Implications of EU Emission Trading Scheme for Competition Between EU and Non-EU Airlines

Joint Report by CE Delft and MVA Consultancy

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Contents

Appendices

Summary

Introduction

MVA Consultancy and CE Delft have been commissioned by DGTL to examine whether, in the event of the Emission Trading Scheme (ETS) being applied to civil aviation flights departing from and arriving at EU airports, there might be appreciable opportunity for non-EU carriers to strengthen their competitive position vis à vis EU airlines.

Though separately contracted to DGTL, the two consultancies were requested to collaborate in seeking a common view on this matter. This report summarises the joint findings of the consultancies.

Initial Considerations

In practice, few flights between EU airports are operated by non-EU carriers, so the study has focused on operations between EU airports and non-EU airports: in other words, on routes from/to the EU. On most such routes there is competition between EU and non-EU carriers.

In accordance with international law affecting civil aviation, the inclusion of aviation in the ETS, as currently proposed by the European Commission, will apply without discrimination to all carriers – non-EU as well as EU – on any route from or to an EU airport. In principle, therefore, no carrier should be advantaged or disadvantaged directly by the ETS.

Since the ETS cost of a flight (that is, the number of emission allowances that must be sacrificed to operate the flight) will be proportional to fuel consumption, carriers that operate more fuel-efficient aircraft on a route will have their efficiency-related competitive position strengthened by the ETS. However, there is no significant discrepancy in fuel efficiency between the aircraft-types operated by EU carriers and non-EU carriers on routes from/to the EU. In any case, if there were such a difference, the ETS would provide the incentive for carriers operating less efficient aircraft to deploy more efficient aircraft to these routes.

Immediate Impact on Competitive Positions of EU and Non-EU Carriers due to Hub Location

Nonetheless, the impact of the ETS on EU carriers and (some) non-EU carriers will be different, because of the location of their hub airports. For most major city-pairs there are direct flights, typically operated in competition between carriers based at the two cities concerned. Other carriers, however, will offer alternative routings via their own hubs, where passengers must transfer (interchange) between flights. This is usually at a lower fare than for the direct flights, to compensate for the additional time and inconvenience of the indirect journey.

Consequently, passengers between major cities typically have a choice between direct flights, or transferring at an EU hub, or transferring at a non-EU hub. Other passengers may not have direct flights, and will always need to transfer at a hub. There may still be choices, however, between transferring at EU or non-EU hubs.

The importance of hub location is this. For passengers who transfer at EU hubs, both the flights that they use will be subject to the ETS. In contrast, only one of the flights used by passengers who transfer at non-EU hubs will be subject to the ETS.

Moreover, if the carrier passes on the ETS cost to passengers in relation to the fuel consumed on flights that are subject to the ETS, the indirect routeing of a journey via an EU hub will involve an ETS-based

fare increase that is higher than that for a direct flight. Routeing via a non-EU hub, on the other hand, may reduce the distance on flights that are subject to the ETS, when compared to using the direct flights.

If carriers pass on their ETS costs as increases in their fares, there will be an overall reduction in the total number of passengers travelling between each pair of EU and non-EU cities. In view of the previous discussion, it can be expected that transfers at EU hubs will fall more than proportionately, and passengers on direct flights less than proportionately. It is also possible that transfers at some non-EU hubs will fall less than proportionately, or even increase, if the reduction in exposure to the ETS (compared to using direct flights) more than compensates for the additional time and inconvenience of using an indirect route.

Since transfers at EU hubs are overwhelmingly with EU carriers, and those at non-EU hubs are almost entirely with non-EU carriers, it can be seen that the hub location can benefit non-EU carriers. Expert opinion is of the view that EU carriers will be unlikely to re-locate hub activities to non-EU airports.

So far as direct flights are concerned, both EU and non-EU carriers will be affected about equally. To some extent offsetting the general reduction in passengers, direct flights may attract some traffic that currently uses indirect routeings. This could imply that direct flights operated by non-EU carriers, as well as those of EU carriers, could gain passengers who now travel on indirect routeings with EU carriers.

Some quantification of these effects has been undertaken, based on the routeings available from Amsterdam to a representative selection of six major cities in North America and six in the Asia/Pacific region. For this purpose, an illustrative ETS allowance price of €30/tonne of CO2 has been assumed. Initially, it is also assumed that all carriers pass this on fully as fare increases. This assumes, therefore, that there is no (additional) cross-subsidisation by non-EU carriers as a result of the ETS. The estimated reductions in passenger numbers are presented in the table below:

Cities	All carriers	EU carriers			Non-EU carriers		
	Total	Total	Direct	Transfer	Total	Direct	Transfer
Nth America	-4.7%	-5.0%	-4.3%	-10.5%	-4.4%	-4.2%	-5.8%
Asia/Pacific	-5.1%	-5.0%	-3.8%	-8.4%	-5.2%	-3.9%	-10.0%

The pattern for the separate groups of cities varies. On routeings to/from North America, the effect on direct traffic is almost the same for EU and non-EU carriers, but the impact on EU carriers' transfer traffic is particularly severe. Non-EU (effectively North American) carriers' transfer traffic is less seriously affected, because of the presence of US East Coast hubs. By transferring at these hubs, passengers making journeys to other parts of the US will be able to reduce substantially the distances they fly that will be subject to the ETS. For some journeys, this reduction in exposure to the ETS is sufficient to offset the increase in journey time and inconvenience of making the transfer.

To/from the Asia-Pacific region, the effects on EU and non-EU carriers are more similar. Non-EU hubs are (mostly) so far from the EU that non-EU carriers could not gain the same advantage in attracting passengers as is provided by US East Coast hubs to North American carriers.

The European Commission's proposal for extending the ETS to the aviation sector includes a substantial initial free allocation of allowances to the sector. It has been estimated that, as a result, the actual outlay by carriers on allowances would be about 10% of the face value of the allowances they consume. If it is next assumed that only 10% of the face value is passed through to fares, the effects on passenger numbers are much reduced, as the next table shows:

Cities	All carriers	EU carriers			Non-EU carriers		
	Total	Total	Direct	Transfer	Total	Direct	Transfer
Nth America	-0.4%	-0.5%	-0.4%	-1.0%	-0.4%	-0.4%	-0.4%
Asia/Pacific	-0.5%	-0.5%	-0.4%	-0.9%	-0.5%	-0.4%	-1.1%

While the impacts on passenger numbers are much smaller, the pattern of changes is similar. The implication is that the ETS will lead to competitive disadvantage for EU carriers in some markets, though this will not be universal.

Potential for Cross-subsidisation Resulting from Inclusion of Aviation in ETS

Another possibility that has been suggested for EU carriers to gain competitive advantage is the scope for cross-subsidisation, i.e. non-EU carriers allocating the ETS costs to their non-EU markets, reducing fares in the geographical scope of the EU ETS and thereby gaining market share from EU carriers. This section summarises a study into the scope for cross-subsidisation.

It is possible and even likely that, in the aviation sector, carriers currently cross-subsidise between markets, e.g. between economy and premium passengers, between passengers and freight, and perhaps even between routes. In general, so-called yield management systems that airlines use are designed to allocate costs to the least price sensitive markets or market segments.

Thus, the question to be answered is whether the inclusion of aviation in the EU ETS constitutes an incentive for additional cross-subsidisation, i.e. cross-subsidisation that is not happening today. In particular, the issue focuses on the question whether non-EU carriers would be able to allocate the costs associated with ETS to their non-ETS markets.

If non-EU carriers would cross-subsidise, they would allocate some or all of the ETS costs to their non-ETS markets. To recoup the ETS costs in those markets, they would need to raise fares there. But basic economic reasoning is that, as prices go up, demand goes down, and if prices of one firm in a market go up, demand shifts to other firms. It implies that, under normal market conditions, it would not be possible for airlines to generate additional profits in non-ETS markets that could be used to offset ETS costs. On the contrary, raising fares in non-ETS markets would more probably reduce profits in them.

This would also apply where carriers have a monopoly in a non-ETS market. By raising fares, they would face a lower overall demand on that market. If they were already seeking to maximise profits, this action would again reduce their profits in non-ETS markets. (If they were not already profit-maximising – possibly to deter the entry of carriers to the market – it is not clear that the ETS should affect that strategy.)

The preceding sections analyse the possibility for cross-subsidisation in liberalised markets, i.e. markets that are already competitive or where the barriers to entry are low. Many markets in aviation are not liberalised but regulated. However, even in regulated markets profit maximising airlines will maximise profits, even though they may be restricted in the ways the can maximise profits. So even in these markets, changing either fares or capacity – if such is permissible – would result in lower profits and could not generate funds to cross-subsidise. Only if the regulators would allow airlines to make very high profits, airlines could be tempted to use these profits to gain strategic benefits in other markets.

So if non-EU carriers in general can be considered as profit maximising companies – and there is no reason to assume that listed airlines are not seeking to maximise profits – they would have no immediate incentive to engage in cross-subsidising their routes to/from the EU. Though companies that have no objective to maximise profits may behave otherwise, neither CE Delft and MVA, nor the experts consulted, could identify major airlines that would not have the objective of maximising profits. Likewise, there seems to be very little, if any, scope for temporarily undercutting fares of competitors (strategic of 'predatory' pricing) in aviation, as it would bring no economic benefits even in the longer term to airlines engaging in such practices.

Thus, if non-EU carriers are already generally seeking to maximise profits, in the large majority of situations, there would be no advantage to them from cross-subsidising their ETS-exposed routes to/from the EU by transferring costs to routes completely outside the EU.

A possible exception to this general finding applies to markets that are regulated in such a way that airlines are able to make supra-normal profits, for example markets where capacity is restricted but fares are free. To the extent that such markets exist, and to the extent that capacity in them is regulated below free-market demand, airlines operating in these markets could have the possibility to make supra-normal profits. Non-EU carriers in this position in non-ETS markets might then engage in strategic pricing on routes to/from the EU, by not passing through their ETS costs to fares on these routes, and financing the ETS costs from their supra-normal profits. The reason behind this behaviour would be that they perceived that it conferred strategic advantage to them (eg pressure on EU carriers' fare levels) on to/from EU routes.

The opportunities for exercising such strategic behaviour depend upon the extent of markets where supra-normal profits can be achieved. These are limited. For example, the UK CAA has recently decided to remove all fares regulation from routes between the UK and points outside the EU, on the ground that competition is sufficient to avoid exploitation of market power ("CAA Air Fares Policy: Removing Regulation", November 2006). This will continue globally as aviation markets become increasingly liberalised.

If airlines operate on markets where they can make supra-normal profits, they can use them to gain market share even prior to the inclusion of aviation in the EU ETS. However, ETS may be perceived as a shock to the market which these airlines may want to exploit strategically. It is therefore questionable whether this type of cross-subsidisation is caused by ETS.

In summary, whether non-EU carriers could engage in cross-subsidisation of their routes to/from the EU depends upon whether they also operate in markets where they can earn supra-normal profits. These opportunities are limited. And this type of strategic behaviour is not necessarily the result of inclusion of aviation in the ETS.

Long-term Impacts on Competitive Position of EU and Non-EU Carriers

It was shown earlier that there are grounds for believing that EU carriers may be disadvantaged in some markets relative to non-EU carriers, even without cross-subsidisation of ETS costs by non-EU carriers.

If this is the case at the outset of the ETS being applied to civil aviation, there is the possibility that it may be aggravated through time, for a number of reasons. First, almost all operations of EU carriers will be subject to the ETS (intra-European as well as from/to the EU), while a generally much smaller proportion of non-EU carriers' operations will be within the scope of the ETS. This implies that opportunities for re-deploying aircraft with different fuel efficiencies will be less for EU carriers. (Non-EU carriers could re-deploy their less efficient aircraft to routes not affected by the ETS.)

The significance of this point will strongly depend upon the price of allowances. At the price of €30/tonne of CO2 assumed earlier, this would be the equivalent of adding less than 2% to the (current) cost of aviation fuel.

If competition with non-EU carriers were to be adversely affected, the potential reduction in the profitability of EU carriers may mean that they have fewer funds to invest, and the cost of raising capital may also increase. That said, the business case for investing in fuel-efficient, cheaper-to-operate, more environmentally-benign aircraft would become stronger, since effectively all their operations would be subject to the ETS.

General Conclusions

Any effects on the competitive positions of airlines are expected to be small, unless the price of allowances increases very substantially above current levels.

For most carriers in most markets, cross-subsidisation would not result in higher profits and would therefore not be in the interest of the carriers. However, it is not possible to rule out completely that some non-EU carriers could engage in cross-subsidisation of their routes to/from the EU, if they also operate in markets where they can earn supra-normal profits. It has been shown that these opportunities are limited and, since this would be strongly dependent upon strategic behavioural choices by individual carriers, it is not possible to establish whether this situation would be aggravated by the inclusion of aviation in the EU ETS.

However, it can be said that EU carriers could be competitively disadvantaged in some markets, as a consequence of the location of non-EU carriers' hub airports. For some non-EU carriers, their hub locations provide opportunities for passengers to substitute transfers at these hubs for transfers at EU hubs, or even direct flights, so that the impact of ETS costs on their fares is reduced.

1 Introduction

1.1 Inclusion of Aviation in the EU ETS

1.1.1 The European Commission has issued a proposal for the inclusion of aviation emissions of carbon dioxide (CO_2) in the European Emission Trading Scheme (EU ETS) (COM(2006)818 final). According to the proposal, aircraft operators will have to surrender allowances for CO_2 emissions on flights within the EU (in 2011) and on all flights departing from or arriving at EU airports (from 2012 onwards). Domestic flights and international flights will be treated alike. Like other participants in the EU ETS, operators will be given a number of free allowances.

1.1.2 Under the proposal, aircraft operators (who will be called airlines or carriers throughout this report) will have to surrender allowances regardless of their nationality. This means that all airlines that operate on a route will face the same requirements. Yet airlines will be affected in different ways, depending on their networks and their fleet:

- Some airlines operate on networks that are centred in EU airports. As a consequence, all or almost all of their flights will be included in the EU ETS. Other airlines operate on networks that are centred on non-EU airports. These airlines will have a smaller share of their flights included in the EU ETS.
- Some airlines operate less efficient fleets than others. As a consequence, they will have to surrender more allowances and face higher costs of compliance than their more efficient competitors.

1.1.3 The European Parliament has debated the proposal and has adopted some changes (P6_TA(2007)0505). One of the changes is to include all flights arriving at or departing from EU airports as of 2011. None of the changes is likely to impact the competitive position substantially.

1.1.4 The European Council is currently debating the proposal.

1.2 Diverging Views on the Impact on the Competitive Position of Airlines

1.2.1 In the period end 2005 till September 2006 MVA Consultancy of London in cooperation with SEO Amsterdam was commission by the DGTL to perform an analysis of the economic and competition effects of the different proposals from the European Commission to include aviation in the EU ETS. Roughly at the same time CE Delft was commissioned to study the overall impacts of this inclusion for the European Commission. The two studies came to different conclusions with respect to this competition issue.

1.2.2 The main difference between the studies was their different views on additional possibilities for cross-subsidisation and a possible distortion of the competitive market on routes where EU-based carriers compete directly with carriers based outside the EU.

1.2.3 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".

1.3 Context of This Project

1.3.1 In view of the conflicting outcomes of previous studies, the Dutch Ministry of Transport, Public Works and Water Management, directorate-general of Civil Aviation and Freight Transport (DGTL), commissioned MVA and CE Delft to study the impact of the inclusion of aviation in the EU ETS on the competitive position of EU and non-EU airlines in more detail.

1.4 Aim of This Project

1.4.1 The main aim of the project is twofold:

- 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.
- 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, and increase their total profits, by undercutting fares on markets where they compete directly with EU based airlines, subsidising potential losses on these routes by increased prices on routes at which they do not compete with EU airlines.

1.4.2 In addition to the main aim, MVA has extended the previous (2005-6) study to include ETS scenarios in which all flights arriving at EU airports, as well as those departing, are subject to the ETS.

1.5 Report Outline

1.5.1 Chapter 2 outlines the methodology used for chapters 5 through 7. Chapter 3 reports on the extension to the 2005-6 study. Chapter 4 discusses whether EU and non-EU carriers' fleets (as used in competitive markets) are likely to have materially different fuel efficiencies. Chapter 5 reports on the relation between hub location and competitiveness under the EU ETS. Chapter 6 focuses on cross-subsidisation. Chapter 7 looks at possible longer term impacts on the competitive position. Conclusions are in chapter 8.

2 Study Methodology

2.1 Introduction

2.1.1 This chapter summarises the methodology used in this study. The methodology applied has been a three-step process. In the first step, MVA and CE Delft sought to clarify their positions. They identified aspects on which they agreed and areas for further study. In the second step, MVA and CE Delft studied these areas and asked two experts for their view. The third step comprised the formulation of a common position by CE Delft and MVA. Each of the steps will be described briefly below.

2.2 Clarifying Positions

2.2.1 From CE Delft (2005) and MVA and SEO (2006) it is clear that their reports start from different assumptions and use different arguments to assess the potential impacts on the competitive market. And although the reports clarify their main line of reasoning, some assumptions and argumentation are not made explicit.

2.2.2 Starting from these reports and other studies on the subject, each consultancy has written a note expanding and clarifying its position. The notes devoted considerable attention to the often unspecified assumptions needed to arrive at the respective positions.

2.2.3 Each consultancy examined the other's note thoroughly and drafted a memo with critiques and questions for clarifications. The consultancies responded to the memo with a second note.

2.2.4 At a day-long meeting, the consultancies discussed the notes and memo's drafted. They identified the common positions and the differences in analysis. Both were incorporated in a common note intended to guide further study and to inform experts and ask for their opinions. This material is reproduced as an appendix.

2.3 Further Study and Expert Opinion

2.3.1 The areas identified for further study were studied by the respective consultancies.

2.3.2 A paper outlining the common position and identifying the remaining questions was presented to two experts in the economics and business strategies of airlines. The experts were asked to answer the questions and comment on the common position. Each of the experts produced a note, on which the consultancies were able to ask some questions for clarification.

2.4 Reaching a Common Position

2.4.1 Based on the research and informed by the expert's opinions, MVA and CE Delft were able to reach a common position on most of the issues. They lay down their findings in this report.

3 Modelling of All Arrivals and Departures

3.1 Introduction

3.1.1 This chapter provides a summary of the additional modelling undertaken using the NetCost model, for scenarios where the ETS applies to all flights arriving and departing from the EU. This follows on from an earlier study by MVA/SEO for DGTL,[1] where several ETS scenarios were analysed. In that earlier study, the main descriptors of the scenarios were:

- Permit prices of €30 and €100 per tonne of CO_2;
- The ETS being applied just to intra-EU flights, or to all flights departing from EU airports;
- No initial allocation of permits to the aviation sector.

3.1.2 The methodology that was developed resulted in a database representing scheduled passenger demand for all global origin-destination (O-D) pairs for which passenger journeys use EU airports, or could reasonably route through an EU airport. This comprehensive approach was found to be necessary to allow estimation of the relative impacts of the ETS on EU compared to non-EU carriers and airports, and to explore whether hubs and carriers **within** Europe would be affected to different degrees.

3.1.3 DGTL have asked that the same methodology be employed again, but this time to assess the ETS being applied to all flights arriving at or departing from EU airports Compared to the scenarios for the earlier study, this implies that flights from non-EU airports to EU airports would become subject to the ETS. This is in line with the European Commission's proposal for extending the ETS to civil aviation.

3.1.4 Another aspect of the Commission's proposal is that the aviation sector would receive a substantial initial allocation of allowances. However, for the purpose of being able to compare results of the present analysis with those of the earlier study, scenarios have been investigated where no initial allocation is assumed. Moreover, the same permit prices of €30 and €100 per tonne of CO_2 have also been assumed, though it is recognised that the higher price is considerably higher than current forecasts of the price.[2]

3.1.5 Thus for the present study, ETS scenarios have been defined by:

- A permit price of €30 per tonne of CO_2, but with no initial allocation of permits to the aviation sector;
- A permit price of €100 per tonne of CO_2, but with no initial allocation of permits to the aviation sector; and
- A permit price of €100 per tonne of CO_2, but with a 90% initial allocation of permits to the aviation sector.

3.1.6 The results for these scenarios are presented below in a similar structure to that provided in the earlier study. From that study, results for the case of a permit price of €30 per tonne of

[1] "Consequences for the Dutch Aviation Sector of Inclusion in the European Emission Trading Scheme", DGTL, September 2006

[2] €100 per tonne was selected in the previous study even though forecasts then were of much lower prices, because the market price of permits at that time were approaching the forecast prices much earlier than those forecasts had anticipated.

CO_2 applied only to flights departing from EU airports, with no initial allocation of permits, are also given, for continuity and comparison.

3.1.7 Implicitly, the objectives of the analysis are also the same as in the earlier study, which can be summarised as follows:

- assess the implications on the Dutch aviation sector for the extension of the ETS to international flights;
- assess the impact on European airports, especially in relation to transfer traffic, and give specific attention to competitive effects for EU compared to non-EU carriers; and
- assess the competitive impacts on the Dutch and EU Aviation sector, concentrating especially on Schiphol and KLM compared to their major European rivals.

3.1.8 These objectives were met by presenting the results in the following ways, and that pattern is again adopted:

- An estimate of the resulting impact on passengers' flights involving the EU;
- An estimate of the resulting demand impacts at Schiphol and competing European hubs; and
- The above impacts split by carrier type, and comparing KLM to competing European airlines.

3.1.9 The major EU airports that are identified explicitly, in addition to Schiphol, are London (including all five airports, though only Heathrow as a hub), Paris (including all airports, though only Charles de Gaulle as a hub) and Frankfurt. This demonstrates the competitive impact because it compares Schiphol with its major European rivals.

3.1.10 With regard to scenarios where the assumption is no initial allocation of permits to the aviation sector, it should be recalled that sectors already included in the ETS have received an initial allocation that covers a very high proportion of their permit requirements, and this system is to be continued in Phase 2 of the ETS. Thus assuming no initial allocation for the aviation sector could be seen as a "worst case" scenario for the sector. It implies the maximum severity of impact on demand, whereas assuming an initial allocation would either reduce this impact or (if the opportunity cost of the allocation could be exploited) allow for a windfall gain.

3.2 Impact on EU-Based OD Traffic

3.2.1 Table 3.1 below demonstrates the relative sizes of the markets considered in this study and the different impacts on these markets. Origin to destination journeys (as opposed to individual flight stages) have been considered for markets where alternative routeings would be subject to the ETS. Passengers on these flights number nearly 400m. Around two thirds of these passengers (256m) are intra-EU, and almost all of the rest (129m) fly between the EU and a non-EU destination. Only around 2% (10m) fly between non-EU cities, but with a plausible route via an EU hub.

3.2.2 For each of these markets there are three possible routes: direct, via a hub in the EU and via a non-EU hub. About 85% of the Intra-EU market is on direct flights, as would be expected

for short-haul movement, while almost all the remaining intra-EU traffic transfers at an EU airport. In the EU to non-EU markets only 20% is direct, with 80% transferring in similar proportions at EU and non-EU hubs. Of the non-EU to non-EU traffic that could reasonably route via an EU airport, about half in fact does so. Of the total passengers considered, 63% are on direct flights and 24% on flights via EU hubs, leaving 12% on flights via non-EU hubs.

3.2.3 The major similarities differences between the "all arrivals and departures" and "all departures only" ETS scenarios are evident from Table 3.1. It can be seen that the impact on intra-EU traffic is effectively identical for both the 'All departures only €30/tonne' and 'All arrivals and departures €30/tonne' scenarios. This is because all intra-EU flights are subject to the ETS in both scenarios.

3.2.4 On the other hand, the inclusion of flights arriving from non-EU airports increases the impact of the "all arrivals and departures" scenario substantially, especially on direct flights. Under this scenario, travel by direct flights between EU and non-EU points is subject to the ETS in both directions, rather than just one.[3] The change in impact via hubs is less, because short-haul feed within the EU would already be subject to the ETS in both directions in the "all departures only" scenario, and, for transfers at non-EU hubs, the additional ETS coverage would apply to (for example) only the Amsterdam – New York leg of a journey to Los Angeles.

3.2.5 It is also worth noting that, though the market for non-EU to non-EU journeys that could reasonably route via EU hubs is small, an appreciably greater proportion of it could be lost as a result of the "all arrivals and departures" ETS scenario. The beneficiaries are not only direct flights but also transfers via non-EU hubs.

[3] In practice, carriers would probably adjust fares in both directions even in the "all departures only" scenario, but (for a given permit price) the cost would effectively be halved for the individual directions.

Table 3.1 Impact on Passengers Journeys from / to or (potentially) via EU airports

Origin-destination	Routing	Base (mppa)	All departures only (€30/tonne)	All arrivals and departures (€30/tonne)	All arrivals and departures (€100/tonne)	All arrivals and departures (€100/tonne, 90% permits)
Intra-EU	Direct	218.3	-1.6%	-1.6%	-5.1%	-0.5%
	EU hub	36.8	-2.0%	-2.0%	-6.3%	-0.7%
	Non-EU hub	0.5	0.0%	-0.3%	-4.4%	-0.5%
	Total	255.6	-1.7%	-1.7%	-5.3%	-0.6%
EU <-> Other	Direct	26.4	-0.8%	-2.1%	-6.9%	-0.7%
	EU hub	54.0	-2.4%	-3.7%	-11.4%	-1.2%
	Non-EU hub	48.2	-0.2%	-0.9%	-2.4%	-0.3%
	Total	128.6	-1.3%	-2.3%	-7.1%	-0.8%
Non-EU	Direct	2.7	0.0%	0.3%	1.2%	0.2%
	EU hub	4.7	-2.6%	-4.8%	-14.5%	-1.6%
	Non-EU hub	2.2	1.3%	3.3%	10.8%	1.1%
	Total	9.6	-0.9%	-1.5%	-4.2%	-0.5%
Total	Direct	247.4	-1.5%	-1.6%	-5.2%	-0.6%
	EU hub	95.5	-2.3%	-3.1%	-9.6%	-1.0%
	Non-EU hub	50.9	-0.1%	-0.7%	-1.9%	-0.2%
	Total	393.8	-1.5%	-1.9%	-5.8%	-0.6%

3.3 Relative Impact on Schiphol and Competing EU Hubs

3.3.1 The previous section summarised the impact on the EU as a whole. This section focuses on the impact on Schiphol itself and on the main competing hubs in the EU: Paris Charles de Gaulle, London Heathrow and Frankfurt. Because of the importance of transfer traffic to this analysis, Table 3.2 shows passengers departing each of these airport or cities, split into originating and transfer traffic.

3.3.2 As an EU benchmark, the corresponding totals for all EU airports combined are also shown. They show that the impact on the four specific airports or cities is slightly higher than the EU average, perhaps reflecting their role as major hubs since transfer traffic is typically impacted more strongly than originating flows.

3.3.3 It is particularly noticeable that there is a large impact on traffic transferring at London. This is because the average intra-EU leg into London Heathrow is longer than for other airports, a function of its geographical location on the edge of Europe and its wider catchment area across Europe.

Table 3.2 Base departing passengers and impact of ETS by Major EU airport by flight stage

Major hubs, and total EU		Base (mppa)	All departures only (€30/tonne)	All arrivals and departures (€30/tonne)	All arrivals and departures (€100/tonne)	All arrivals and departures (€100/tonne 90% permits)
Amsterdam	Origin	12.4	-1.6%	-2.0%	-6.1%	-0.7%
	Transfer	9.2	-2.5%	-3.4%	-10.4%	-1.2%
	Total	21.6	-2.0%	-2.6%	-7.9%	-0.9%
Paris	Origin	25.4	-1.6%	-1.7%	-5.3%	-0.6%
	Transfer	10.6	-2.5%	-3.8%	-11.5%	-1.3%
	Total	36.0	-1.8%	-2.3%	-7.1%	-0.8%
London	Origin	48.3	-1.6%	-1.9%	-5.9%	-0.6%
	Transfer	11.3	-3.1%	-4.2%	-13.1%	-1.4%
	Total	59.5	-1.9%	-2.3%	-7.3%	-0.8%
Frankfurt	Origin	13.2	-1.5%	-1.6%	-5.2%	-0.6%
	Transfer	13.8	-2.6%	-3.9%	-11.8%	-1.3%
	Total	26.9	-2.1%	-2.8%	-8.6%	-0.9%
Total EU	Origin	319.9	-1.6%	-1.8%	-5.6%	-0.6%
	Transfer	95.5	-2.3%	-3.1%	-9.6%	-1.0%
	Total	415.4	-1.7%	-2.1%	-6.5%	-0.7%

3.4 Relative Impact on EU and Non-EU Carriers

3.4.1 Table 3.3 presents the impact on departing passengers split by EU and non-EU carrier, which allows an assessment to be made of the competitive effects between these two categories of airline. (The data are expressed in terms of Origin-Destination flows – as in Table 3.1.).

Table 3.3 Impact on OD passengers departing (m) of EU ETS by carrier type

		Base (mppa)	All departures only (€30/tonne)	All arrivals and departures (€30/tonne)	All arrivals and departures (€100/tonne)	All arrivals and departures (€100/tonne 90% permits)
EU carriers						
Intra EU		255.1	-1.7%	-1.7%	-5.3%	-0.6%
EU<->other	direct	13.2	-0.8%	-2.1%	-6.8%	-0.7%
EU<->other	via hub	54.0	-2.4%	-7.6%	-11.4%	-1.2%
Non-EU		4.7	-2.6%	-4.8%	-14.5%	-1.7%
Total		327.0	-1.8%	-2.7%	-6.5%	-0.7%
Non-EU carriers						
Intra EU		0.5	0.0%	-0.3%	-3.4%	0.6%
EU<->other	direct	13.2	-0.8%	-2.1%	-6.8%	-0.7%
EU<->other	via hub	48.2	-0.2%	-0.9%	-2.4%	-0.3%
Non-EU		4.9	0.6%	1.7%	5.4%	0.5%
Total		66.8	-0.3%	-0.9%	-2.7%	-0.3%

3.4.2 For the purposes of this table, reasonable approximations are that:

- **direct** flights between EU cities are made with EU carriers;
- **direct** flights between non-EU cities are made with non-EU carriers;
- **direct** flights between EU cities and non-EU cities are split 50%:50% between EU and non-EU carriers;
- **indirect** flights via EU hubs are made with EU carriers; and
- **indirect** flights via non-EU hubs made with non-EU carriers.

3.4.3 Intra-EU traffic forms 65% of the total OD movement that is handled by or could reasonably route through EU airports, and, whether on direct flights or by transfer, almost all of it is conveyed by EU carriers. In both the ETS scenarios, all intra-EU flights are covered by the ETS, and so the loss of intra-EU traffic is estimated to be the same, at 1.7% of their intra-EU traffic.

3.4.4 Similar levels of traffic are conveyed by EU and non-EU carriers from EU cities to non-EU cities. By assumption, the direct flows are the same, and the effects of the ETS on these flows are also the same. On the other hand, there is a marked difference in the impact on indirect flows.

3.4.5 Under both scenarios, all traffic from EU to non-EU cities will incur charges, but again the impact on EU and non-EU carriers is different. In these cases, the incentive will tend to be to minimise the distances within OD journeys to which the ETS applies. The least attractive options in this regard are indirect movement with EU-carriers, and it is not surprising that the largest reduction in EU to non-EU traffic is on such routings: 2.4% in the "€30 all departures only" scenario, increasing to 7.6% in the "€30 all arrivals and departures" scenario.

3.4.6 Direct flights with either EU or non-EU carriers will be more attractive, but indirect routings with non-EU carriers will be still more attractive for many OD pairs: for example, transferring in the eastern US *en route* to the west coast or in the Middle East *en route* to Asia would significantly reduce the distances over which the ETS would apply. The results show this effect. Reductions in direct flows between EU and non-EU cities are 0.8% in the "€30 all departures" scenario, rising to 2.1% in the "€30 all arrivals and departures" scenario, while reductions on indirect routings with non-EU carriers are very small: respectively 0.2% and 0.9%. These may be contrasted against the impact on indirect traffic with EU carriers: 2.4% and 7.6%, as noted above.

3.4.7 Turning now to non-EU OD flows that could nevertheless route through EU hubs, the fortunes of EU and non-EU carriers are again different. Essentially, these flows are incentivised to avoid hubbing in the EU, and EU carriers lose traffic in consequence. Non-EU carriers gain some of the displaced traffic both on direct flights and on indirect routings via non-EU hubs.

3.5 The Impact on KLM Specifically

3.5.1 In the earlier study, one objective was to identify the impact of the ETS on KLM in particular, and on the major competing EU carriers. The endemic extent of intra-alliance code-sharing

in the OAG data on which the model is based precludes the straightforward attribution of flights to individual carriers, but it is possible to estimate the impact of the ETS on the major EU carriers using the assumption that a large proportion of traffic of each alliance at its EU hub (or hubs) will be carried by the airline based there.

3.5.2 Thus the impact on this "home" airline can be approximated by the impact on its alliance at the hub(s), as shown in Table 3.4. There, the impact on KLM is represented by the impact on Sky Team at Amsterdam, while the impact on Air France, British Airways and Lufthansa is approximated by that on Sky Team, One World and Star at their respective hubs.

Table 3.4 Approximation of impact on passenger flight stages (m) of major EU airlines

Representation of carriers at hubs		Base (mppa)	All departures only (€30/tonne)	All arrivals and departures (€30/tonne)	All arrivals and departures (€100/tonne)	All arrivals and departures (€100/tonne 90% permits)
KLM	Origin	14.4	-1.4%	-1.9%	-5.9%	-0.6%
Sky Team at AMS	Transfer	18.4	-2.5%	-3.4%	-10.4%	-1.2%
	Total	32.8	-2.0%	-2.7%	-8.4%	-0.9%
AF	Origin	27.5	-1.6%	-1.6%	-5.2%	-0.6%
Sky Team at Paris	Transfer	21.2	-2.5%	-3.8%	-11.5%	-1.3%
	Total	48.7	-2.0%	-2.6%	-8.0%	-0.7%
BA	Origin	36.6	-1.7%	-2.0%	-6.2%	-0.7%
One World at London	Transfer	18.3	-3.2%	-4.5%	-13.7%	-1.5%
	Total	55.0	-2.2%	-2.8%	-8.7%	-1.0%
Lufthansa	Origin	32.7	-1.5%	-1.6%	-5.0%	-0.5%
Star at Frankfurt, Munich	Transfer	36.6	-2.5%	-3.7%	-11.3%	-1.2%
	Total	69.3	-2.0%	-2.7%	-8.3%	-0.9%

3.5.3 The table suggests that the overall impact on traffic is broadly similar for all four carriers, but there are interesting differences at a more detailed level.

3.5.4 Under all the ETS scenarios, all the four carriers are impacted more strongly in transfer than in originating markets. This is to be expected following the discussion of the previous section. The most seriously affected airline appears to be British Airways, while, overall, KLM's loss of traffic is proportionately very similar to that of Air France and Lufthansa in the "€30 all departures only" scenario and not so severe as for the other carriers in the "€30 all arrivals and departures" scenarios.

4 Benchmarked Initial Allocation of Allowances

4.1 The Hypothesis that Fleet Age Differences Would Benefit EU Carriers

4.1.1 The draft EU Directive on introducing civil aviation into the ETS proposes that carriers be given an initial allocation of allowances on the basis of "benchmarking". The effect would be that the initial allocation would cover a higher proportion of the activity of carriers with performances better than the benchmark and a lower proportion for carriers with performances inferior to the benchmark. Consequently, carriers with higher levels of performance relative to the benchmark would need to purchase fewer additional allowances in the ETS market (or would have more allowances to sell) than carriers with lower performance levels.

4.1.2 If the benchmark metric were to reflect fuel efficiency, past investment by carriers in fuel-efficient fleets would be rewarded, since such carriers would be able to undertake more of their activity with a given allocation of allowances than would carriers with less fuel-efficient fleets. Setting this kind of benchmark would incentivise all carriers to (continue to) improve the fuel-efficiency of their fleets in the future.

4.1.3 A commonly-held view is that aircraft of younger designs are typically more fuel-efficient than older aircraft, for a given mission capability. A rule-of-thumb has been that fuel-efficiency across the global aircraft fleet improves by an average of 1% per year. (This effectively implies that retired aircraft of N years old are N% less fuel-efficient than aircraft newly introduced into the global fleet.)

4.1.4 In preparing for this study, MVA Consultancy found that the age distributions of aircraft operated by European, American and Asia-Pacific carriers were substantially different. In 2005, for example, 33% of European carriers' aircraft were five years old or less, compared to 21% among American carriers and 28% for Asia-Pacific carriers. A substantial majority of European carriers' aircraft – 71% - were not more than 10 years old, while the corresponding proportions of American carriers' aircraft was only 45%. For Asia-Pacific carriers, 58% of their aircraft were 10 years old or less.[4]

- There was thus felt to be a *prima facie* case that, given an allowance allocation benchmark that reflected fuel-efficiency, EU carriers might be better placed than their American or Asia-Pacific competitors.

4.2 Findings

4.2.1 On further investigation, however, it transpires that this scenario is not strongly supported by the facts of the case. The issues are:

- The benchmark definition in the proposed Directive does not relate strongly to fuel-efficiency in the sense required for the foregoing scenario;
- Despite the variation in fleet age distributions, the ages of EU and non-EU carriers' aircraft may be much more similar where they compete on routes to and from the EU;

[4] These data are sourced from "Age of Fleet, October 2006" by the Association of European Airlines.

- The correlation between fuel-efficiency and the "vintage" of aircraft design has become increasingly tenuous over recent years.

4.2.2 The proposed Directive's benchmark metric is – to all intents and purposes – revenue-tonne-kms (RTKs). A carrier would receive an initial allocation proportional to its RTKs. This is essentially a "scale" metric; larger carriers will secure a larger initial allowance than smaller carriers. Measuring "scale" on "output" rather than "input" (such as available seat-kms (ASKs)), it will incentivise higher rather than lower load factors, and possibly larger aircraft rather than smaller ones. In these senses, therefore, the metric could be said to encourage fuel-efficiency.

4.2.3 However, the hypothesis advanced above is more concerned with differentials in fuel-efficiency that arise from the ages and technology levels of different carriers' fleets. The RTK-based metric offers only a limited fuel-efficiency incentive in this sense; indeed, there would be no more incentive than simply being subject to the ETS would create.

4.2.4 Though the RTK-based metric is the only one set out in the proposed Directive, there has been substantial interest in the implications of alternative metrics. CE Delft and Manchester Metropolitan University (MMU) have recently carried out a study into these, and much of what follows is drawn or inferred from that study.[5]

4.2.5 The CE Deft/MMU study assessed the extent to which carriers of different types and domiciles would tend to have a greater or smaller proportion of their activity covered by the initial allocation of allowances, compared to the average for the aviation sector. The comparison was carried out for several benchmark metrics, in the three major categories of "output", "input" and "energy efficiency". It was expressed as the number of allowances per unit of emissions relative to the sector average. This quantity will be positive where the proportion of activity covered by the initial allocation is higher than the sector average, and it will be negative where the proportion is lower than the average.

4.2.6 Considering only carrier-types that are in competition on routes to and from the EU, the CE Delft/MMU study estimated the effects of different benchmark metrics for large network carriers based in the EU, in the US, and in the Far East.

4.2.7 The small variation of EU-based network carriers from the average is attributed by the CE Delft/MMU report to the dominance of the long-haul activities of these carriers in computing the benchmark values.

4.2.8 The US-based carrier was shown to gain relative to the other carriers on the "output" (RTK-based) metric partly because its operations that would be subject to the ETS would all be long-haul. Unlike the EU-based network carrier, the US-based carrier's short-haul activity – which will be intrinsically less fuel-efficient – would be outside the scope of the ETS. While these considerations should also influence the carrier's position with the "input" (ATK-based) metric, the RTK basis includes additionally the effect of higher load factors on long-haul flights.

[5] CE Delft and Manchester Metropolitan University: "The Impacts of Different Benchmarking Methodologies on the Initial Allocation of Emission Trading Scheme Permits to Airlines" for the UK Department for Transport and Environmental Agency, July 2007; MVA Consultancy accepts responsibility for any inferences therefrom in the present report.

4.2.9 The same contrast between the RTK-based and ATK-based benchmarks applies also to the Far-East-based network carrier. Moreover, like the US-based carrier, only the Far-East-based carrier's long-haul movements to and from the EU will be subject to the ETS. However, this carrier sees less advantage (on both metrics) than the US-based carrier.

4.2.10 The reason for this appears to lie in the aircraft-types that these carriers deploy to their routes to and from the EU. The dominant aircraft-type of Far-East-based carriers flying to the EU is the Boeing 747-400. This type is less fuel-efficient than the Boeing 767-300ER and 777-200ER models and the Airbus A330-200 that US-based carriers typically operate across the Atlantic; these types undertake about 75% of scheduled trans-Atlantic flights by US-based carriers.

4.2.11 In contrast, only about 40% of EU-based operations across the Atlantic employ these types, with 25% of movements being performed by747-400s. The average trans-Atlantic fuel-efficiency of EU-based carriers looks therefore to be no better than that of US-based carriers, and may well be poorer.

4.2.12 To the Far-East, EU-based carriers deploy Boeing 747-400s, plus the large Airbus types. Thus on these routes the fuel-efficiency of the EU-based carriers closely matches that of the Far-East based operators.

4.2.13 In short, it cannot be claimed that EU-based carriers utilise more fuel-efficient aircraft than the non-EU competitors in their major long-haul markets.

4.2.14 The differences in fuel-efficiency between aircraft-types just discussed are not wholly a function of their ages (measured as entry into service). The CE Delft/MMU study investigated the basis of the commonly-cited presumption of fuel-efficiency increasing by 1% per year, on average. The study presented data that suggested that, while this pattern may have been true during the 1970s and 1980s, it has been much less apparent subsequently. The study concludes that "both modelled data and a detailed examination of the origins of a 1% per year improvement in fuel-efficiency reveal that a projected technological improvement of [this extent] …cannot be supported by empirical evidence".

4.2.15 For this study, the conclusions must be that:

- EU-based carriers do not operate aircraft with materially higher (and possibly lower) fuel-efficiency compared those of competing non-EU carriers in major long-haul markets;
- It cannot be assumed that a younger fleet is necessarily a more fuel-efficient fleet (within a comparable mission-capability requirement).

5 Impact of the ETS on Competitive Positions of EU and Non-EU carriers Due to Hub Locations

5.1 Overview of Hub Location Effects

5.1.1 In accordance with international law affecting civil aviation, the inclusion of aviation in the ETS, as currently proposed by the European Commission, will apply without discrimination to all carriers – non-EU as well as EU – on any route from or to an EU airport. In principle, therefore, no carrier should be advantaged or disadvantaged directly by the ETS.

5.1.2 Nonetheless, in the context of journeys between EU and non-EU cities, the impact of the ETS on EU carriers and (some) non-EU carriers will be different, because of the location of their hub airports. For most major city-pairs there are direct flights, typically operated in competition between carriers based at the two cities concerned. Other carriers, however, will offer alternative routings via their own hubs, where passengers must transfer (interchange) between flights. This is usually at a lower fare than for the direct flights, to compensate for the additional time and inconvenience of the indirect journey.

5.1.3 Consequently, passengers between major cities typically have a choice between direct flights, or transferring at an EU hub, or transferring at a non-EU hub. Other passengers may not have direct flights, and will always need to transfer at a hub. There may still be choices, however, between transferring at EU or non-EU hubs.

5.1.4 The importance of hub location is this. For passengers who transfer at EU hubs, both the flights that they use will be subject to the ETS. In contrast, only one of the flights used by passengers who transfer at non-EU hubs will be subject to the ETS.

5.1.5 Moreover, if the carrier passes on the ETS cost to passengers in relation to the fuel consumed on flights that are subject to the ETS, the indirect routeing of a journey via an EU hub will involve an ETS-based fare increase that is higher than that for a direct flight. Routeing via a non-EU hub, on the other hand, may reduce the distance on flights that are subject to the ETS, when compared to using the direct flights.

5.1.6 If carriers pass on their ETS costs as increases in their fares, there will be an overall reduction in the total number of passengers travelling between each pair of EU and non-EU cities. In view of the previous discussion, it can be expected that transfers at EU hubs will fall more than proportionately, and passengers on direct flights less than proportionately. It is also possible that transfers at some non-EU hubs will fall less than proportionately, or even increase, if the reduction in exposure to the ETS (compared to using direct flights) more than compensates for the additional time and inconvenience of using an indirect route.

5.1.7 Since transfers at EU hubs are overwhelmingly with EU carriers, and those at non-EU hubs are almost entirely with non-EU carriers, it can be seen that the hub location can benefit non-EU carriers. Expert opinion is of the view that EU carriers will be unlikely to re-locate hub activities to non-EU airports.

5.1.8 So far as direct flights are concerned, both EU and non-EU carriers will be affected about equally. To some extent offsetting the general reduction in passengers, direct flights may attract some traffic that currently uses indirect routeings. This could imply that direct flights

operated by non-EU carriers, as well as those of EU carriers, could gain passengers who now travel on indirect routeings with EU carriers.

5.2 Quantification of Hub-Location Effects

5.2.1 Some quantification of these hub location effects has been undertaken, based on the routeings available from Amsterdam to a representative selection of six major cities in North America and six in the Asia/Pacific region.

5.2.2 The approach has been to set up a predictive model of the choice by passengers of alternative routeings for their journeys between Amsterdam and each of the selected cities. Route choices are related to the "generalised costs" of the available routes, where generalised cost includes travel time, (inconvenience of) transfers and less frequent departure opportunities, and fare.

5.2.3 For the purpose of this study, it has been assumed that all components of the generalised cost of any particular routeing remain constant, apart from the fare, which is allowed to change in response to the pass-through of ETS costs by carriers. Since the extent to which a given journey is subject to the ETS will vary according to the routeing taken, the change in fares by different routes will also vary. This leads to the model's predicting a change in the proportion of passengers that selects each available routeing. Those routeings for which the increase in fare is least will attract a higher proportion of the total flow of passengers for the city-pair in question.

5.2.4 In addition to changing the route-choice proportions, however, the model also recognises that, since all routes will suffer an increase in fare, there will be an overall reduction in the flow of passengers on the city-pair.

5.2.5 The reasons behind the selection of the 12 cities are presented in section 5.3. In section 5.4, the modelling for one of these cities (Los Angeles) is described in detail. The effects for the eleven other cities are then given in section 5.5.

5.2.6 An illustrative ETS allowance price of €30/tonne of CO_2 has been adopted for this analysis. Initially, it is assumed that all carriers pass this on fully as fare increases. This assumes, therefore, that there is no (additional) cross-subsidisation by non-EU carriers as a result of the ETS.

5.3 Selection of 12 Cities

5.3.1 Selection of the 12 cities has been based upon their connections to/from Schiphol, and the nature of competition between non-EU carriers and KLM.

5.3.2 Most of KLM's non-European competitors are members of one of the three alliances, SkyTeam, STAR and oneWorld. As KLM is a member of SkyTeam, competition is mainly felt from STAR and one World members. In addition to this, there is a limited number of independent airlines that are not (yet) member of an alliance. With two airlines in this

category KLM has a code share agreement. In summary the following 24 non-European airlines as well as routes to their hubs are identified:

Table 5.1 Non-EU Airlines Serving Schiphol

Non-EU carrier	Code	Hub	Frequency of non-EU carrier services	Frequency of KLM services	Competition on direct routes with KLM
SkyTeam					
Northwest Airlines	NW	DTW	35	-	
		MSP	21	-	
Continental Airlines	CO	EWR	14	-	
		IAH	11	13	(X)
Delta Airlines	DL	ATL	7	7	(X)
		JFK	7	21	(X)
Aeromexico	AM	MEX	-	7	(X)
Korean Air	KE	ICN	3	7	(X)
Code Share partners of KLM					
Kenya Airways	KQ	NBO	7	7	(X)
Malaysian Airlines	MH	KUL	7	7	(X)
China Southern	CZ	CAN	7	-	
STAR Alliance					
Air Canada	AC	YYZ	-	12	
		YUL	-	7	
United Airlines	UA	IAD	7	7	X
		ORD	7	7	X
US Airways	US	PHL	7	-	
All Nippon Airways	NH	NRT	-	7	
Thai International Airways	TG	BKK	-	7	
Singapore Airlines	SQ	SIN	7	7	X
South African Airways	SA	JNB	-	7	
oneWorld Alliance					
American Airlines	AA	ORD	-	7	
		DFW	-	-	
Cathay Pacific	CX	HKG	7	7	X
Japan Airlines	JL	NRT	7	7	X
Independent airlines					
Varig Brasil	RG	GIG	-	-	
		GRU	-	7	
EVA Air	BR	TPE	3	7	X
China Airlines	CI	TPE	7	7	X
China Eastern	MU	PVG	-	10	
Emirates	EK	DXB	-	10	
Qatar Airways	QR	DOH	-	5	

5.3.3 The main conclusion from this table is that there are only few routes to non-EU hubs where KLM feels competition at its direct routes. Starting at the routes to other SkyTeam hubs, although KLM shares the routes marked (X) with its non-EU counterparts, the competition is

limited, if not absent, as these airlines are in the same alliance. The same holds for the routes that it shares with its code share partners, Malaysian and Kenya Airways.

5.3.4 Competition may be more prominent at the routes to the hubs of the other airlines,. Nevertheless at many of these routes, there is only one operating airline, either KLM, such as the route to Toronto (YYZ), or the competing hub carrier, such as the route to Philadelphia (PHL). Only for the six routes marked by X does KLM have competition with the relevant hub carrier at the direct connections: Washington (IAD), Chicago (ORD), Singapore (SIN)), Hong Kong (HKG), Tokyo Narita (NRT) and Taipei (TPE). These routes will therefore be taken into the sample of twelve routes.

5.3.5 KLM may however also face competition on other intercontinental routes, than the routes to main hubs only. This is particularly relevant for larger markets, where KLM competes with other airlines than the hub carriers.

5.3.6 An example is the route to Toronto, where KLM does not compete with Air Canada, but with Air Transat (TS). Martinair (MP) also has flights to Toronto, but the extent to which it competes with Martinair can be questioned. The other example is Bangkok, where KLM does not compete with Thai Airways, but with China Airlines (CI) and EVA Air (BR), who make intermediate stops at Bangkok. Table 5.2 identifies large intercontinental markets where there is competition with KLM.

Table 5.2 Routes Where KLM Faces Competition From Non-EU Airlines

		Hubs of non-EU's + competition with KLM	Large markets + competition with KLM	Large markets without competition on direct routes
North America				
IAD Washington	KL, UA	X		
ORD Chicago	KL, UA	X		
JFK New York	KL, DL			X
YYZ Toronto	KL, MP, TS		X	
EWR New York	CO, NW			X
LAX Los Angeles	KL, UA		X	
SFO San Francisco	KL			X
IAH Houston	KL,CO			X
BOS Boston	NW			X
MIA Miami	MP			X
YVR Vancouver	KL, MP, TS		X	
ATL Atlanta	KL, DL			X
MCO Orlando	MP			X
Asia /Pacific				
SIN Singapore	KL, SQ	X		
HKG Hong Kong	KL, CX	X		
NRT Tokyo	KL, JL	X		
TPE Taipei	KL, CI, BR	X		
BKK Bangkok	KL, CI, BR		X	
PEK Beijing	KL, CZ			X
KUL Kuala Lumpur	KL, MH			X
PVG Shanghai	KL			X
CGK Jakarta	KL			X
ICN Seoul	KL, KE			X
MNL Manila	KL			X

5.3.7 From this analysis, there are four other North American/Asian routes identified: Toronto (YYZ), Los Angeles (LAX), Vancouver (YVR), and Bangkok (BKK). Toronto was rejected in Table 5.1, as KLM did not compete with the hub carrier Air Canada, but is now included, as it is a large market with competition with other carriers. This results in four new selected routes on top of the six chosen earlier.

5.3.8 There are also routes, where KLM (or in some cases Martinair) has direct flights, with no competition on direct routes, but with possible competition on indirect routes, indicated by "X" in the most right column of the above table. To San Francisco, for example, KLM is the only operator with direct flights. It may therefore be seen as a monopolist, but there may be competition from indirect routes, such as the United Airlines connection via Washington, or the British Airways connection via London. There are a significant number of such routes with large markets. The two routes chosen with significant competition on indirect routes as well as large markets are New York and Shanghai.

5.3.9 To summarise the twelve cities chosen are:

North America

- New York (JFK+EWR)
- Washington (IAD)
- Chicago (ORD)
- Los Angeles (LAX)
- Toronto (YYZ)
- Vancouver (YVR)

Asia / Pacific

- Singapore (SIN)
- Bangkok (BKK)
- Tokyo Narita (NRT)
- Hong Kong (HKG)
- Taipei (TPE)
- Shanghai (PVG)

5.4 Impact of ETS on an Example Route

5.4.1 The possible impact of the inclusion of aviation in the ETS is illustrated for one example route, the route from Amsterdam to Los Angeles. The route is selected, as this particular example has connections of airlines from both continents, in a fairly comparable share. It is estimated that in 2006 in total 130 thousand passengers travelled between Amsterdam and Los Angeles (in both directions). There are therefore 65 thousand round trips between the two airports. A significant part travels on the direct routes, but a significant part also on the indirect routes via intermediate hubs, such as London, Detroit or Washington.

5.4.2 In this example it is assumed that an ETS-system is introduced, where the price per ton CO_2 is € 30 and all intra-European as well as all flights departing from and arriving in Europe are subject to this ETS-regime. As noted earlier, it is assumed that this cost is passed through to fares by all airlines.

5.4.3 For a direct flight from Amsterdam to Los Angeles of 11 flight hours, corresponding with 9.100 kilometres, this implies an exhaustion of 937 kilograms (or 0,937 tons) of CO_2, for which € 28.10 is charged under this regime. For a return flight, the total charge would be doubled, € 56.20. However, not all passengers travel on the direct route and in practice many take other routes via intermediate hubs. Other routes, with detours, have therefore different exhaustion levels and hence different ETS-charges. Table 5.3 below shows a selection of the available route alternatives, with their ETS-charges.

Table 5.3 ETS-Costs per Passenger on Selected Route Alternatives from Amsterdam to Los Angeles

	Leg 1	Leg 2	Total
Direct route (AMS-LAX)	28.10	n/a	28.10
Indirect routes:			
via London Heathrow	5.22	27.41	32.63
via Frankfurt	5.22	29.38	34.60
via Paris Ch.de Gaulle	5.26	28.62	33.88
via New York Newark	17.59	0.00	17.59
via Washington	18.67	0.00	18.67
via Atlanta	21.52	0.00	21.52
via Houston	24.89	0.00	24.89
via Chicago	20.00	0.00	20.00

5.4.4 The table shows that the ETS costs on routes via European hubs are slightly more expensive than via the direct route. Like the direct route, these indirect routeings are subject to the ETS throughout, but the additional ETS costs arise from the detour (extra distance, and additional landing/take-off cycle) that has to be made. The detour is the largest for the route via Frankfurt and hence the ETS-costs are highest by this route: € 34.60. This amount can be decomposed into the charge at the stretch Amsterdam-Frankfurt of € 5.22 plus the charge for the stretch Frankfurt-Los Angeles of € 29.38.

5.4.5 The routes via the east coast USA-hubs have the lowest ETS-cost, as a significant part of the kilometres flown are not subject to the ETS-system. The route via Newark for instance is only charged for the Amsterdam-Newark stretch (€ 17.59) and not for the Newark-Los Angeles stretch, as domestic flights in the USA are not subject to the ETS-system. This sets the East Coast hubs (operated by non-European airlines) in a more favourable position, an effect that has already been observed in the MVA/SEO-report of September 2006.

5.4.6 The issue here is the extent to hub locations confer on non-European airlines an advantage over European airlines. Airlines of both continents are represented in this market and it is estimated that the total ETS-costs for all passengers in this market are € 1.730 thousand for European airlines and € 1.935 thousand for non-European airlines, almost € 3.7 million in total. To assess this, a scenario whereby ETS-costs are passed on fully to passengers by all airlines was investigated.

5.4.7 The modelled impacts are summarised in the table 5.4 below. The table makes a distinction into European and non-European airlines, in comparison with the base case where no ETS-costs are applicable.

Table 5.4 Impact of ETS-Costs on the Route Amsterdam and Los Angeles

	All Airlines		European Airlines		Non European Airlines	
	No ETS	ETS	No ETS	ETS	No ETS	ETS
ETS Costs Total (*000 €)		3.665		1.730		1.935
ETS Costs charged to pass.		3.665		1.730		1.935
-- actually paid by passengers		3.446		1.612		1.834
-- mitigated by passengers		219		118		100
ETS Costs not charged						
Passengers	130.324	123.227	59.044	55.161	71.280	68.066
% change from “no ETS”		-5.4		-6.6		-4.5
Airline Revenues (*000 €)	61.009	58.171	27.729	26.181	33.281	31.990
Change from “no ETS”		-2.838		-1.547		-1.291
% change from “no ETS”		-4.7		-5.6		-3.9
ETS Collected from passengers		3.446		1.612		1.834
ETS Costs (paid to system)		3.665		1.730		1.935
Net Airline Revenues (*000 €)	61.009	57.953	27.729	26.063	33.281	31.889
Change from “no ETS”		-3.057		-1.666		-1.391
% change from “no ETS”		-5.0		-6.0		-4.2

5.4.8 Total costs for European airlines are € 1.730 thousand, of which all costs are charged to passengers. However, the actual amount that is actually paid by passengers is about 7% less, € 1.612 thousand. The reason is that passengers try to mitigate the ETS-costs, by either not travelling (overall demand reduction) or seeking alternative routes where the ETS-costs are lower. Table 5.3 has shown that there is some scope for this by – for instance – travelling via Newark instead of taking the direct route. In total, it is expected that passengers travelling with European airlines mitigate € 118 thousand of their ETS-costs. Similar effects are seen with the non-European airlines: € 100 thousand of the ETS-costs are mitigated, or about 5% of the ETS costs incurred.

5.4.9 The implication for the airlines is twofold. Firstly, there is demand reduction, 6.6 % for the European and 4.5 % for the non-European airlines. Non-European airlines can slightly increase their market share, as they operate the east-coast hubs, which become relatively more attractive in this scenario. This demand reduction leads to an estimated revenue loss for European airlines of € 1.547 thousand (5.6% of estimated no-ETS revenues). The revenue loss of the non-European airlines is less, € 1.291 thousand (3.9%% of estimated no-ETS revenues).

5.4.10 The other effect is that airlines have to pay the full ETS-costs to the trading system (€ 1.730 and € 1.931 thousand respectively), while they collect slightly less of these costs from passengers, as some of these passengers are able to mitigate a part of these costs: € 118 and € 100 thousand respectively). This increases the revenue loss little more, adding up to the total of € 1.666 and € 1.391 thousand respectively.

5.5 Impact of ETS on All Selected Routes

5.5.1 In the previous section, the effects of ETS have been analysed in detail for one particular example route: from Amsterdam to Los Angeles. Earlier in this report, eleven other intercontinental routes from Amsterdam have been identified, for which a similar analysis has been made. A summary of the results for these – in total – twelve routes is provided in the table below.

Table 5.5 Impact of ETS-Costs on Traffic between Amsterdam and 12 Cities

	All carriers	EU carriers			Non-EU carriers		
AMS Amsterdam to/from	All routes	All routes	Direct routes	Transfer routes	All routes	Direct routes	Transfer routes
North America	**-4.7%**	**-5.0%**	**-4.3%**	**-10.5%**	**-4.4%**	**-4.2%**	**-5.8%**
JFK+EWR New York	-4.4%	-4.6%	-3.8%	-11.7%	-4.3%	-3.6%	-10.4%
IAD Washington	-3.4%	-3.5%	-2.5%	-7.8%	-3.2%	-2.5%	-5.2%
ORD Chicago	-2.8%	-3.2%	-1.9%	-7.9%	-2.5%	-1.9%	-3.5%
LAX Los Angeles	-5.4%	-6.6%	-5.5%	-11.8%	-4.5%	-5.5%	-1.0%
YYZ Toronto	-5.7%	-5.5%	-5.2%	-11.7%	-6.0%	-5.5%	-9.2%
YVR Vancouver	-6.8%	-6.7%	-6.5%	-14.4%	-6.9%	-6.7%	-10.5%
Asia /Pacific	**-5.1%**	**-5.0%**	**-3.8%**	**-8.4%**	**-5.2%**	**-3.9%**	**-10.0%**
SIN Singapore	-4.8%	-4.9%	-3.3%	-10.4%	-4.8%	-3.3%	-9.0%
BKK Bangkok	-6.9%	-7.4%	-4.3%	-11.4%	-6.5%	-4.3%	-11.2%
NRT Tokyo Narita	-3.9%	-4.0%	-3.1%	-6.4%	-3.7%	-3.1%	-8.7%
HKG Hong Kong	-4.2%	-4.0%	-3.7%	-4.9%	-4.5%	-3.7%	-8.8%
TPE Taipei	-4.4%	-4.4%	-4.5%	-0.5%	-4.5%	-4.5%	-3.5%
PVG Shanghai	-3.7%	-3.7%	-3.9%	-2.8%	-4.5%	-	-4.5%

5.5.2 The table clearly shows that traffic between Amsterdam and all 12 cities has been reduced, as expected, given that fares on all routes are assumed to be higher to some extent. It is also apparent that both direct (no transfer) and indirect (involving intermediate transfer) routeings are forecast to experience a reduction in traffic.

5.5.3 However, the impacts on transfer traffic are generally more variable than on direct traffic. It may be noted that the reduction in direct traffic is almost the same for EU and non-EU airlines on each city-pair, reflecting that the ETS costs for direct operations are effectively the same irrespective of carrier.

5.5.4 This is evidently not the case for transfer traffic, however. The cities demonstrate different paradigms of substitution of transfer routeings for direct routeings and *vice versa*. Thus, as previously shown, for Los Angeles there is a diversion from transfers at EU hubs to transfers at non-EU hubs. This implies that non-EU carriers gain at the expense of EU carriers. Such

is the potential benefit, moreover, of transferring at the East Coast hubs, there appears to be some switching from direct to (non-EU) transfer routeings.

5.5.5 More typically, the reduction in transfer traffic for both EU and non-EU carriers is greater (in proportional terms) than of direct traffic. This implies that the low-fare advantages of indirect routeings may to some extent be overturned when the ETS costs associated with indirect routeings are passed through to fares, dependent on the size of detour required by the indirect routeings. To the Far East, for example, the detours required to route through non-EU carriers' (Asian) hubs are likely to be longer than those via EU carriers' hubs.

5.5.6 The overall estimated reductions in passenger numbers between Amsterdam the North American and Asia/Pacific cities are summarised in the table below for the assumption that an ETS allowance price of €30/tonne of CO_2 is passed on fully as fare increases:

Cities	All carriers	EU carriers			Non-EU carriers		
	Total	Total	Direct	Transfer	Total	Direct	Transfer
Nth America	-4.7%	-5.0%	-4.3%	-10.5%	-4.4%	-4.2%	-5.8%
Asia/Pacific	-5.1%	-5.0%	-3.8%	-8.4%	-5.2%	-3.9%	-10.0%

5.5.7 However, the European Commission's proposal for extending the ETS to the aviation sector includes a substantial initial free allocation of allowances to the sector. It has been estimated that, as a result, the actual outlay by carriers on allowances would be about 10% of the face value of the allowances they consume. If it is next assumed that only 10% of the face value is passed through to fares, the effects on passenger numbers are much reduced, as the next table shows:

Cities	All carriers	EU carriers			Non-EU carriers		
	Total	Total	Direct	Transfer	Total	Direct	Transfer
Nth America	-0.4%	-0.5%	-0.4%	-1.0%	-0.4%	-0.4%	-0.4%
Asia/Pacific	-0.5%	-0.5%	-0.4%	-0.9%	-0.5%	-0.4%	-1.1%

5.5.8 While the impacts on passenger numbers are much smaller, the pattern of changes is similar. The implication is that the ETS will lead to competitive disadvantage for EU carriers in some markets, though this will not be universal.

6 Potential for Cross-subsidisation Resulting from Inclusion of Aviation in ETS

6.1 Introduction

6.1.1 When aviation is included in the EU ETS, different airlines will be affected in different ways. One of the reasons for these differences is the geographical scope of the ETS. Since its geographical scope is limited, airlines will have a varying share of flights under the ETS.

6.1.2 In view of the varying share of flights under the ETS, some have argued that airlines with a low share of flights under the ETS would have the possibility to spread the costs associated with ETS over all their flights. They would then be able to undercut fares of airlines with a majority of flights under the scheme and gain market share.

6.1.3 This chapter examines the possibilities for non-EU carriers to cross-subsidise operations under the EU ETS from their other operations. The term 'cross-subsidisation' is defined in section 6.2. Section 6.3 analyses the possibilities to cross-subsidise, starting from a simplified model. Section 6.4 examines the assumptions used in this model. Section 6.5 considers some special cases that appear to deviate from the conclusions drawn from the simplified model, and Section 6.6 looks at cross-subsidisation in the context of strategic pricing. Section 6.7 concludes.

6.2 Definition of Cross-Subsidisation for This Study

6.2.1 It is possible and even likely that, in the aviation sector, carriers currently cross-subsidise between markets and market segments, e.g. between economy and premium passengers, between passengers and freight, and perhaps even between routes. In general, so-called yield management systems that airlines use are designed to allocate costs to the least price sensitive markets or market segments. This chapter is not about cross-subsidisation in general.

6.2.2 This chapter focuses on cross-subsidisation that is caused by the inclusion of aviation in the EU ETS. This is called ***additional*** cross-subsidisation throughout this report.

6.2.3 Consequently, additional cross-subsidisation is defined as allocating the costs of ETS to flights outside the scope of ETS.

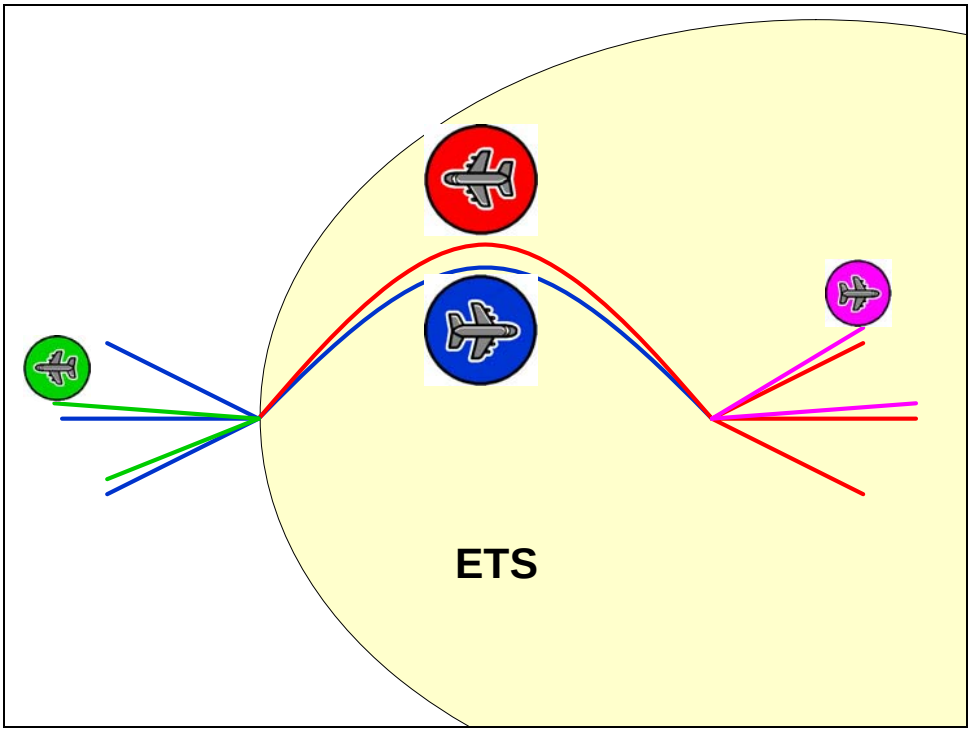
6.3 Basic Analysis of Possibilities to Cross-Subsidise

6.3.1 For the sake of the clarity of the analysis, this section first considers a simplified aviation model. In a second step, the findings will be generalised.

6.3.2 The simplified model is a system in which four airlines compete. Two airlines are based in the EU; one has intra-EU flights only; the network of the other airline extends to airports outside the EU. Two airlines are based outside the EU; again, one has flights outside the scope of the EU ETS only, while the other also has flights to EU airports. Figure @@ shows this schematically.

6.3.3 In Figure 6.1, two airlines with a varying share of operations under the EU ETS are in direct competition with each other. RedAir has all its operations under the EU ETS, whereas BlueAir has a significant amount of operations outside the geographical scope of the scheme. Consequently, BlueAir would have the opportunity to allocate costs it incurs on routes under ETS to routes outside the ETS. But would that be in the interest of BlueAir.

Figure 6.1 Schematic Representation of a Competitive Market Situation



6.3.4 What would happen if BlueAir were to cross-subsidise? First of all, its fares on its routes where it competes directly with RedAir would become more attractive. As a consequence, BlueAir would gain market share. Second, on its routes outside the scope of ETS, BlueAir would raise its fares. On some of these routes, BlueAir competes with GreenAir. Here, it would loose market share to GreenAir. On routes where BlueAir has a monopoly, increased fares would result in lower demand and thus lower revenue and profits.

6.3.5 Assuming that BlueAir has pursued profit maximisation before the introduction of the EU ETS, all its fares in its non-ETS market would be set to maximise overall profits. If it increases those fares, it would necessarily reduce profits. Therefore, by allocating the ETS costs to non-ETS routes, BlueAir cannot recoup these costs.

6.3.6 So as a result of cross-subsidisation, BlueAir's profits would be reduced instead of increased. Cross-subsidisation is not an attractive option for BlueAir. In fact, the analysis shows that cross-subsidisation is even less attractive than absorbing the ETS costs in the profits of an airline, e.g. not allocating them to routes outside the scope of the EU ETS.

6.3.7 This result is central to this chapter's analysis: to have an opportunity to cross-subsidise there must be a pool of capital from which the subsidy is drawn. If firms are profit maximizing, no pool will exist because airlines will be profit maximizing in each market. In

the large majority of situations, to try to raise money in one market to reduce prices in another will result in a decrease of profits and thus be unattractive.

6.3.8 Of course, the model above is a simplification of the aviation market. It assumes that flights are the same as markets and it assumes that profit maximisation is done at the flight (or market) level, not for the entire network. Below, the implications of both simplifications are discussed.

6.3.9 In aviation, markets are generally considered to be city or airport pairs. The logic underlying this market definition it that there is a demand for people currently in A to go to B, and most of these people would not consider going to C instead, and neither could they start their journey from D. Many city pairs are connected by direct and by indirect routes, i.e. routes involving no transfers between flights or one or more transfers. In most cases, direct flights are more fuel efficient and the inclusion of aviation in the EU ETS will therefore be an incentive for passengers to take direct flights. This does not change the competitive position of EU carriers versus non-EU carriers so far as direct flights are concerned, but – as chapter 5 demonstrated – the competitive environment can be affected by the location of airlines' hub airports.

6.3.10 Network carriers appear to maximise profits on a network basis, rather than for individual routes. EU-based network carriers are more likely to fly to intercontinental destinations and therefore to be competing with non-EU carriers. So it is important to consider whether the potential for ETS-induced additional cross-subsidisation on a network basis is different from a route-by-route basis. The question can be re-phrased as to whether, if the ETS-exposed routes of a non-EU carrier were regarded as one sub-network and the carrier's non-ETS routes as another sub-network, there would be a greater likelihood of the carrier cross-subsidisng between the sub-networks.

6.3.11 There is no obvious reason why the conclusions should be different. It remains the case that it is unlikely that the inclusion of aviation in the EU ETS will open up possibilities in the non-ETS market where additional profits can be made that can be used to cover the ETS costs.

6.4 Assumptions Underlying the Analysis of Cross-Subsidisation

6.4.1 In the above analysis, a number of assumptions have been made, most of them implicitly. The most important assumption is that airlines operate as profit-maximising companies. Most of the major airlines are listed on the stock market and can therefore be regarded as profit-maximisers. Relaxing this assumption, or assuming instead that airlines would maximise size, for example, or would be a prestige instrument for a country, would potentially lead to a different conclusion.

6.4.2 If airlines would not maximise profits, current prices would not result in maximum profits. Then airlines could then respond to the introduction of aviation in the EU ETS by changing fares on routes outside the scope of ETS to increase profits and cross-subsidise routes under ETS. This would not be ***additional*** cross-subsidisation in the sense that the ETS had created new opportunities for cross-subsidisation. The increase in profits on routes outside the EU could have been achieved by changing fares on those routes, irresepctive of the ETS. However, the ETS may be perceived as a shock to the market which these airlines may want

to exploit strategically. It is therefore questionable whether this type of cross-subsidisation is caused by ETS.

6.4.3 A second assumption is that airlines pass on expenditures. For most airlines, the inclusion of aviation in the EU ETS will result in the need to buy emission allowances. Airlines will not absorb these expenditures in their profits, but will pass them on to their customers, at least partly. If airlines would not pass on any expenditures, there would be no scope for additional cross-subsidisation. The available evidence on pass-through of kerosene costs suggests that they are passed through fully with a time-lag of one year (PWC 2005).[6] The experts consulted agreed that airlines would pass on expenditures.

6.4.4 It should be emphasised that the analysis does not assume that there is perfect competition on all markets. In the analysis, the non-zero price elasticity of demand is core, and profit maximisation is assumed. Both under perfect competition and under oligopolies and monopolies these assumptions result in prices that cannot be altered to increase profits.

6.4.5 Likewise, it has not been necessary to assume that ticket prices reflect either average or marginal costs on routes. This assumption would imply that there would be no cross-subsidisation, since all prices would be cost related. It is acknowledged that cross-subsidisation may exist. Airlines may use strategic pricing to attract more passengers and improve their network, either in frequency or in number of destinations. But still, even when airlines do so, raising prices in some parts of the network would not result in higher profits, since it would mean losing market share.

6.5 Special Cases

6.5.1 There are situations that deviate enough from the base case as analysed in section 6.3 to warrant a separate discussion. The first is non-EU airlines with operations under ETS and also operations outside the scope of the EU ETS where they exclusively compete with each other. The second is heavily regulated markets.

6.5.2 With regard to the first situation, on some markets outside the scope of the EU ETS, only airlines compete that also have operations in the EU ETS. Analysis of the OAG shows that these markets constitute a substantial share of world aviation. Measured in seat-km, these markets account for between 50% and 60% of the operations on routes outside the EU for each of the three major airline alliances.

6.5.3 In this case, carriers may not be so restrained by competitive pressures to cross-subsidise. It could be in their ***collective*** interest to allocate ETS costs to these non-ETS markets. However, it is hard to imagine that it would be in an ***individual*** airline's interest to do so, since the airline it competes with on the non-ETS market would simply not have to raise its fares to gain market share and greater profitability. The first airline would then not raise more revenue or profits and thus not create funds to cross-subsidise with.

6.5.4 Thus this situation would not lead to cross-subsidisation without common action on the part of all the carriers. Short of outright collusion, sustained common action is unlikely as a stable scenario. In any case, as markets become increasingly liberalised, there would be a

[6] PWC (2005) Aviation Emissions and Policy Instruments, S.I. : PWC (Price Waterhouse Coopers), 2005

clear risk of new entrants who based their prices on the true costs of operating these routes, rather than on the inclusion of costs transferred from ETS-exposed routes. The contestability posed by the risk of new entrants would always impose strong downward pressure on fares.

6.5.5 Turning to the second situation, though market liberalisation is taking place, some markets remain tightly regulated. In some markets, capacity is controlled. In other markets, prices are regulated or both capacity and prices. If capacity is tightly regulated but prices are not, airlines operating on these markets may make higher-than-normal profits. To the extent these markets continue to be regulated there is potential to use the supranormal profits to gain in more competitive markets, and one of these markets could be a market where the airline competes with EU carriers. Presumably protected carriers will invest these excess profits until the marginal value of the additional profits equals the opportunity cost of the invested funds.

6.6 Cross-Subsidisation as Strategic Pricing

6.6.1 The discussion above shows clearly that micro-economic analysis reveals very limited scope for additional cross-subsidisation, if any. However, because ETS would affect EU and non-EU carriers differently, it could create an additional possibility for strategic pricing. This section analyses the rationale for strategic pricing and possible differential impacts on EU and non-EU carriers.

6.6.2 Strategic pricing (also called predatory pricing) is defined here as temporarily charging prices to customers that are lower than equilibrium prices in order to achieve a strategic goal, such as driving a competitor out of business, or reducing a new entrant's expectation of future profits (Milgrom, 1988, OECD, 1989).[7] Strategic prices are lower than marginal costs under perfect competition and lower than marginal revenue under imperfect competition.

6.6.3 Strategic pricing is not sustainable and therefore has to be temporary. It will end once the strategic goal has been reached or when the company runs out of resources needed to sustain strategic pricing.

6.6.4 Most of the research in predatory pricing is concerned with the behaviour of monopolists towards new entrants. In these cases, it has been shown that although neoclassical micro-economic theory renders predatory pricing irrational, allowing for incomplete information and gaming may make predatory behaviour rational in some cases.

6.6.5 Strategic goals that could be aimed for by strategic pricing include:

- forcing an airline out of the market
- forcing an airline to give up a specific route
- preventing an airline from raising flight frequency or capacity or entering the market
- forcing an airline to give up a specific slot

[7] Milgrom, Paul, 1988: 'Predatory Pricing', The New Palgrave: A Dictionary of Economic Theory and Doctrine, J. Eatwell, M. Milgate, and P. Newman (eds.), London: MacMillan Press Ltd., 1988; OECD, 1989: Predatory Pricing, Paris.

6.6.6 In aviation barriers of entry seem to be low and this limits the scope for strategic pricing. Aircraft are easily leased, tickets are easily sold, and consumer loyalty seems to be limited. So even if an airline would be able to force a competitor out of a certain market, and even if it would be able to force its competitor to sell some of its fleet and discontinue some routes, the competitor could rapidly bounce back and resume operations as soon as the airline would raise its prices to a higher level.[8] (Remember that this was the ultimate goal of the strategic pricing).

6.6.7 Furthermore, in the traditional case of strategic pricing, where a monopolist prevents a new entrant from entering the market, the objective is reached by lowering the new entrants expectations of future revenue or signalling that the monopolist has low costs. In a standardised industry as aviation is, it would be very hard, if not impossible, to leave a new entrant in doubt about the marginal costs of operating a flight. Therefore, a new entrant would also be able to make a worst case estimate of future revenue, e.g. if future prices would become equal to marginal costs.

6.6.8 The only commodity that may be in short supply and that may be hard to evaluate financially is airport slots. It has to be recognised that slots are not destination or aircraft specific. So even if airlines decide to discontinue certain routes for which they currently use some specific slots, nothing precludes using these slots to take-off for other destinations (though there may be restrictions on aircraft types or regions served imposed by gate and terminal considerations). In the EU, EU airlines could easily open up new routes that would perhaps be less profitable but would enable them to hold on to their slots. At non-EU airports, this would depend on the rights that an EU airline would have to pick up passengers and transport them to a third country. In most cases, these rights will be either non-existent or limited. In that case, sustained strategic pricing could lead to the loss of a route. In all other cases, the strategic objectives seem unlikely to be met.

6.6.9 In sum, there seems to be very little, if any, scope for temporarily undercutting fares of competitors (strategic or 'predatory' pricing) in aviation, as it would bring no economic benefits even in the longer term to airlines engaging in such practices.

6.7 Conclusion

6.7.1 If non-EU carriers in general can be considered as profit maximising companies – and there is no reason to assume that listed airlines are not seeking to maximise profits – they would have no immediate incentive to engage in cross-subsidising their routes to/from the EU. Though companies that have no objective to maximise profits may behave otherwise, neither CE Delft and MVA, nor the experts consulted, could identify major airlines that would not have the objective of maximising profits. Likewise, there seems to be very little, if any, scope for temporarily undercutting fares of competitors (strategic of 'predatory' pricing) in aviation, as it would bring no economic benefits even in the longer term to airlines engaging in such practices.

[8] In this analysis it is assumed that consumer loyalty is limited. If consumer loyalty would be large and one airline would be forced out of a market and loyalty would shift to other airlines, the barrier of re-entry could potentially be large.

6.7.2 Thus, if non-EU carriers are already generally seeking to maximise profits, in the large majority of situations, there would be no advantage to them from cross-subsidising their ETS-exposed routes to/from the EU by transferring costs to routes completely outside the EU.

7 Long-Term Impacts on Competitive Position of EU and Non-EU Carriers

7.1.1 It was shown earlier that there are grounds for believing that EU carriers may be disadvantaged in some markets relative to non-EU carriers, even without cross-subsidisation of ETS costs by non-EU carriers.

7.1.2 If this is the case at the outset of the ETS being applied to civil aviation, there is the possibility that it may be aggravated through time, for a number of reasons. First, almost all operations of EU carriers will be subject to the ETS (intra-European as well as from/to the EU), while a generally much smaller proportion of non-EU carriers' operations will be within the scope of the ETS. This implies that opportunities for re-deploying aircraft with different fuel efficiencies will be less for EU carriers. (Non-EU carriers could re-deploy their less efficient aircraft to routes not affected by the ETS.)

7.1.3 The significance of this point will strongly depend upon the price of allowances. At the price of €30/tonne of CO2 assumed earlier, this would be the equivalent of adding less than 2% to the (current) cost of aviation fuel.

7.1.4 If competition with non-EU carriers were to be adversely affected, the potential reduction in the profitability of EU carriers may mean that they have fewer funds to invest, and the cost of raising capital may also increase. That said, the business case for investing in fuel-efficient, cheaper-to-operate, more environmentally-benign aircraft would become stronger, since effectively all their operations would be subject to the ETS.

8 Conclusions

8.1 Introduction

8.1.1 The European Commission has issued a proposal to include aviation in the EU ETS. Although this proposal is in line with the non-discrimination principle that is one of the basic rules of international aviation – carriers of different nationality will have the same rights and obligations – it may impact EU airlines in a different way that non-EU airlines. The reason is the limited geographical scope of the system. EU airlines will have a far larger proportion of operations under the scheme than non-EU carriers.

8.1.2 This report assesses the impact of the EU ETS on the competitive position of EU and non EU carriers. It focuses on a number of aspects:

- The impact on total demand for aviation, demand for direct flights and for transfer flights.
- Specifically on the impact on Schiphol and KLM
- The impact of the benchmarked initial allocation
- The differential impact due to hub location
- The potential for cross-subsidisation
- Possible long-term impacts

8.1.3 The findings on each aspect will be summarised below.

8.2 Impact on Demand

8.2.1 As costs of ETS will be passed through in fares, demand for aviation is reduced. This effect is larger for indirect flights via EU hubs than for direct flights, and is smaller for indirect flights via non-EU hubs.

8.2.2 Of the major EU hubs, transfer traffic at London Heathrow seems to be affected most substantially, a function of its geographical location on the edge of Europe and its wider catchment area across Europe.

8.2.3 KLM, like the other major European network airlines, is impacted more strongly in transfer than in originating markets. Overall, KLM's loss of traffic is proportionately not so severe as for the other carriers.

8.3 Impact of the Benchmarked Initial Allocation

8.3.1 Since the ETS cost of a flight (that is, the number of emission allowances that must be sacrificed to operate the flight) will be proportional to fuel consumption, carriers that operate more fuel-efficient aircraft on a route will have their efficiency-related competitive position strengthened by the ETS. However, there is no significant discrepancy in fuel efficiency between the aircraft-types operated by EU carriers and non-EU carriers on routes from/to the EU.

8.4 Differential Impact due to Hub Location

8.4.1 The importance of hub location is this. For passengers who transfer at EU hubs, both the flights that they use will be subject to the ETS. In contrast, only one of the flights used by passengers who transfer at non-EU hubs will be subject to the ETS.

8.4.2 Since transfers at EU hubs are overwhelmingly with EU carriers, and those at non-EU hubs are almost entirely with non-EU carriers, it can be seen that the hub location can benefit non-EU carriers. Expert opinion is of the view that EU carriers will be unlikely to re-locate hub activities to non-EU airports.

8.4.3 There is a differential impact due to hub location, but it depends on the location of the non EU hub. When that hub is relatively close to the EU, such as the hubs on the East Coast of the US, non-EU carriers gain transfer traffic at the expense of EU carriers. In contrast, when the hubs are far from the EU, such as the major hubs in the Far East, there is either no differential impact or even a slight advantage to EU carriers.

8.5 Potential for Cross-Subsidisation

8.5.1 If non-EU carriers in general can be considered as profit maximising companies – and there is no reason to assume that listed airlines are not seeking to maximise profits – they would have no immediate incentive to engage in cross-subsidising their routes to/from the EU. Though companies that have no objective to maximise profits may behave otherwise, neither CE Delft and MVA, nor the experts consulted, could identify major airlines that would not have the objective of maximising profits. Likewise, there seems to be very little, if any, scope for temporarily undercutting fares of competitors (strategic of 'predatory' pricing) in aviation, as it would bring no economic benefits even in the longer term to airlines engaging in such practices.

8.5.2 Thus, if non-EU carriers are already generally seeking to maximise profits, in the large majority of situations, there would be no advantage to them from cross-subsidising their ETS-exposed routes to/from the EU by transferring costs to routes completely outside the EU.

8.6 Possible Long Term Impacts

8.6.1 Since there are grounds for believing that EU carriers may be disadvantaged in some markets relative to non-EU carriers, there is the possibility that it may be aggravated through time. Because almost all operations of EU carriers, but only a much smaller proportion of non-EU carriers' operations, will be subject to the ETS, the opportunities for re-deploying aircraft with different fuel efficiencies will be less for EU carriers, though the significance of this point depends upon the impact of allowance prices on the *de facto* cost of aviation fuel. (At €30/tonne of CO_2, less than 2% would be added to the (current) cost of fuel.)

8.6.2 The potential reduction in the profitability of EU carriers may mean that they have fewer funds to invest, and the cost of raising capital may also increase. On the other hand, the business case for investing in fuel-efficient, cheaper-to-operate, more environmentally-

benign aircraft would become stronger, since effectively all the operations of EU carriers would be subject to the ETS.

8.7 Overview of Conclusions

8.7.1 Any effects on the competitive positions of airlines are expected to be small, unless the price of allowances increases very substantially above current levels.

8.7.2 For most carriers in most markets, cross-subsidisation would not result in higher profits and would therefore not be in the interest of the carriers. However, it is not possible to rule out completely that some non-EU carriers could engage in cross-subsidisation of their routes to/from the EU, if they also operate in markets where they can earn supra-normal profits. It has been shown that these opportunities are limited and, since this would be strongly dependent upon strategic behavioural choices by individual carriers, it is not possible to establish whether this situation would be aggravated by the inclusion of aviation in the EU ETS.

8.7.3 However, it can be said that EU carriers could be competitively disadvantaged in some markets, as a consequence of the location of non-EU carriers' hub airports. For some non-EU carriers, their hub locations provide opportunities for passengers to substitute transfers at these hubs for transfers at EU hubs, or even direct flights, so that the impact of ETS costs on their fares is reduced.

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