two test for cross-subsidy are the stand-alone and incremental cost test; the stand alone test considers whether revenues of each group of services is less than or equal to the 'services' stand alone costs and if yes, there is cross-subsidy (Zajac, 1978), a group of services is not being subsidized if its revenues cover its stand-alone costs. The incremental cost test states that the revenue from each group of services should be greater than the services incremental cost to have no cross-subsidy.

In my view the issue of whether the costs of the emissions permits, which are flight specific, are fully reflected in the ticket price will depend on whether a profit maximizing airline flying in that market will, given market demand and supply characteristics and market structure, find it profitable to pass on all of the cost increase. If we think of the ETS costs as a tax, the issue is one of tax incidence. We know that in a simple market analysis the incidence or distribution of a tax burden between consumers and producers depends on the relative values of the demand and supply elasticities. In oligopolistic markets, our theories predict that more than one half but less than 100% of any tax or other source of cost increase would be passed on in prices in the short term depending on price and cost elasticities, strategies (Cournot, Bertrand, market share) and other market parameters (see Anderson et al. 2001 and Hamilton, 1999). In the long term 100% might be passed on as entry/exit occurs to restore the normal rate of profit.

If we look at fuel surcharges, airlines are not passing on 100% of the fuel cost increase and the amount of the surcharge can vary from market to market. Similarly with the security charges, this is a good empirical example of fees that differ from airport to airport (as in Germany) let alone among countries. What happened to fares for carriers operating in the same market where the carriers would have different home markets? This seems to me to be the same problem as ETS costs. As an example, in work I have done in Canada, I have calculated that WestJet passed on only 50 percent of the security charge in some highly competitive markets when these security charges were initially levied. If we consider the electricity market in the UK, they did raise prices and pass on the cost of ETS permits, they also increased profits because of the way permits were allocated.

In all of the discussion of the impact of ETS there is no mention of the level of demand for airport capacity in the discussion. In effect there is the assumption that there is no shortage of airport capacity, that there is no peak problem or that it does not matter. This is wrong and which airports flights are or will be using and whether they are capacity constrained does matter.

Airports for the most part are slot coordinated in Europe. Many flights into the EU from outside go into congested airports and certainly slot controlled airports. At the peak air fares are not determined by costs and competition. Rather, they are set so as to ration demand to available capacity. Slots are scarce, and the slot premium comes about because the net revenue from a flight exceeds the airport charge. When the airport increases its charges at the peak, or if the ETS results in additional charges for flights in the peak this will not affect the balance between demand and capacity, and thus it will not affect the air fare. Therefore, airline costs rise, but airline revenues remain the same- the airline will bear the full burden of the charges increase. The profitability of flights at the peak will fall, and the values of slots will fall by the extent of the charges increase.

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Finally, let me note that the ETS may affect the competitive balance between different business models. Low fare airlines face a demand sensitivity which is higher than for legacy carriers and the increase in marginal cost from ETS permits will be a greater proportion of variable costs. Therefore I expect low fare carriers will offset their disadvantage by obtaining fuel efficient aircraft, increasing seating density where possible and absorbing a greater proportion of the ETS costs than would be the case for legacy carriers.

Questions Asked

I have been asked to address the following questions:

1. Do you agree with the analysis presented in section 3 (see Faber et al. October 9, 2007)? If not, please specify.
2. Key to the desirability of cross subsidisation is that the cross price elasticity between carriers is high. Do you believe this to be true? Could you give an estimate of the cross-elasticity?
3. The analysis in section 3 refers mainly to an equilibrium situation and rational, profit-maximising actors. In reality, the market may need some time to adjust to the new situation. During this transitional period, airlines may have extra incentives to cross-subsidise. Do you believe this to be true? How long would you expect this period to last?
4. In general, how much time would it take for airlines to adjust their capacity to reduced and/or growing demand? How would this depend on the pace of demand growth or reduction?
5. How likely do you consider the strategic behaviour of airlines to be, such as that is described at the end of section 3?
6. Apart from the issue of cross-subsidisation, the competitive position of EU carriers may be affected by the fact that routes via EU hubs will incur larger cost increases than routes via non-EU hubs (see footnote 2). Do you believe it is feasible that EU carriers could overcome this disadvantage by making use of non-EU hubs, e.g. through code sharing and alliances? If so how widespread do you think this would be?

Responses

1. *Do you agree with the analysis presented in section 3 (see Faber et al. October 9, 2007)? If not, please specify.*

Answer

I agree with most all of the analysis contained in section 3 except the discussion beginning in paragraph 7. I agree that airlines operating in market segment 1 and 2 would not have the opportunity to cross-subsidize. There is no source of funds from which to cross-subsidize; that is, no subsidy capital provided the airlines are profit maximising in each market.

I understand market segment 1 would represent all intra-EU flights, segment 2 would represent 5th freedom markets for EU (it would not include 6th since the home market must be accessed between the two foreign markets on a 6th freedom flight). Market segment 3 would seem to be saying these markets are where only EU carriers compete and they are not in the EU and there is no domestic airline. I cannot think of a market with these characteristics where say, KLM would compete with BA on 5th Freedom routes but there is no domestic airline on those routes. Therefore, I am puzzled in paragraph 7 where there is reference to market segment 3.

I disagree (I think since the wording is a bit confusing) with the notion that markets outside the EU will be 'modified' by the ETS. In my view there is no reason why markets outside the EU should be modified since nothing has happened in these markets. It may be the case that some airlines currently serving the EU market will find their cost increase on EU origin or destination flights has changed the route or the market's relative profitability compared with other routes and may therefore shift capacity to other routes or even open new routes. This is a natural response to a change in relative costs in serving markets. However, if two carriers one EU one non-EU are flying between an EU city and a foreign city (e.g. Frankfurt and Singapore), prior to the introduction of ETS there is some market equilibrium. Once ETS is introduced flight costs increase. If they are flying the same aircraft their relative costs would not change. In the medium to long term an airline may have an incentive to shift fuel efficient aircraft to EU origins and destinations. Airlines which have the scope to do so will deploy their more fuel efficient aircraft to EU routes, and less efficient aircraft to other routes. This will affect the relative price of fuel efficient and non efficient aircraft, and this could have an impact on prices in EU and Non EU markets, though I cannot think of good reasons why this should be systematic. This will reduce the effectiveness of the imposition of the ETS in reducing GGEs.

There is a suggestion in section 3 that non-EU airlines might find it attractive to cross subsidise to dominate markets. I do not see the logic in this. It is similar to the idea of predation. While one can target particular groups or markets which may make predation profitable in the short term, under very specific conditions, it is not a successful long run strategy unless entry is blockaded. However, I do not see this as a

particularly serious issue since international markets are liberalising and the costs of predation can be high.

It may be the case that airlines may increase the gauge of aircraft to reduce flight costs per passenger with the new ETS. This increase in gauge may increase capacity sufficiently that fares may fall. It would have to be explained why different airlines would have an incentive to respond in this fashion in a systematic way.

In a Cournot world, the low cost firm garners more market share and presumably profits. Prior to the introduction of ETS each market will have an equilibrium of firms, frequencies, fares, profits, routes and capacity. If it is the case that ETS adds to flight costs, the relative costs between carriers will change but only to the extent one carrier is flying a more efficient aircraft than another and/or it is flying a different routing.

Therefore my conclusion is that I see no reason why non-EU airlines would have either the opportunity or desire to cross subsidise in any market setting; the idea of cross-subsidisation does not seem to make any sense. Its proponents are claiming that, simply because 'non-EU' airlines have profit streams from other markets (which may or may not be subject to emissions or other taxes) then they would wish to use some of these profits to pay the EU tax? Why? And in any case the 'EU' carriers themselves will in many or most cases have profit streams not subject to the tax (outer legs of long haul flights, revenues from non-flying activities....) Why wouldn't they cross subsidize too? The only condition I can think of is if one moves away from profit maximizing behaviour.

2. *Key to the desirability of cross subsidisation is that the cross price elasticity between carriers is high. Do you believe this to be true? Could you give an estimate of the cross-elasticity?*

Answer

High cross elasticities are necessary but not sufficient. Also it is not just the carriers but also route cross elasticities that must be considered. It is possible to substitute between carriers on the same route, to substitute between routes on the same carrier and to substitute between carriers and routes. I am aware of two studies which provide measures of cross elasticities for carriers on different routes; Gillen and Taweelertkunthon (2007) and Fu (2006).

Fu (2006) estimates own and cross price elasticities by route and carrier for a set of routes and for the carriers Southwest, American and United which compete on those routes. His results are presented in the table below:

Looking at the table, the cross elasticities between full service airlines (FSAs) (American and United, $E_{23} = 0.99$, $E_{32} = 1.10$) are much higher than their cross elasticities with Southwest ($E_{21} = 0.34$, $E_{31} = 0.5$, $E_{12} = 0.21$, $E_{13} = 0.18$). This indicates that Southwest

appears to provide services differentiated from its FSA competitors. The services offered by American and United are, however, fairly homogenous as evidenced by their high substitutability implied by the high cross-price elasticities. Based on these elasticity estimates, it Is not clear that a relatively small difference in fares would lead to a significant shift in traffic between carriers. It is also important to note the elasticites vary by route.

Table 2.4 Calculated Firm Specific Elasticities
(1 -WN; 2 - AA; 3-UA)

Route (Airport, City)	Own Price Elasticity			Cross Price Elasticity					
	E11	E22	E33	E12	E13	E21	E23	E31	E32
BNA (Nashville, TN)	-1.24	-1.64	-3.32	0.19	0.13	0.20	0.57	0.62	1.36
DTW (Wayne County, MI)	-1.53	-2.69	-3.01	0.32	0.31	0.47	1.57	0.59	1.23
MCI (Kansas City, MO)	-1.24	-2.03	-2.59	0.16	0.15	0.36	0.99	0.39	0.93
PVD (Providence, RI)	-1.38	-1.84	-2.22	0.28	0.28	0.25	0.84	0.31	0.67
STL (St Louis, MO)	-1.28	-2.37	-3.35	0.18	0.15	0.46	1.26	0.65	1.45
Sample Average	-1.30	-2.05	-2.85	0.21	0.18	0.34	0.99	0.50	1.10

Note: Eij: price elasticity of demand for firm i's product w.r.t. firm j's price

The following two tables are taken from Gillen and Taweelertkunthon (2007). They come from the estimation of a nested logit model on seven routes out of Bangkok to destinations within Thailand. There are three low cost carriers and one legacy; Thai Airways (legacy), One Two Three Go, NOK Air and Thai Air Asia (all LCCs). Note the first table refers to own and cross fare elasticities separated by business and leisure and the second table refers to own and cross service quality (measured by frequency) elasticities. As with the result sof Fu (2006), the cross elasticities are not particularly high. There is clear vertical differentiation between Thai and the LCCs while the horizontal differentiation among the three LCCS is evident in their somewhat higher cross elasticities.

Table 1

Own and cross elasticity derived from Leisure Model

Leisure	Own and Cross Elasticities			
<u>Fare</u>	TG	NOK	TAA	OTG
TG	**-0.853**	0.183	0.159	0.129
NOK	0.952	**-0.978**	0.196	0.167
TAA	1.057	0.252	**-0.918**	0.171
OTG	0.973	0.239	0.192	**-0.962**
Leisure	Own and Cross Elasticities			
<u>Frequency</u>	TG	NOK	TAA	OTG
TG	**0.181**	-0.029	-0.025	-0.028
NOK	-0.205	**0.154**	-0.038	-0.038
TAA	-0.189	-0.04	**0.159**	-0.029
OTG	-0.245	-0.039	-0.038	**0.202**

Note: own elasticity is highlighted

Table 1

Own and cross elasticity derived from Business Model

Business	Own and Cross Elasticities			
Fare	TG	NOK	TAA	OTG
TG	-0.69	0.151	0.121	0.1
NOK	0.747	-0.985	0.243	0.234
TAA	0.818	0.306	-0.871	0.223
OTG	0.682	0.332	0.257	-0.941
Business	Own and Cross Elasticities			
Frequency	TG	NOK	TAA	OTG
TG	0.656	-0.123	-0.113	-0.092
NOK	-0.791	0.765	-0.235	-0.231
TAA	-0.67	-0.223	0.823	-0.188
OTG	-0.673	-0.251	-0.241	0.863

3. *The analysis in section 3 refers mainly to an equilibrium situation and rational, profit-maximising actors. In reality, the market may need some time to adjust to the new situation. During this transitional period, airlines may have extra incentives to cross-subsidise. Do you believe this to be true? How long would you expect this period to last?*

Answer

I do not believe that profit maximizing airlines will have an incentive to cross-subsidize in the short or long term. With the introduction of the ETS there will be disequilibrium in the system of routes falling under the ETS system. In the case of routes going into or out of slot controlled congested airports, airlines will have a lower level of profit because they cannot raise fares. In other cases airlines will adjust fares in relation to demand and supply conditions and elasticities, as well as market structure. It may turn out that in the short term fares do no increase and airlines absorb the ETS cost in the form of lower

profits as they did with increasing fuel costs and the imposition of security charges. In this case there is no cross subsidy, airline shareholders suffer a capital loss. Airlines will adjust fares in light of competitive conditions. My sense is that given yield management (price discrimination) and thinking in terms of an inverse elasticity basis of allocating flight costs, business class fares will rise disproportionately more as will tickets sold in the last week (or two) of travel; see Gillen and Hazledine, 2007 for an analysis of such price discrimination in oligopoly. Given experience with both security charges and fuel surcharges, I would expect this adjustment process would be 6 to 10 months.

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4. *In general, how much time would it take for airlines to adjust their capacity to reduced and/or growing demand? How would this depend on the pace of demand growth or reduction?*

Answer

The question I start with is, why would an airline adjust capacity with the introduction of ETS? How would it mitigate the impact of ETS charges?

With fixed fleets airlines are adept at moving or redeploying capacity - measured as seats. They can do this changing gauge or frequency. My view is that the introduction of the ETS will lead to increases in gauge on shorter haul routes as well as an increase in seating density where possible to reduce the CASK. I do not see much change on long haul routes simply because there are fewer large differences in long haul aircraft. In addition there will be no change in fares or systematic change in gauge at capacity constrained airports. It may be that ETS will add to marginal costs that airlines may have an incentive to increase aircraft gauge at some capacity constrained airports, but again, I do not see this as being systematic. One interesting outcome of the ETS may be that non-mega hub airports with some available capacity will become more attractive since airlines have greater latitude in passing ETS costs on to passengers. In addition direct flights will be more appealing than hubbing since the overall ETS cost should be lower with single segment rather than two (or multi) segment routes.

There is an active leasing market but the ETS will result in an increased demand for fuel efficient aircraft, hence they will become more valuable. Airlines with older fleets such as KLM, Alitalia and Virgin Express will be at a competitive disadvantage. A fleet renewal could take from five years to a decade depending on the current fleet renewal programs of airlines. In the short term general traffic growth will be somewhat slower due to rising fares from fuel surcharges and ETS charges. However, redeployment and small forays into the leasing market may be effective in the short term.

One added factor that comes to mind is the growth of markets in Asia, India and South America. This growth will place increased demands on aircraft capacity needs. It may be that EU carriers can sell off fuel inefficient aircraft to these markets and obtain newer more efficient ones, but this will lead to a falling value for their current aircraft capital

stock. Alternatively they may end up bidding for new capacity against carrier sin these regions, which will increase their capital costs and slow the growth in capacity.

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5. *How likely do you consider the strategic behaviour of airlines to be, such as that is described at the end of section 3?*

Answer

I am assuming this is reference to non-EU airlines holding fares fixed. To begin if you are referring to predatory behaviour, this is speculative and there are mechanisms to deal with it. Second, I repeat my central message, cross-subsidy is not profitable if airlines are behaving a value-maximizing firms. I see no reason to suggest that non-EU carriers would behave any differently than EU carriers. The ETS cost increases an airline's marginal costs. These may differ due to differences in fuel efficient aircraft being flown; this can be relatively easily remedied. If both carrier's costs increase they have an incentive to increase fares given demand and supply elasticites and strategic interaction of carriers. A simple Cournot model shows both carriers' will increase fares. To the extent costs differ that firm with lower costs will gain market share. This is not a bad thing because the shift in competitive circumstances is favouring the more environmentally efficient firm. There may be differences across business models as between legacy and low fare carriers. However, very few non-EU carriers will be low fare carriers. Also it will simply mean that low fare carriers may absorb a greater portion of the ETS cost increase in the form of lower margins.

Therefore I do not agree that non-EU carriers will behave strategically, as it is described, since it is a profit reducing strategy for the firm.

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6. *Apart from the issue of cross-subsidisation, the competitive position of EU carriers may be affected by the fact that routes via EU hubs will incur larger cost increases than routes via non-EU hubs (see footnote 2). Do you believe it is feasible that EU carriers could overcome this disadvantage by making use of non-EU hubs, e.g. through code sharing and alliances? If so how widespread do you think this would be?*

Answer

This is a very interesting question. On the face of it, it would appear that airlines like Emirates or Qatar may gain a competitive advantage by hubbing more traffic through their Middle East hubs. It would also mean that congested mega hubs may see a relative decline in traffic for two reasons; first, airlines like Emirates may choose to go to secondary airports like Hamburg and Düsseldorf or Manchester, for example. Second, recall airlines cannot raise fares at congested slot controlled airports; they would have to suffer lower margins on routes that do use congested hubs.

I would agree the EU carriers would have an incentive to shift traffic to non-EU hubs. For example, rather than fly Frankfurt-Vancouver, Lufthansa may fly Frankfurt-Montreal or Frankfurt-Toronto to reduce the ETS costs and let their alliance partner carry passengers the rest of the way. However, there are a number of mitigating factors. First, it is the growth of markets not market growth that has been taking place for the last decade; that is, more direct markets are opening up and this goes against using non-EU hubs. Even using alliances where alliance partners would carry passengers would not change the situation because they still face ETS costs from EU origins. My sense and understanding of airline demand is markets would decline more from a shift to indirect routings and lower frequencies than to the relatively modest increase in fares on long haul connecting flights.

Therefore, I think there are limited circumstances for EU carriers to use non-EU hubs or code shares for the reasons just discussed. In addition there may be scope clauses in the pilot's contracts which limit such strategies. Finally, as I have identified above there may be an incentive to move away from mega hubs to secondary airports where there are fewer capacity constraints. It may also be the case that carriers increase seating densities or upgauge aircraft to reduce the CASK.

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Brief response to David Gillen's "Expert Panel" paper   SLv1   SL011107

1   General

1.1   David Gillen's paper excellently fulfils the brief that we provided to him.

1.2   In this section I make some general observations, and in subsequent sections I address the specific parts of David's paper.

1.3   I agree with his fundamental view that it would not be in non-EU carriers' interests if they attempted to cross-subsidise in any circumstances or markets, assuming that they are endeavouring to profit-maximise.

1.4   Importantly, I have come to this view for the situations that we surmised might allow cross-subsidisation to enhance overall profits of non-EU carriers: *viz* where they compete in "extra-EU" markets only with other (non-EU) carriers that also operate routes to/from the EU. I have arrived at this view through demonstrating it mathematically to my satisfaction.

1.5   I agree also that it is no more likely in general that non-EU carriers than EU carriers will have reserves (a sort of "war-chest") from which to finance strategic or predatory pricing.

1.6   While this rules out cross-subsidisation, I wonder whether the more general issue of the conditions under which some carriers might be more seriously affected by the ETS in any particular market should be further considered. This thought arises from David Gillen's comment that, while theory shows that the pass-through will be between 50% and 100% of the increase in marginal cost imposed by the ETS, this could increase to nearer 100% (to restore "normal" profit rates) through changes in the number of carriers in the market. In other words, what would be the characteristics of firms that might exit (or enter) the market, and would these characteristics be correlated with whether carriers were EU or non-EU?

2   David's Summary Statement

2.1   My remarks on this are mainly covered by the foregoing.

2.2   Additionally, however, David draws our attention very relevantly to the effect of capacity constraints, especially at congested and slot-coordinated airports. In these circumstances, the supply curve (and equivalently the marginal cost curve) becomes vertical at the point of constraint. This is one of the cases in which profit-maximising producers have to bear the full extent of additional costs; there can be no pass-through to consumers.

2.3   I agree with this, except possibly for the following caveat. As David notes, fares will reflect the scarcity value of slots. In this, carriers are exercising what might be termed a "derived" monopoly. The "true" monopoly, however, rests with the airport. Depending upon the regulatory environment of the airport, its charges may be pitched to extract monopoly rent from the carriers. If carriers are faced with an increase in operating costs (through the ETS, or for any other reason), this may end up being "shared" with the airport, through a reduction in the latter's ability to extract rent from the carriers. This outcome depends upon the degree of over-subscription for slots, but if the airport had a free hand in setting charges this would already have been priced-off; to maintain demand for slots, therefore, the airport would – in principle – have to reduce its charges.

2.4   In this eventuality, carriers would be to some extent cushioned against the ETS, even though there would be no point (from the profit-maximising perspective) to increase fares. In any case, the situation would not obviously discriminate between EU and non-EU carriers.

3   His response to Q1

3.1   David has misunderstood the "segments" – particularly segment 3 – and hence the point that we were seeking to make. However, given my own findings (paragraph 1.4 above), this does not matter to me.

3.2   In the matter of predation, I agree that this is unlikely (paragraph 1.5 above). Nonetheless, my feeling is that there remains a lot of protection from new entrants in international markets for any carrier that wished to engage in predation. Many bi-lateral ASAs are still restrictive on "balanced" numbers of carriers and flights, which can be exacerbated by airport congestion and grandfather rights on slots, leaving the prices and efficiencies of (other) incumbent carriers as the only competitive threats.

4   His response to Q2

4.1   I find the results from the Fu study more consistent and (hence) convincing than those from the second study.

4.2   It is especially significant that Fu's study appears to show that LCCs and FSAs are poor substitutes and thus – even for the same city-pairs – seem to serve substantially differentiated markets. As a consequence, the LCC has a form of monopoly in its specific market, leading – ironically – to lower own-price elasticities than those of the FSAs. Could this allow LCCs a greater opportunity to recoup their ETS costs than is perhaps generally conceded or feared?

4.3   The cross-elasticities between the FSAs are fairly high, as David notes. I am therefore somewhat surprised by the "not" in "it is not clear that a relatively small difference in fares would lead to a significant shift in traffic between carriers".

5   His response to Q3

5.1   I agree that lower-elasticity market segments could be expected to be charged disproportionately more, and that premium-class travel would normally be typical of this. However, it seems (from the very little evidence I can recall seeing) that the differential between elasticities for different classes at the **market** level may be less-marked between **own-price** elasticities. (The separate "leisure" and "business" tables in the previous section appear to bear this out, though this may refer to travel purpose rather than class of travel).

6   His response to Q4

6.1   David's observation on direct flights' being more appealing than hubbing is (in my view) appropriate to transfers via EU hubs but not via non-EU hubs. The SEO model demonstrates this credibly.

6.2   David returns to this theme in his response to Q6 (see below).

7   His response to Q5

7.1   This concerns the propensity for strategic pricing. He concludes that it is unlikely. I agree (see paragraph 1.5 above).

8   His response to Q6

8.1   I agree with David's point that carriers are unlikely to constrain direct origin-destination opportunities (by reducing frequencies and/or forcing more transfers at hubs closer to the EU). However, this will ultimately depend upon the ETS costs that would be saved, relative to the revenue foregone and maybe other costs incurred, by taking such action.

8.2   Another possibility (that we didn't ask David about directly) is that carriers might introduce intermediate stops outside the EU on long-haul flights, to reduce the length of haul which would be subject to the ETS. While this is a complex trade-off of some revenue loss, an increase in costs such as landing fees, crewing and maintenance, and a reduction in fuel (assuming re-fuelling is undertaken), much of the trade-off has already been established through making the non-stop flights currently. It turns out that, if the net advantage of non-stop over stopping intermediately is B currently, the criterion for introducing the intermediate stop is:

$$\theta > \frac{B}{F_N - F_1},$$

where: F_N is fuel consumed flying non-stop;

F_1 is fuel consumed flying the first leg to the intermediate stop;

θ is the proportionate effective increase in fuel cost as a consequence of the ETS.

(The greater the saving in fuel consumption on the first-leg by shortness of distance and/or re-fuelling at the intermediate stop, the lower the threshold ETS cost at which it becomes advantageous to introduce the stop.)

Response to Questions Raised by Report prepared by David Gillen

November 11, 2007

David Gillen

The questions are raised in section 1.6, 4.2 and 4.3. I respond in the same order. I also raise a few added issues which I had not included in my initial report and attach two articles which assist in understanding my thinking for Thought (A).

1.6. A very good point. Ignore for the moment the issue of congested airports. In the short term the pass through will depend on the demand and supply elasticities. The supply elasticities will of course be affected by the market structure. Over time markets will adjust and there may be firm exit or entry. Other adjustments may be to upgauge depending on the market where the frequency elasticity tops the fare elasticity. Non-EU carriers would shift fuel efficient (newer) aircraft to EU routes, EU carriers would optimize aircraft in their network; some shifting will occur because relative prices have changed with the introduction of ETS. I do not see that non-EU carriers would have an advantage over EU carriers on market entry costs. One might consider 3 types of carriers; (1) long haul international North America with Open Skies, (2) long-haul international bilateral, (3) short haul adjacent to EU – eastern Europe and former Soviet republic. [1]

Type 1: - entry will increase as more markets are opened up, less growth of existing large markets; this occurs due to Open Skies agreement nothing to do with ETS. ETS will make new destinations relatively more attractive if congestion is factored into the ETS charges. Regardless I think ETS will not discourage entry but may lead to one stops when previously there were non-stops to minimize the impact of ETS but I can only see this with leisure markets or charter carriers. I find it difficult to see a shift to one-stops from non-stops unless ETS permit prices become very large; this is a very good research question.

Type 2: - holding current bilateral conditions constant, I can see upgauge if possible or increased seating density. There may be exit but only among charter carriers. I cannot see exit for full service carriers. No real LCC competition on long haul (yet).

Type 3: - ETS increases marginal costs but one might also think of ETS as increasing the fixed costs of entry because they are aircraft not passenger specific. The costs will vary only with the length of haul so clearly entry will tend to be for relatively shorter routes but these routes also tend to have relatively higher price elasticities. Therefore the trade off is higher entry costs as length of haul increases but falling demand elasticity as length of haul increases. So there may be a trade of medium for shorter routes.

Finally, I am not aware that fuel surcharges or increased security costs led to either entry or exit of carriers. However, the markets have been quite buoyant over the last 4-5 years so demand growth trumped rising costs. When markets turn down, which I believe they will in the next two years, exit will be affected by ETS but also by other charges. When one looks at the various airports involved in EU and non-EU flights, they have different rates and charges, these prices change with time and with aircraft type (weight), but I am not aware that such charges, very similar in effect to ETS permit charges, led to a material influence on entry or exit. So the view of impact and response depends on whether you believe the ETS permit cost is a shift in the marginal cost function or simply increase the fixed costs associated

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[1] One could perhaps split long haul international bilateral into loose and tight bilateral, but bilateral are becoming more liberal over time.

with a given route. If it is an increase in fixed cost, in theory it will discourage entry but as a practical matter, I think this would be very low if any impact at all, depending of course on the permit price level.

4.2 I agree that with the relatively lower elasticities, if one treats the ETS costs as increasing marginal costs, the profit maximizing carrier has an incentive to increase fares. It is not clear to what extent the fares would increase more for LCCs than legacy as they have different marginal cost curves.

If one thinks of ETS permit costs as fixed, this is a common cost to be allocated across passengers. With LCCs due to small variation in fares, it would appear to be equivalent to a shift in marginal cost. With legacy carriers there is significant price discrimination and hence the 'fixed' cost would be allocated in some Ramsey like fashion depending on market circumstances.

The 'concern or fear' as expressed at the end of the point in 4.2, where LCCs may have an advantage will only apply where these two types of firms compete. My understanding is that there is not significant market overlap in Europe between LCCs and legacy; maybe easyjet more than others. I would also note that firm specific own and cross elasticities will be affected by service frequency (see paper by Oum, Zhang and Zhang). My suspicion is that in the FU thesis Southwest has higher service frequency on these routes and may be using larger aircraft as well.

4.3 I said 'not' because with the very high cross elasticities between AA and UA, their fares cannot deviate from one another or there will be shifts in traffic. I guess I was thinking of the final equilibrium as distinct from a process. I was thinking the legacy carriers would have no incentive to change fares relative to one another.

Point 2.3 – I would add to this discussion that airports in the EU are regulated by either rate of return or price caps so the airport's ability to extract monopoly rent is limited. Airports in the US are not regulated but are considered as not-for-profit, similarly in Canada. Airports in Australia and New Zealand are not regulated while most Asian airports are government owned and not regulated.

Additional Thoughts

Thought (A)

I have been thinking about some potential anti-competitive impacts of the ETS permits. I have included two papers that have stimulated my thinking (see Ellison and Burstein). Suppose we have an additive pricing scheme where additive pricing is the mirror of product bundling where a firm instead of selling a bundle of products for one price sells a single product for a bundle of prices. Additive pricing can increase firm's profits (if firms compete under price competition-Bertrand) and result in higher consumer prices. This will happen if firms commit to base prices (existing fares) and add on other prices. This is what has happened in fuel surcharges. In effect the presence of ETS permit charges signals a kind of cartel agreement which limits firms' competitiveness. However, if firms do not commit to base prices and compete on final prices, there will be a loss of superior profits. In fact it may have been such a breakdown that led to both passenger and cargo airlines trying to act in a cartel like fashion in agreeing on fuel surcharges (and they were caught!). So why is this important? You would expect a breakdown in discipline in markets with many airlines. Therefore on EU-US routes with the new open sky agreement, competition will likely be in final prices and airlines will face higher cost and lower profits. However, on routes were there are fewer firms, which may be due to market size or restrictions of bilaterals, firms will be able to act in a cartel like fashion and raise prices to cover the ETS permit cost and perhaps more.

<u>Thought (B)</u>

I had argued that cross-subsidy will not work in my initial report. I wanted to add that in those markets where there are restrictive bilaterals there is a market distortion. In the presence of these distortions including restricted entry firms will be able to earn 'superior' profits. It may be these profits could be used to cover ETS permit costs in other markets if there is demand complementarity (such as an additional leg of a flight into a before or beyond market) and/or if there is a high cross elasticity between other carriers and the protected carrier. However, I want to be careful here, since in restricted markets there are limited firms and fares are higher than they would be in competitive or liberal markets. These are profit maximizing fares. To the extent these markets continue to be 'regulated' by a bilateral there is potential to use the supranormal profits to gain in more competitive markets. Presumably protected carriers will invest these excess profits until the marginal value of the additional profits equals the opportunity cost of the invested $. In competitive markets, I stand by my position, cross- subsidy is not profitable.

Appendix C - Opinion from Peter Morrell

mvaconsultancy

Paper on airline ETS cross-subsidisation

This paper is in response to an invitation from MVA to provide an expert opinion on the likely additional cross-subsidisation by airlines as a result of the introduction of an EU Emissions Trading Scheme or ETS (e-mail, 10 October 2007).

The paper addresses the report entitled 'Expert panel on additional cross subsidisation', CE Delft and MVA, 9 October 2007 (Delft/MVA).

The focus here will be the routes that serve air passenger markets between EU and non-EU countries that are operated by both EU- and non EU-based airlines.

The key question is whether the inclusion of aviation in the ETS as proposed by the European Commission will offer non-EU airlines the opportunity to increase their market share on markets where they compete directly with EU based airlines by undercutting fares in these markets through cross-subsidisation.

The actual severity of the cost increases faced as a result of ETS are not yet known, and with the likely initial granting of sizeable free allowance the degree of cross subsidisation may not be large. This was not taken into account in the Delft/MVA report although it may influence some of the arguments presented here.

Preliminary discussion

Cross-subsidisation occurs where an airline uses profits it makes in one market or market segment where it has market power to support low prices in other markets or segments which are subject to greater competition.

Markets are usually defined on a city or airport pair basis. But they could also be the various market segments travelling on the same city-pair, often simplified to premium and economy passengers. Cargo is another segment carried on the same flight but not considered here.

Premium passengers are generally thought to be price inelastic and economy price elastic, although there are sub-groups within each category that behave differently. Increasing premium prices and reducing economy fares would thus be expected to increase revenues, other things being equal. Some commentators think that this has been exploited to the full and that premium or business passengers are becoming more price elastic. Airlines are also keen to increase their share of premium passengers on competitive routes, which is where the concept of cross-elasticity comes in (see B below). In Europe, this is likely to take the form of discounting premium transfer

passengers (those connecting at their hubs) but not non-stop markets from their hubs.

In the context of the EU ETS, the routes in question will involve all airlines (EU and non-EU) incurring additional costs from the need to purchase emissions permits. These costs would lead initially to reduced profits. All carriers could pass on the additional costs to the passengers in this market in higher fares in the same way as fuel surcharges, but in highly competitive markets they may prefer to absorb the costs in lower profits or take steps to reduce other costs (such as labour) further to compensate.

Another possibility would be to absorb the additional costs on the particular route and try to compensate this with higher revenues elsewhere on its network. For EU carriers it faces the additional ETS costs over almost all its network (apart from fifth freedom markets). For non-EU carriers this is not the case, and it could spread the ETS cost increase across the rest of its network. This would probably mean an increase in less price sensitive passengers and where competition was more limited.

My preference is to examine the problem on a system-wide or network basis, since that is how I understand the airlines to address profitability. One of the scenarios that should be considered is both EU and non-EU carriers absorbing the ETS cost increase in markets where they compete (more likely to be longer-haul markets). This could be done by:

- Reduced overall profitability

- Passing the costs on to other markets not subject to ETS

EU carriers do not have the second option (as Delft/MVA rightly argue) and must either pass on the costs or are likely to suffer reduced profits leading to higher cost of borrowing, less ability to invest in more fuel efficient aircraft and more competitive products. This reduced their ability to compete with non-EU carriers in the future.

Non-EU carriers could take a hit on profitability much more easily, since the markets in question will probably account for a small part of their total revenues. They could also much more easily pass on the costs to other markets (see comment on 'optimal' pricing in A below).

Response to specific questions

A. Do you agree with the analysis presented in section 3? If not, please specify.

The analysis is largely correct, but does not tell the whole story because it doesn't recognise the network characteristics of the type of airlines that are the main subject of discussion. In particular and first it would be better to talk about EU and non-EU carriers because this is what the debate is essentially about. Second, I think the four 'market segments' might have been described as 'types or categories of market'. This is because there are market segments within those markets that are more or less price elastic, and deserve separate consideration.

The first 'segment' confuses 'flight' with 'market', illustrating the problem in any analysis of demand and supply in air transport. To avoid this it could be defined as *all passengers travelling solely on flights arriving at and/or departing from EU airports* (ie the expected scope of the EU ETS). This will include only those transferring between flights both of which would be subject to the EU ETS. It would not include those passengers transferring at a non-EU hub to/from an EU destination, and sharing a sector with those defined above, which might be the larger part of total sector traffic (see section F below).

Cross-subsidisation is usually used in relation to market profitability not route profitability (see definition above). Airlines often incur losses on routes over many years because the route contributes to network profitability. The effect of the ETS costs on the one-stop markets described above would be diluted by the ETS cost-free first sector.

As I understand it, the second and third 'market segment' would apply to a very limited number of markets, at least for EU carriers. These would only be fifth freedom markets that would most likely be carried on a flight that included markets that came within ETS on another sector of the aircraft's routing. The EU carrier would in any case not have a very strong competitive position on these flights due to low frequency and less attractive flight timing.

Within the third 'market segment', it would make more sense to consider that *all* competing airlines should have some operations under ETS. Non-EU carriers may only have a very small proportion of their flights within the ETS and thus would not have any significant ETS induced disadvantage in competing with other non-EU carriers that had no flights within the ETS (eg American Airlines competing with Southwest in the US). I would agree that they would be better placed to cross-subsidise when competing only with airlines that had some flights under ETS, but it would very much depend on the proportion.

I would also challenge the notion that pricing in the non-ETS markets is always 'optimal' and revenue is already maximised. Prices maybe lower than optimal in monopoly markets to deter entry and the risk of entry and subsequent loss might be offset by the perceived gain of increasing market share in the ETS markets. This would open up opportunities for cross-subsidisation under 'market segment' 2, as does the previous paragraph.

B. Key to the desirability of cross subsidisation is that the cross price elasticity between carriers is high. Do you believe this to be true? Could you give an estimate of the cross-elasticity?

This question examines the degree to which non-EU carriers can increase their market share at the expense of EU carriers as a direct result of ETS. Cross-subsidisation gives the non-EU airline the ability to reduce fares in the ETS market, or at least not to pass on the ETS costs to passengers travelling on competitive routes, thus having a relative price advantage.

The market segment that this is likely to focus on is the premium traffic, since the marginal revenue gained from attracting these passengers far exceeds marginal costs. However, price is only one of a number of important factors governing premium traffic purchase decisions.[1] Others include:

- Frequent flyer programmes
- Corporate agent and travel manager incentives
- Product features (flight timings, service levels, frequency etc)

The last is difficult to adjust on a shorter term basis, and one carrier may have a marked advantage that is already reflected in market share and yield. The first two factors are also very important and give the home carrier a built-in advantage that price changes would not easily shift (eg BA in the markets/routes connecting London). This applies to home market sales, and explains why premium sales in adjacent markets (BA sales in, for example, Germany connecting with their long-haul flights to/from London) are much less dependent on the first two bullet points above and easier to attract. Thus cross price elasticity in the non-stop home markets is relatively low and in the multi-stop (hub-feed) markets much higher.

British Airways' bubbles*
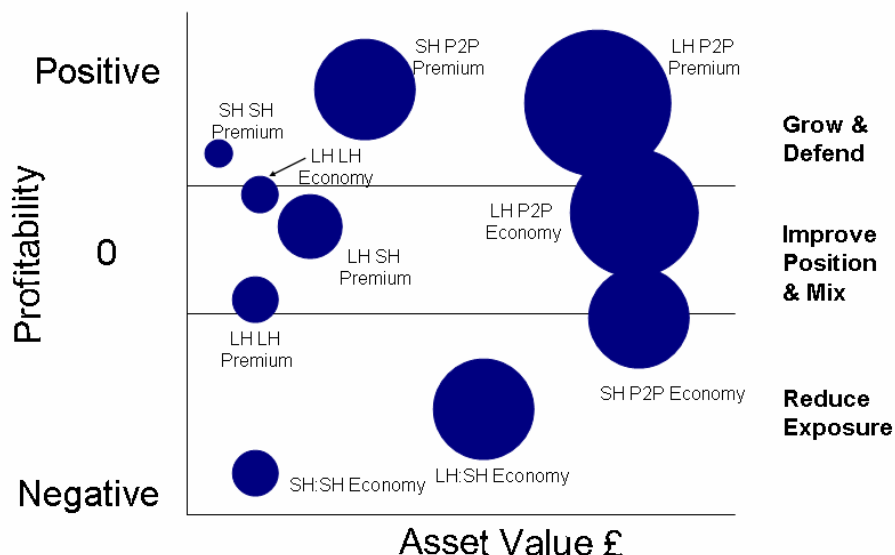
* Source: British Airways presentation to Cranfield MSc course, 2001

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[1] see Brons et al 'Price elasticities of demand for passenger air travel: a meta-analysis' Journal of Air Transport Management, 2 (2002)

This example needs to be expanded to include non-EU carriers. They will be competing in the non-stop flights to/from EU carrier hubs, but efforts to attract home market sales will be limited for the above reasons. The home carrier might also defend its premium point-to-point passengers by allocating more of the flight's ETS costs to other segments (see graph above showing the profitability of BA's point-to-point versus transfer markets). On the other hand the non-EU carrier will be able to cross-subsidise in all multi-stop markets travelling on the flight between its hub and the EU carrier hub, and also the non-stop market sold in its home country (although this is less likely since these may already be subject to corporate deals).

I have never seen estimates of these cross-elasticities, or any research that tries to estimate them. Price elasticity by market segment is itself very difficult to estimate, and cross-elasticity presents even more insurmountable obstacles to measurement. Data availability is the key problem, but finding the price effect independent of other factors would also present huge problems.

C. The analysis in section 3 refers mainly to an equilibrium situation and rational, profit-maximising actors. In reality, the market may need some time to adjust to the new situation. During this transitional period, airlines may have extra incentives to cross-subsidise. Do you believe this to be true? How long would you expect this period to last?

I think the equilibrium situation is an over-simplification, and in reality airlines are responding to many changes in both demand and supply as the date of departure of the flight approaches. In the short term airlines tend to try to maximise revenues, with costs relative fixed. This amounts to profit maximisation and thus the Delft/MVA analysis in this respect is valid.

Price reactions can be quite quick as airlines have shown with fuel surcharges. I assume that Delft/MVA meant the time for adjustment of frequency, aircraft type and other supply side changes. This period might be 6-12 months long and responds to many other factors which have less to do with ETS and more to do with their whole network. Profit maximisation can only be viewed on a network basis, and there is in any case considerable scope for cross-subsidisation that has nothing to do with ETS (eg short-haul feeder routes from profits from long-hauls).

I do believe that airlines might try to impose extra costs in different markets and market segments, and this is an on-going task undertaken by revenue management. So I don't believe in a transition period followed by equilibrium.

D. In general, how much time would it take for airlines to adjust their capacity to reduced and/or growing demand. How would this depend on the pace of demand growth or reduction?

We are talking here about network airlines that traditionally plan capacity on a twice yearly basis, and deal with any unexpected surge or drop in demand within that six monthly timescale through their revenue management systems. This would usually be using price to choke off or capitalise on surges in demand or stimulate lower demand (the recent rugby world cup is an example of the latter for UK/France air travel). In a few cases, revenue managers initiate an aircraft swap between low and high demand sectors, but this does not happen often and has some significant implications in terms of other resources. Chartering or wet-leasing in additional

capacity tends only to be used for unexpected unserviceability of aircraft, since it is expensive.

Airline reaction would depend on the extent of changes in demand and the expectation that such changes would be permanent. Some extreme changes can be forecast, but because they are not permanent the airline may be able to programme some additional capacity to meet them (eg trade fairs); other changes cannot be forecast accurately (ie the rugby world cup final venue is known but not the teams competing), and prices tend to rise very rapidly as the departure date approaches.

The systematic adaption of airline capacity to demand changes is called 'Dynamic Capacity Management', and recent research suggested that only 20-35 airlines are practicing it out of 209 airlines capable of doing so.[2] Even with families of aircraft, maintenance planning and crewing is a problem. The research indicated that some airlines could make a swap up to the day of departure while others required longer lead times. All of the swaps occurred on short/medium haul sectors where families of aircraft with common crewing can be swapped.

Medium to long-haul sectors have limited possibilities for aircraft swaps, but excess demand in a multi-stop market can be re-directed without too much loss of revenue:

1. A long-haul passenger flying on an EU carrier via its hub could be diverted via its secondary hub, if it has one (eg Lufthansa routing a Berlin-Frankfurt-New York passenger via its Munich hub)

This only works if the airline has more than one EU hub. Only Air France-KLM and Lufthansa have this possibility without using alliance partners, and the second hub may not have the range of frequencies and destinations offered by the primary hub.

2. A long-haul passenger flying from the EU carrier's hub via one partner's hub could be diverted via another alliance partner's hub, selected to be closest to the desired routing in terms of quality but also trying to maximise the revenue allocated to the EU airline (eg a British Airways London/San Francisco/Las Angeles passenger switched from BA's San Francisco to its Dallas/Fort Worth flight with an American Airlines connection to LA).

For a non-stop passenger from the EU airline's hub, the solution must be a one-stop flight via a partner's hub, unless there is another non-stop flight offered by the same airline or code-share partner at a convenient alternative time. Otherwise, the on-stop option offers a lower quality product and also sacrifices revenue to the alliance partner.

E. How likely do you consider the strategic behaviour of airlines to be, such as that is described at the end of section 3?

It is a possible scenario; it assumes that the EU carrier passes on its ETS costs and the non-EU airline decides to absorb them elsewhere on its network. The EU airline is most likely to pass them on to business and longer haul markets that show less overall price elasticity, and the non-EU carrier might keep its prices unchanged and achieve a higher share of these segments. So far I agree with the analysis, but the

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[2] David Forrester 'Benefits and challenges of Dynamic Capacity management', MSc thesis, Department of Air Transport, Cranfield University, 2005-06.

motive for such strategic behaviour doesn't necessarily need to include driving the EU carrier off the route. This would in any case be unlikely.

I would look at it in terms of the non-EU carrier being better placed to gain some advantage but the price signals from the EU carrier may not be clear cut with many other changes going on at the same time. I would be reluctant to use the term 'long-run equilibrium' in this respect. It looks nice in economic textbooks but difficult to apply to the airline industry.

Another consideration is the possible marketing advantages of including the ETS charge as a separate add-on to the fare. This might be attractive to some passengers in confirming that the polluter is paying (and to the airline in withdrawing its voluntary offset mechanism). In this case, the non-EU airline gets a clearer signal from its competitor and can include a similar charge but reduce the underlying fare accordingly.

F. Apart from the issue of cross-subsidisation, the competitive position of EU carriers may be affected by the fact that routes via EU hubs will incur larger cost increases than routes via non-EU hubs (see footnote 2). Do you believe it is feasible that EU carriers could overcome this disadvantage by making use of non-EU hubs, e.g. through code sharing and alliances? If so how widespread do you think this would be?

This point was made with reference to 'market segment' 1 in A above. I would view it in terms of markets flying via EU versus non-EU hubs. A topical example might be a passenger carried by Emirates from Kuala Lumpur to Düsseldorf via Dubai compared to the same passenger carried by Lufthansa via Frankfurt. Both trips are just over 10,000 kms, but the first only has around 50% of its distance included in the ETS and the second 100%.

This is not cross-subsidisation using the Delft/MVA single route definition, but looking at the two routes needed to serve the market, it is not hard to envisage the spreading of ETS costs over the routes that are used to serve the market in question.

Another consequence of ETS would be that flights going non-stop from the non-hub city would become more viable for the home carrier since they would avoid the take-off/landing phase of the feeder flight that is relatively fuel intensive coupled with the feeder flight generally operated with a less fuel efficient aircraft than the long-haul flights. The EU ETS would accentuate this effect. In the above example this would give some benefit to Lufthansa in competition with Emirates, but it would still incur 100% ETS costs.

However, it makes general economic sense for the home carrier to concentrate long-haul flights at one or two hubs (to obtain other scale economies apart from fuel). Thus the operator of the 'hub by-pass' flight is more likely to be based outside the EU as in the Emirates example. Hubs located nearer EU countries would benefit from lower ETS emissions allowance requirements.

Lufthansa's major alliance partner in the US is United Airlines, and it could operate a joint service, say, New York-Washington DC-Hamburg with Lufthansa's and its own code. United's Hamburg-Washington DC flight might be operated by a reasonably fuel efficient aircraft since it would benefit from feed traffic from the Americas to/from this hub. Lufthansa would not have the advantage of feed from other EU points if it were to operate a stand-alone flight from Hamburg to North America, although it

would have alliance feed at the US end. Lufthansa would have to sacrifice quite a bit of revenue, with its feeder flight system and related costs still in place in the short-term. In the longer term its network would have to be adjusted to the new situation.

Overall, I do not think that EU carriers' increased use of non-EU hubs operated by alliance partners will be much of a solution for them. It would weaken their own strategic position and probably reduce the number of viable long-haul flights that they could operate.

Conclusions

EU carrier hubs would be in a weaker position relative to non-EU hub airports, giving them longer term strategic problems depending on the cost impact of ETS. The main theatre of competition between EU and non-EU carriers is longer haul sectors. In this respect, the larger part of the EU hub carriers' traffic is hub/non-EU city point-to-point and one-stop traffic from other EU cities via their hub. All will be subject to ETS. The major part of the non-EU carrier traffic is the mirror image of this: hub to EU city and traffic fed from non-EU points. A smaller part will be subject to ETS.

Whether or not this is strictly cross-subsidisation, it gives non-EU carriers more scope to move costs from one sector involved in the carriage of the ETS critical market to another flight sector that serves other markets. The extra profit earned from this market could also be used to offer better corporate deals, product upgrades etc. to the detriment of the profit earned on the second non-ETS sector.

The point should also be made that the size of the non-EU airline ETS burden in relation to its total non-EU network might be small enough to be spread across many markets without any adverse reaction from other airlines, even those with no EU ETS involvement.

There is limited scope for non-EU airlines cross-subsidise to gain market share from EU carriers on their single sector (non-stop) traffic sold in their home markets. This does not apply to all other types of traffic (eg non-EU country sales and multi-sector routings).

A final consideration is the possible marketing advantages of including the ETS charge as a separate add-on to the fare. In this case, the non-EU airline gets a clearer signal from its competitor and can include a similar charge but reduce the underlying fare accordingly.

Memo

Delft, 13 november 2007

To	: Peter Morrell
CC	: Adam Mason, Steve Lowe
From	: Jasper Faber
Subject	: Paper on airline ETS cross-subsidisation

Peter Morrell's 'Paper on airline ETS cross-subsidisation' is an adequate response to the questions posed by CE Delft and MVA.

In my opinion, Morrell points out two important issues that may have implications for the analysis. First of all, he stresses several times that profits and profit maximisation should be analysed on a network basis, not on a route basis. Second, Morrell points out the difference between flight and market. A market is a connection between two cities or airports, which may involve one or more flights between airports.

First I consider the first issue, the importance to analyse profit maximisation on a network basis. My initial response would be that this is true, but that I wonder whether this has implications on the outcome of the analysis. The point here is that ETS changes the cost structure on a route basis, not on a network basis, as Morrell also notes. The question to be answered is then whether network profit maximisation would have a different result for networks with a varying impact of ETS. At first sight, I would be tempted to believe that the network optimisation would only be different in case there are different routes available to serve the same market (e.g. Kuala Lumpur – Dusseldorf via Frankfurt or via Dubai), or when cross-subsidisation on specific routes would be an option. If my first impression is correct, I do not expect a large difference between analysing network profit maximisation, which I believe is hard due to the large differences in network sizes and scopes, and route profit maximisation, which is certainly much easier.

The second issue has important implications for the competitive positions of EU carriers, which have hubs in Europe and have strong incentives to use these hubs rather than hubs of alliance partners outside the EU.

Apart from this, I have three specific questions for clarification on Morrell's paper:
1. On page 2, second paragraph, it is stated that 'All carriers could pass on the additional costs to the passengers in this market in higher fares in the same way as fuel surcharges, but in highly competitive markets they may prefer to absorb the costs in lower profits …'. Would this mean that in highly competitive markets, where prices are set at marginal costs, airlines would be willing to charge less than marginal costs? Why?

2. Page 3, last paragraph, reads: '…Prices [in non-ETS markets] maybe lower than optimal in monopoly markets to deter entry and the risk of entry and subsequent loss might be offset by the perceived gain of increasing market share in the ETS markets. This would open up opportunities for cross-subsidisation …'. I have two questions for clarification here. (a) Why would the non-EU carrier in this example decide to increase prices on its non-ETS route, if this would attract new entrants? (b) Would this opportunity be caused by the inclusion of aviation in the EU ETS, or would it be an opportunity that already exists today?

3. Page 8, third paragraph of the conclusions, argues that 'the size of the non-EU airline ETS burden in relation to its total non-EU network might be small enough to be spread across many markets without any adverse reaction from other airlines, even those with no EU ETS involvement'. In the light of the preliminary discussion, which states that costs would be allocated to markets or market segments with the lowest price elasticity of demand, doesn't this conclusion depend on the assumption that the price elasticity in non-ETS markets is lower than in ETS markets, and doesn't this assumption depend on the nationality of the airline, as pointed out in the answer to question B?

Paper on airline ETS cross-subsidisation:

Response to Memo from Jasper Faber, 13 November 2007

The first point related to whether network or route profit maximisation would produce very different results following ETS induced changes in the costs of operating certain routes. Since we are largely concerned with long-haul sectors, there will be numerous cases of markets served by different route combinations. I would agree that in these cases network optimisation would produce a different outcome from point-to-point network analysis

Furthermore we are looking at one set of carriers that have networks serving a given set of markets that have a greater number of routes outside the scope of ETS than inside ETS, and another set of carriers with almost all their sectors serving the same markets within ETS. I agree that it is very much easier to analyse airlines on a route basis, and this is a reasonable approximation when looking at intra-EU markets. But I believe that EU/non-EU markets need to be evaluated on a network basis, although this doesn't give very precise answers.

On the specific numbered points:

1. This question pre-supposes that competitive market prices are set at marginal costs. Since marginal costs for an airline that has fixed its schedule are very low I do not agree that this is the case. I would also doubt whether they would be willing to charge less than marginal costs (except for loss leaders and 'fire sales'). Airlines increasingly pass through costs as surcharges (fuel, baggage handling etc) leaving the revenue managers to price what's left.

2. a) There is no certainty that it would attract new entrants, although the airline would have previously estimated that the chance was great enough to keep fares lower. In the new situation it trades off this chance with the potential gain from the ETS route.

b) The case in a) would be re-evaluated as a direct result of the ETS application. This is the application of a network rather than a route response.

3. I think my statement was based on the fact that there will be sufficient non-ETS markets with lower price elasticities than for at least some of the ETS route markets segments. Routes will combine markets and market segments of varying elasticities, so there is no simple answer to this question. The nationality of the carrier is relevant in determining the absolute size of the ETS burden.

Dr Peter Morrell, Department of Air Transport, Cranfield University, 30/11/2007

Under E, I have put forward various ways of responding to ETS imposed costs.

Most of the routes and markets in question (EU/non-EU sectors) are subject to competition between EU and non-EU network carriers, most of them relatively large or shielded by large strategic alliances. For this reason I did not see the strategic response of driving a carrier off a route as likely. It would be more likely should a low cost carrier enter a long-haul market (similar to the network carrier response to Laker Airways).

Network airline pricing strategy experience with large fuel cost increases seems to have been to pass these on in surcharges and then use their revenue management system to gain advantage in selected market segments. Passing on ETS costs might be perceived positively by the market in confirmation that their airline and they are 'paying' for their environmental damage. Few airlines will have any cost advantage in operating more environmental friendly aircraft and load factors are relatively high for all competitors.

Both EU and non-EU airlines might pass on ETS costs in the same way as fuel surcharges, and they need not be identical since additional ETS costs would need allocating to various passenger and cargo markets (the latter excluded from the discussion so far but further complicating matters). However, non-EU carriers will have lower ETS costs to allocate across their entire network of passenger and cargo market segments and so will have much greater scope to discount (assuming that they apply some environmental surcharges) on the routes serving EU/non-EU markets in competition with EU carriers.

Dr Peter Morrell, Department of Air Transport, Cranfield University, 30/11/2007