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Report

# Can Polluter Pays principles in the aviation sector be progressive?

## Assessing the distributional impacts on households of taxation measures on the aviation sector

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# EXECUTIVE SUMMARY

Aviation has been one of the fastest growing transport sectors in recent years. This has clear environmental implications: emissions in 2050 are expected to be seven to ten times higher than 1990 levels, according to the International Civil Aviation Organization (ICAO) projections. This level of emissions growth will consume a significant portion of the remaining carbon budget to stay well below 2°C. In addition, aviation emissions are amongst the most unequal in the world, with a small group of travellers accounting for a large proportion.

Although some measures have been in place to limit the emissions of the sector, they have been largely ineffective. In fact, the aviation sector has enjoyed numerous tax benefits compared to other transport modes and industries over the years, including exemptions and free allowances within the EU ETS, tax exemptions on kerosene and VAT, and significant state aid to the industry.

This paper continues the work of our recent report on the distributional impacts of the Energy Taxation Directive reform and the extension of the EU ETS to the buildings and transport sectors.[1] We now aim to take a similar approach but focusing on the distributional impact of policy measures concerning the aviation sector.

We have developed a microsimulation model that allows us to simulate the distributional and social impact at a household level of new environmental taxes on aviation.

This report finds that if carefully designed and implemented, imposing additional environmental taxes on the aviation sector can have progressive distributional results and create positive welfare effects for the majority of EU households.

Therefore, this paper advocates for:

- The implementation of a tax on kerosene in the EU;
- Full auctioning of EU ETS permits for the aviation industry; and
- The implementation of a stepped tax rate with a higher tax for longer flights.

[1] Gore, T. (2022) Can Polluter Pays policies in the buildings and transport sectors be progressive? Assessing the distributional impacts on households of the proposed reform of the Energy Taxation Directive and extension of the Emissions Trading Scheme. Research report, Institute for European Environmental Policy

# 1. INTRODUCTION

## 1.1 Context

Aviation has been one of the fastest growing transport sectors in recent years. According to the International Civil Aviation Organization (ICAO), the total number of passengers carried on scheduled services reached 4,486 million in 2019 globally, an increase of 3.6% over the previous year. In Europe, passenger traffic (expressed in passenger-kilometres) increased by 6.9% in 2019 compared to the previous year, making Europe the region with the second highest passenger-kilometre share of global air traffic (26.8%) after the Asia-Pacific (34.7%)[2]. Emissions from this sector accounted for 3.8% of total emissions and 13.4% of transport emissions in the EU in 2017.[3] With the forecast growth in air traffic, emissions in 2050 are expected to be seven to ten times higher than 1990 levels, according to ICAO projections.

As emissions in other sectors drop, the sector's proportion of total emissions is expected to grow rapidly, and calculations show that even if aviation meets its targets it will use up 12% of the global carbon budget available between 2015-2050 to remain under 1.5C, while business as usual growth will use up 27%.[4]

At the same time, emissions from the aviation sector are among the most unequal in the world. Less than 20% of the global population has ever been on a plane and only about 5 to 10% of the global population flies at least once a year.[5] This is also the case for the EU. For the 27 EU countries, air travel contributed a higher proportion of the carbon footprint for the top 10% of households (in terms of carbon footprint per capita) in both absolute and relative terms compared to the bottom 5% of households in all countries.[6] A small group of frequent flyers makes up the bulk of emissions in this industry. One estimate shows that about 60% of

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[2] ICAO (2020a), Annual Report of the Council – 2019 https://www.icao.int/annual-report-2019/Pages/default.aspx

[3] European Commission (2022a), Reducing emissions from aviation https://ec.europa.eu/clima/eu-action/transport-emissions/reducing-emissions-aviation_en

[4] Carbon Brief (2016), Analysis: Aviation could consume a quarter of 1.5C carbon budget by 2050 https://www.carbonbrief.org/aviation-consume-quarter-carbon-budget/

[5] Sullivan, A. (2018) To fly or not to fly? The environmental cost of air travel. Deustche Welle. Article updated on January 24, 2020 with new estimations. Available at: https://www.dw.com/en/to-fly-or-not-to-fly-the-environmental-cost-of-air-travel/a-42090155

[6] Ivanova D and Wood R (2020). The unequal distribution of household carbon footprints in Europe and its link to sustainability. Global Sustainability 3, e18, 1–12. https://doi.org/10.1017/sus.2020.12

flights from the UK, for example, are taken by only 10% of the population.[7] Other numbers show that 1% of English travellers take a fifth of all international flights.[8]

It is thus a sector that has the potential to use up a significant portion of the remaining carbon budget, disproportionately to the benefit of a small and privileged group of travellers. Given the many other competing economic sectors which also face challenges to decarbonise in a fair way, it makes sense to consider significantly and rapidly expanding climate mitigation measures for aviation as part of a just low-carbon transition that distributes burdens as fairly as possible.

At the international level, several measures have been adopted to limit the growth of aviation emissions. In 2009, the International Air Transport Association (IATA) announced a target of a 50% reduction in aviation emissions by 2050 compared to 2005. In October 2016, ICAO adopted a Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to monitor, report and offset CO2 emissions from international civil aviation on an annual basis. CORSIA, which entered into force in 2021, includes the option for airlines to meet their emission reduction obligations by using alternative fuels or offsetting their GHG emissions. However, it only applies to international flights, not domestic flights[9]. On the other hand, aviation within the European Union has been included in the EU ETS market since 2012.[10]

Despite this, these measures are considered insufficient and rather weak, often non-binding and based on good will. In addition, aviation has enjoyed numerous tax benefits over the years compared to other transport modes and industries. For example, a large part of the allowances of aviation companies operating in the ETS are granted free of charge (82% in 2016). Only 15% comes from auctions and the remaining 3% is a reserve for new entrants or high-growth airlines.[11] In terms of taxes on kerosene, commercial aviation fuel in the EU is exempt from

[7] Banister, D. (2018) Inequality in Transport: Who Travels by Air? https://inequalityintransport.org.uk/exploring-transport-inequality/who-travels-air

[8] Kommenda, N. (2019) "1% of English residents take one-fifth of overseas flights, survey shows" The Guardian. https://www.theguardian.com/environment/2019/sep/25/1-of-english-residents-take-one-fifth-of-overseas-flights-survey-shows

[9] European Commission (2016), ICAO Agreement on CO2 emissions form aviation. http://www.europarl.europa.eu/RegData/etudes/ATAG/2016/589848/EPRS_ATA(2016)589848_EN.pdf

[10] European Commission (2022b), Aviation and the EU ETS https://ec.europa.eu/clima/eu-action/european-green-deal/delivering-european-green-deal/aviation-and-eu-ets_en

[11] European Commission (2022c), Allocation to Aviation https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/allocation-aviation_en

excise duty.[12] VAT is the most common tax on aviation and is levied on domestic flights in 17 EU+EFTA[13] countries. Yet international aviation is largely not subjected to VAT (even though the large bulk of emissions take place in this modality)[14]. For international aviation only 6 EU+EFTA countries levy some form of tax. Countries where the only tax is VAT on domestic flights have relatively lower average levels of taxation.[15] Finally, airports also receive several subsidies in the form of state aid under the Aviation Guidelines.[16]

The EU is committed to achieving climate neutrality by 2050, which will require significant efforts from all sectors of the economy. Electrification will play an important role, but there are significant challenges in decarbonising some sectors, including aviation. The use of synthetic fuels can be a sustainable and competitive alternative to current fossil fuels as long as the energy in the whole process comes from 100% renewable sources. Currently regulation allows the use of sustainable aviation fuels (SAF) up to 50% with jet fuel and manufacturers have committed to produce 100% SAF compatible aircraft. Furthermore, as part of the "Fit for 55" package, the European Commission has proposed to boost the use of SAF in air transport, starting with 2% in 2025 and reaching 5% by 2030.[17] It is expected that by 2050 at least 63% of the fuel used on flights departing from EU airports will be SAF. For years the lack of incentives to introduce renewable energy in this sector has led to stagnation in the uptake of SAF.

It is also worth noting that SAF is still a developing technology, which will not be available in large enough quantities to replace conventional fuel for at least several decades even in optimistic scenarios. It will thus be necessary to enact demand management measures and to provide alternative transport options to aviation if climate targets are to be met in the short and long term.

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[12] Transport and Environment (2021), Kerosene Taxation https://www.transportenvironment.org/wp-content/uploads/2021/07/2020_06_Kerosene_taxation_briefing.pdf
[13] Including the United Kingdom
[14] Dobruszkes, F., Mattioli, G., Mathieu, L. (2022) Banning super short-haul flights: Environmental evidence or political turbulence?, Journal of Transport Geography, Volume 104. https://doi.org/10.1016/j.jtrangeo.2022.103457
[15] European Commission (2019), Directorate-General for Mobility and Transport, Taxes in the field of aviation and their impact: final report, Publications Office https://data.europa.eu/doi/10.2832/913591
[16] European Commission (2014). State aid to airports and airline (Aviation Guidelines). https://ec.europa.eu/commission/presscorner/detail/fr/memo_14_121 and
Transport & Environment (2019) A cheap airline ticket doesn't fall from the sky. https://www.transportenvironment.org/discover/cheap-airline-ticket-doesnt-fall-sky/
[17] European Commission (2021), Proposal for a REGULATION OF THE EUROPEAN PARLIAMANT AND OF THE COUNCIL on ensuring a level playing field for sustainable air transport. https://eur-lex.europa.eu/resource.html?uri=cellar:00c59688-e577-11eb-a1a5-01aa75ed71a1.0001.02/DOC_2&format=PDF

In addition to regulation already proposing to introduce more SAF in the coming years, the European Commission has proposed to eliminate the exemption on kerosene and to progressively reduce free allocations of EU ETS permits to aviation. From 1 January 2021, the quantity of allowances allocated to aircraft operators decreases by the linear factor[18] of 2.2 % annually.[19] Moreover, several European countries (for example Germany, France and Sweden) have recently introduced some environmental tax on aviation at the national level.

## 1.2 Objective and structure of this study

This study analyses the distributional impact of the implementation of different policies on the aviation sector that are currently being discussed at the EU level: tax on kerosene, a stepped tax on tickets and a full auctioning of EU ETS permits. It also aims to complement existing discussions on the environmental impact of the measures.

[18] The Linear Reduction Factor determines the rate of emission reductions under the EU Emissions Trading System, by reducing the total number of emission allowances each year.

[19] European Commission (2020b), Notice on the Union-wide quantity of allowances for 2021 and the Market Stability Reserve under the EU Emissions Trading System https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020XC1211(07)&from=EN

# 2. METHODOLOGY

## 2.1 Modeling

We have developed a microsimulation model that allows us to simulate the distributional and social impact at a household level of new environmental taxes on aviation. This model has been developed using the large amount of household data available at the Household Budget Survey (HBS) of each Member State (MS). The rich representation of households of these surveys allows us to develop vertical distributional impact analysis, i.e. by income level, as well as horizontal distributional impact analysis, i.e. by other socio-demographic characteristics of the households.

This micro-data source is the latest harmonised data wave of Eurostat's HBS. This survey collects data on household consumption expenditure on goods and services in monetary units (for all items) and in physical units (only for food categories in some countries) following the classification of individual consumption by purpose (COICOP) and includes different socio-demographic variables of households and individuals. The most recent information available covers most EU countries for 2015 (with the exception of Austria, Malta, Portugal and Slovenia) [20]. Although the data are not fully comparable across countries due to differences in data collection approaches, Eurostat's joint framework enhances comparability and allows us to utilise harmonised and consistent data[21].

The HBS provides information related to the households' characteristics and their expenditures. Table 1 offers an overview of the different transport services that we have included in our model and also provides the COICOP categories of each of them.

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[20] For Spain, latest available data (year 2019) from the Spanish National Institute was incorporated.

[21] https://ec.europa.eu/eurostat/documents/54431/1966394/HBS_EU_QualityReport_2015.pdf/72d7e310-c415-7806-93cc-e3bc7a49b596

**Table 1: Energy product used in the micro model by COICOP category**

| Variable | HBS COICOP Code(s) | Description |
|---|---|---|
| **Total** | **HE00** | **Total consumption expenditure** |
| Total transport services | HE073 | Transport services |
| Domestic flights | HE07331 | Expenditure on Domestic flights |
| International flights | HE07332 | Expenditure on International flights |
| Train | HE07311 | Expenditure on train |
| Metro | HE07312 | Expenditure on underground and tram |
| Bus | HE07321 | Expenditure on transport by bus and coach |
| Taxi | HE07322 | Expenditure on taxi and hired car with driver |
| Water transport | EUR_HE07341<br>EUR_HE07342 | Expenditure on Passenger transport by sea and inland waterway |
| Other transport | EUR_HE07350<br>EUR_HE07361<br>EUR_HE07362<br>EUR_HE07369 | Expenditure on Combined passenger transport and Other purchased transport services |

As explained in the next section, we have applied an increase in the expenditure of intra-EEA flights. However, the consumption categories in the HBS do not differentiate on international flights (EUR_HE07332) that are intra-EEA or outside the EEA. To distinguish the intra-EEA, we use additional information from Eurostat[22] to calculate the share of international flights that is intra-EU27. This is not exactly the intra-EEA area (that includes also Iceland, Liechtenstein and Norway) but can be considered a proxy. Then, we have applied this share to the expenditure on international flights (category EUR_HE07332 of the HBS) and added the result to the expenditure on domestic flights (category EUR_HE07331)[23].

The higher aviation price scenario is complemented by the revenue recycling scenarios (see next section). The recycling scenarios are based on the use of revenues to subsidize the cost of other modes of public transport: bus and train, as

[22] Eurostat (2015), Air passenger transport by reporting country [avia_paoc], Commercial passenger air flights, Schedule: total https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=avia_paoc&lang=en

[23] For the case of Germany, the HBS does not have information on the split between national and international flights. For that reason, in this case, we calculate with the data from Eurostat the share that national plus international intra-EU27 flights represent on total flights and then we apply this share to the total expenditure in air transport services. Besides, due to lack of data on expenditure in bus and train services we cannot compute the impact of the tax revenues recycling for Germany.

alternatives to air transport. To calculate the reduction in the price of these public transport, we use the total expenditure per country on public transport in 2019 from Eurostat. However, as this information is aggregated for all transport services, to distinguish the total expenditure on bus and train transport, we apply the shares obtained from the HBS for these services. Once the total expenditure on bus and train services at the country level is known, we can calculate the impact of the subsidy through the revenue from the new aviation taxes.

## 2.2 Scenario

The scenarios analysed are extracted from a previous report for the European Commission – Directorate General Taxation and Customs Union by Ricardo Confidential.[24] This study used a modelling framework based on the aviation model AERO-MS and the macro-economic model GINFORS-E.

Ricardo (2021) offers a set of scenarios with a different set of policies in each of them. After having taken into careful consideration the results for all the scenarios and sensitivity analyses proposed in that report, we focused on a scenario that combines different policies:

- A tax on kerosene of €10.34/GJ in 2025 (including inflation) in intra-EU27 flights[25]);
- The full auctioning of EU ETS permits for aviation, with a carbon price of €26.5/tonne $CO_2e$ in 2025, applicable to intra-EU27 flights; and
- A stepped ticket tax with a higher tax rate for longer flights, reflecting the increased environmental impacts of such flights:
  - €10.12 per ticket for all intra-EEA flights
  - €25.30 per ticket for extra-EEA flights less than 6,000km
  - €45.54 per ticket for extra-EEA flights over 6,000km
  - Cargo tax of €0.10 per tonne-km

The combined impact on ticket prices of these measures is translated into an increase for intra-EU flights between a range of 3.8% to 7.6%; and an increase in extra-EU flights of between 1.2% to 2.2%.

[24] Ricardo Confidential (2021), Study on the taxation of the air transport. Final Report. Report for European Commission (DG TAXUD). Ref: ED 14102, Issue number 2.1 https://taxation-customs.ec.europa.eu/system/files/2021-07/Aviation-Taxation-Report.pdf

[25] This is a similar tax rate to the €10.75/GJ in 2033 proposed in the "Fit for 55" legislative proposal as explained in: European Court of Auditors (2022), Energy taxation, carbon pricing and energy subsidies. Review No 01/2022 https://www.eca.europa.eu/Lists/ECADocuments/RW22_01/RW_Energy_taxation_EN.pdf

We extract the total revenues estimated in Ricardo (2021)[26] for the year 2025, i.e. €6.04 billion, and we take the distribution by countries from the analysis provided in Ricardo (2021) of the stepped ticket tax as the closest approximation, and then continue with the calculation of the recycling of revenues as explained.

## 2.3 Limitations

Our microsimulation model does not capture the "behaviour" of households, i.e. it does not reflect the reaction of different types of households to expected changes in prices. In this sense, the results only reflect the change in relative prices applied to household consumption structures before the new taxes. A "behavioural" impact study would require the use of a more sophisticated tool that would capture direct reactions (through price elasticities of demand for goods) and also induced reactions (through cross-elasticities and also income elasticities). Moreover, as warned in Hopkinson and Cairns (2020)[27] the data collected for spending on air travel may be misleading because flights are an infrequent purchase. Therefore, the survey may reflect a more skewed distribution over income deciles than in reality, since higher income groups are more likely to purchase flights.

For some countries such as Austria, Malta, Portugal and Slovenia, the 2015 surveys were not available, thus these countries are excluded from the study. Furthermore, there are some data gaps in the HBS microdata of some countries, mainly due to the lack of disaggregation of some categories of consumption. Therefore, other adjustment has been done on the expenditure categories used in our microsimulation model when necessary.

Finally, this report does not analyse the potential impact of the measures on greenhouse gases (GHGs) emissions reductions. However, further taxation on the aviation sector, especially on kerosene, is expected to lead to GHG emission reductions of some magnitude. Ricardo (2021) gives an estimate: a policy mix of tax on kerosene plus stepped ticket price (quite similar to the policy mix used in this report) would lead to a 6% decrease of CO2 emissions in 2030 in the sector. In addition, a report from the European Commission estimates that the sector’s carbon footprint would fall by 11% if the EU were to scrap the tax derogation on jet fuel.[28]

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[26] Ibid.

[27] Hopkinson and Cairns (2020) Elite Status. Global inequalities in flying. Report for Possible https://static1.squarespace.com/static/5d30896202a18c0001b49180/t/605a0951f9b7543b55bb003b/1616513362894/Elite+Status+Global+inequalities+in+flying.pdf

[28] European Commission (2019) *Taxes in the field of aviation and their impact: final report*. https://data.europa.eu/doi/10.2832/913591

# 3. THE DISTRIBUTIONAL IMPACTS OF THE PROPOSED POLICY MEASURES

This section will mainly focus on the results derived from the modelling of the policy mix combining **a tax on kerosene, plus the full auctioning of EU ETS permits for aviation and a stepped ticket tax**. The combined impact on ticket prices of these measures is translated into an increase for intra-EU flights between a range of 3.8% to 7.6%; and an increase in extra-EU flights of between 1.2% to 2.2%.

Results are presented below in terms of the welfare impact, reflecting price differences for households as a share of total current household expenditure. A 1% welfare gain thus indicates that the household will save the equivalent to 1% of its current total expenditure, and conversely a 1% welfare loss indicates that the household will face additional costs equivalent to 1% of its current total expenditure.

## 3.1 EU-wide results

Figure 1 shows the welfare impact – as a share of household expenditure[29] – of the proposed policies across the EU-wide income distribution, and the impact when also considering recycling the additional revenues generated by higher taxation levels into subsidizing other modes of transport (buses and trains).

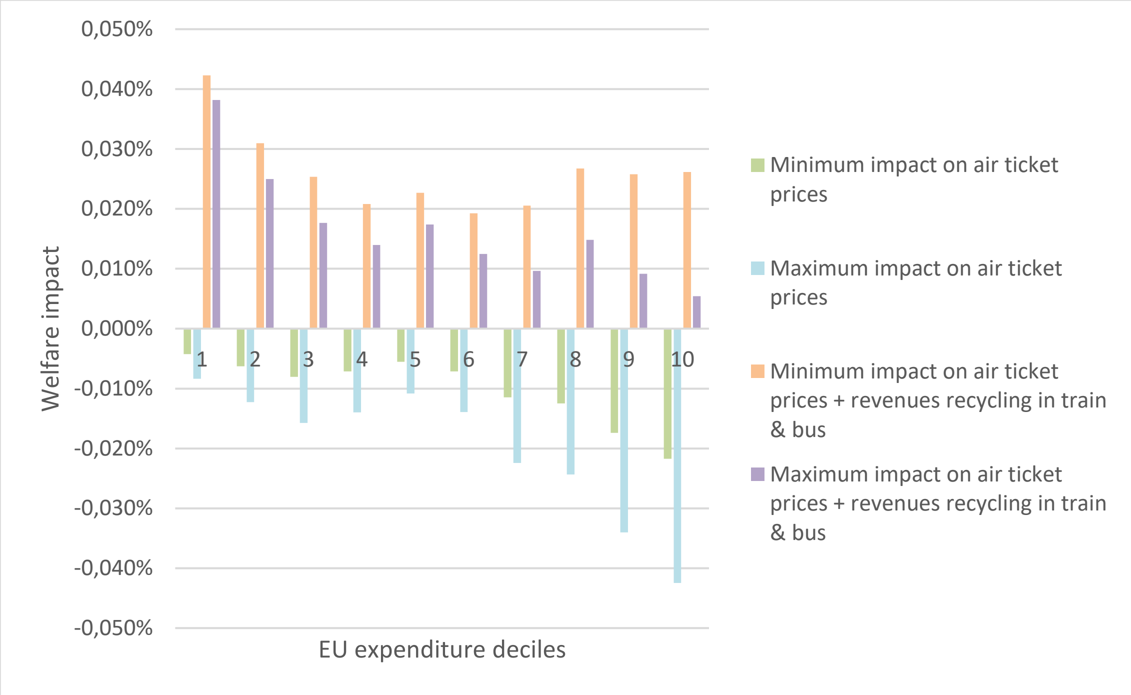
Green and blue bars can be interpreted as demarcating an interval of impact. The green bar reflects the impact in the extreme case that all households would only fly with traditional carriers. If, opposite, all households would only fly with low cost and charter flights (with lower prices), then the impact would be that represented by the blue bars. The real impact would lie somewhere between these two extreme cases.

Orange and purple bars represent also an interval of impacts after recycling the revenues into subsidies for buses and trains. The minimum impact (if households would only fly in low cost) is indicated by purple bars, and the maximum impact (when households only fly with traditional carriers) is indicated by orange bars. Again, the real impact of recycling revenues would lie in between these two points.

[29] The welfare impact of each household has been calculated based on the total household expenditure, since it is considered a better proxy for the permanent income of families as it undergoes a lower fluctuation than income both in the medium and long term (Goodman y Oldfield, 2004)

We would like to emphasize that both the highest and lowest impacts (with and without revenue recycling) show the extreme cases derived from modelling. The real impact on welfare will lie somewhere within that range.

**Figure 1: Welfare impact (% of total expenditure) in the EU, without and with revenue recycling**




One of the first conclusions is that **the scale of the welfare impact across the different income deciles in the EU is rather limited** (ranging from -0.04% for the wealthiest 10% of the population to almost 0.06% for the poorest 10% of the distribution). This indicates that even after applying an ambitious policy mix with different taxes, it is unlikely to impact households' welfare drastically.

**Results also suggest that the proposed reforms in this scenario have progressive distributional impacts.** In the case of no revenue recycling (blue and green bars), the wealthiest segments of the income distribution are relatively more affected compared to the least wealthy ones. These wealthier segments devote a higher proportion of their income to flying, which explains why they are more affected by the policy.

Even more significant, **after recycling the revenues from increased taxation levels into subsidies to other transport alternatives (bus and train), the tendency shows that the policy can be even more progressive,** implying greater positive impacts for the less affluent deciles.

This comes as no surprise, since the public transport is more related with low-income groups, especially transport by bus. This transport service tends to be more affordable and/or require less upfront costs than the private alternatives. However, public transport is subsidized by definition, and HBS reflect only the part of the co-pay. This means that our analysis might underestimate the progressive impact of additional subsidies for public transport. While this seems plausible for buses, the case of trains is more complex, since it includes less affordable high-speed train services typically used for business travels and higher income groups, which explains that larger subsidies on public transport also benefit higher income groups. Finally, part of the revenues from the proposed policies come from non-EU households purchasing flights departing from EEA airports. This impact may explain why the use of revenues offsets the negative effects of higher ticket prices for most EU households in the scenarios with revenue recycling through public transport subsidies.[30]

## 3.2 Distributional impacts between selected Member States

To get a more complete idea of the impact of the measures on the welfare of households in the EU, this report also analysed the effects of applying the selected policy mix in different Member States. We have selected a few Member States according to different geographical and socioeconomic situations.[31]

Figures 2 to 5 show the welfare impact of the analysed policy measures across the income distributions of **France, Spain, Greece and Poland**, and the impact when also considering recycling revenues as has been done for the EU-wide results.

[30] The revenues used from Ricardo (2021) (€6.04 billion) do not differentiate between European and non-European flight consumers. Therefore, although the cost of the policy would affect both EU and non-EU households, most of the benefit of revenue recycling would accrue to European households, which are the main users of train and bus services.

[31] Results for other individual countries are available under request.

**Figure 2: Welfare impact (% of total expenditure) in France, without and with revenue recycling**

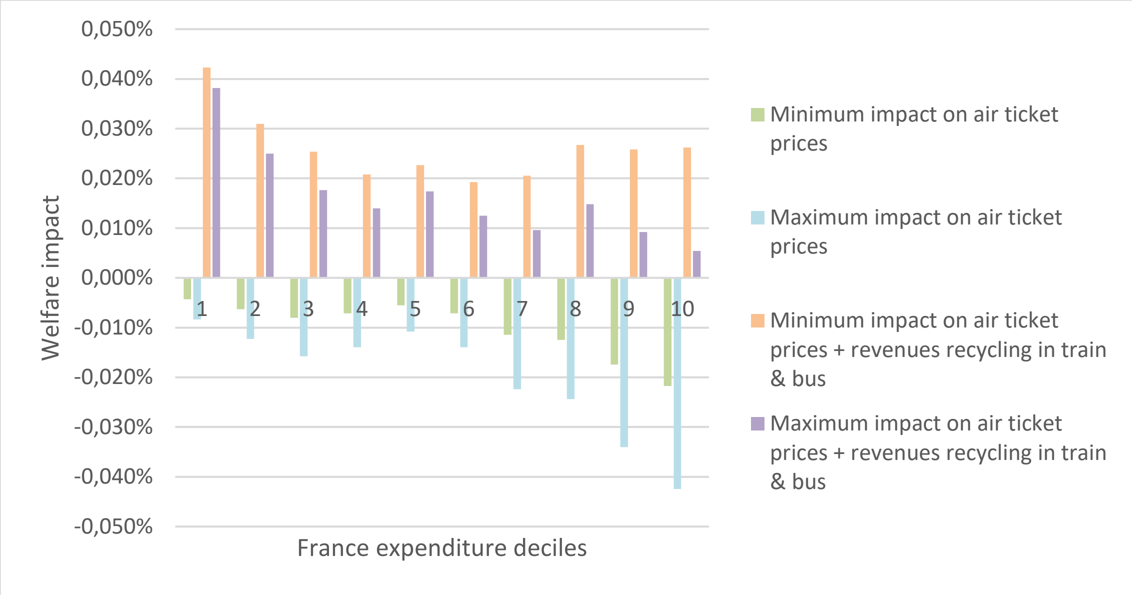



**Figure 3: Welfare impact (% of total expenditure) in Spain, without and with revenue recycling**

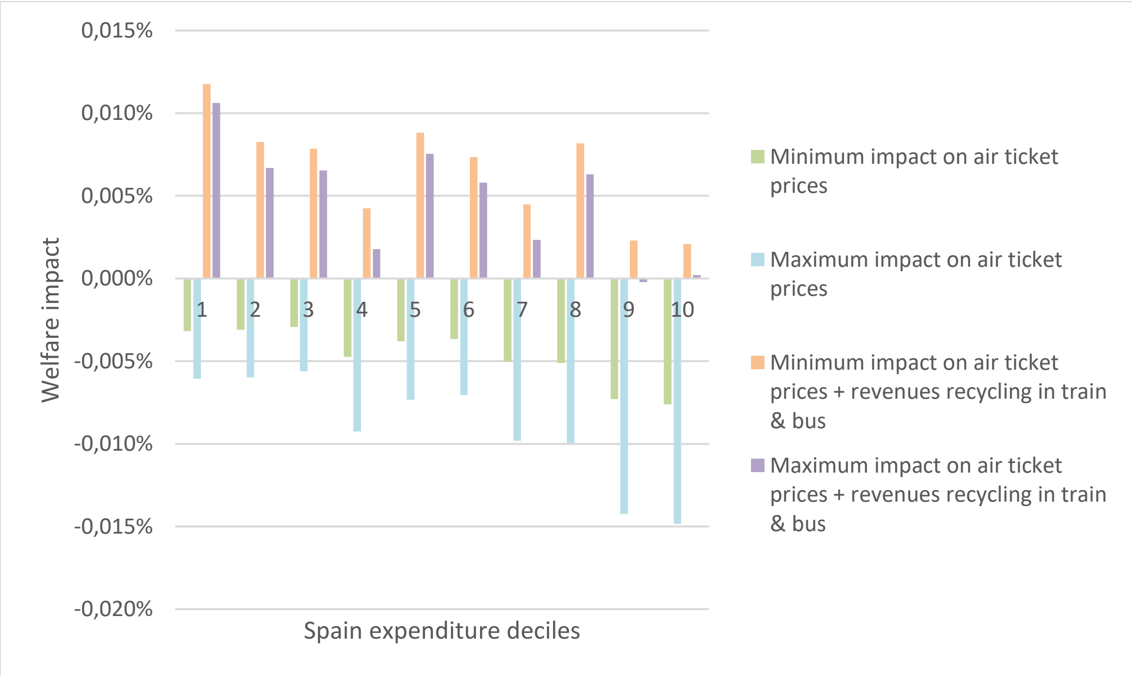


**Figure 4: Welfare impact (% of total expenditure) in Greece, without and with revenue recycling**

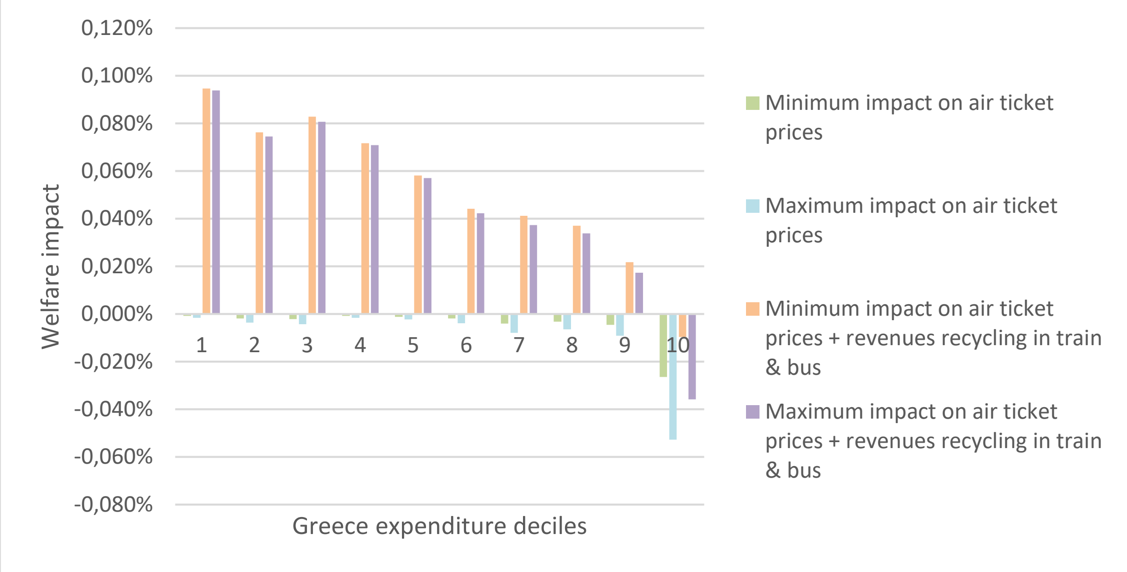
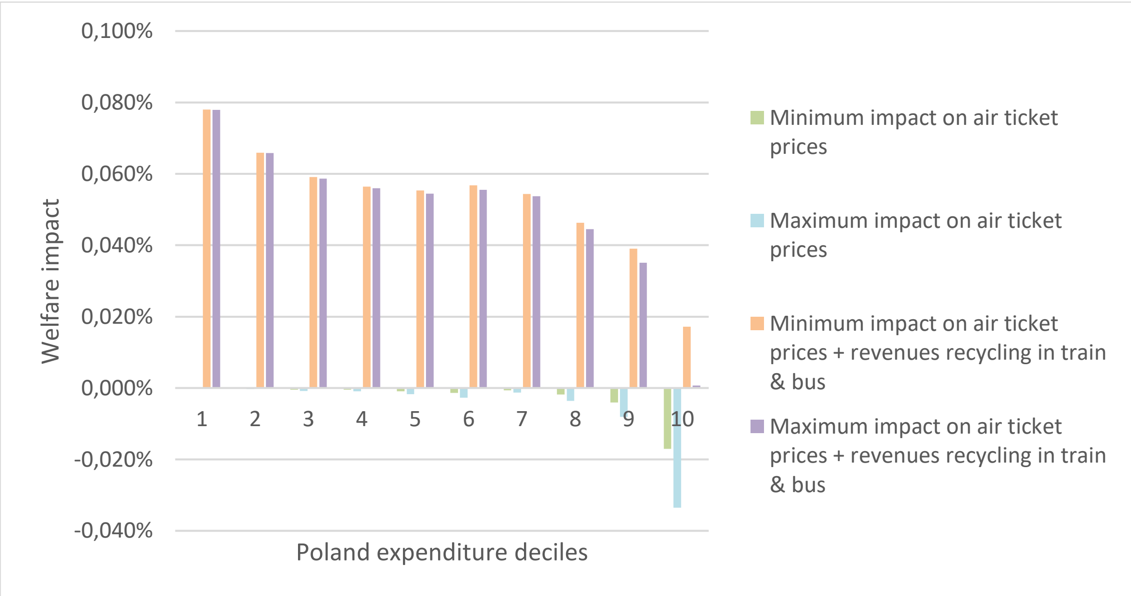



**Figure 5: Welfare impact (% of total expenditure) in Poland, without and with revenue recycling**




Overall, all **Member States follow similar patterns, and the policy measures analysed give progressive results**. However, some differences have been observed.

Lower income countries such as Poland and Greece with similar levels of income inequality present wider differences in magnitude of the welfare impacts compared to higher income and lower income inequalities countries such as

France[32] (ranging from 0.10% to -0.05% in Greece as opposed to 0.04% to -0.04% in France).

They also show a clear and steeper tendency, where the top wealthiest deciles of the income distribution are most affected by the measures, while the poorest deciles are almost not affected. This denotes that the expenditure on flights is concentrated in the wealthiest deciles.

On the other hand, middle-income countries such as Spain and higher income countries like France show a less steep tendency, denoting a more generalised use of flights across their income distribution. Hence, the impacts of the policy measures analysed are more even across the income distribution.

However, differences between countries are most likely due to a broad range of circumstances beyond the levels of income or inequality. Immigration patterns, quality and quantity of alternatives to flying, tourism dynamics, airlines strategies and public funding for air connectivity are some variables that also have the potential to play a key role in explaining differences among Member States. Further research would be needed to explore these variables and their impact in different Member States.

## 3.3 Results from a gender perspective

It is widely acknowledged that transport is not gender-neutral and mobility needs and patterns differ between genders.[33] For this reason, this report analysed possible gender based impacts derived from the policy proposals analysed.

The modelling framework employed in this report allows to differentiate between genders. However, this does not reflect properly possible gender differences. It merely indicates the person of reference of the household (typically that with higher income), and not a situation where gender differences can come to light e.g. a family where the mother works, the father is unemployed, two teenage sons studying and one pensioner grandfather would count as a "female" household when most of its members are male.

For this reason, we employed other socioeconomic categories that are disproportionately female-dominant as proxies to verify possible gender divergences on the welfare impact of policy measures. These categories are

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[32] Information related to income inequalities can be found at Eurostat's Gini coefficient survey (EU-SILC survey) https://ec.europa.eu/eurostat/databrowser/view/ilc_di12/default/table?lang=en
Information related to GDP per capita can be found at Eurostat https://ec.europa.eu/eurostat/databrowser/view/sdg_08_10/default/table?lang=en

[33] World Bank (2022). Gender and Transport. https://www.worldbank.org/en/topic/transport/publication/gender-and-transport

households formed of one elderly person living alone, one adult with children (Figure 6), and part-time workers (Figure 7).

However, **no conclusions can be drawn from our analysis that indicate a gender bias derived from the implementation of the policy measures analysed**. Further research in this domain is required to shed some light on why in this specific case gender implications are not found.

**Figure 6: Welfare impact (% of total expenditure) for different household types, without and with revenue recycling**

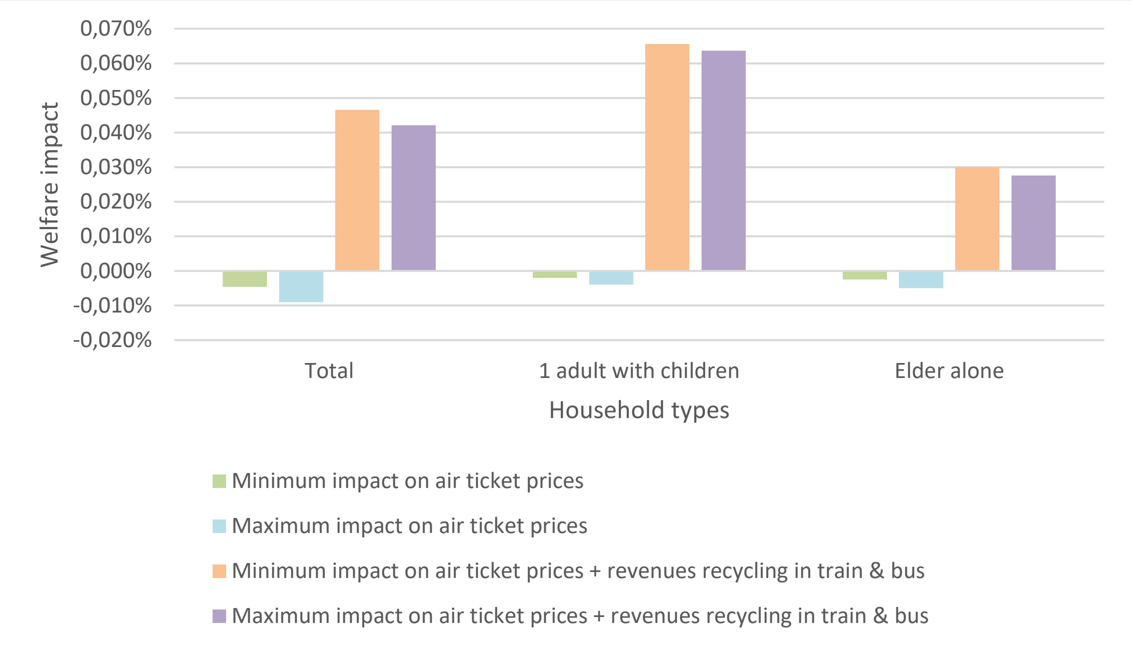
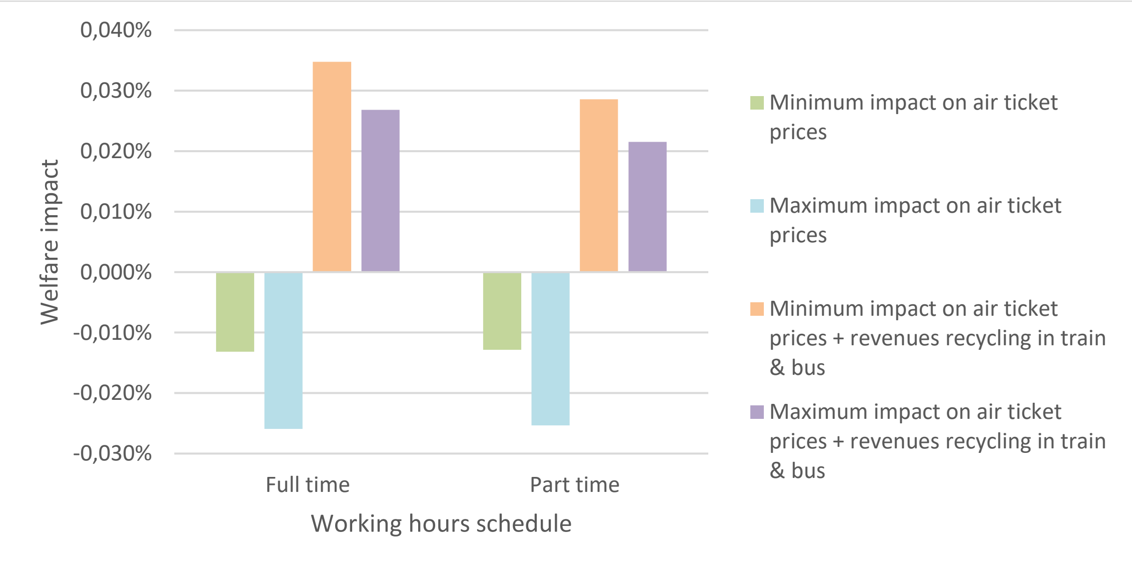



**Figure 7: Welfare impact (% of total expenditure) for different working hours schedules, without and with revenue recycling**



# 4. CONCLUSIONS AND RECOMMENDATIONS

Assessing the distributional impacts of policy proposals for the aviation sector is a complex task given the heterogeneity among households in the EU. This is enhanced by the complexity of the aviation sector (linked to multiple other phenomena such as tourism, immigration, freight transport, etc.).

Despite this and some methodological limitations, our model provides a general picture of the potential impacts on the welfare of households across the EU from implementing different policies in the aviation sector.

**This report finds that if carefully designed and implemented, the measures proposed have progressive distributional results and can create positive welfare impacts for a large number of households.**

In addition, these measures have the potential to reduce the sector's carbon footprint. Further research must be carried out to estimate the specific emissions reduction potential of the measures included in this analysis, but they could be expected to make a small but substantial contribution to reducing aviation emissions (Ricardo 2021; European Commission 2019).

Although the impacts on welfare are limited, they are still real and could in combination with other policies make a significant difference to a fair low-carbon transition. The measures have a significant symbolic and political weight as they show that the wealthier segments of the population and all economic sectors can contribute to the just and ecological transition enshrined in the European Green Deal. This is particularly important for the aviation sector which is one of the starkest examples of carbon inequality in the world today, and at a time when many of the poorest in our societies are bearing significant costs to implement the measures needed to reduce emissions in other sectors.

However, these measures on their own will not be enough to make a significant reduction in aviation emissions. They will require supporting measures to reduce emissions significantly, in terms of other PPP measures, investment in alternative modes, and development of low emission aviation technologies.

We recommend to:

- Implement the different measures analysed in this report: **a tax on kerosene, full auctioning of the EU ETS permits for the aviation sector and a stepped ticket tax rate** with a higher tax for longer flights. We emphasize the need to end the current tax exemption for kerosene.
- Avoid negative effects on household welfare by **recycling raised revenues into subsidizing low carbon transport modes** (e.g. buses and trains). This is

expected to generally benefit all households regardless of their economic positioning, but in particular the poorest income deciles.

- Continue to pursue a **more systematic approach to planning short and medium range travel in Europe**. The measures in this report on their own will make a marginal difference without supporting measures. Decarbonising the transport sector will require modal shift to trains and buses where possible, necessitating a significant improvement on the train and bus networks in Europe and beyond.

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