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Options for improving the EU Emissions Trading Scheme (EU ETS) for aviation

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Abstract

The EU Emissions Trading Scheme (EU ETS) for air transport has been in force since 2012. Since 2013, CO₂ emissions from flights within the EEA (European Economic Area = EU27 plus Norway, Iceland and Liechtenstein) have been regulated by the European ETS. In July 2021, a first proposal by the European Commission for a review of the current EU ETS has been published, as part of its ‘Fit for 55 package’, which shall then go through the legislative process. This revision of the EU ETS is likely to strengthen the existing scope and rules for aviation – also considering its interplay with the CORSIA (Carbon offsetting and reduction scheme for international aviation), the first global CO₂ offsetting scheme for civil aviation. The challenges to be addressed by the revised EU ETS for aviation are manifold: the inclusion of aviation’s non-CO₂ species (NO_x, H₂O, SO_x, aerosols, contrails and contrail cirrus), the relationship between the EU-ETS and CORSIA, the contribution of air transport to the 2030 EU GHG reduction target and to the commitment to EU climate neutrality in 2050 (European Green Deal), the introduction of incentives for the use of sustainable aviation fuels (SAF), and its interplay with a potential taxation of kerosene. This paper discusses the pros and cons of different options for revising the current EU ETS for aviation. On this basis, recommendations for a revised EU ETS for air transport will be provided.

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1. Background

Aircraft operations contribute to anthropogenic climate change by emissions of carbon dioxide (CO₂), nitrogen oxides (NO_x), sulfur oxides (SO_x), water vapor (H₂O), aerosols, and the formation of contrails and contrail cirrus. According to the International Panel on Climate Change (IPCC), the total climate impact by aviation is two to four times larger than the effect of its past CO₂ emissions alone (IPCC, 1999 and 2007). In 2009, Lee et al. (2009) estimated for the year 2005 that aircraft-induced CO₂ contributed 1.6 % to the total anthropogenic radiative forcing while the total aviation effect, i.e., the sum of the CO₂ and the non-CO₂ effects, amounted to 4.9 %. In 2021, Lee et al. estimated that ‘global aviation contributes a few percent to anthropogenic radiative forcing. So-called non-CO₂ impacts comprise about 2/3 of the net radiative forcing.’ However, uncertainties concerning the impact of some of these species, especially NO_x emitted on high altitudes, and cloud effects are still large (Lee and Fahey, 2016 and Lee et al., 2021).

Since 2012, aviation’s CO₂ emissions have been regulated by the European Emission Trading Scheme (ETS). All flights within the European Economic Area (EEA = EU27 + Norway, Iceland and Liechtenstein) are subject to this scheme. According to Article 30(4) of the revised EU ETS Directive 2018/410, ‘the Commission shall present an updated analysis of the non-CO₂ effects of aviation, accompanied, where appropriate, by a proposal on how best to address those effects (before January 2020).’ Against this background, the European Commission commissioned a study which has been published in 2020 (European Commission, 2020a). However, concrete proposals for regulating aviation’s non-CO₂ impacts have not been published yet.

Another major challenge to the EU ETS for aviation is how to address its linkage to and geographical overlaps with CORSIA (Carbon offsetting and reduction scheme for international aviation), the first global CO₂ offsetting scheme for civil aviation. CORSIA has been developed by the International Civil Aviation Organization (ICAO). Under CORSIA the international airline sector, apart from some exceptions, is obliged to offset any post-2019 (“baseline”) growth in CO₂ emissions on international routes from 2021 onwards. More precisely, offsetting under CORSIA is possible on a voluntary basis since 2021 and will become mandatory in the year 2027. On international routes within the EEA and between the EEA and Switzerland, CORSIA and the EU ETS overlap, and from the UK to the EEA, CORSIA and the UK ETS overlap.

A further challenge to the EU ETS for air transport is how this sector can contribute to the 2030 EU GHG reduction target and to the commitment to EU climate neutrality in 2050 (European Green Deal) (European Commission, 2019). A possible means in this respect is an increase of the share of auctioned allowances for aviation, which is 15 per cent currently. Another option would be to reduce the total amount of emission permits issued to the airlines under the scheme, the so-called emissions cap, or to increase the linear cap reduction factor of currently 2.2% p.a.

A first draft for a revision of the current EU ETS for the period up to 2030 has been published in July 2021, addressing most of these challenges (European Commission, 2021). This revision of the EU ETS aims to strengthen the existing scope and rules for aviation – also considering its interplay with CORSIA. However, there is still a number of issues to be solved.

This paper discusses the main advantages and challenges for revising the current EU ETS for aviation. On this basis, recommendations for a revised EU ETS for air transport will be provided. This paper is organized as follows: Initially, a brief overview of the most important literature is provided (section 2). Section 3 presents the current EU legislation on emissions trading for air transport as well as the proposed changes according to the European Commission in July 2021. In addition, the rules and regulations of the global CO₂ offsetting scheme CORSIA are presented. Section 4 discusses options for revising the current EU ETS for aviation. Section 5 provides some selected quantitative results illustrating the effects of the proposed revision of the EU ETS for aviation. On this basis, recommendations for improving the EU ETS for air transport are provided (section 6).

2. Literature Review

Meanwhile, literature on the EU emissions trading system (EU ETS) for air transport as well as on its interplay with CORSIA is extensive. Our literature review shows some important initial studies on the economic impact of the EU ETS on air transport have been published in the timeframe 2005 – 2013. In 2005, CE Delft published the study “Giving wings to emission trading – Inclusion of aviation under the European emission trading scheme (ETS): design and impacts”. This study had been conducted on behalf of the European Commission. Studies by Anger and Köhler

(2010), Malina et al. (2012), Anger (2010), Scheelhaase et al. (2010), Ares (2012) and Derigs and Illing (2013), i. e., followed. Most of these studies investigated the economic and environmental impact of the EU ETS for aviation.

Recently, more work on the economic effects of the EU ETS for aviation has been presented by Meleo et al. (2016), Zanin et al. (2016), Nava et al. (2018), Efthymiou and Papatheodorou (2019) and Erling (2018), inter alia. Meleo et al. (2016) investigated the direct costs of the European Emission Trading Scheme focusing on Italian airlines. Zanin et al. (2016) presented a newly developed secure multi-party computation framework which enables confidentiality in an auction-based allowance market. Nava et al. (2018) focused on the competitive effects deriving from the abatement efforts of airlines under the EU ETS. Efthymiou and Papatheodorou (2019) developed options for improving the current EU ETS for air transport. Erling (2018) and Maertens et al. (2019) analyzed the possible interplay between the EU ETS for air transport and CORSIA.

3. Regulatory Framework

3.1. Regulatory Framework on European Level

The current regulatory framework for the EU Emissions Trading Scheme for aviation in the European Union comprises of two Directives: EU Directives 2008/101/EC and 2009/29/EC (Council of the European Union, 2009a and Council of the European Union, 2009b). Subject to certain de-minimis rules, the EU ETS for aviation regulates CO₂ emissions from most flights departing AND arriving in the EU, Iceland and Norway (EEA). General exclusions refer to aircraft below 5.7 t Maximum Take-Off Mass (MTOM), VFR, government & military flights, or certain flights to remote regions. Originally, all flights to and from the EEA were meant to be covered from 2012, including those to and from extra EEA states, but this idea was shelved by the so-called “Stop-the-clock” decision to facilitate negotiations for a worldwide measure at ICAO level. Following the transitional “Stop-the-clock” phase in 2012, during which only flights within the EEA and between the EEA and Switzerland as well as Croatia were covered, a “reduced scope” regime was implemented and later extended until 2023. It covers flights within the EEA which, since 2014, also includes Croatia as a new EU member state. A summary of the geographical scope of the EU-ETS for aviation over time is provided by Deutsche Emissionshandelsstelle (2021), p. 93.

As indicated above, CO₂ emissions from extra EEA flights are temporarily derogated until the end of 2023. In 2020, however, the system has been linked to the Swiss emissions trading system (Swiss ETS). (European Union, 2020). As a result, emissions from flights between EEA and Switzerland are subject to the EU ETS while emissions from flights from Switzerland to EEA fall under the Swiss ETS which, in addition, also covers emissions from Swiss domestic flights. The EU ETS is currently not officially linked to the UK emissions trading system (UK ETS) which came into force on the 1st of January 2021. However, flights from the UK to the EEA are actually covered by the UK ETS (Environment Agency, 2021). A linking agreement with the UK similar to the one concluded with Switzerland is expected to be negotiated soon.

Since 2013, the emissions cap for aviation is defined as 95 per cent of the sector’s average 2004-2006 emissions (so-called historical emissions). 82 per cent of the emission allowances from 2013 are freely allocated based on a benchmark of 0.6422 emission allowances per 1000 ton kilometers; 3 per cent make a special reserve for new entrants; and 15 per cent are auctioned. From 2021, a linear reduction factor (LRF) of 2.2 % p. a. is applied to the CO₂ emissions cap in aviation. Non-CO₂ emissions of aviation are currently not included in the EU ETS.

In the current EU ETS, two types of emission allowances are used, EUAs (European Union Allowances), and EUAA (European Union Aviation Allowances). Until 2020, Aviation was allowed to submit both types of allowances to comply with the regulations, whilst stationary sources were bound to EUAs. In the past, aviation has been a net buyer of allowances, i.e. also submitted EUAs for compliance (European Commission, 2020b). From 2021, in Phase IV of the EU ETS, stationary sources may also submit EUAA (European Commission, 2020c).

3.2. Revision of the Regulatory Framework as proposed by the European Commission

In July, 2021, the European Commission proposed a revision of the current EU ETS for aviation as part of the ‘Fit-for-55-package’ (European Commission, 2021). The main changes to the actual legislation can be summarized as follows:

- The existing rules for aviation shall be strengthened. In detail, the EC proposes to phase out the allocation of free allowances and to reduce the number of aviation allowances. By the year 2027, full auctioning of allowances shall be reached. Furthermore, the number of European Aviation Allowances (EUAA) shall be reduced by 4.2 % annually.
- The CORSIA offsetting scheme shall be integrated. More precisely, CORSIA shall be implemented on most international routes outside the European Economic Area (EEA), provided both the country of departure and the country of arrival participate in CORSIA, while the EU ETS shall remain geographically limited to most intra-EEA flights. In addition, it shall become effective on routes between the EEA and CORSIA-states for airlines from countries not participating in CORSIA, and, from 2027, on routes to countries not participating in CORSIA.
- All proposed regulations refer to aviation's CO₂ emissions. Non-CO₂ emissions from aviation are not been regulated yet.

Along with the also (by the European Commission) proposed fuel taxes for intra-EU flights and blending quotas for sustainable aviation fuels (SAF), which are not further dealt with in this paper, such a proposal for the EU ETS for aviation is likely to increase the cost for intra-EEA air services significantly. This is because the lower emissions cap and the expected higher CO₂ prices will lead to increased operational costs for all airlines under the trading scheme.

3.3. Regulatory Framework on ICAO level

At the 37th ICAO Assembly (Assembly Resolution A37-19), the goal of carbon neutral growth from the year 2020 onwards – the so-called “CNG 2020 goal” had been agreed (ICAO, 2010). Six years later, at the 39th ICAO Assembly, a formalized global market-based measure system in form of an offset scheme called CORSIA was agreed (ICAO, 2016). CORSIA aims at supporting ICAO's CNG goal from 2020 onwards.

In brief, CORSIA functions as follows:

- In principle, all CO₂ emissions from international routes are subject to CORSIA offsetting, if they occur from flights between participating states (hereinafter referred to as “CORSIA-states”).
- Exemptions apply to CO₂ emissions from domestic operations, emissions from small operators (<10 000 t CO₂ p.a.), from small aircraft (<5.7 t MTOM) and rotorcraft, and those from humanitarian, medical and firefighting operations (ICAO, 2016). In addition, military and governmental aviation are excluded as they are not subject to the Chicago Convention.
- Until the year 2026, participation is voluntary. As of July 2021, 106 states have agreed to participate in this period already, which represent more than 75% of international revenue ton kilometers. Key exceptions are Brazil, China, Russia and India (ICAO, 2021c).
- From 2027, all countries have to participate in CORSIA whose carriers accounted for more than 0.5% of 2018 international revenue ton kilometers (RTK). Exempted are airlines from small islands, least developed countries and land-locked developing countries. However, those states can participate on a voluntary basis.
- Originally, the CORSIA baseline had been defined as the average of 2019/2020 emissions. To reflect the effects caused by Covid-19, the year 2019 has been agreed by the ICAO Council as new, single baseline year for the period 2021-2023 (ICAO, 2020). As a short-term effect, offsetting obligations will not be relevant as long as CO₂ emissions on CORSIA routes remain below 2019 levels.
- For compliance, airlines have to purchase and surrender so-called offsets. Eligible carbon credits are generated by certified greenhouse gas reduction projects like reforestation which, in return, shall deliver measurable reductions in emissions. However, criticism has been raised concerning the environmental effectiveness of at least some of these projects (see for instance Cames et al., 2016).

4. Advantages and key challenges

A revision of the current EU ETS for aviation is necessary to address the challenges and questions listed in section 1. However, the revision of the EU emissions trading scheme could be an important means to achieve climate-neutrality in the European Union by 2050 as well as the intermediate goal of minus 55% GHG emissions by the year

2030 as compared to 1990 levels (Council of the European Union and European Parliament, 2021). Aviation could contribute to these goals. Against this background, the revision of the EU ETS implies some important chances.

Key challenges for a revision of the EU ETS for aviation include:

- The relationship of the EU ETS for aviation with ICAO's carbon offsetting and reduction scheme for international aviation (CORSIA);
- The geographical scope of EU ETS for aviation;
- The level of auctioning, which is currently 15 %;
- The level of the CO₂ emissions cap which is currently 95 % of 2004 – 2006 average emissions;
- The inclusion of aviation's non-CO₂ species in order to regulate the sector's full climate impact;
- Additional incentives for the use of sustainable aviation fuels (SAF).

The pros and cons of different options to address these challenges will be discussed in the following.

The revision of the EU ETS Directive should define the relationship of the European scheme with ICAO's scheme in a way that is consistent with the EU's 2030 climate objectives. This will be challenging, as Erling (2018) already has shown. In this respect, it could be problematic that CORSIA is less ambitious in terms of environmental objectives than the EU ETS for aviation. The latter defines the CO₂ emission cap for aviation as 95 % of the 2004- 2006 average emissions, which will probably be subject to further reductions in the future, while under the former only CO₂ emissions exceeding the 2019 level have to be offset by the airline sector. And CORSIA will only become mandatory by 2027 whereas the EU ETS has already been in force since 2012.

Against this background, the EU may have to tighten CORSIA's regulations in order to gain consistency with the more ambitious European climate objectives. Whether tightened regulations can legally be applied to non-EEA airlines for their flights operated in or even from and to Europe is a question of international law and diplomacy. If this is legally not possible, two parallel systems will have to be maintained: One system, e.g. a strengthened EU ETS, consistent with the EU climate objectives for EEA airlines or for flights within Europe, and a second system (most likely CORSIA) for non-European airlines or for flights to and from non-European countries. This would lead to a complicated co-existence of measures and to a relatively high administrative effort both for participating airlines as well as for administering authorities. In addition, possible competitive impacts of two parallel systems for the airlines would have to be considered.

The geographical scope of the EU ETS for aviation is of great importance for its effectiveness in terms of climate protection. This has been shown by Anger and Köhler, (2010), e. g. At the same time, it is closely linked with the (yet unsolved) relationship between the European Trading Scheme and CORSIA. Extending the geographical scope of EU ETS for aviation will probably lead to a higher CO₂ reduction as compared to the current the scheme. However, higher overall cost for air transport and – from a demand perspective – increased air fares and air cargo rates will also be the result of an extended geographical scope. This may or may not lead to a decreased demand for air services, depending on the price elasticities of demand. Carbon leakage by a re-routing of cargo and passengers to, from and via airports located outside the scope of a tightened EU ETS may be a further challenge.

Until 2023, the EU ETS for aviation has been temporarily derogated to flights within the EEA (plus the linked flights with Switzerland). Irrespectively of this development, all European (as well as most other) international routes will also subject to CORSIA. Any extension of the EU ETS to non-EEA routes, if legally feasible, would result in an even larger geographical overlap with CORSIA. This situation may raise difficult multilateral questions. Recently, in a study on behalf of the European Commission, ICF Consulting et al. (2020) discussed a number of options for the future relationship between the EU ETS for aviation and CORSIA. These options include:

- 'Return to the full EU ETS scope (incl. extra-EEA routes); no implementation of CORSIA
- Continuation of the current EU ETS scope (intra-EEA/EFTA); no implementation of CORSIA
- CORSIA replaces the EU ETS; no regulation of EEA domestic emissions anymore
- Continuation of the current EU ETS scope (intra-EEA/EFTA) and implementation of CORSIA on routes to/from third countries

- ETS continues in its current scope for emissions below the CORSIA baseline while CORSIA is applied to emissions exceeding the CORSIA baseline and on routes to/from non-EEA countries
- Continuation of the current EU ETS scope (intra-EEA/EFTA) for European airlines and implementation of CORSIA rules and regulations for non-European carriers and on routes to/from third countries' (ICF Consulting et al., 2020).

Additional options are possible from our point of view: One would be to implement CORSIA as planned by ICAO on international routes and to stick to the EU ETS for EEA domestic flights only. This option could legally and technically be implemented in a straightforward way as the two schemes would no longer collide and the MRV systems of both schemes are already in operation. Another option which would also avoid disturbance with third countries could be to withdraw the current EU ETS regulations for aviation completely and to expand the CORSIA mechanism to domestic EEA flights on a voluntary basis (Maertens et al., 2019 and Scheelhaase et al., 2020).

In general, all options have their pros and cons: While the options favoring CORSIA would result in relatively lower environmental benefits, as the ICAO CO₂ reduction target is considerably lower than the EU ETS aviation target, the EU ETS dominated strategies will probably raise significant multilateral objections as it was the case in 2012 when the EU first tried to apply the EU ETS for aviation to non-EEA flights. As a result of these objections in the past, the EU ETS for aviation has been derogated to flights within EEA countries in the timeframe 2013 - 2023.

The envisaged relationship between the EU ETS and the UK ETS is another question to be solved. A possible means in this respect would be to arrange for a linking agreement between the EU and the UK scheme. The existing linking agreement between the EU and the Swiss scheme could serve as an example here. With a view to the increasing number of national emission trading schemes also addressing aviation on a global scale, in the long-run also further linking agreements with other schemes could be envisaged (e.g. with the South Korean ETS).

Furthermore, the definition of the future cap for aviation as well as the share of allowances issued free of charge to the airlines under the scheme are subject to discussion. As mentioned above, since 2012, the cap is defined as 95 % of 2004- 2006 average CO₂ emissions (so-called historical emissions). From 2021, a linear reduction factor of 2.2 % per annum is applied. At present, 82 % of allowances are allocated for free on the basis of a performance-based benchmark, 15 % are auctioned and 3 % are held as a special reserve for new entrants. Any additionally required allowances have to be purchased by aircraft operators from stationary sources like powerplants, where emissions are reduced by the same amount.

According to the main results of Efthymiou and Papatheodorou, (2019), the definition of the emissions cap and of the auctioning share are directly determining the environmental performance and the compliance costs of the sector. In principle, a relatively high share of auctioning and a relatively low cap will provide considerable incentives to reduce emissions and to develop emission reducing technologies. However, the financial burden imposed by the emissions cap and the level of auctioning should not cause a financial burden and/or competitive disadvantage threatening the existence of the airlines under the scheme.

The inclusion of aviation's non-CO₂ species in order to regulate the sector's full climate impact would be very important from an environmental point of view. This is because the non-CO₂ impacts comprise about 2/3 of air transport's net radiative forcing (Lee et al., 2021), as mentioned above. In principle, a number of calculation methods for non-CO₂ effects are available, which differ in the degree of detail, the administrative and operational complexity and are subject to uncertainties related to atmospheric science.

In 2019, the German Environmental Agency published the main results of a study conducted by DLR which investigated the operational feasibility of measures for reducing non-CO₂ species in aviation (Niklaß et al., 2019). Main results show the principal possibility to regulate relevant non-CO₂ species by market-based measures, especially by including them into the current EU-ETS. As a next step, economic impacts of this approach could be estimated and pilot projects could be conducted. However, in order to deal with the existing uncertainties from an atmospheric science point of view, a risk assessment is required to better understand the possible effect of these uncertainties on the calculation of non-CO₂ effects and thus on the probability of setting wrong incentives (Niklaß et al., 2021).

Providing incentives for the use of sustainable aviation fuels (SAF) is an important issue to be addressed by a revised EU ETS for aviation. In principle, SAF offer a large potential to reduce the climate impact of aviation. Depending on the production process, the well-to-wake emissions reductions of SAF based on energy crops are estimated to be in a range of 70 % - 118 % (including the impact of indirect land use change) compared to fossil fuels.

Other production processes not based on biomass, such as municipal solid waste, used cooking oil or power-to-liquid fuels are estimated to have a well-to-wake emissions reduction potential of 58 % - 140 % (ICCT, 2021)). Against this background, the use of SAF under the EU ETS could be incentivized by introducing a reduction factor based on the actual life cycle emissions of each SAF production process. Under the scope of CORSIA, both the default values for life cycle emissions of the so-called CORSIA eligible fuels and a methodology for the calculation of life cycle emissions of SAF have been published in March 2021 by ICAO (ICAO, 2021a and ICAO, 2021b). In addition, further research should be undertaken to evaluate the allocative efficiency and distributional effects of using revenues from the CO₂ allowances auctions under the EU ETS to be (partly) used for funding the market ramp-up of SAF. Such funding will be very important as actual cost for SAF are far from being competitive and even long-term cost estimations for SAF still show a cost level considerably higher than the price estimations for conventional kerosene in the future (Scheelhaase et al., 2019). This way, funding for SAF could promote necessary technological progress, help creating incentives for further investment and support setting up a well-functioning SAF market.

Finally, a revised EU ETS should be consistent with a revised EU Energy Directive that may pave the way towards a taxation of kerosene, as currently leaked in the press (Euractiv, 2021).

5. Selected Quantitative Results

In this section, we provide some selected quantitative results illustrating the effects of the proposed revision of the EU ETS for aviation (European Commission, 2021). In principle, the proposed revision of the EU ETS for aviation leads to additional administrative costs, emission reduction costs, and costs for the purchase of the allowances covering the residual emissions for the sector. In the following we conduct some calculations to quantify the cost and fare effects stemming from full auctioning. For these calculations, we refer to some available statistics and sources.

Our calculations are based on the following assumptions:

- Ceteris paribus assumptions concerning traffic, air fare and non-ETS operational costs at the time of full auctioning (i.e. 2027) on the level of 2019;
- Uniform fuel consumption per passenger flight;
- The assumptions on the future value of EU allowances is in line with the impact assessment accompanying (European Commission, 2021)) (45 EUR, 83 EUR and 120 EUR per ton of CO₂ under different scenarios)
- Airlines will pass-through the full cost of the EU-ETS to passengers;
- a uniform cost pass-through to all intra-EEA segment passengers and one average fare for all intra-EEA passengers (neglecting the fact that, in reality, air transport demand is characterized by different customer groups with different willingness to pay and price elasticities).

In the year 2019, the EU ETS covered 68.2 million tons of verified CO₂ emissions (EEA, 2021). Aircraft operators received 30.2 million allowances free of charge through the initial allocation by EU/EEA Member States. In 2019, 96 % of flights within the EEA were passenger flights, as reported by Eurostat (2020). When this share is applied also to emissions / free allocation of allowances, passenger services account for 65.3 million tons of CO₂ emissions and 28.9 million allowances.

In 2019, on average one EU allowance was valued at 24.6 EUR. Hence, airlines spent 895 million EUR for allowances used for passenger operations. Divided by 714.8 million passengers on intra-EEA services (source: Sabre MI database), this equals an EU ETS cash operating cost share of 1.25 EUR per passenger. Under the assumption that in future all allowances will be auctioned and the price for an allowance will increase to 120 EUR, cash operating expenses for passenger airlines in the EEA will increase by 7.8 billion EUR, or 11 EUR per passenger. Interviews with European aviation stakeholders confirmed these assumptions, which on similar levels are used for internal planning purposes. All else equal, air fares would rise by 9 % for an average intra-EEA ticket, based on the average air fare of 108 EUR in 2019 (Sabre MI) and the price differential of 9.75 EUR (11 EUR future EU allowance cost minus 1.25 EUR EU allowance cost in 2019). Under alternative allowance price scenarios (45 EUR or 83 EUR, as assumed in the accompanying impact assessment (European Commission (2021))), the increase in air fares would be in the order of 2.9 EUR (or +2.6 %) and 6.3 EUR (or 5.9 %), respectively.

6. Recommendations

The EU Emissions Trading Scheme (EU ETS) for air transport has been in force since 2012. Since 2013, CO₂ emissions from flights within the EEA (European Economic Area = EU27 plus Norway, Iceland and Liechtenstein) have been regulated by the European ETS. In July 2021, the EU Commission published a draft proposal for a review of the current EU ETS. The revision of the EU emissions trading scheme could be an important means to achieve climate-neutrality in the European Union by 2050 as well as the intermediate goal of minus 55% GHG emissions by the year 2030 as compared to 1990 levels (Council of the European Union and European Parliament, 2021). Aviation could contribute to these goals. However, as discussed above, the challenges to be addressed by the revised EU ETS for aviation are manifold. On this basis, we recommend considering the following issues for the revision of the EU-ETS for aviation:

- A sound and (from our perspective) legally uncritical linkage or co-existence with CORSIA: This may, e.g., be achieved by restricting the EU ETS to domestic flights within the EEA (probably against a much stricter share of auctioning), or by applying the EU ETS on international intra-EEA routes to emissions up to CORSIA baseline levels.
- Achieving the highest possible environmental effect even on routes which will be subject to CORSIA: Low CORSIA offsetting effectiveness could be targeted by a commitment of EC carriers to make use of higher-quality offsets only, with a higher level of additionality;
- Dealing with carbon leakage and competitive distortion:
 - If the reduced scope regime of the EU ETS is maintained, routings via non-EEA hubs (subject to CORSIA only, if at all) will continue to have a competitive advantage over routings via EEA hubs, which are fully or partly subject to the environmentally stronger EU ETS. E.g., a routing from Milan via Moscow to Bangkok is not regulated at all (until 2027 when Russia will have to join CORSIA), while a routing via Dubai to Bangkok is only subject to CORSIA and a routing via Munich to Bangkok is partly subject to the ETS (the Milan-Munich portion) and CORSIA (the Munich-Bangkok portion), respectively, rising environmental costs for EU carriers.
 - If the EU ETS returns to the full scope, routings via non-EEA hubs tend to have a growing competitive advantage the geographically closer the non-EEA hub is to the EEA point of departure. E.g., a routing from Paris via Bangkok to Phuket would largely fall under the EU ETS (the Paris to Bangkok portion) while a routing from Paris via Istanbul to Phuket would largely be regulated by the less stringent CORSIA scheme (the Istanbul to Phuket portion) and only to a minor extent be subject to the EU ETS (the Paris to Istanbul portion). A compromise acceptable both from the environmental and competitive perspective will have to be achieved.
- Including non-CO₂ emissions: The revised EU ETS directive should include a path towards a mandatory inclusion of non-CO₂ emissions as soon as this is feasible from an implementation and scientific perspective. The actual proposal for a revision of the EU ETS published by the European Commission in July 2021 does not provide such provisions.

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