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EU trilogue results for the aviation sector – key issues and expected impacts

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Abstract

In July 2021, the European Commission had proposed additional and tightening measures to reduce the climate impact of the air transport sector as part of its 'Fit for 55 package'. In December 2022, so-called trilogue negotiations of the European Commission, the European Parliament and the Council of the European Union came to new rules for the EU emissions trading scheme (EU ETS) for aviation. In April 2023, further trilogue agreements on mandatory blending quotas for sustainable aviation fuels (SAF) were reached. This paper aims at identifying and illustrating the agreed new rules and regulations for the aviation sector in comparison with the previous regime. In addition, key impacts on stakeholders and the environment will be discussed. So far, the trilogue parties have reached an agreement on a strengthened EU ETS for aviation, which integrates the global offsetting scheme CORSIA and creates incentives for the increasing use of SAF. Also, a monitoring, reporting and verification scheme for aviation's climate relevant so-called non-CO_2 emissions will be introduced as a basis for a later integration of these emissions into the EU ETS. Aviation's non-CO_2 emissions include H_2O, aerosols, NO_x, contrails and cirrus clouds. Moreover, a mandatory sustainable aviation fuels (SAF) blending quota, which rises gradually up to 70 per cent in the year 2050, has been agreed. However, further policy measures originally proposed within the 'Fit for 55 package', such as a European kerosene tax, are still subject to final negotiations. As our analysis indicates, several and diverse economic and environmental effects arising from these climate protection policies for European aviation can be expected.

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Keywords: Fit for 55 package; Trilogue agreements; Climate regulation for aviation

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1. Introduction

Aviation contributes to anthropogenic climate change by emitting both CO_2 and so-called non-CO_2 emissions. The non-CO_2 emissions of aviation include H_2O, aerosols, NO_x, contrails and cirrus clouds. The climate impact of the non-CO_2 emissions depends on flight altitude, flight time, atmospheric conditions and other specifics of the individual flights (Niklaß et al., 2019). Recently, Lee et al. (2021) estimated that the non-CO_2 emissions comprise about 2/3 of aviation's net radiative forcing. However, it has to be noted that uncertainties on the climate impact of some of these species, especially NO_x emitted on high altitudes, and cloud effects are still large (Dahlmann et al., 2022 and Lee et al., 2021).

Apart from technological and commercial improvements (like higher load factors or higher density seating), market-based policy measures aim at putting a price on CO_2 in order to incentivize airlines and the aircraft industry to switch to cleaner aircraft and more climate friendly kerosene. In this context, the European Union can be regarded as a forerunner as the EU Emission Trading Scheme for CO_2 emissions also has been regulating aviation since 2012.

In July 2021, the European Commission's 'Fit for 55' proposal for air transport was published (European Commission, 2021a, 2021b, 2021c, 2021d). With respect to air transport, the objective is to tighten the EU ETS for aviation and to introduce additional climate policy measures like a mandatory blending quota for sustainable aviation fuels (SAF). In December 2022, a first trilogue agreement was reached on the EU 'Fit for 55' proposal for the revision of the EU ETS for aviation (Council of the European Union, 2022 and European Commission, 2022). In April 2023, a further trilogue agreement focusing on a mandatory SAF blending quota was reached (European Parliament, 2023).

In this paper, we are investigating the differences between the current and the future climate protecting regulations for European air transport, as well as the key impacts of the trilogue results on the environment and on airlines and travelers. This paper is organized as follows: Firstly, a literature review on the topic is being provided. Secondly, the novel European climate policy regulations are analyzed in detail and compared with the actual regulations for European air transport. Thirdly, the environmental impacts as well as the costs and possible demand impacts of the trilogue results for the airlines are being discussed. Finally, conclusions and recommendations are drawn on this basis.

2. Literature review

Literature on the economic and environmental impacts of the EU ETS for aviation as well as sustainable aviation fuels blending quotas is manifold: Scheelhaase and Grimme (2007) and Anger (2010) were among the first papers published on the EU ETS for aviation. More recent publications on the EU ETS include Efthymiou and Papatheodorou (2019), Fageda and Teixidó (2022) as well as Meleo et al. (2016). Recent literature on SAF blending quotas were published by Keshavarzzadeh et al. (2022) as well as Jiang and Yang (2021).

On the European Commission's Fit-for-55-proposal of 2021, some papers have been published in academic literature: Oesingmann (2023), SEO and NLR (2022), Oxera (2022) as well as Ehlers et al. (2022) are investigating the cost impacts as well as the potential climate effect of the Commission's proposal. While Ehlers et al. are mainly analyzing the cost effect on airlines and the possible pass-through of the additional ETS costs, Oxera (2022) and SEO and NLR (2022) are investigating the potential risk of carbon leakage caused by the proposed new regulations. Oesingmann (2023), however, models the economic and environmental impacts of all proposed policy measures for aviation: the tightened EU ETS, a blending quota for sustainable aviation fuels (SAF) as well as a possible kerosene tax for European aviation.

However, to the best of our knowledge, literature on the economic and environmental impacts of the European climate protecting regulations for aviation as agreed in December 2022 and April 2023 is missing at this point. Moreover, a thorough academic investigation of the impacts of the trilogue results is also important since a number of industry stakeholders (see for instance A4E, 2022 and BDL, 2022) as well as NGOs (for instance Transport and Environment, 2022) have already been arguing against the trilogue agreements of December 2022. The trilogue agreements of April 2023, however, have found acceptance from some stakeholders such as A4E (A4E, 2023) as this blending quota could prevent fragmentation of the EU's single market for aviation.

3. Future climate protecting regulations for European air transport

Overall, the climate policy regulations of emissions trading for European aviation were tightened by the trilogue agreements of December 2022: The emissions 'cap' which, under the current regulation, is reduced by 2.2% p. a., will be reduced by 4.3% annually from 2024 to 2027 and in the timeframe 2028–2030 by 4.4% p. a. In comparison to the Commission's original proposal from 2021 (-4.2% from 2024), the trilogue resulted in an even stronger linear reduction factor to be applied to the cap. Furthermore, the allocation of free emission allowances is to be reduced by 25% in 2024 and by 50% in 2025. From 2026, no more free emission allowances are to be issued to aircraft operators. As compared to the European Commission's proposal, these trilogue decisions lead to a one year earlier phase-out of the free allocation of CO_2 allowances. Moreover, these trilogue agreements include an obligation to monitor, report and verify (MRV) the so-called non-CO_2 emissions from 2025. It is planned that the European Commission will report on the MRV system in 2027, and a decision will be made in 2028 on how the non-CO_2 effects will be regulated in the future (see for instance Niklaß et al. (2020) on methods to integrate non-CO_2 emissions into the EU ETS for CO_2 emissions). The proposal to take account of non-CO_2 emissions via a flat-rate factor ('multiplier') on CO_2 emissions, which has been discussed in the past, does not appear to be being pursued further. Finally, for the use of SAF, aircraft operators are to be provided with additional emission allowances for 20 million tons of CO_2 free of charge between 2024 and 2030. This is intended to cushion the price difference between fossil fuels and SAF by exempting the CO_2 emissions caused by SAF from financial obligations under the EU ETS at predefined percentages (100% for small islands, small airports and the outermost regions, 95% for renewable fuels of non-biological origin (RFNBOs), 70% for advanced biofuels and 50% for all other SAFs). All of these trilogue decisions will lead to a greater contribution to climate protection by European air transport from 2025 onwards.

According to the trilogue results of April 2023, the agreements on a mandatory blending quota for sustainable aviation fuels are as follows: From the year 2025, kerosene should contain at least two percent of sustainable aviation fuels in Europe. This proportion will increase every five years: To six percent in 2030, 20 percent in 2035, 34 percent in 2040, 42 percent in 2045, and finally 70 percent in 2050. In addition, a certain share of the fuel mix – 1.2 percent in 2030, two percent in 2032, five percent in 2035 and progressively 35 percent in 2050 – should consist of synthetic fuels such as e-kerosene. According to the agreement, 'sustainable aviation fuels' will include synthetic fuels (such as e-kerosene), certain biofuels produced from agricultural or forestry residues, algae, bio-waste, used cooking oil or certain animal fats, and recycled jet fuels produced from waste gases and waste plastic (European Parliament, 2023). Renewable hydrogen could also be part of a sustainable fuel mix.

The SAF-quotas now agreed are a significant increase compared to the European Commission's original 'Fit for 55'-proposal. In order to bridge the actual price difference between sustainable and conventional fuels, the EU Member States will receive around two billion euros from non-compliance fines from airlines, airports or fuel suppliers to support research and innovation of SAF (European Parliament, 2023). The trilogue results of April 2023 also include obligations for airlines to refuel with kerosene containing SAF when their flight departs from an EU airport. In order to prevent so-called 'tankering', i.e. the purchase of cheaper fossil kerosene at non-EU airports and its subsequent use for departures from the EU, airlines are obliged to refuel 90% of the annual average of their kerosene requirements at the respective EU airport of departure, even if flights are operated to a non-EU destination. Correspondingly, European airports are required to develop and provide refueling infrastructure suitable for SAF.The following table provides an overview of the main differences between the current and the upcoming climate protecting regulations for European air transport.

Table 1. Significant changes for European aviation according to the trilogue decisions in December 2022 and April 2023.

Reference point	Current rule	New rule
Geographical scope of EU-ETS	Intra-EEA flights ("reduced scope", since 2013) and flights from EEA to Switzerland (since 2020) and UK (since 2021)	Intra-EEA flights and flights from EEA to Switzerland and UK; scope extension from 2027 onwards possible if CORSIA is considered insufficient by the Commission in an evaluation in 2026
Definition of the EU ETS-‚cap'	- 2012: 97% of the so-called historical emissions (average 2004 - 2006) - From 2013: 95 % of so-called historical emissions	As before, but plus free allocation of 20 million t CO_2 (2024 - 2030) to compensate for the use of Sustainable Aviation Fuels (SAF)
Reduction of the EU-ETS-‚cap'	minus 2.2 % p. a. (2021 – 2030)	minus 4.3 % p. a. (2024 – 2027); minus 4.4 % p. a. (2028 – 2030)
Allocation of EU-ETS allowances free of charge	82 % of total quantity (cap) in accordance with benchmark procedure	minus 25 % (2024) minus 50 % (2025) minus 100 % (2026)
Coverage of flights to and from EU outermost regions by EU-ETS	No coverage, except for flights within the same outermost region	Coverage, except for domestic flights to and from, but not within, an outermost region
Coverage of Non-CO_2-Emissions by EU-ETS	No coverage	Monitoring, Reporting, Verification (MRV) mandatory from 2025
Introduction of CORSIA	No EU-requirement	Only on routes outside the EEA to avoid double charging of airlines
SAF blending quota	No requirement	Mandatory SAF blending quota: 2 % (2025); 6 % (2030); 20 % (2035); 34 % (2040); 42 %

		(2045) and 70 % (2050)
EU Member States funding for SAF research and innovation	No provision	2 billion euros for all EU Member States
Airlines SAF fuelling obligations	No requirement	Obligation for refuelling SAF blended kerosene of at least 90 % of the average annually required fuel

Source: Own compilation. EEA = European Economic Area.

Overall, the climate policy regulations of emissions trading for European aviation were tightened by the trilogue decisions. At the same time, the additional free allocation of emission allowances for 20 million tons of CO_2 provides incentives for increasing the use of sustainable aviation fuels (SAF).

4. Opportunities and risks of the novel European climate regulations for air transport from an economic and environmental perspective

What opportunities and risks do the new climate protection policy regulations open up for aviation? In general, the trilogue results will lead to higher operating and additional administrative costs, especially for European airlines. These costs mainly result from the reduction of the emissions cap for aviation, the reduction of the free allocation of emission allowances as well as the mandatory SAF blending quota since SAF come at much higher prices than conventional kerosene.

On 2010-2021 average, the price of conventional kerosene was around 690 USD per ton. According to a recent meta-study on SAF production costs and market prices by Braun et al. (2023), even in the long run, SAF prices are likely to remain significantly above the price for conventional kerosene whereas the lowest prices are expected for SAF produced with the HEFA process. These SAFs are expected to achieve market prices of at least 1068 USD_{2020} per ton (Braun et al., 2023). A study published by the European Commission in 2021 (European Commission, 2021d) comes to almost the same conclusion: SAF production costs can hardly be pushed below €1,200 per ton (e.g., for SAF with the HEFA conversion process) even in the long term (European Commission, 2021d). Costs for SAF from other conversion processes are significantly higher (European Commission, 2021d).

Whether, and to what extent, these additional costs will reduce airline revenues and profits depends crucially on the pass-through rate of additional costs to passengers and shippers of air freight and the reaction of demand to ticket price increases. On the price elasticity of demand for air passenger transportation a large number of studies has been carried out since the 1990s. Recent academic papers include Ventura et al. (2022), Bruin and Yakut (2022), Oesingmann (2021) and Oesingmann (2023). The findings in literature show that the price elasticity of demand in air travel depends on the nature of the travel, for instance business air travel or holiday air travel (Oum et al., 1990, Graham, 2000, Brons et al., 2002, Mumbower et al., 2014, Scheelhaase et al. (2016)) as well as on the availability of comparable substitute transport modes (Brons et al., 2002, Kopsch, 2012, Granados et al., 2012) which should mainly be given on short-haul routes. However, the demand reaction in air travel due to the 'Fit for 55' policy measures has, so far, hardly being investigated in academic literature. To the best of our knowledge, only Ehlers et al. (2022), Bruin and Yakut (2022) as well as Oesingmann (2023) analyze this research question. A review of this literature shows that at least a partial pass-through of additional costs to the ticket prices is likely. Ehlers et al. (2022) and Oesingmann (2023) even assume a full pass-through of the additional 'Fit for 55' costs from the airlines to their customers. As a consequence, a moderate increase in ticket prices (particularly for intra-EU flights) by 2035 in the sum of the effects of all 'Fit for 55'-measures combined is likely, which will decline in subsequent years due to learning curves and economies of scale in SAF production (Oesingmann, 2023). This leads to a decreasing demand for air transport, especially for intra-EU flights. While Ehlers et al. (2022) do not quantify this demand reaction, according to Oesingmann (2023) this decrease will, at maximum, be around 23 percent in the reference scenario.

Furthermore, literature and industry stakeholders such as the airline associations A4E and BDL (A4E, 2022 and BDL, 2022) discuss a possible risk of carbon leakage from the 'Fit for 55'-proposals. However, according to the findings in literature, this risk may be less significant than some stakeholders fear. For example, a June 2022 study by Oxera (2022) on behalf of the airport association ACI-Europe concludes that EU hubs could lose 4% of their transfer passengers in 2030 and 9% in 2050 who switch to less charged flights to non-EU hubs. Overall, Oxera concludes that while a small amount of carbon leakage occurs due to the increase in emissions on routes to non-EU airports, the EU package of measures nevertheless leads to an overall reduction in emissions. A recent study by SEO and NLR (SEO and NLR, 2022) comes to a similar conclusion, assuming a carbon leakage risk of 1% of 2035 baseline emissions. Studies by DLR show that the risk of carbon leakage will be limited (Oesingmann, 2023 and Ehlers et al., 2022).

Within the EU, the future restriction of the EU ETS obligation to domestic flights to and from outermost regions may result in (transfer) traffic via the respective national airports being strengthened at the expense of direct cross-border connections. IAG (Iberia/Vueling) and TAP Air Portugal in particular are likely to benefit from this on routes to the Azores, the Canary Islands and Madeira, while the French overseas territories are essentially only demanded by the French market.

In addition, cost increases on intra-EEA routes are expected to result in a certain percentage of air transport to EEA tourist destinations, such as those in the Mediterranean, shifting to non-EEA destinations, for example from Greece, Spain and Cyprus to destinations such as Egypt, Turkey, Tunisia and Morocco.

The introduction of monitoring/reporting obligations for non-CO_2 emissions can be seen as a first, important step towards the regulation of these climate-relevant effects caused by air transport. In this context, DLR has been investigating the inclusion of non-CO_2 emissions into the EU ETS and in other policy measures in various projects (on behalf of the German Federal Environment Agency (UBA), inter alia) for several years and has confirmed their feasibility (see e.g. Niklaß et al., 2020). From 2025, the monitoring, reporting and verification (MRV) of non-CO_2 emissions will be mandatory for the airlines as explained above. Until then, the European Commission will be setting up a MRV scheme for these emissions. In the medium term, non-CO_2 species shall be included in the EU ETS for aviation which would be an important step forward in terms of climate protection in air transport.

The allocation of additional emission allowances for 20 million tons of CO_2 for the use of sustainable aviation fuels will partially compensate the airlines for cost increases resulting from the blending mandate. However, this will not eliminate the price difference between SAF and fossil kerosene discussed above in full. As a consequence, the mandatory SAF blending quota will impose additional costs especially on the European airlines.

The auctioning of emission allowances is generally viewed positively in the environmental economic literature, as this avoids windfall profits (free allocation of valuable emission allowances that lead to higher profits when passed on to the customer) for the airlines. If the so-called opportunity costs are passed on in full to the customer, it makes no difference to the ticket price whether emission allowances are distributed free of charge or through auctions to the aircraft operators. Opportunity costs are, in a simplified explanation, avoided costs or lost benefits of an alternative that was not chosen or could not be realized, in this case avoided costs for emission allowances, since these were (partially) allocated to the airlines free of charge. Even if no (full) pass-through of opportunity costs to airline customers has occurred in the past, the price effect from auctioning emission allowances is likely to be mitigated because less than 40% of the emission allowances required by aircraft operators in Germany have already been allocated for free in 2019.

The funding of SAF-research and development for EU Member States can be regarded positively in principle. However, in view of the expected amount of €2 billion (European Parliament, 2023) and the forecast SAF costs, the question arises as to whether this funding will be sufficient. Presumably, considerable investments in research and development will still be necessary to reduce SAF costs in the long term. This naturally presupposes a corresponding political will.

5. Conclusions and recommendations

The European Commission, the European Parliament and the Council of the European Union have so far reached two main agreements on the climate protecting policy measures for European air transport in the future. These so-called trilogue decisions have been reached in December 2022 and in April 2023. Both lead to a greater contribution to climate protection by European air transport from 2025 onwards. The basis was the European Commission's 'Fit for 55'-proposal published in summer 2021. According to the trilogue results, the regulations of EU emissions trading

for aviation will be tightened and at the same time economic incentives will be provided for the increasing use of sustainable aviation fuels (SAF). In addition, a mandatory blending quota for SAF will be in force from 2025. Whether further policy measures also proposed as part of the 'Fit for 55 package', such as a European kerosene tax, will be introduced is currently open.

From an environmental point of view, the decision to tighten up EU emissions trading for aviation and the additional free allocation of CO_2 emission allowances for SAF use are fundamentally positive. This will provide an increased economic incentive to reduce CO_2 emissions in air transport. The introduction of a mandatory blending quota for SAF can also be regarded positively from an environmental point of view. In addition, so-called non-CO_2 emissions are also being addressed for the first time. The non-CO_2 emissions from aviation include H_2O, NO_x, contrails and cirrus clouds. These species can also contribute to the climate effect of aviation depending on flight altitude, flight time, atmospheric conditions and other specifics. From 2025, there will be an obligation for monitoring, reporting and verification (MRV) of non-CO_2 emissions for the airlines. It is planned that the European Commission will report on the MRV system in 2027 and that a decision will be taken in 2028 on how non-CO_2 emissions will be regulated in the future. If non-CO_2 species are actually included in the EU ETS in the medium term, this would be an important step forward in terms of climate protection and a significant political signal.

From an economic point of view, the trilogue results lead to higher costs, especially for airlines from the European Economic Area (EEA). Firstly, these costs will result from the reduction of the emissions cap for aviation and the reduction of the free allocation of emission allowances. Secondly, additional costs for the airlines can be expected due to the introduction of the mandatory SAF blending quota. Currently, the price difference between conventional kerosene and SAF is quite large and even in the long run, SAF prices are expected to remain significantly above the price for fossil fuel, as a recent meta-study on SAF prices and availability by Braun et al. (2023) shows. On 2010-2021 average, the price of conventional kerosene has been around 690 USD per ton. According to Braun et al. (2023), the lowest prices are expected for SAF produced with the HEFA process in the long run. These SAFs are expected to achieve a minimum market prices of 1068 USD_{2020} per ton (Braun et al., 2023). In order to bridge the actual price difference between sustainable and conventional fuels, the EU Member States will receive funding of around two billion euros to support research and innovation of SAF.

Whether and to what extent these additional costs will reduce airline revenues and profits depends crucially on the demand reaction to a ticket price increase. However, a review of the relevant literature reveals that at least a partial pass-through of the additional costs to the ticket prices is likely (see e.g. Ehlers et al., 2022). Further research has to be carried out on the additional costs for both airlines and air transport passengers as well as on possible changes of the competitive situation of the airlines affected by the novel European climate regulations in comparison with airlines being not affected.

Furthermore, the evaluation of the academic literature on the possible risk of carbon leakage from the 'Fit for 55 package' showed that this risk may be less significant than feared by some stakeholders, even if certain traffic and thus emission shifts to regions outside the EEA cannot fully be ruled out. The allocation of additional emission allowances for 20 million t CO_2 for the use of Sustainable Aviation Fuels (SAF) offers the aviation industry an economic incentive to use these kinds of fuel. This will be supported by the mandatory SAF blending quota which will be in force from 2025.

Finally, research, development, and use of more energy-efficient aircraft and low-emission aviation propulsion systems and other technological options for action, such as the reduced-emission air transport system can also support a more climate friendly air transport system (DLR, 2021). Of course, this presupposes a corresponding political setting for the use of financial resources as part of the weighing of political interests, similar to what has already been agreed, for example, for revenues from the aviation tax in the German coalition agreement (SPD, Buendnis 90/Die Gruenen and FDP, 2021).

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