

## Aviation and carbon markets



The proposed introduction of ICAO’s “single global mechanism” for carbon abatement (CORSIA) raises questions about the future of the EU’s own cap and trade scheme (EU-ETS) for aviation. Moreover, the design of the two schemes is an interesting case study of how alternative economic instruments can create different incentives for companies and markets to pursue abatement.

Compared to power, heating and road transport, aviation accounts for a relatively small proportion of total greenhouse gas emissions. But given the clear and stable link between the growth in the demand for aviation and general economic growth, aviation emissions are growing fast, which is a concern given the pressing need to act to reduce climate-changing emissions.

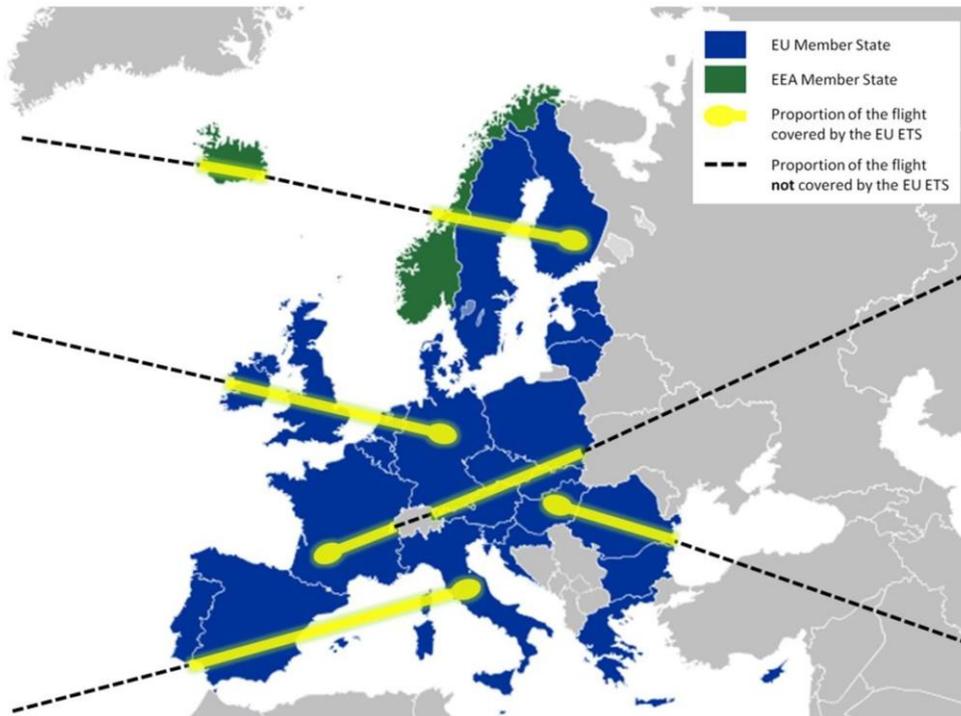
**3.4%**

**Aviation’s contribution to total EU28 GHG Emissions.**

**4.7%**

**Expected compound annual growth in air traffic to mid 2030s**

To address this issue, in 2005 the EU proposed including aviation in the EU Emissions Trading Scheme (EU-ETS). Under its original proposals all flights within the EEA and into and out of this area would be covered by EU-ETS. However, the EU met substantial international opposition to applying EU-ETS to extra-EEA flights. So when the scheme was finally introduced in 2012 it was limited to intra-EEA movements.

**Figure 1: Coverage of aviation in EU ETS**

Source: European Union

Note: [http://europa.eu/rapid/press-release\\_MEMO-13-905\\_en.htm](http://europa.eu/rapid/press-release_MEMO-13-905_en.htm)

In exchange for the exclusion of extra-EU flights from EU-ETS, the International Civil Aviation Organization (ICAO) made a commitment at its annual assembly in 2013 to introduce a “single global market-based measure (MBM)”. At its 2016 assembly the UN aviation agency agreed that its scheme, the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), would come into effect from 2021.

The co-existence of CORSIA and EU-ETS represents a specific challenge in the application of climate change policy. Where the UK sits in all of this with regard to Brexit is another little local wrinkle<sup>1</sup>. More specifically, however, the different design of the two schemes shows how alternative economic instruments intended to address climate change can embody very contrasting incentives to achieve emissions abatement and can have very different financial impacts on the players involved.

<sup>1</sup> In fact the UK has historically been a lead actor in pushing for stricter controls.

## Comparing EU-ETS and CORSIA

In comparing EU-ETS and CORSIA it is important to start by noting that EU-ETS is an established, functioning scheme with known rules and procedures and (some) certainty over how it is intended to evolve in the future. CORSIA, by contrast, is still under development, so the exact rules that will apply are essentially more uncertain and still subject to international agreement.

### EU-ETS

EU ETS for aviation is a mandatory cap and trade mechanism that applies to intra-EEA flights. The cap and trade system means that all participants in the sectors covered by EU-ETS (power and heat generation; energy-intensive industry sectors such as oil refineries, steel works and the production of iron, aluminium and metals; and civil aviation from 2012) are legally required to acquire and surrender at the end of each year tradeable allowances (or permits) equivalent to their total CO<sub>2</sub> emissions in the relevant year.

45%

**Percentage of greenhouse gas emissions in the EEA currently covered by EU-ETS**

Total emissions from these sectors are “capped” in the sense that the total volume of permits available in any one year is fixed. When aviation was included in EU-ETS in 2012, in what is known as Phase 3 of the scheme, the total volume of permits was increased by an amount equivalent to 95% of aggregate annual aviation emissions in the period 2004-06<sup>2</sup>. From 2021 the volume of aviation permits is scheduled to be reduced by a further 2.2% p.a., which means that by 2035 the total will fall by 33% from 2021 levels.

During Phase 3, 82% of aviation allowances are being allocated free of charge to airlines and 15% are being auctioned. The remaining 3% are held back for subsequent attribution to “new market entrants” and “fast-growing” operators.

Given the time lag between this limit being fixed and its introduction in 2012, the growth in air travel meant the volume of new allowances created was significantly less than total aviation emissions. Carriers can make up the difference by abating their output of carbon or by acquiring additional permits in the open market. The economic logic of this scheme is that the incentive to abate, within the cap, is optimised. That is because those participants best placed to actively reduce CO<sub>2</sub> emissions will do so, selling permits to other participants for whom abatement is more costly. Airlines are not restricted to using allowances created for aviation. They are also allowed to acquire general ETS allowances (EUAs) to cover their emissions<sup>3</sup>.

In the case of aviation, abatement opportunities arise from flying fewer kilometres (i.e. reducing output), by changing to alternative fuels with lower or zero net carbon content, or by reducing fuel consumption per km flown. This latter trend is accelerating, with the introduction of much more fuel efficient aircraft such as the 787 Dreamliner, A320neo, 737 MAX and 777X.

<sup>2</sup> Adjusted for the reduction in scope when extra-EEA flights were excluded from the scheme.

<sup>3</sup> Airlines are also permitted to account for up to 1.5% of their emissions through internationally approved “offset” schemes, although from 2020 the use of these offsets will not be permitted.

Nevertheless, the acquisition of new aircraft has a limited short-run impact on emissions, given growth in distances flown and the existing stock of aircraft. Hence, since becoming part of EU-ETS, aviation has become a significant net buyer of allowances. Over the period 2013-2015, it is estimated that the sector emitted a cumulative 165m tonnes of CO<sub>2</sub> and that aircraft operators had to purchase 42.7m EUAs at an annual cost of €150m to €180m.

## CORSIA

In contrast to EU-ETS, CORSIA, which is intended to be introduced from 2021, is initially (in its first phase to 2027) a voluntary scheme covering 66 countries and 80% of international aviation emissions.

EU-ETS is a cap and trade system, which means that even if gross emissions from aviation rise there is no net increase in CO<sub>2</sub> emissions across the scheme as a whole. But CORSIA is an “offset” scheme, which means carriers must buy offsets from internationally accredited programmes. While a small proportion of emissions under EU-ETS can be accounted for by international credits, the EU has already agreed to stop this practice from 2020. This is because under the Paris Agreement the EU has made a commitment to internalise all abatement within its borders to avoid any possibility of double counting of emission reductions. By contrast, CORSIA’s international character means there is no mechanism to internalise abatement in this way<sup>4</sup>.

Furthermore, while EU-ETS applies to all emissions within the relevant geographic area, CORSIA applies only to growth in emissions over the 2021 baseline. Furthermore, it applies only to international flights. Domestic routes are specifically excluded. While domestic flights are a relatively small proportion of the intra-EEA total, they account for a much bigger share in countries with large surface areas such as the US, India and China. While these flights are excluded from CORSIA, the emissions they produce are still covered by the Paris climate agreement.

Finally, while under EU-ETS airlines are required to surrender allowances equivalent to their own relevant CO<sub>2</sub> emissions, in phase 1 of CORSIA they will have to acquire offsets based on their share of total industry growth in emissions. But the share is computed according to the individual airline’s proportion of total emissions, not its contribution to the growth in those emissions.

This is an important distinction, because these rules blur the incentive properties of CORSIA, as I discuss below. There is an aspiration within CORSIA to move towards better reflecting individual airline contributions to emissions growth, but it is unclear when 100% individual accountability is likely to be achieved; certainly not before 2035.

## Incentive properties of the two schemes

The two schemes represent an interesting case study in how different abatement incentives can affect participants in a particular market. It also casts light on how the impact of such schemes is often evaluated.

From the economist’s point of view, what is most interesting for evaluating the incentive properties of the schemes is to think about their impact on the marginal costs of airlines and how this feeds through into airfares. By exploring these two metrics we can see how the incentives to change behaviour on the part of producers (airlines) and consumers (passengers) translate into potential abatement behaviour.

As for marginal costs, it is important to consider how the decisions an airline makes and the actions it takes affect its cost obligations. As regards the impact on fares, we expect that changes in ticket prices will reflect shifts in marginal costs to some degree. But the extent to which this happens depends on the competitive conditions in a given market.

A common mistake is to equate the cost to airlines with the amount they spend on EUAs, and to assume that the impact on fares is this sum, spread across the existing cost of air services. In the case of EU-ETS, with about 85% of all aviation allowances being allocated free of charge, it is sometimes thought (and computed) that the impact on fares is very small (we have seen estimates of less than €1 on an intra-EU short-haul flight and less than €10 on a transatlantic one).

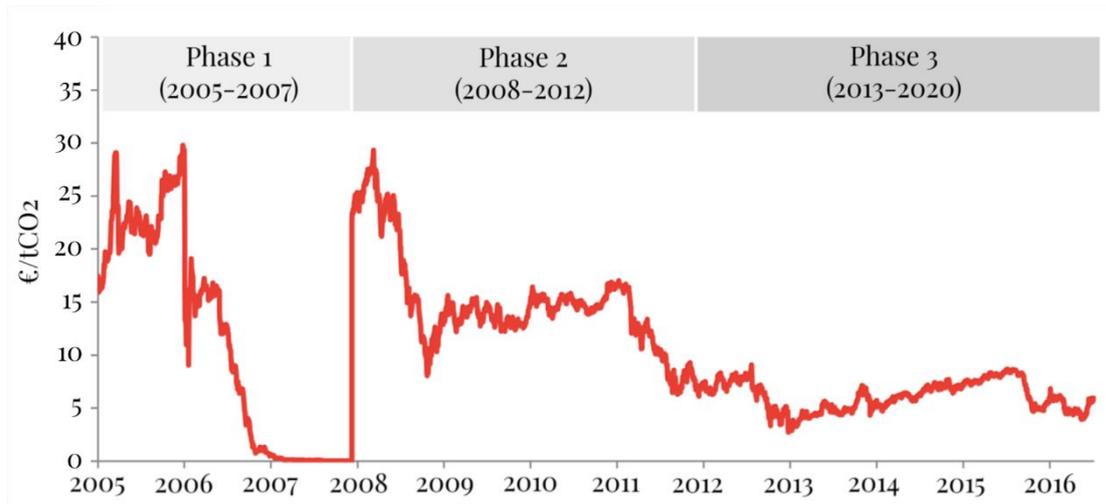
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<sup>4</sup> Under the Paris Agreement, if the EU buys allowances from another country these allowances cannot simultaneously be counted these against both the EU’s Paris commitments and that country’s. International offsets create a lot of concern due to this possibility of double counting.

These estimates likely understate the impact of EU-ETS on marginal costs and also on fares. In reality, whether the airline buys an EUA or is allocated it for free is irrelevant for the impact EU-ETS has on its marginal cost, because every tonne of CO<sub>2</sub> it emits on an intra-EEA flight requires a 1 tonne permit to be relinquished at the end of the year. Whether the airline can submit the permit from its existing stock or has to go to the market to buy it first is irrelevant, because the opportunity cost is the same. The permit is worth its market price, and emitting a tonne of CO<sub>2</sub> means the airline either has to buy the permit or forego the option to sell one it already has.

It remains the case that the overall impact on marginal costs has not been huge, because the market price of EUAs has remained extremely low for many years (see figure 2).

Figure 2: The market price for EUAs



Nevertheless, regardless of the mechanism by which airlines acquire EUAs, under EU-ETS their marginal costs will reflect the full market cost of each tonne of CO<sub>2</sub> they emit.

If nothing were then to happen to airfares as a result, the profitability of each paying passenger flown would be reduced by EU-ETS. As a result, airlines would be expected to reduce the capacity flown relative to the counterfactual without EU-ETS.

What actually happens to fares depends on both the impact of the abatement scheme on marginal costs and competitive conditions in the relevant aviation market. There is some debate about the best assumption to use for cost pass through. In a perfectly competitive market (and to be strictly accurate, assuming that the demand curve is linear, a straight line) then we expect 1:1 pass through of any change in marginal costs in terms of fares. In less competitive conditions (when there may be relatively few competitors on a route), the pass through may be less than 100%. If we replace the assumption of linear demand with one of constant price sensitivity of demand, then pass through of more than 100% becomes a possible outcome.

There is also a view that the actual number of airlines is less relevant in determining whether a particular aviation market is “contestable”. According to this reasoning, close to competitive outcomes occur even with few actual competitors, because the threat of entry deters the incumbents from attempting to exploit any apparent short-run advantage.

Overall, given the competitiveness of aviation markets, it does not then seem unreasonable to assume 1:1 cost pass through when we are considering the effect of EU-ETS.

What this ultimately means for the overall impact of EU-ETS on abatement is that the scheme raises marginal costs and fares approximately in line. The result is a reduction in traffic (relative to the counterfactual of no EU-ETS) because passenger demand for air travel is price sensitive to some degree (with estimates of price elasticity varying from 0.4 to 1.5 depending on the type of flight and market segment). Overall, this does mean, however, that EU-ETS induces abatement behaviour on the part of the airline sector rather than just causing it to buy offsetting allowances from elsewhere in the ETS scheme.

As an aside, we often hear from airlines that they cannot “pass through” cost increases because they function in a competitive market. We understand this perception, but it represents a misunderstanding of how cost pass through works in a competitive environment. Airlines do not mechanically raise prices because EU-ETS increases marginal costs. Rather, the cost increase causes airlines to reduce capacity for a given level of fares, due to the fall in marginal profitability. Thus supply is reduced relative to demand and so fares, which are set for the most part by algorithm to fill aeroplanes, tend to rise to bring demand down to the new level of capacity. A new equilibrium is established where ticket prices are higher than before without anybody actively choosing to increase them.

In comparison to EU-ETS, CORSIA as it is designed in its initial phase breaks the link between the cost of allowances and marginal cost. Instead of being required to purchase offsets in proportion to their own growth in emissions, each airline will share in the industry’s overall need to abate more or less in proportion to their size. As a result, the marginal impact on an individual airline’s costs of electing to emit another tonne of CO<sub>2</sub> is negligible. Which in turn means no incentive to cut back on capacity and no upward pressure on fares.

In summary, the first phase of CORSIA makes airlines (collectively) abate the increase in their emissions but provides little incentive to reduce emissions themselves, whereas EU-ETS is clearly designed to encourage airlines to actively contribute to abatement through the introduction of new technology. The mechanism for attributing emissions to airlines is intended to be phased into CORSIA over time, but for many years it will lag behind the incentives incorporated in EU-ETS. Remember, too, that CORSIA aims only to abate growth in emissions above a 2021 baseline, whereas EU-ETS’s target is much more demanding. And CORSIA does not apply to domestic flights - a major issue for the US contribution to abatement. CORSIA’s global reach is a factor in its favour, but, all told, the scheme is significantly less ambitious than EU-ETS.

## Will EU-ETS give way to CORSIA or will they co-exist?

At present it is unclear what will happen to EU-ETS when CORSIA is introduced. The fact that CORSIA applies to flights entering and leaving the EEA, which are currently not subject to any abatement scheme, is clearly a positive step. But will the EU choose to replace EU-ETS for aviation with CORSIA, or run the two schemes in parallel?

The lesser ambition of CORSIA, its weaker incentives to encourage abatement and less challenging baseline threshold would make it difficult for the EU to switch to the scheme. Doing so could be interpreted as Brussels backtracking to some extent on its pledge to keep tightening emissions targets. Furthermore, the reliance of CORSIA on international offsets runs counter to the EU's commitment to ensure that abatement is addressed by local actions.

The definition of "domestic" flights within CORSIA would also present a challenge. Taking the simple definition of existing national boundaries would create an issue for the EU if intra-German flights were exempt from CORSIA but France-Germany flights were not. This would constitute a form of discrimination between routes within the EU that might be considered unacceptable. In order for the EU to maintain its commitments, it would seem appropriate for it to be regarded as a single entity for the purposes of CORSIA. Thus all intra-EU flights would be exempt from CORSIA, which would permit the EU to continue to apply EU-ETS on those services.

Finally, as regards the UK's position, it is to be presumed that post-Brexit the UK will remain part of EU-ETS, at least until the end of its transition phase in December 2020. At that point, whether the UK falls wholly within CORSIA or fits in with the EU-ETS arrangements discussed here will depend on the exit agreement yet to be struck with the EU and the UK's commitments under the Climate Change Act.



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