

Evaluation Support Study for the Revision of the Guidelines on State Aid to Airports and Airlines

Final Report

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Evaluation Support Study for the Revision of the Guidelines on State Aid to Airports and Airlines

Final Report

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Abstract

This Study supports the revision of the EU Guidelines on State Aid to Airports and Airlines in light of evolving market dynamics, the impact of COVID-19, and the challenges of the green transition for the European aviation sector. Evidence was collected through literature review, data analysis, stakeholder consultations, and six case studies. The findings show that profitability remains a structural challenge for regional airports (i.e. airports with annual passenger traffic volume of up to 3 million passengers per year): only about 54% of European regional airports that the Study has sampled were cost-covering in 2024 (figures reported by EU airport associations are even lower). Based on the literature review and stakeholders' consultations, smaller regional airports are most vulnerable due to high fixed costs, seasonality, and limited non-aviation related revenues. While regional airports with above 700,000 passengers per year are more likely to be cost-covering on average, the expected minimum number of passengers to break-even is reportedly rising due to increasing operating and investment costs, and reliance on operating and investment aid is widely acknowledged. Regional airports contribute positively to connectivity and local economic development, especially in peripheral regions of the EU. Regional airports exert limited competitive pressure on hubs but compete strongly with each other. COVID-19 intensified financial pressures, though leisure-driven recovery was relatively swift. Airports have a modest direct environmental footprint but play a crucial enabling role in decarbonisation of the aviation sector. The majority of consulted stakeholders call for additional State aid tools and incentives to address environmental and climate impacts in aviation, with airports in particular expressing stronger backing. Support for green conditionality falls short of a majority in all stakeholder groups except NGOs.

Résumé

Cette étude soutient la révision des lignes directrices de l'UE relatives aux aides d'État aux aéroports et aux compagnies aériennes, compte tenu de l'évolution des dynamiques du marché, de l'impact du COVID-19 et des défis liés à la transition écologique pour le secteur du transport aérien européen. Elle s'appuie sur une analyse documentaire, une analyse de données, des consultations des parties prenantes, ainsi que sur six études de cas. Les résultats montrent que la rentabilité reste un défi structurel pour les aéroports régionaux (c'est-à-dire les aéroports dont le trafic annuel de passagers est inférieur ou égal à 3 millions): seuls environ 54 % des aéroports régionaux européens échantillonnés par l'étude couvriraient leurs coûts en 2024 (les chiffres rapportés par les associations aéroportuaires européennes sont encore plus faibles). D'après l'analyse documentaire et les consultations des parties prenantes, les petits aéroports régionaux sont les plus vulnérables en raison de coûts fixes élevés, de la saisonnalité du trafic et des revenus non liés au transport aérien limités. Alors que les aéroports régionaux de plus de 700 000 passagers par an sont plus susceptibles de couvrir leurs coûts en moyenne, le nombre nécessaire de passagers pour atteindre le seuil de rentabilité serait en hausse en raison de l'augmentation des coûts d'exploitation et d'investissement, et la dépendance aux aides opérationnelles et à l'investissement est largement reconnue. Les aéroports régionaux contribuent positivement à la connectivité et au développement économique local, en particulier dans les régions périphériques de l'UE. Les aéroports régionaux exercent une pression concurrentielle limitée sur les hubs mais rivalisent fortement entre eux. La COVID-19 a intensifié les pressions financières, bien que la reprise liée voyages d'agrément ait été relativement rapide. Les aéroports ont une empreinte environnementale directe modeste mais jouent tout de même un rôle crucial dans la décarbonation du secteur du transport aérien. La majorité des parties prenantes consultées appellent à la mise en place d'outils et d'incitations supplémentaires en matière d'aides d'État pour lutter contre les impacts environnementaux et climatiques du transport aérien, les aéroports en particulier exprimant un soutien plus marqué. Le recours à l'éco-conditionnalité n'atteint pas un soutien majoritaire dans tous les groupes de parties prenantes, à l'exception des ONG.

Zusammenfassung

Diese Studie unterstützt die Überarbeitung der EU-Leitlinien für staatliche Beihilfen für Flughäfen und Luftverkehrsgesellschaften vor dem Hintergrund der sich wandelnden Marktdynamiken, der Auswirkungen von COVID-19 sowie der Herausforderungen des ökologischen Wandels für den europäischen Luftverkehrssektor. Die Erkenntnisse wurden durch Literaturrecherche, Datenanalyse, Konsultationen mit Interessengruppen sowie sechs Fallstudien gewonnen. Die Ergebnisse zeigen, dass die Rentabilität für Regionalflughäfen (d. h. Flughäfen mit einem jährlichen Passagieraufkommen von bis zu 3 Millionen Passagieren) nach wie vor eine strukturelle Herausforderung darstellt: Nur etwa 54 % der europäischen Regionalflughäfen, die in der Studie untersucht wurden, konnten 2024 ihre Kosten decken (die von den EU-Flughafenverbänden gemeldeten Werte sind sogar noch niedriger). Basierend auf der Literaturrecherche und den Konsultationen mit Interessengruppen sind kleinere Regionalflughäfen aufgrund hoher Fixkosten, Saisonabhängigkeit und begrenzter nicht-luftverkehrsbezogener Einnahmen am stärksten gefährdet. Zwar weisen Regionalflughäfen mit mehr als 700.000 Passagieren pro Jahr im Durchschnitt eine höhere Wahrscheinlichkeit auf, ihre Kosten zu decken; doch Berichten zufolge steigt die erwartete Mindestzahl an Passagieren zur Erreichung der Gewinnschwelle aufgrund steigender Betriebs- und Investitionskosten an, wobei die Abhängigkeit von Betriebs- und Investitionsbeihilfen weiterhin anerkannt ist. Regionalflughäfen leisten einen positiven Beitrag zur Anbindung und lokalen Wirtschaftsentwicklung, insbesondere von Gebieten in Randlage der Union. Regionalflughäfen üben nur begrenzt Wettbewerb auf Drehkreuze aus, konkurrieren jedoch stark untereinander. COVID-19 verschärfte den finanziellen Druck, obwohl die durch den Freizeitverkehr bedingte Erholung relativ schnell einsetzte. Flughäfen verfügen über einen geringen direkten ökologischen Fußabdruck, spielen jedoch eine entscheidende unterstützende Rolle bei der Dekarbonisierung des Luftverkehrssektors. Die Mehrheit der konsultierten Interessengruppen fordert zusätzliche Beihilfeinstrumente und Anreize, um die Auswirkungen des Luftverkehrs auf die Umwelt und das Klima zu adressieren, wobei insbesondere Flughäfen eine stärkere Unterstützung zum Ausdruck bringen. Mit Ausnahme von Nichtregierungsorganisationen lehnen es Interessengruppen jedoch ab, Beihilfen an Umweltauforderungen zu knüpfen.

Executive summary

The Guidelines on State Aid to Airports and Airlines ("AG" or "Aviation Guidelines") set out the criteria under which certain State support measures granted to airlines and airports are compatible with the single market. To let airports adjust to the persistent impact of the COVID-19 pandemic, the Aviation Guidelines were amended in July 2023 to prolong the 10-year transitional period for operating aid to regional airports by a further three years, from April 2024 (when it was originally due to expire) until April 2027. However, the Fitness Check conducted by the Directorate-General for Competition of the European Commission ("DG COMP") in 2019 and 2020 identified several issues that may require adjustments in the medium term, to better reflect the evolution of competition between airlines and between airports, the possible medium- to long-term consequences of COVID-19 and the challenges the sector faces to align with the green transition. To identify and better design the changes, the European Commission ("EC" or the "Commission") has gathered different types of evidence, through a series of initiatives. Within this context, the EC has also appointed a consortium of firms (hereinafter, collectively, the "Project Team"), led by Lear and comprising Deutsches Institut für Wirtschaftsforschung e. V. ("DIW") and EY Economic and Policy Advisory Services SRL ("EY"), to carry out this Evaluation Support Study for the Revision of the Guidelines on State Aid to Airports and Airlines (the "Study").

The Study leverages evidence stemming from:

- a review of the available literature;
- consultations of key stakeholders of the aviation industry;
- data analysis based on public data, commercial aviation data and data collected from airports as part of the Study;
- six case studies, each covering in-depth interviews with industry stakeholders.

The main findings of the Study are outlined below, organised by topic.

Airport Profitability

There has been no structural improvement in the profitability of European airports since 2014. The stakeholder consultations suggest that regional airports have not become more cost-covering compared to the situation before the introduction of Aviation Guidelines in 2014, and that achieving full cost coverage for loss-making regional airports by 2027 remains unlikely. Shocks such as the COVID-19 pandemic, geopolitical instability and rising costs due to higher energy prices and supply chain bottlenecks have worsened the outlook. The data analysis confirms that the proportion of cost-covering regional airports has declined from about 61% in 2014 to 54% in 2024, a downward trend already evident before COVID-19. Reports and consultation of regional airport associations suggest even lower shares (about one third) of cost-covering regional airports, which could be explained by the fact that smaller regional airports are underrepresented in the airport survey conducted for the Study.

Profitability is primarily driven by size. The literature points to high fixed costs, implying that smaller airports, with lower passenger spending and weaker non-aeronautical revenues, are structurally disadvantaged. Seasonality of traffic further reduces efficiency, particularly at tourist-dependent airports, while airline bargaining power may exacerbate difficulties and negatively impact aeronautical revenues of airports. The data analysis shows that medium-sized airports, i.e. airports that are neither regional airports nor hubs, often cover operating costs, while many regional airports operate at a loss. In particular, the results from the data analysis of this Study locate the break-even point (where airports fully cover operating costs absent subsidies) between 506,000 and 684,000 ppa, although this estimate needs to be interpreted with caution, due to the limited size and representativeness of the sample.

Among the consulted airports and airport associations, broader aviation industry associations, airlines and public authorities, the majority believes that the current rules on operating aid are not fulfilling their objectives or are unsure about this (especially among airlines). In each stakeholder group, however, a majority favours extending operating aid beyond April 2027 (the current AG state that operating aid will be phased out in April 2027) proposing amendments. Regional public authorities argue that since the disadvantages faced by small and peripheral airports are structural, transitional measures are not an appropriate solution. Several broader aviation industry associations and airports based in Denmark and Finland suggest raising the passenger thresholds under the General Block Exemption Regulation ("GBER"). Several airports and broader aviation industry associations view the State aid rules related to Services of General Economic Interest ("SGEI") as too narrow to serve as a viable alternative, while others believe that, if adapted, both GBER and SGEI rules could play a significant role in safeguarding connectivity.

Investment aid has supported projects aimed at ensuring compliance with new regulatory requirements and infrastructure improvements, including decarbonisation, safety and security upgrades, as well as modernisation and digitalisation. Smaller airports, which lack scale and already struggle with high operational costs, depended more heavily on public support to finance such projects, and will do so even more to align with climate change policies.

Connectivity and Economic Development

Airports generally provide significant connectivity benefits, though the scale and importance of regional airports vary widely. Their contribution is greatest in peripheral, island and rural areas where alternative transport options are scarce. In such regions, airports often act as critical enablers of economic activity, tourism and labour mobility. Data analysis confirms a positive association between regional airport traffic and local economic performance, although the effects are overall modest and highly dependent on the local context.

Since 2014, 35 commercial regional airports have ceased operations across Europe, most of which were very small. Simulations suggest that closures can lead to measurable declines in employment and gross domestic product ("GDP") per capita, though the actual impact depends on the availability of transport substitutes. Stakeholders reported that closures often resulted from bankruptcy or competition with nearby airports and had generally little impact except in peripheral regions where effects were more visible.

Competition and Market Dynamics

The impact of neighbouring airports in a catchment area remains central to understanding competition for passengers between airports. The definition of an airport's catchment area in the current State aid rules, i.e. around 100 km distance or around 60 min travel time, is generally considered too restrictive, with data showing substitutability within wider geographical ranges, at least up to 200 km and 120 min. However, catchment areas vary significantly based on, *inter alia*, airport size, routes overlap or route length (e.g. airports offering mainly long-haul flights seem to have larger catchment areas), business models, cross-border dynamics and local transport conditions.

The evidence collected suggests that regional airports exert only limited competitive pressure on hub airports. Consulted airlines tend to regard hubs and regional airports as serving complementary rather than substitutable markets, while airports themselves perceive competitive tension among them as stronger. Data analysis indicates that, at short distances from hubs, regional airports can substitute some traffic, but at greater

distances they are more likely to complement hub activity by stimulating additional demand.

Competition among regional airports themselves is shaped by geographical proximity. Data analysis confirms that when regional airports are located close together, traffic volumes are negatively correlated, indicating potential substitutability. The effect extends beyond the current catchment area definition.

Establishing new routes entails substantial fixed switching costs for airlines, particularly for full-service carriers ("FSCs"), whereas low-cost carriers ("LCCs") appear more flexible. Start-up aid measures provided in the AG, initially intended to reduce barriers for new and initially unprofitable routes and to increase connectivity, have been scarcely used compared to the number of new routes established without start-up aid. As of 2025, only 26 such measures were approved across the EU under the AG and previous 2005 State aid guidelines for airports and airlines. Airlines, public authorities and airports consistently pointed out the perceived unattractiveness of start-up aid provisions and administrative burdens. The consultations indicate thus that stakeholders broadly favour retaining start-up aid provisions and suggest introducing greater flexibility, particularly regarding duration and eligible costs. Empirical analysis on the other hand fails to show significant positive effects of start-up aid, though small sample sizes limit the robustness of this conclusion.

Impact of COVID-19

The pandemic created a severe shock for airports, including regional airports, which rely heavily on leisure travel. They were hit harder than hubs, but also rebounded faster as leisure demand returned more quickly than business demand. Still, smaller airports lagged in recovery, facing new vulnerabilities linked to seasonality. The years 2020 and 2021 were outliers, with very few airports covering costs, but financial performance has since converged back towards pre-crisis levels. Many stakeholders, mainly regional public authorities, national aviation authorities and airport industry associations underlined that the crisis reversed progress towards cost recovery for many airports and reinforced structural weaknesses.

Air Cargo

Air cargo activities differ markedly from passenger air transport in several respects on both the supply side and the demand side. Profitability appears to be more volatile. The catchment area approach appears to have no relevance for cargo, as competition between airports seems to take place at a much larger geographic scale. All in all, there are fundamental differences suggesting that cargo should be treated distinctly from passenger services when it comes to State aid. Evidence, in fact, would not support a joint evaluation of passenger and cargo traffic, at least not in general, for the purpose of assessing thresholds in the AG using simple metrics such as conversion ratios, as their relationship to profitability is likely more heterogeneous.

When coming to the scope of potential State aid rules for air cargo, the stakeholder consultations reveal limited support for revising the AG to introduce freight-specific State aid rules, as a number of stakeholders are concerned that such rules may distort competition. Most respondents agreed that special, freight-specific, rules could be justified only when freight services are essential for resilience, regional cohesion, or decarbonisation, but there is no call for a broad aid regime.

Greening of Aviation

Airports contribute only modestly to the direct emissions of the aviation sector but play a key enabling role in the decarbonisation of the aviation sector. Industry and regulatory initiatives have driven the adoption of electrified ground handling operations, sustainable aviation fuel ("SAF"), carbon offsetting, renewable energy, and

environmental reporting. Smaller airports face particular challenges in this transition due to limited financial resources and scarce access to in-house technical capability. The industry broadly calls for stronger EU support to airports and airlines, including aviation-specific measures under the AG for decarbonisation projects with eligibility extended to the entire supply chain at airports, notification exemptions for these investments under the GBER, and targeting aid to address bottlenecks in SAF production and deployment. Some environmental non-governmental organisations (“NGOs”), however, argue that demand reduction is the only meaningful climate response to reduce the direct emissions of the aviation sector.

Measuring sustainability performance of airports and airlines respectively is based on various metrics and methodologies. A sizeable group of stakeholders, in particular, environmental NGOs but also some broader aviation industry associations, support linking State aid for airports and airlines under the AG to measurable green outcomes (“green conditionality”) but caution that proportionality is needed to avoid burdening small and remote airports. Overall, stakeholders that support conditionality, in particular, airlines, airports and some (regional, local) public authorities, argue that environmental conditionality should be designed flexibly.

Regional airports are not generally seen by consulted stakeholders as having a considerable or significant role in easing congestion at major EU hubs and reducing emissions related to taxiing and holding patterns, as well as to shorter direct journeys. Data analysis shows no significant evidence that passenger volumes at regional airports reduce departure delays at nearby hubs. Any substitution that does occur appears too limited to be reflected in average delay statistics. On the other hand, a direct analysis of local air pollution data shows that shifting flights from hubs to regional airports may improve air quality in the hub area, but data limitations do not allow us to conclude that a redistribution of traffic from hubs to regional airports has positive effects on overall CO₂ and air pollutant emissions.

Last, State aid to airports and airlines may interact with competition from high-speed rail (“HSR”). Although start-up aid is not allowed when the same connection is already operated by HSR service, the concern may still be justified due to more dynamic interactions or at least for other types of aid. Where HSR offers competitive travel alternatives, it has eroded the market share of airlines, which shows that HSR is a competitive alternative to air travel on some routes. In this context, aid to airports and airlines may distort competition with HSR and undermine climate goals. Airports, airlines and aviation industry associations see little overlap due to limited existing HSR coverage in some parts of the EU, while environmental NGOs highlight risks of slowing substitution from air travel to rail travel. Integrating airports with HSR networks is widely seen as a promising path, with potential to reduce the number of short-haul flights and level of emissions, but effectiveness depends on a careful design to avoid stimulating air traffic demand for long-haul flights to/from hubs connected to the rest of the territory via HSR, which in turn could offset any emission reductions achieved through substitution effects on short-haul routes.

Clarity and burdensomeness of the Aviation Guidelines

Consulted stakeholders including airports, airlines, broader aviation industry associations, public authorities and environmental NGOs perceive the AG as containing some unclear definitions and rigid provisions, especially concerning start-up aid rules. Furthermore, they are perceived as being complex due to overlaps with other State aid rules, especially the Climate, Energy and Environmental Aid Guidelines (“CEEAG”). Clarifications are needed on non-economic activities like security, perimeter protection required to safeguard the physical boundaries of an airport, and dual-use investments. Regional public authorities and regional airports report that eligibility criteria and cost definitions require extensive legal and financial interpretation, imposing a heavy

workload on airports with limited resources. Preparing detailed business plans, funding gap analyses (i.e. calculating the part of project costs that cannot be covered by expected revenues and therefore requires public support), and counterfactual scenarios is demanding, and notification and approval processes are seen as too lengthy, bureaucratic, and costly when accounting for consultancy fees. Especially smaller airports and municipalities find the procedures disproportionately burdensome, as detailed legal and financial analyses are required even for limited aid amounts. Moreover, the lack of flexibility to prolong existing measure especially in the context of a crisis, or to review measures when market conditions change is seen as discouraging. Therefore, public authorities call for greater reliance on the GBER.

1 Introduction and overview of the approach

The current Guidelines on State Aid to Airports and Airlines – as issued in 2014 and thereafter amended – (“AG” or “Aviation Guidelines”)¹, set out the criteria under which certain State support measures granted to airlines and airports are compatible with the single market. To enable airports to adjust to the persistent impact of the COVID-19 pandemic, the Aviation Guidelines were amended in July 2023 to prolong the 10-year transitional period for operating aid² to regional airports³ by a further three years, from April 2024 (when it was originally due to expire) until April 2027. Moreover, the *Fitness Check* conducted by the Directorate-General for Competition of the European Commission (“DG COMP”) in 2019 and 2020⁴, identified several issues that may require adjustments, to better reflect the evolution of competition between airlines and airports, the possible medium- to long-term consequences of COVID-19 and the challenges the sector faces to mitigate the impact of airlines and airports on climate and the environment.

To identify and better design the changes, the European Commission (“EC” or the “Commission”) has appointed a consortium of firms (hereinafter, collectively, the “Project Team”), led by Lear and comprising Deutsches Institut für Wirtschaftsforschung e. V. (“DIW”) and EY Economic and Policy Advisory Services SRL (“EY”), to carry out an Evaluation Support Study for the Revision of the Guidelines on State Aid to Airports and Airlines (“Study”).

The objective of this Study is to provide scientific evidence to underpin the revision of the AG. Specifically, the Study seeks to contribute to the EC’s reflection on the policy options being considered to revise the AG, which are the following:

- whether and to what extent operating aid to regional airports, currently allowed in the AG until April 2027, should be extended;
- whether start-up aid⁵ to airlines is still needed and adequate;
- whether rules on investment aid⁶ to airports should be adjusted to ensure alignment with regional accessibility and connectivity⁷ needs, also in light of the existing options for granting aid to airports and airlines in the form of public compensation for Services of General Economic Interest (“SGEI”);

¹ Communication from the Commission — Guidelines on State Aid to airports and airlines, OJ C 99, 4.4.2014, pp. 3–48.

² “Public funding to cover the operating losses, either in the form of an upfront payment or in the form of periodic instalments to cover expected operating costs (periodic lump sum payments).” (AG, §25(21)).

³ ‘Regional airports’ are airports with annual passenger traffic volume of up to 3 million ppa.

⁴ Fitness Check of the 2012 State aid modernisation package, railways guidelines and short-term export credit insurance. 2019–2020. https://competition-policy.ec.europa.eu/state-aid/legislation/modernisation/fitness-check_en.

⁵ “State aid granted to airlines for launching a new route with the aim of increasing the connectivity of a region.” (AG, §138).

⁶ “Public funding to finance fixed capital assets, specifically, to cover the capital costs funding gap.” (AG, §25(18)).

⁷ Level to which an airport (or a region) is connected to the rest of the world, through the global air transport network, either by direct flights (in terms of destinations and frequency of flights) or accounting for the availability of indirect connections via other airports.

- whether the catchment area⁸ definition is still valid to establish the compatibility of the different forms of aid, given the evolution of competition between airports and airlines;
- whether the AG should include new rules to promote the alignment of the aviation sector with Green Deal objectives, or whether the existing rules under the Climate, Energy and Environmental Aid Guidelines ("CEEAG")⁹ and the Framework for State aid for Research and Development and Innovation ("RDI guidelines")¹⁰ sufficiently support these goals;
- and how compliance with a possible green conditionality¹¹ of State aid measures could be implemented and ensured.

This document represents the final report of the Study.

Section 1.1 briefly explains the methodological approach and the essence of the four workstreams that have been combined to collect and process the evidence needed to complete the Study, while Section 1.2 summarises the content of each section of the Study.

1.1 Methodological approach

The Terms of Reference ("ToR") required the Study to provide evidence-based answers to a set of more than 30 research questions (individually "RQ", collectively "RQs"). The tasks to collect and process different types of evidence required to support the AG revision have been organised into four workstreams, based on the type of evidence: literature review, data collection and analyses, consultations and case studies.

Sections 1.1.1 to 1.1.4 provide an overview of the main features of the specific workstreams' methodological approaches.

1.1.1 Literature review

The literature review draws on a broad range of sources, including academic papers, reports, and case law, with studies selected primarily for their relevance to the RQs and analytical quality. In instances where direct evidence on the RQs was scarce, studies on related topics that could offer indirect insights were considered. Older studies were included only where more recent evidence was unavailable, clarifying to what extent the results could still be valid. Studies with methodological limitations were included if they were frequently cited in other works, while critically assessing their contributions.

To ensure readability, detailed methodological descriptions are omitted, though the assessment of methodological soundness informed both the selection of studies and the weight given to their results. A complete list of references is provided in Annex B.

⁸ Geographic area surrounding an airport where the latter can reasonably expect to draw passengers. Based on the AG "it is normally set at around 100 kilometres or around 60 min travelling time by car, bus, train or high-speed train to/from the airport (...)", although it can vary depending on specific characteristics of an airport "including its business model, location and the destinations it serves." (AG, §25(12)).

⁹ Communication from the Commission – Guidelines on State Aid for climate, environmental protection and energy 2022 (OJ C 80, 18.2.2022, pp. 1–89).

¹⁰ Communication from the Commission Framework for State aid for research and development and innovation (OJ C 414, 28.10.2022, pp. 1–38).

¹¹ A policy mechanism linking State aid to airports and airlines under the Aviation Guidelines to measurable decarbonisation outcomes that the aid recipient should comply with.

1.1.2 Consultations

This Study gathers evidence from four different stakeholder consultations. The stakeholder survey and the airport survey have specifically been designed and delivered by the Project Team for this Study.

The airport survey was designed as a complementary data collection tool by the Project Team to obtain detailed airport-level data unavailable through public sources or commercial databases. Its main goal was to collect detailed financial and operational information from a sample of EU regional airports for the period 2014–2024, to support the quantitative analyses. Sample selection criteria are described in Annex D.1.2. The collected data are integrated in the data analysis and summarised in Section 1.1.3 and, presented in more detail in Annex E.4.¹²

The stakeholder survey has been designed as a central part of the Study, to ensure a representative and balanced coverage across Member States of all stakeholder groups. It gathered views on the broad set of topics defined by the ToR regarding the relevance, effectiveness, and clarity of the AG. It was launched on February 24 and closed on September 30, 2025.¹³

The other two consultations were designed and managed by the EC. First, the EC published a call for evidence¹⁴ in August 2024, which ran until 8 October 2024, to launch the review of the AG. This initiative was open to everyone and aimed to collect initial comments and views on the current needs of the aviation sector that could be addressed by revised AG. A subsequent public consultation¹⁵ was open from 11 December 2024 to 5 March 2025. It took the form of an in-depth questionnaire intended to help the EC identify the necessary changes and better design the new rules.

Section 1.1.2.1 describes the diverse nature and treatment of the call for evidence. Section 1.1.2.2 briefly illustrates the overlaps between the stakeholder survey and the public consultation and the methods used to merge and present the combined evidence in the Study.

1.1.2.1 Call for evidence

The call for evidence received 77 valid feedback instances in total.¹⁶ Given the broader nature of these submissions focusing on the general objectives, the Project Team restricted the attention to feedback relevant to the RQs examined in this Study and submitted by the same categories of stakeholders considered in the other consultations. As a result, 48 feedback submissions were retained. Among these, companies and businesses accounted for 39.6% (including airlines and airports operators), public authorities 27% (including ministries, governmental bodies, and local or regional authorities), business associations 23% (including airline and airport associations) and non-governmental organisations ("NGOs") 10.4%. Given the non-structured nature of

¹² More details on the airport survey design and dissemination are provided in Annex D.

¹³ More details on the stakeholder survey design and dissemination are provided in Annex D.

¹⁴ EC (2024), Call for evidence on "State aid in the aviation sector – Commission guidelines on airports and airlines (revision)", available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13915-State-aid-in-the-aviation-sector-Commission-guidelines-on-airports-and-airlines-revision_en.

¹⁵ https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13915-State-aid-in-the-aviation-sector-Commission-guidelines-on-airports-and-airlines-revision-/public-consultation_en.

¹⁶ Respondents included companies/businesses (35%), EU citizens (20.8%), public authorities (16.9%), business associations (15.6) and NGOs (7.8%, including public entities' associations and environmental NGOs).

the input, only the most important takeaways are presented in the Study, when they provide any additional insights to the evidence collected through the other consultations.

1.1.2.2 The Stakeholder survey and the Public Consultation

The stakeholder survey and the public consultation share a similar design and overlap to a certain extent. Both are based on detailed questionnaires, which partially overlap in terms of topics and, in some cases, in the phrasing of the questions. However, the stakeholder survey went further and included more technical and implementation-oriented questions that were not part of the public consultation.¹⁷ As a result, some topics or specific questions rely solely on responses from the stakeholder survey. On the other hand, each consultation also includes questions that explore different nuances of the same topic, which are not reflected in the other questionnaire.

There was also a significant overlap in the stakeholders targeted. For example, both surveys addressed key EU and national associations of airports and airlines, as well as EU-level organisations working on climate-change issues related to air transport. In addition, some national and regional public administrations responsible for granting support to actors in the aviation sector were considered relevant in both surveys. Consequently, throughout the consultation process, the Project Team encouraged respondents to the public consultation to also participate in the stakeholder survey in order to provide answers to the questions included only in the latter.¹⁸

A total of 106 responses to the stakeholder survey were received.¹⁹ In addition, the public consultation questionnaire was completed by 136 stakeholders, 30 of whom also participated in the stakeholder survey. The relevant stakeholder groups are:²⁰

- national or regional granting authorities (e.g. ministries, municipalities or regional governments);
- airports, airport managing bodies or airport associations;
- “broader” aviation industry associations, i.e. broad-based industry associations that bring together stakeholders with diverse (and at times conflicting) interests and cannot be identified with any single stakeholder group;²¹
- environmental NGOs;
- airline or airline associations;
- citizens.²²

¹⁷ These covered, for instance: (i) information on regional airports (closures, cost coverage, profitability, differences in size), (ii) information on airlines (routes opened with start-up aid, differences in types of airlines); (iii) the adequacy of aid thresholds; (iv) information concerning notifications on different types of aid; (v) administrative burdens; (vi) information on environmental best practices and standards.

¹⁸ To maximise the number of responses to all questions of the stakeholder survey, that not always had an equivalent in the public consultation questionnaire, the Project Team sent customised, shortened versions of the stakeholder survey to respondents who had already participated in the public consultation but not in the stakeholder survey, allowing them to provide additional input while preventing survey fatigue.

¹⁹ It is important to note that this number includes five stakeholders who responded to our invitation to participate in the full or customised survey after the Project Team contacted them, following information about their participation in the public consultation organised by the EC.

²⁰ The distribution is shown in Annex D.2. Stakeholder groups reflect the categories defined in the ToR.

²¹ Associations that may combine airlines, airports, aircraft manufacturers, cargo associations, workers in the aviation industry, or national business associations that also work in the general field(s) linked to aviation.

²² Citizens are only present in the public consultation.

The harmonised stakeholder categorisation described above is used throughout the Study to present in detail the consolidated results from both consultations. In 30 cases, stakeholders participated either partially or fully in both the stakeholder survey and the public consultation. To avoid double counting, the Project Team applied a question-level reconciliation approach. Specifically, when a respondent provided an answer to the same question in both exercises, only the response from the stakeholder survey was counted. Conversely, when a respondent answered a question that appeared in only one of the two consultations, that response was included in the results of the respective consultation. This method ensured that each organisation's views were counted only once per question, thereby maintaining consistency.

Each thematic subsection of this Study that presents consultation results in detail explicitly indicates whether the evidence draws on both sources or relies solely on one, ensuring transparency in how the findings are derived and interpreted.

Further information on the methodological approach to the Study's surveys is provided in Annex D.

1.1.3 Data analysis

The empirical analysis conducted by the Project Team combines several quantitative data sources to provide evidence base on airport performance, and competition across the EU-27, the United Kingdom ("UK") and Türkiye. The work draws primarily on four categories of information: (i) commercial aviation data from Cirium, (ii) airport survey data collected specifically for this Study, (iii) information on approved start-up aid measures from the EC's Competition Case Search Database, the Transparency Database and EC's own State aid records (information shared by the EC), (iv) official statistics from Eurostat and the European Environment Agency ("EEA"), and (v) complementary desk research. These sources were harmonised and validated to construct consistent airport- and region-level datasets covering the 2014–2023 period.

The Cirium database provides detailed information on passenger volumes, flight frequencies, airline presence and route structures for all commercial airports in the EU-27, the UK and Türkiye. It is used to classify airports by size, define hub and regional airport categories, and analyse competition and catchment-area overlaps. Cirium also allows the identification of new route entries and the composition of airline routes over time.

The airport survey, implemented by the Project Team, adds financial and operational detail unavailable in commercial datasets. It covers 76 airports (often referred to as "surveyed airports" in the context of the data analysis), of which 59 are regional, and spans more than 800 airport-year observations over 2014–2024. The questionnaire collected information mainly on Earnings Before Interest, Taxes and Depreciations ("EBITDA") net of any aid received to cover operating costs²³ and of any compensation received to cover SGEI obligations (referred to as "EBITDA net of aid" or simply as "EBITDA" in the context of the data analysis), providing direct evidence on airports' financial performance and cost coverage.

²³ "Underlying costs of an airport in respect of the provision of airport services, including cost categories such as cost of personnel, contracted services, communications, waste, energy, maintenance, rent and administration, but excluding the capital costs, marketing support or any other incentives granted to airlines by the airport, and costs falling within a public policy remit." (AG, §25(22)).

The start-up aid database is built from the EC's data (Competition Case Search Database²⁴, Transparency Database²⁵ and EC's own State aid records). It records all approved start-up aid measures granted to airlines that apply to the period 2014-2024, amounting to 26 cases across the EU.²⁶ The dataset includes the characteristics of each measure, the airports and routes concerned, and the type of carrier supported. It is used to describe the incidence and design of start-up aid within the overall evolution of European air transport.

Eurostat data provide regional socioeconomic indicators, including gross domestic product ("GDP") per capita, employment and population at NUTS 2 and NUTS 3 levels, allowing the analysis of links between regional airports and regional economic outcomes. Data from the EEA complement this with environmental indicators, such as emission factors.

The Project Team applies descriptive analysis that combines the various data sources to provide an integrated and comprehensive picture of the structure and performance of the European airport sector. By pooling operational, financial, and regional information, the Study establishes indicators of market structure, profitability, and regional development.

The Study also applies quantitative and econometric techniques to examine the relationships most relevant for the revision of the AG. These models are used to quantify associations between airport activity, financial performance, and regional economic indicators, while controlling for structural differences across airports and regions.

1.1.4 Case studies

The case studies complement the quantitative and consultation-based analyses by providing qualitative, context-specific evidence on the functioning and challenges of regional airports and airlines. A detailed methodology of the case studies is presented in Annex A.

Six case studies were selected to cover a range of airport profiles and policy-relevant themes:

- a regional airport located near a hub airport, examining topics such as competition and complementarity of regional airports with hubs, environmental challenges, and intermodality ("regional airport close to a hub case study");
- a regional airport that has a record of profitability without State aid, with a focus on topics such as profitability drivers, competition, regional connectivity, and the complexity of the AG ("profitable regional airport case study");

²⁴ Available here: <https://competition-cases.ec.europa.eu/>.

²⁵ Available here: <https://transparency.dsa.ec.europa.eu/>.

²⁶ The dataset also includes measures approved under the 2005 Aviation Guidelines (Communication from the Commission — Community guidelines on financing of airports and start-up aid to airlines departing from regional airports, OJ C 312, 9.12.2005, pp. 1–14). These guidelines were applicable from 2005 until 3 April 2014, and the dataset includes also measures approved under the 2005 Aviation Guidelines before 2014, but that apply in and beyond 2014 as well.

- an outermost region ("OR")²⁷ airport, focusing on topics such as its relevance for connectivity, regional development, and the role of State aid ("OR airport case study");
- an airport specialising in cargo operations, analysing profitability challenges, investment needs, competition, and connectivity from a cargo perspective ("cargo airport case study");
- a regional airport, considering the greening of aviation and related environmental measures ("regional airport/greening case study");
- a regional airline²⁸, exploring the functioning and relevance of start-up aid ("regional airline case study").

Each case study was developed using: i) evidence collected through interviews with the target of the case study, as well as through separate interviews with relevant stakeholder(s), where available; ii) secondary data and desk research from publicly available sources (e.g. Eurostat, Cirium, airport annual reports, national statistics) to provide context to the perspectives of targets and stakeholders.

Case study evidence is qualitative and illustrative, intended to contextualise other workstreams rather than provide representative findings; relevant insights are integrated into thematic sections and occasionally summarised as anecdotal, policy-relevant examples.

1.2 Final report structure

The RQs to which the Study has to provide evidence-based answers, have been grouped into seven thematic sections connected to the general objectives of the AG revision. Each section of the Study focuses on one of the seven themes, presenting all the evidence collected for relevant RQs that are discussed for each respective topic. Each section can be further divided into thematic subsections based on how the topics have been organised to better guide the discussion. In each thematic section or subsections, the Study presents sequentially the contributions available from the different workstreams (literature review, consultations and case studies, data analysis). Case study insights are included in the form of boxes only in the consultation's sections, reflecting their illustrative, anecdotal nature. At the end of each thematic section or subsection, the Project Team's conclusions elaborating on the output of the different workstreams are provided.

This structure has been designed to triangulate all available evidence for a set of RQs that are strictly related to each other, and are therefore grouped under the same topic, ensuring consistency.

The rest of the document is structured as follows:

²⁷ Close list of nine EU territories (Guadeloupe, French Guiana, Martinique, Mayotte, Réunion and Saint Martin (France), the Canary Islands (Spain) and the Azores and Madeira (Portugal)), defined in Article 349 TFEU and distinguished by their remoteness from mainland Europe, insularity, small size, difficult topography and climate and economic dependence on a few products.

²⁸ There is no technical or legal definition of regional airline under EU aviation law. However, the concept is acknowledged by EU institutions and associations. Regional airlines, also called feeder or commuter airlines, are understood as typically operating short-haul routes with smaller aircraft (e.g. Turboprops or regional jets), often serving lower demand ("thin") markets that are not viable for larger carriers, thereby enhancing connectivity between regional/peripheral airports and major hubs, often under a Public Service Obligation (PSO) or as feeders for larger network carriers. They can operate independently or under franchise/codeshare agreements with larger carriers.

- Section 2 analyses airport profitability, presenting both descriptive evidence and econometric estimates, and discussing the impact of size, seasonality²⁹, non-aeronautical revenues³⁰, ownership models, and other structural factors on airports' profitability;
- Section 3 explores the contribution of regional airports to connectivity and economic development, including their role in regional accessibility and integration into transport networks;
- Section 4 examines competition and market dynamics, covering the definition of catchment areas, the extent of competition between regional airports and hubs, and the role of airlines in shaping competitive outcomes;
- Section 5 reviews the impact of the COVID-19 pandemic, focusing on traffic recovery patterns, financial resilience, indebtedness, and long-term structural changes in demand;
- Section 6 provides evidence from the literature and from stakeholders' consultations on the air cargo segment;
- Section 7 addresses the greening of aviation, describing airports' practices to mitigate aviation emissions and existing standards to measure their environmental performance, analysing the environmental impact of traffic distribution between hubs and regional airports, and providing evidence on the environmental and competitive impact of intermodality, particularly high-speed rail ("HSR");
- Section 8 illustrates stakeholders' perception of the clarity, burdensomeness, and compliance of the AG, based on evidence collected throughout the Study.

The annexes provide supporting material to the main report as outlined below:

- Annex A presents the methodology and the process of data collection for the case studies;
- Annex B lists the references examined as part of the literature review;
- Annex C presents tables and data from the literature review focused specifically on the environmental impacts of airports, supporting the contextual analysis;
- Annex D describes the methodology and fieldwork of the stakeholder and airport surveys, covering sample selection, pilot testing, full dissemination (including alignment with the EC public consultation), and the resulting survey responses, attached to the final report;
- Annex E contains the description of data sources used in the Study (commercial aviation, publicly available, State aid, and survey data), with detailed statistics on airlines, airports, and the final survey dataset;
- Annex F contains the analysis of airport catchment areas, including definitions of relevant markets, summary statistics, congestion delays, and the general modelling approach;

²⁹ Annual fluctuation in flight demand and ticket prices, driven by factors like holidays, weather, and peak travel periods.

³⁰ Revenues coming from commercial services to airlines or other users of the airport, such as ancillary services to passengers, freight forwarders or other service providers, renting out of offices and shops, car parking and hotels. (AG, §25(20)).

- Annex G contains the analysis of start-up aid, including statistics on low-cost carriers ("LCCs")³¹ and airlines as well as definitions and data on routes;
- Annex H contains the analysis of airport closure and its impact on regional development, including summary statistics and details of the simulation performed;
- Annex I contains the glossary and definitions used throughout the Study, providing clear explanations of key terms, concepts, and abbreviations.

³¹ Type of airline (also known as a no-frills, discount or budget airline) operating with a business model that focuses on reducing operational expenses while providing lower basic fares than FSCs. LCCs usually operate direct high-demand routes between secondary or regional airports, avoiding complex hub-and-spoke systems to reduce turnaround times and increase aircraft utilization, and rely on fewer aircraft models than FSCs. To make up for revenue lost in low-cost ticket prices, the airline usually charges extra fees for food, baggage, priority boarding, seat selection.

2 Airport profitability

Regional airport profitability is a central issue in the design of State aid policy. The extent to which State aid remains justified under the EU competition framework depends on whether there are structural impediments to the ability of certain regional airports to finance their operations and investments without public support, and on whether they provide essential connectivity. This section examines the first limb of this question, whereas the second limb is examined in Section 3.

The section begins with an overview of the airport landscape across the EU, the UK and Türkiye (Section 2.1), describing how airports are distributed by country, size, and type. Section 2.2 examines the profitability of airports, presenting the descriptive evidence collected by the different workstreams on the share of airports that are cost-covering and the extent to which it has evolved since 2014. Section 2.3 reviews the main factors affecting profitability. Section 2.4, building on the airport survey data, provides estimates of a threshold representative of the minimum number of passengers per year (“ppa”) typically required for airports to reach financial break-even³² and discusses the results of the stakeholder consultations on operating aid (presenting stakeholders’ perspectives on whether the current rules on operating aid have met their objectives and on the need for, and possible design of, an extension beyond April 2027). Section 2.5 reviews stakeholders’ past experience and anticipated future need of investment aid.

Table 2.1 summarises the RQs addressed in this section.

³² Minimum annual passenger traffic necessary for an airport’s operating revenues to fully offset its operating costs, absent external subsidy.

Table 2.1: Mapping of the RQs against sections

Research questions	Section
1. How many airports/regional airports exist currently in the EU? Main statistics, relevant typology for the airport sector in the EU (including size, type of ownership, whether or not part of an airport network).	Section 2.1
3. How many regional airports are cost-covering? How many of these became cost-covering since 2014?	Section 2.2
4. How many regional airports are not cost-covering? How many of these airports are expected to be cost-covering by April 2027 and how will they achieve this? By when are the remaining airports expected to be cost-covering?	
5. What are the common features of unprofitable airports that are unlikely to achieve full operating cost coverage by the end of the transitional period (e.g. size, Member State, location within territory, population size within a catchment area, intensity of competition from neighbouring airports, business model, management organisation, type and number of airlines operating at the airport, type of customers, financial situation, including main revenue and cost items)? What are the common features of unprofitable airports that are unlikely to ever achieve full operating cost coverage?	Section 2.3
6. Which level of traffic is typically needed, in terms of passengers/traffic, for an airport to be able to achieve full operating cost coverage (considering fixed and variable costs and aeronautical and non-aeronautical revenues)?	Section 2.4
10. (i) Has operating aid to airports been granted without notification by Member States since 2014? (ii) If so, which amounts of aid are involved and (iii) what was the form of unlawful operating aid granted (e.g. loan, direct grant, etc.)?	
11. Do Member States and stakeholders consider that the current rules on operating aid for airports are fulfilling their objective, i.e. helping regional airports to cover their operating costs and becoming costs covering by the end of the transitional period?	
12. Do Member States and stakeholders consider that operating aid to airports should be allowed beyond April 2027, if so, for how long and for which reasons?	
13. If operating aid is to be discontinued, could regional airports qualify for aid in the context of a Service of General Economic Interest?	
14. (i) Has investment aid been granted without notification by Member States? (ii) For which investment purposes?	Section 2.5
15. For which investment purposes do airports consider that investment aid will be needed in the future? Are there any differences between airports (e.g. because of their size, location or business model, etc.)?	

Source: Project Team

2.1 Overview of airports in the EU, UK and Türkiye

Understanding how many airports exist in the EU, UK and Türkiye, how they are distributed across countries, and how they differ by size and type is crucial for assessing both competition and the potential role of State aid. The hypothesis is descriptive: if the EU airport sector is characterised by a large number of small regional airports alongside a small set of hubs, this structure implies that competition is highly fragmented and that many (smaller) airports may struggle to be financially self-sustaining.

To examine this, the Study provides descriptive statistics on the number and distribution of airports by country and by airport type.

We distinguish between regional airports, hubs, and “mid-size” airports:

- *regional airports* are defined as those with traffic of up to 3 million ppa;
- *hub airports* are defined based on the following criteria: (i) more than 10% transfer passengers on average between 2014–2024, and/or (ii) more than 1% of total European transfer passenger volume on average between 2014–2024, and/or (iii)

designation as a hub by the main full-service carriers ("FSCs")³³ and handling over 5 million ppa;

- *mid-size* airports are those that are neither classified as hub nor regional airports.

For details, see definitions in Annex E.1.

We also group airports into size classes (classes 1–5)³⁴, which allows us to analyse the sector both in terms of number of facilities and in terms of passenger throughput. This dual classification helps us link the descriptive structure of the airport sector to subsequent analyses of profitability and break-even points.

The data are mostly drawn from a commercial aviation data provider, Cirium (see Annex E for more details). The publicly available database *OurAirports*³⁵, has instead been used to ensure consistency in airport nomenclature and for airport geolocalisation.

We caution that, while the descriptive statistics provide a comprehensive overview of the airport landscape, they do not capture quality differences, ownership models, or institutional frameworks that also affect airport performance. Moreover, simple counts of airports do not indicate actual market relevance, since some facilities handle very small numbers of passengers or operate only seasonally.

Table 2.2 shows the distribution of airports per country, in total, and split up by type (hub, mid-size and regional). As shown in the table, France and UK have the most airports (80 and 65), France, Germany and Türkiye have the most hubs (4 each), and France and UK have the most regional airports (69 and 50). Whereas Italy and Spain have fewer airports in total (44 and 50), they have the largest number of mid-size airports (18 and 15). Overall, while airports exist across all size classes, their distribution is uneven, with a strong concentration in the smallest passenger categories.

³³ Type of airline (also referred as "legacy" or "network" or "flag" airline or carrier) that offers a comprehensive range of services to its passengers, distinguishing itself from LCCs through its operational model and customer experience. FSCs typically operate hub-and-spoke networks, offer short-, medium-, and long-haul routes, and multiple travel classes, and may provide amenities such as in-flight meals, entertainment, seat selection and free checked baggage included in the ticket price.

³⁴ The size classes are those defined in the AG for operating aid (§118). The AG rely on a categorisation that divides airports into five groups based on their average ppa with respect to a certain reference period ("size classes" or "classes"), to flag the varying degree of airports' ability to cover operating costs and, accordingly, determine access to and intensity of operating aid. Regional airports are those that belong to the first four classes. The five classes are: Class 1: up to 200,000 ppa; Class 2: 200,000-700,000 ppa; Class 3: 700,000-1 million ppa; Class 4: 1,000,000-3,000,000 ppa; and Class 5: above 3 million ppa.

³⁵ *OurAirports.com* is an independent website aggregating airport-related data from multiple publicly available sources, based on reported changes and user submissions. Further details on data sources and update mechanisms are available at: *OurAirports.com*

Table 2.2: Distribution of airports in the EU, UK and Türkiye by country and type of airport

Country name	Total number of airports	Number of hub airports (% of total)	Number of mid-size airports (% of total)	Number of regional airports (% of total)
Austria	6	1 (16.7%)	0 (0.0%)	5 (83.3%)
Belgium	6	1 (16.7%)	1 (16.7%)	4 (66.7%)
Bulgaria	4	0 (0.0%)	1 (25.0%)	3 (75.0%)
Cyprus	4	0 (0.0%)	3 (75.0%)	1 (25.0%)
Czechia	6	0 (0.0%)	1 (16.7%)	5 (83.3%)
Germany	39	4 (10.3%)	5 (12.8%)	30 (76.9%)
Denmark	11	1 (9.1%)	1 (9.1%)	9 (81.8%)
Estonia	5	0 (0.0%)	0 (0.0%)	5 (100.0%)
Greece	40	0 (0.0%)	6 (15.0%)	34 (85.0%)
Spain	50	1 (2.0%)	15 (30.0%)	34 (68.0%)
Finland	21	1 (4.8%)	0 (0.0%)	20 (95.2%)
France	80	4 (5.0%)	7 (8.8%)	69 (86.3%)
Croatia	9	0 (0.0%)	2 (22.2%)	7 (77.8%)
Hungary	3	0 (0.0%)	1 (33.3%)	2 (66.7%)
Ireland	7	1 (14.3%)	1 (14.3%)	5 (71.4%)
Italy	44	1 (2.3%)	18 (40.9%)	25 (56.8%)
Lithuania	4	0 (0.0%)	1 (25.0%)	3 (75.0%)
Luxembourg	1	0 (0.0%)	1 (100.0%)	0 (0.0%)
Latvia	2	1 (50.0%)	0 (0.0%)	1 (50.0%)
Malta	1	0 (0.0%)	1 (100.0%)	0 (0.0%)
Netherlands	7	1 (14.3%)	1 (14.3%)	5 (71.4%)
Poland	15	1 (6.7%)	5 (33.3%)	9 (60.0%)
Portugal	21	1 (4.8%)	3 (14.3%)	17 (81.0%)
Romania	17	1 (5.9%)	0 (0.0%)	16 (94.1%)
Sweden	40	1 (2.5%)	1 (2.5%)	38 (95.0%)
Slovenia	2	0 (0.0%)	0 (0.0%)	2 (100.0%)
Slovakia	5	0 (0.0%)	0 (0.0%)	5 (100.0%)
Türkiye	54	4 (7.4%)	5 (9.3%)	45 (83.3%)
United Kingdom	65	3 (4.6%)	12 (18.5%)	50 (76.9%)
Total	569	28 (4.9%)	92 (16.2%)	449 (78.9%)

Source: Project Team based on Cirium.

Table 2.3 looks at airports by size class. Most airports are recorded in class 1 (236). All airports in class 1-4 are defined as regional airports for the purpose of this Study. There are 92 mid-size airports and 28 hubs (see Table E.2 for the list of hub airports), which are all class 5 airports (i.e. airports with more than 3 million ppa).

Table 2.3: Distribution of airports in the EU, UK and Türkiye by class size and type of airport

Airport class (by annual passengers)	Total number of airports	Number of hub airports	Number of mid-size airports	Number of regional airports
Class 1: <200k	236	0	0	236
Class 2: 200k–700k	111	0	0	111
Class 3: 700k–1M	20	0	0	20
Class 4: 1M–3M	82	0	0	82
Class 5: >3M	120	28	92	0
Total	569	28	92	449

Note: The class size of the airports was defined using Cirium data.

Source: Project Team based on Cirium.

Table 2.4 shows the distribution of airports between OR and inner regions (see Annex E.1 for a detailed classification of this type of regions). It can be observed that OR regions have 27 airports, of which none are hubs, six are mid-size airports and 21 are regional airports.

Table 2.4: Distribution of airports in the EU, UK and Türkiye by region (inner vs OR) and type of airport

Region type	Total number of airports	Number of hub airports	Number of mid-size airports	Number of regional airports
Inner regions	542	28	86	428
Outermost regions ³⁶	27	0	6	21
Total	569	28	92	449

Source: Project Team based on Cirium.

2.2 Cost-covering/not cost-covering airports

2.2.1 Literature review

According to Airports Council International (“ACI”) Europe (2021a) 54% of the sampled European airports³⁷ were loss-making in 2019, showing that unprofitable airports are a widespread phenomenon. 65% and 71% of European airports with, respectively, less than 3 million ppa and less than 1 million ppa, were loss-making in 2019; while larger airports (more than 3 million ppa) typically manage to be profitable (Pauwels et al., 2024).

The share of unprofitable airports in 2014 was 51%. Hence, at a very first glance there has been no shift towards higher profitability in the European airport sector. Oxera (2024) analyses the profitability trends of 14 regional airports on which they perform case studies. They find no evidence of increasing profitability trends over the 2016-2019 period. Profits for the 2023-2027 period are expected to increase, according to the

³⁶ The mid-size airports in ORs are: César Manrique–Lanzarote Airport, Fuerteventura Airport, Gran Canaria Airport, Madeira International Airport Cristiano Ronaldo, Tenerife Norte–Ciudad de La Laguna Airport and Tenerife Sur Airport.

³⁷ According to the report, data was collected from 63 airport operators representing 176 airports in 28 countries, with the collective passenger traffic of those airports representing 56% of total European passenger traffic in 2019.

managers of some airports. These projections are based on an increasing number of passengers, whereas in terms of profit per passenger most of the analysed airports do not expect any increase in 2023-2027 compared to 2019. However, it should be noted that the sample of airports analysed in this Study is too small to be representative of the population of European airports.

2.2.2 Consultations

In the public consultation, respondents were asked whether regional airports are more cost-covering compared to the situation before 2014. The distribution of answers was broadly similar across stakeholder groups, with the majority (55%) indicating that regional airports are not more cost-covering than before; a modest proportion (18%) of positive responses, and a significant share (27%) of stakeholders selecting the option "I do not know". When it comes to the responses by the stakeholder type:

- a clear majority of airports (57%, n=60) answered "No";
- similarly, the majority of national and regional granting authorities (60%, n=25) indicated that regional airports did not become more cost-covering;
- among airlines and airline associations (50%, n=8), opinions were more divided;
- broader aviation and industry associations (20%, n=6) were less decisive, with most either unsure or not responding, while citizens (40%, n=5) were split;
- environmental NGOs (n=2) generally did not express a clear position on this question.

Stakeholders were asked to substantiate their responses. Airports and airport associations, including organisations from Estonia, Denmark, Finland, Croatia, Poland and particularly Sweden emphasised that regional airports are not more cost-covering than a decade ago, mainly due to a combination of external shocks and structural constraints. They pointed to the impacts of COVID-19, the war in Ukraine, inflation and higher energy prices, which raised costs while demand recovered unevenly, especially in some domestic markets. For instance, the passenger volume on domestic routes in Sweden remains at around 60% of 2019 levels. Airports noted that they have limited scope to increase charges³⁸ or reduce fixed costs³⁹, and that smaller airfields continue to experience weaker non-aeronautical revenues. Airports did not report that regulation imposes binding limits on charge levels; rather, several explicitly stated that airlines exert downward pressure on charges, that airports freeze tariffs to retain traffic, and the market structure (characterised by few airlines and many small airports) weakens airports' negotiating power.

Several airport associations and airport managing bodies referred to the Oxera (2024) analysis and the EC's 2020 support study⁴⁰, arguing that smaller airports (below 500,000–1 million ppa) are structurally loss-making and unlikely to achieve profitability by 2027. This assessment was also reflected in the feedback received through the call

³⁸ Airport charges are the charges that airlines pay to airports for using their infrastructure and facilities. These charges concern aircraft landing, freight and the use of different types of airport infrastructure (for instance, passenger terminals).

³⁹ Operational and capital costs that, given airport capacity, do not change with traffic volume (e.g. capital costs, infrastructure maintenance, administrative and personnel expenses).

⁴⁰ Support study for the evaluation of the rules for operating aid under the EU aviation framework – Final report, Publications Office, 2020, <https://data.europa.eu/doi/10.2763/070570>.

for evidence, where several airport operators confirmed that without operating aid most smaller airports would remain loss-making.

Across both consultations, airports repeatedly highlighted additional headwinds such as new security and cybersecurity requirements, environmental and decarbonisation⁴¹ investments under the Fit for 55 package⁴², the decline in business travel, and the increasing bargaining power of LCCs demanding discounts. Airports located in OR and on islands further stressed that seasonal and thin traffic and the need to maintain territorial continuity keep fixed-cost burdens high, making the continuation of operating aid beyond 2027 necessary.

One EU-level association representing around 130 regional airports estimated that only 5–10% of its members became cost-covering since 2014, even when including non-aviation revenues. The same association reported that approximately one-third of its members (45–50 airports) are fully cost-covering.

Public authorities echoed similar concerns. Three authorities responding to the call for evidence indicated that without operating aid, most of the smaller regional airports would remain loss-making. Another public authority, referring specifically to Sweden, observed that nearly all regional airports continue to rely on public funding, with very few achieving full cost coverage since 2014.

Several broader aviation industry associations mentioned similar structural and market constraints. They noted that regional airports face difficulty in offsetting rising operating costs and have limited capacity to diversify revenue streams or reduce fixed costs.

Across these groups, the evidence suggests that regional airports have not improved their financial sustainability compared to 2014. While some airports and authorities highlighted limited improvements tied to traffic growth or EU-funded modernisation, these gains appear modest and uneven. The prevailing view remains that operating aid and complementary aid instruments will continue to be necessary beyond 2027 to ensure connectivity and resilience, particularly for small, peripheral⁴³, and island airports.

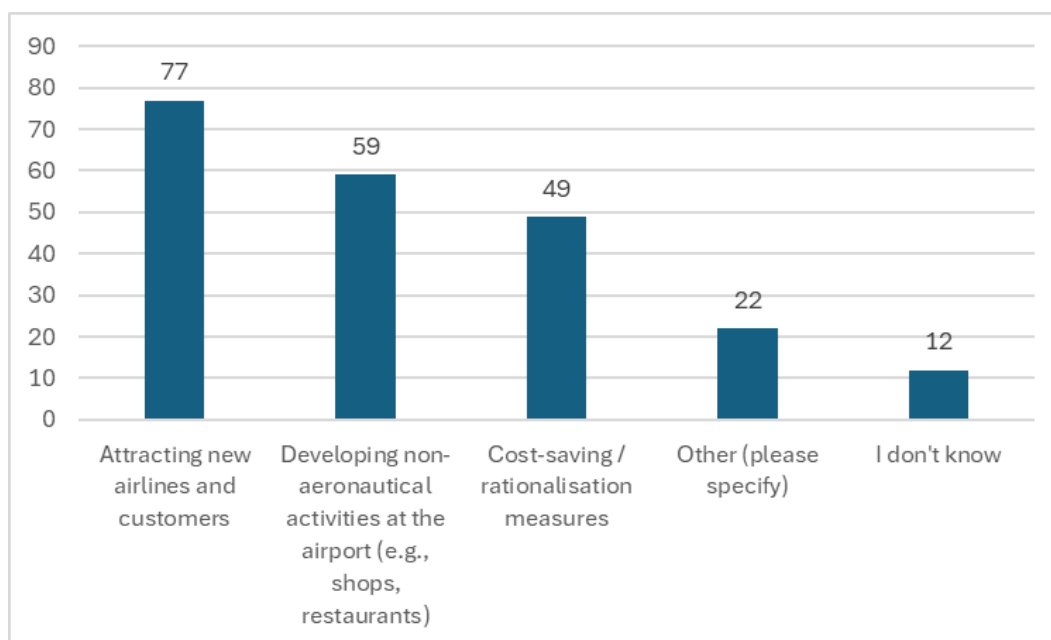
In the public consultation, stakeholders have been asked how loss-making airports can become cost-covering by 2027. Most respondents believe a combination of strategies, as shown in the Figure 2.1, would improve the situation. The most frequently mentioned measures include attracting new airlines and customers, implementing cost-saving and rationalisation measures, and developing non-aeronautical activities such as retail and dining services. A smaller number of responses also highlight that very small or peripheral airports are unlikely to ever reach full cost coverage and will require ongoing public support. Overall, the pattern of responses was broadly consistent across all stakeholder types, with similar priorities identified by airports, broader aviation industry associations, public authorities and airlines alike.

⁴¹ The process of reducing CO₂ and other GHG emissions across the aviation sector, through e.g. the implementation of market-based measures, the adoption of technologies, the use of alternative fuels, the adoption of operational measures, and infrastructure upgrades, with the goal of aligning the sector with I climate targets.

⁴² The Fit for 55 package is the EU's legislative framework to reduce greenhouse gas emissions by 55% by 2030, which includes measures affecting aviation such as SAF obligations (ReFuelEU Aviation), revisions to the EU ETS for aviation, and energy taxation reforms. These measures increase operating and investment costs for airports and airlines as they decarbonise.

⁴³ Airports located in peripheral regions. Peripheral regions are areas located far from economic or transport hubs, often with limited alternative transport options.

Figure 2.1: How can loss-making airports become cost-covering by 2027?



Source: Public consultation (n=97).

Examining answers to the public consultation in more detail, many note that attracting airlines is difficult given intense intra-Europe competition, scarce aircraft⁴⁴ and, in some countries, high levels of state-imposed airport charges.⁴⁵ In addition, non-aeronautical revenues (shops, parking, car rentals) are largely passenger-driven, making it difficult for small regional airports to generate sufficient commercial income to offset high operating costs. Key suggestions from airports and airport associations as well as national public authorities include stimulating traffic (route development, designating a Public Service Obligation ("PSO")⁴⁶ where justified) and opening new lines of business (renewable energy production/storage, Maintenance, Repair, and Overhaul⁴⁷, drone logistics), often via public-private partnerships and tighter coordination with tourism bodies. Yet several Nordic submissions (mainly airports) stress that, in very sparsely populated areas⁴⁸, full cost coverage is unlikely "now or ever," and regional airports should be treated as essential connectivity infrastructure with predictable public funding. Others urge the Commission to issue AG/General Block Exemption Regulation

⁴⁴ Several airports and airlines explained that, even where incentives are available, carriers are constrained by their ability to source additional aircraft and crews, due to long order backlogs and delivery delays from manufacturers and a tight leasing market.

⁴⁵ Airport charges are prices or levies that airlines pay for the use of airport's facilities and services which are exclusively provided by the airport and which are related to landing, take-off, lighting and parking of aircraft, processing of passengers and freight.

⁴⁶ Tendered air services ensuring minimum connectivity on routes which are vital for the economic development of the region they serve, for which public compensation can be granted.

⁴⁷ Set of services ensuring aircraft are airworthy and compliant.

⁴⁸ "Sparsely populated" are "NUTS 2 regions with less than 8 inhabitants per km² or NUTS 3 regions with less than 12.5 inhabitants per km² (based on Eurostat data on population density)". AG, §25(28).

("GBER")⁴⁹-based guidance (templates and common methods) and to mobilise Cohesion/European Regional Development Fund⁵⁰, national GBER schemes and PSO instruments to reduce regional asymmetries in how these tools are applied.

2.2.3 Data analysis

The analysis relies on survey data from 76 airports (59 regional airports) over 2014–2024, yielding 828 airport–year observations.⁵¹ As a reminder, EBITDA values in the context of the data analysis are always reported net of aid, as defined in Section 1.1.3 (even when referred to as EBITDA). Passenger numbers come from Cirium and airport submissions. Annex E.4 describes the survey questions, sample composition, and data cleaning procedures.

A first step in assessing the financial sustainability of regional airports is simply to document how many of them achieve positive operating results. The underlying idea is straightforward: if a substantial share systematically reports negative EBITDA, this suggests that many facilities cannot cover their costs through commercial revenues alone. The descriptive hypothesis is therefore that airports with larger passenger numbers are more likely to generate positive EBITDA, while smaller regional airports more often record persistent losses.

To test this descriptive hypothesis, all airport-year observations are classified into two groups based on whether reported EBITDA is positive or negative. The share of airports with positive vs. negative EBITDA is then computed, both overall and broken down by airport type (hub, mid-size, regional) and by size classes. Table 2.5, Table 2.6, Table 2.7, Table 2.8 and Table 2.9 report these distributions for the period 2014–2024, highlighting how the proportion of cost-covering airports has evolved over time. The tables also show how the probability of positive EBITDA rises sharply with size, with hubs consistently profitable, mid-size airports often breaking even, and small regional airports commonly recording losses.

These descriptive statistics should be interpreted with caution. The sample is based on voluntary survey responses, which may not fully represent the population of EU airports. Financial reporting practices differ across airports, with some including or excluding certain cost categories, which may affect the comparability of EBITDA values. Moreover, a positive or negative EBITDA in a single year does not necessarily reflect long-term viability, as results may be influenced by exceptional events, temporary traffic shocks, or changes in accounting treatment. Finally, descriptive evidence cannot disentangle the role of underlying structural differences – such as geography, ownership, or business model – which means the observed distributions provide important context information but not causal explanations.

The size distribution of airports covered by the survey differs markedly from that in the Cirium dataset at the lower end of the distribution. Table E.21 and Table E.22 show that, even when the four largest airports (defined based on the number of passengers

⁴⁹ Commission Regulation which sets out the conditions that allow European Union (EU) Member States to give significant amounts of public aid to a wide range of projects and activities without having to formally notify a measure to and receive an express approval from the EC.

⁵⁰ EU fund providing investments to develop infrastructures, productive investments in enterprises and "soft" support (consultancy services and advice) to strengthen economic, social and territorial cohesion in the European Union by correcting imbalances between its regions.

⁵¹ Not all airports provided data for the full 2014–2024 window (11 years); the panel is therefore unbalanced, and the 828 observations reflect only the years actually covered. See Section 2.1 for a detailed definition of regional airports.

handled) are excluded, the survey contains a relatively high proportion of airports in the 200,000–700,000 and 1–3 million ppa category, while only about one fifth of respondents fall into the smallest category (<200,000 ppa). By contrast, Table E.23, which reports the distribution of airports in Cirium, indicates that the EU-wide population is dominated by very small airports: around 42% of all listed airports handle fewer than 200,000 ppa, with 21.1% above 3 million. This indicates that the survey is skewed toward medium and larger regional airports, whereas very small regional airports are systematically underrepresented.

The country distribution of responses also reflects this bias. Table E.21 shows that especially Germany contributes a disproportionate share of survey airports compared with their overall presence in Cirium, while countries such as Greece and Spain, are relatively under-sampled. This concentration reinforces that the survey responses provide stronger coverage of medium and larger regional airports in a few countries, but do not fully reflect the broader universe of smaller facilities observed in the Cirium dataset. Consequently, while the survey is informative on the financial situation of regional airports of some scale, caution is warranted in extrapolating its results to the EU airport population as a whole.

Based on the airport survey (see Annex E.4 for more details), Table 2.5 shows that the percentage of cost-covering regional airports declined from about 61% in 2014 to 54% in 2024. The COVID-19 years 2020 and 2021 stand out, with very few regional airports being cost-covering (19% and 37% respectively), but also the years before and after are around 50%. In any case, the general tendency is that the percentage of regional airports being cost-covering is going down. These figures, however, are derived from a relatively limited survey sample – 59 responses (regional airports) out of more than 300 airports contacted. This low response rate raises concerns about external validity, as the responding airports may not constitute a representative sample of the broader population. In particular, if survey participation is systematically related to unobserved airport characteristics (e.g. financial situation, governance structure, or regional context), the estimated trends may be subject to selection bias. Accordingly, the reported percentages should be interpreted as descriptive patterns within the respondent group, rather than as precise estimates of sector-wide developments.

Table 2.5: Financial performance of surveyed regional airports measured by EBITDA net of aid (2014–2024)

Year	Total number of airports	Airports with a positive EBITDA net of aid (%)	Airports with a negative EBITDA net of aid (%)
2014	56	34 (60.7%)	22 (39.3%)
2015	56	33 (58.9%)	23 (41.1%)
2016	57	33 (57.9%)	24 (42.1%)
2017	59	37 (62.7%)	22 (37.3%)
2018	59	28 (47.5%)	31 (52.5%)
2019	59	32 (54.2%)	27 (45.8%)
2020	59	11 (18.6%)	48 (81.4%)
2021	59	22 (37.3%)	37 (62.7%)
2022	59	28 (47.5%)	31 (52.5%)
2023	59	31 (52.5%)	28 (47.5%)
2024	59	32 (54.2%)	27 (45.8%)
Total distinct airports	59	48	52

Note: In the total count of distinct regional airports, the number of airports that recorded at least one year with either positive or negative EBITDA net of aid is reported.

Source: Project Team based on Survey data.

To answer *how many of these airports are expected to be cost-covering by April 2027 and how will they achieve this, and by when are the remaining airports expected to be cost-covering*, the survey asked: “Do you expect your airport to likely achieve operating or full cost coverage by April 2027?” (see Annex E.4.1). Overall, 11 respondents answered yes (of these, 5 indicated they expect to reach equilibrium at the EBITDA level (i.e. covering at least operating costs) and 6 indicated they expect to reach equilibrium at the EBIT level (i.e. also covering depreciation and amortisation), whereas 16 ticked the remaining box, “none of the above”, which can be interpreted as including no (expecting not to cover costs). Focusing on regional airports, 14 out of 22 responded “none of the above”, which can be interpreted as including no (expecting not to cover costs).

2.2.4 Conclusions on cost-covering airports

The literature (mainly airport industry reports) shows that there has been no shift towards higher profitability in the European airport sector.

This is also reflected consistently in the results of the consultations: stakeholders believe that regional airports are not more cost-covering than before 2014 (broadly similar across stakeholder groups). Evidence from a survey response of an EU-level association representing 130 regional airports supports the stakeholders’ views, with only one third of its members being cost-covering and 5-10% becoming so since 2014. Respondents partly credit this outcome to shocks (COVID-19 and wars), that spurred general inflation and higher energy prices, to a declining number of business customers, and increased security/cyber requirements, with limited scope to raise airport charges or cut fixed costs. EU environmental/decarbonisation policies are also mentioned as a factor putting pressures on operating costs and investments.

The descriptive data analysis (based on information on annual EBITDA net of aid collected in the airport survey) highlights a downward trend in profitability: out of 59 regional airports, the percentage of cost-covering airports (with positive EBITDA net of aid) has declined from about 61% in 2014 to 54% in 2024. This tendency does not

appear to be completely attributable to COVID-19 and wars as, before these shocks, in 2019, the share of cost-covering regional airports was already down at 54% in the airport survey; this number is better than what was reported by airport associations (e.g. ACI for European regional airports in 2019 reports 65% of regional airports being loss making in 2019), which might be explained by the fact that the Study's survey sample underrepresents smaller regional airports.

As to the outlook, the stakeholder consultations indicate a broad consensus that achieving full cost coverage for regional airports by 2027 remains unlikely, especially for small ones (below 1 million ppa), even more so when located in remote regions.⁵² These airports are, based on stakeholder's opinions, structurally loss-making. However, airports surveyed for the project provided little evidence on their outlook (out of 22 regional airports that provided feedback, 14 reported that they do not expect to become cost-covering by 2027). As to measures to improve the prospects of non-profitable airports, the most frequently mentioned by stakeholders are attracting new airlines and passengers and increasing non-aeronautical revenues, limited by factors that are not fully under airport control (due to competition with neighbouring airports, or with airports sharing a similar destination profile, and associated airline bargaining power); cost rationalisation is only third-placed.

2.3 Factors affecting profitability

2.3.1 Literature review

Small airports frequently operate at a loss, and understanding the drivers of airport profitability is a central theme in the literature. This section summarises the main factors identified by previous studies.

Before digging into the possible factors, let us note that efficiency (or productivity) and profitability are two different but closely related variables: all other things equal, a more efficient enterprise will be more profitable. Profitability can be measured, for example, by the profit margin (e.g. EBIT(DA) divided by total revenues). Efficiency is typically more difficult to measure, given the variety of outputs and inputs involved in a firm's activity. Nonetheless, an indicative measure could be e.g. the ratio of revenues to cost of employees. It is straightforward to see that a firm could be highly efficient, but still not profitable, due to e.g. very high financing costs. Nonetheless, these two variables are highly connected. Fageda & Voltes-Dorta (2012) study the relationship between revenue and cost efficiency and profitability of Spanish airports, highlighting the close link between the two concepts.

In fact, most of the studies in the literature focus on investigating the factors affecting the efficiency of airports rather than their profitability. This choice is probably due to the lack of data availability and a greater general interest of economists towards efficiency. For this reason, and given the interconnection between the two variables, in the next paragraphs these studies will be reported as well, along those analysing profitability directly, which are fewer. The two most used methods to measure efficiency of an airport are Data Envelopment Analysis ("DEA") and Stochastic Frontier Method

⁵² Remote regions include ORs and "Malta, Cyprus, Ceuta, Melilla, islands which are part of the territory of a Member State, and sparsely populated areas" (AG, §25(27)).

("SFM").⁵³ It should be noted that, depending on the method used for measuring efficiency, its role in driving profitability levels may change. Zuidberg (2017) shows, for example, that the profitability of European airports is not affected by a simple measure of labour productivity, namely the cost of employees divided by the number of passengers. For recent reviews analysing the large literature on airports' efficiency see Iyer & Jain (2019) and See et al. (2023).

2.3.1.1 Size

The primary factor that may drive profitability is the size of the airport, which can be measured through the number of passengers, the number of aircraft operations or other comparable variables. This is a natural consequence of the cost-structure of airports, where fixed costs play a major role. For example, depreciation and amortisation of fixed assets account for 28% of total operating expenses in the 2023 financial statement of AENA, a company managing more than 30 airports of different sizes, mainly in Spain. The major role of fixed costs implies that increasing traffic will play a role in profitability levels, and airports, even when they are run as efficiently as possible, must generate a minimum amount of traffic and traffic related revenue to break-even. This minimum amount of traffic is naturally airport-dependent, as airports differ in the amount of fixed costs they must bear. The question therefore is whether smaller airports struggle more than larger ones to reach this minimum threshold.

Lower profitability levels can be driven either by higher unit costs or lower unit revenues, or both. ACI Europe (2023) reports the average cost per passenger of airports in 2019, as a function of the number of passengers. No clear relationship is evident, with small airports (with less than 3 million ppa), reporting costs per passenger ranging from 5 Euros to 40 Euros, and very large airports (with more than 20 million ppa), reporting cost per passenger ranging from 7 Euros to 25 Euros.⁵⁴ On the contrary, there emerges a clear relationship between non-aeronautical revenues per passenger and the number of passengers: 12 Euros on average for airports with more than 40 million ppa versus 4 Euros for airports with less than 5 million ppa (ACI Europe, 2023, Graph 7).

EC - DG Comp (2020) shows, on a sample of 68 European airports observed over the 2010-2018 period, a clear upward relationship between the amount of profit (EBITDA) per passenger and the number of passengers of airports.⁵⁵ While airports under 200,000 ppa display a negative average value (around -6 Euros per pax), airports with more than 3 million ppa display an average EBITDA per passenger of around 7 Euros. Furthermore, a regression of total profits on the number of passengers, estimated separately for different classes of airports, shows a steeper relationship between the

⁵³ DEA is a non-parametric method which proves particularly useful when one needs to measure efficiency of a production process which involves several outputs and several inputs, such as that of airports. For example, Adler et al. (2013) use a four-outputs (number of passengers served, commercial air traffic movements, tons of cargo and amount of non-aeronautical revenues) and three-inputs (staff costs, other operating costs and total runway length) model. The basic idea is to solve the non-parametric model to estimate the efficient production function; afterwards each airport is compared to this benchmark, giving an efficiency score to each airport. SFM, similarly to DEA, can be used to estimate the efficient frontier, i.e. the most efficient production function, to which each airport can be compared with. Unlike DEA, however, SFM is based on a regression analysis, assuming therefore that there is a random error component over which airports have no control. Other methods include estimating Total Factor Productivity assuming e.g. a Cobb-Douglas production function.

⁵⁴ Similarly, an older study (Bottasso & Conti, 2012) analysed the cost structure of UK airports over the 1994-2005 period, finding a non-linear pattern: average cost decrease until the 5 million ppa threshold, then remain constant until 14 million ppa, and start increasing afterwards.

⁵⁵ Figure 5.2 of the cited study.

two variables for larger airports compared to smaller ones. This suggests, once more, a stronger ability of larger airports in extracting profits from additional passengers.

This descriptive evidence is in line with an older but more sophisticated analysis carried out by Fageda & Voltes-Dorta (2012). They separately estimate cost-efficiency and revenue-efficiency⁵⁶ of 42 commercial airports in Spain in 2010 and compare these estimates with their profitability levels. Cost-efficiency refers to the ability to minimise costs for a given level of output (e.g. by reducing the cost of heating system thanks to energy-efficient building), while revenue-efficiency refers to the ability to maximise revenues for a given level of output (e.g. by increasing the expenditures of passengers at the airport). To further strengthen the validity of the results, an international unbalanced panel sample of 240 airports (108 of which in Europe) observed over the period 1985-2010 is used for estimating efficiency frontiers. Their analysis suggests that most unprofitable airports are constrained by revenue-efficiency rather than cost-efficiency. Under revenue-efficiency, almost all airports with passengers above 500,000 would become profitable. The authors suggest the following paths for improving revenue-efficiency of airports: more individualised management⁵⁷, tailoring airport charges to airport-specific demand and costs⁵⁸, and the promotion of commercial activity at the airport.

Zuidberg (2017) is one the few studies in the literature which systematically analyse factors affecting the profitability of airports directly, rather than their efficiency (results from this study will be cited often later on). Zuidberg (2017) analyses a sample of 106 airports in the United States ("US"), Europe (41 airports), Canada, Australia and New Zealand, over the period 2010-2016, of size ranging from 150,000 ppa to 98 million ppa. The study estimates a panel regression, with airport fixed effects, using the profit margin (EBIT as % of operating revenues), as the dependent variable. The number of passengers does not affect the profit margin significantly, neither for the full sample nor for the restricted European one. However, a significant negative effect is found for the depreciation-per-passenger variable, which negatively affects profitability. What matters is therefore not the absolute level of the number of passengers, rather its relative level compared to the cost of fixed assets. The methodology used in this study (panel fixed-effect regression) implies that the results come from the comparison of profitability across years, within airports.⁵⁹

When measuring efficiency instead of profitability, there is large consensus in the literature on the fact that larger airports are able to be more efficient. The majority of studies on airport performance find indeed that size has a positive influence on airport efficiency (Abbott, 2015; Carlucci et al., 2018; Coto-Millán et al., 2014, 2016; Curi et al., 2011; D'Alfonso, Daraio, et al., 2015; Li, 2014; Merkert & Mangia, 2014).

⁵⁶ They use a composite non-standard profit function to estimate it.

⁵⁷ All airports in Spain are managed by the same company, AENA. More individualised management refers to a management more attentive to the needs of the single airport, rather than the needs of the group as a whole.

⁵⁸ Notice that in the period this study refers to, airport charges in Spain were fixed at the country level, distinguishing between three only categories of airports depending on their traffic level (Fageda & Voltes-Dorta, 2012).

⁵⁹ In other words, these results say that, in a given airport, profitability in year t_2 will be higher than profitability in year t_1 if the ratio between the number of passengers and depreciation is higher in year t_2 , all other things equal. As we can assume depreciation to be rather stable over time, this is equivalent to say that, within an airport, a higher number of passengers implies higher profitability levels. Notice that this is different from saying that a higher number of passengers implies higher profitability across airports.

2.3.1.2 Seasonality and tourism

Facing seasonal demand may harm airports' efficiency and profitability, due to low levels of utilisation in the off-season. Zuidberg (2017) finds a non-linear relationship between seasonality and airports' profitability. Seasonality is measured as the lowest number of monthly departing seats divided by the highest number of monthly departing seats in a given fiscal year (hence this measure ranges from zero – highest possible seasonality – to 1 – lowest possible seasonality). Panel-regression results show that, until a certain level, lower seasonality increases airports' profitability, but as the measure approaches its maximum level of 1, profitability decreases. This result is likely because airports with seasonality close to 1 are operating close to full capacity during the whole year, meaning that they are capacity-constrained/congested, which lowers their profitability, *ceteris paribus*, likely because of reduced efficiency levels. Notably, the negative effect of seasonality is found to be larger for smaller airports, likely because of a larger variability of the seasonality index in this subsample of airports, while large/hub airports always operate close to full capacity.

Other studies focus on the efficiency of airports. Tsekeris (2011) uses DEA to measure the efficiency of 39 Greek airports in 2007 and show that under-utilisation of the most tourist-related airports during the off-peak season leads to significant drops in their efficiency. Similarly, Curi et al. (2011) use DEA to measure the efficiency of 18 Italian airports over the 2000-2004 period, arguing that high seasonality explains the poor efficiency of several airports in the sample. Clearly, this is a consequence of the fact that airports face a large amount of fixed costs, which they bear during off-peak seasons as well, which in turn drives down their efficiency levels.

Conversely, other studies find that tourist-related airports are able to be more efficient, probably due to a superior ability of generating commercial revenues. Coto-Millán et al. (2014) and Fernández et al. (2018) both analyse the efficiency of 35 Spanish airports, using respectively DEA and SFM, and focusing respectively on the 2009-2011 period and 2009-2016 period. They both find that tourist-oriented airports display higher efficiency levels.

2.3.1.3 Competition with other airports/infrastructures

Competition by rival airports (a topic further analysed in Section 4) may affect the profitability of airports. First of all, fiercer competition from a nearby airport may impair the ability of an airport to attract passengers, hence limiting its size and therefore its efficiency and profitability. In this regard, an airport could be unprofitable just because its catchment area is already served by a more efficient (or bigger) airport. Moreover, competition may induce airports to reduce airport charges to attract airlines, thus limiting airports' ability to extract revenues from traffic levels.

Other more subtle mechanisms could be at play. For instance, facing fiercer competition could push airports to be more efficient, everything else equal, in order to be able to operate with potentially a smaller number of passengers and with lower prices charged to aircraft operators. The overall effect on profitability is therefore not straightforward to predict.

Adler & Liebert (2014) studied 48 European airports and 3 Australian airports from 1998 to 2007 and estimate their efficiency with DEA. They show that airport facing competition from other airports (i.e. airports with at least another airport in their catchment area) tend to be more efficient. Similar results are found also in Merkert & Mangia (2014), which analyse efficiency (estimated using DEA) of 46 Norwegian airports and 35 Italian airports over the 2007-2009 period.

Bel & Fageda (2010) analyse a cross-section of the 100 largest European airports, with data referring to 2008, and conclude that competition with nearby airports and other

transport modes is likely to lead to lower airport charges. Although the evidence provided in this study is quite old and the current situation may be substantially different – especially because this evidence pre-dates EU rules on airport charges⁶⁰ –, no other study has yet conducted such a comprehensive analysis. Also, it sheds light on which factors affect the degree of competition among airports and therefore the prices charged. A positive effect of total traffic at the airport is found, suggesting that more congested⁶¹ airports fix higher prices as they have higher market power. A higher share of domestic traffic predicts lower charges, reflecting higher competition from other modes of transport in the domestic market. A higher share of network airlines predicts higher charges, suggesting higher buyer power of LCC, as suggested also by Thelle & Sonne (2018). Private and unregulated airports tend to set higher charges, but are also more responsive to competitive pressure from nearby airports, although this latter result holds only for airports located on continental Europe.

Similarly, Bottasso et al. (2017) study the relationship between airport charges and the degree of competition, measured as concentration of airports in the same catchment area, on a sample of 24 UK airports of different size (ranging from 3,457 ppa to 69.5 million ppa) over the 1996-2008 period. The authors use an instrumental variable strategy to measure the impact of concentration on airport charges, showing that indeed more intense competition (lower concentration) causes a reduction in airport charges.

Bilotkach et al. (2012) instead find no evidence that proximity to other airports lowers airport charges. They analyse a panel of 61 European airports over 18 years (1990-2007). Using a fixed-effect regression, they exploit within-airport variation in the number of active nearby airports driven by LCCs starting to use previously not utilised airports (31 airports experience at least a change in the number of nearby active airports). However, the consequently small within-airport variation in the proximity measure could explain the lack of statistically significant results. Importantly, though, the results from these studies refer to a period before the adoption of EU rules on airport charges and of the AG.

A different source of competition could be the presence of alternative transport modes, such as HSR. Fernández et al. (2022) study efficiency levels of the 21 largest European airports over the 2009-2014 period, using DEA. They find that airports with a direct link to the HSR network have overall efficiency levels 27% above the others.

2.3.1.4 Airlines' buyer power

Another factor that could potentially influence airports' margins is the bargaining power of the airlines utilising the airport: the more an airport is dependent on a single airline (or on few of them), the higher the airline's buyer power, which in turn should lower the prices that airports are able to charge. Zuidberg (2017) includes, among the explanatory variables of his panel regression analysis, the Herfindahl-Hirschman Index ("HHI")⁶² of

⁶⁰ Directive 2009/12/EC established common principles for setting airport charges at EU airports, ensuring transparency, non-discrimination, and consultation between airport operators and airlines. It requires Member States to create an independent supervisory authority to oversee charging systems and resolve disputes. It entered into force on 15 March 2009 and was to be transposed by Member States by 15 March 2011, through national laws. It applies to airports that are subject to EU law and whose commercial traffic is over five million passenger movements per year or to at least the largest airport in each Member State.

⁶¹ Congestion arises when access to airport facilities (capacity utilisation) equals or exceeds the supply capacity of the airport, causing delays and inefficiencies. There are two main areas where airport congestion can arise: (1) in the passenger terminals and (2) on the runway(s). The allocation of capacity at congested airports is regulated in the EU by Regulation (EEC) No 95/93 on common rules for the allocation of slots at European Union airports (slot regulation).

⁶² The HHI is a measure of market concentration used to assess the level of competition within an industry.

airlines using the airport. It is computed as the sum of the squared shares of seats of each airline on that airport, hence a higher HHI would indicate that few airlines dominate the traffic in that airport. For the European sample, results indicate that a higher HHI is associated with higher profitability for airports, suggesting that the bargaining power of airlines is not as strong in practice as could be expected, or that other factors play a role. For example, it may be that having to serve a lower number of different airlines may have beneficial effects on costs, due to specialisation and simpler management of airport's operations, hence leading to higher profitability of airports. Notice also that the effect found in this study is quite homogeneous across airports of different size class (the analysis is conducted separately for airports with pax above and below 10 million).

On the other hand, Karanki & Yu (2025) shows, by studying a sample of 59 large and medium US⁶³ airports over the 2009-2019 period, that airlines have generally higher bargaining power than airports, which results in airport charges being below what would be the optimal level⁶⁴ for airports. Similar results are found by Choo et al. (2018), which analyse 61 major airports around the world over the 2008-2014 period, finding that profit margins of public airports are indeed negatively affected by higher airline concentration, while the opposite is true for private airports.

To the best of our knowledge, no study has focused explicitly on small/regional airports, for which the bargaining power of airlines may potentially be a more influential factor.

2.3.1.5 Low-cost carriers

Many studies evaluate the impact of LCC activity on airports' efficiency and profitability. Several studies point out that the share of LCC passengers may significantly impact non-aeronautical revenues. For example, Fasone et al. (2016) investigate 15 German airports over the 2009-2012 period, showing that a higher share of LCC passengers predicts lower levels of non-aeronautical revenues per passenger. Furthermore, Huderek-Glapska & Nowak (2016) points to the lower bargaining power of airports where traffic is dominated by a single LCC airline. Zuidberg (2017) includes the share of LCC seats among the list of explanatory variables in the panel regression and finds no role of it in driving profitability levels. Also, no role is found when looking specifically at the share of Ryanair seats (for the European sample). Karanki & Yu (2025) also find no effect of LCC dominance on the capacity of US airports to extract higher gains from airlines through airport charges. On the other hand, Choo et al. (2018) find a negative effect of the LCC share of airports' profit margins, but this study only focuses on major airports around the world.

Studies analysing the effect of LCC traffic on airports' efficiency partly differ in their results. For example, Choo & Oum (2013) use SFM to measure the efficiency of a sample of major US airports over the 2007-2010 period and find that the share of LCC passengers predicts lower operating efficiency levels. This result may be due to the sample used in the analysis, namely major US airports. The literature suggests that specialising in either FSCs or LCCs may have a positive effect on efficiency, while these major airports are characterised by a mix of activities with the two types of airlines. Martini et al. (2013) analyses the efficiency of 33 Italian airports for the period 2005–2008, finding no role for LCC traffic. The majority of studies, however, report a positive relationship between the share of LCC traffic and efficiency. For example, Bottasso & Conti (2012) study the largest airports in the UK over the 2002-2005 period, finding a

⁶³ Notice that the study focuses on airport charges and the US market is rather different than the European one in this regard, as airport charges are less regulated.

⁶⁴ Optimal airport charges are estimated using an economic model for prices, and represent the charges that would be in place if airports and airlines had the same bargaining power.

positive effect of LCC passengers on airports' total factor productivity. Martín et al. (2013) shows that LCC traffic may increase the ability of airports to control costs, due to a limited infrastructure demand from this type of airlines. This result is obtained by estimating the efficiency of 194 airports worldwide over the period 2007-2009 using SFM and comparing it with their share of LCC traffic. Coto-Millán et al. (2014) estimate the efficiency of 35 Spanish airports over the 2009-2011 period (using DEA), finding that it is positively affected by the presence of LCCs. Carlucci et al. (2018) use DEA to estimate the efficiency of all 34 Italian airports certified by ENAC (the Italian Civil Aviation Authority) for the period 2006-2016, finding that a higher share of LCC passengers predict higher efficiency levels.

2.3.1.6 Non-aeronautical revenues

Non-aeronautical revenues play an important role in airports' financial accounts. For instance, AENA in 2023 reported 2,800 million Euros of aeronautical revenues and 1,500 million Euros of non-aeronautical revenues, i.e. more than 50% of the aeronautical revenues. Chen et al. (2020) provides a literature review of 50 studies, carried out from 1998 to 2018, that analyse the factors affecting shopping behaviours of passengers at airports. There is indeed an increasing focus on non-aeronautical revenues of airports: with increasing competition between airlines, and falling profit margins, they pay higher attention to reduce cost, thus exerting pressure on aeronautical revenues of airports, which look at non-aeronautical ones to compensate.⁶⁵ Airport retail is the largest source of non-aeronautical revenues (32.6% of non-aeronautical revenues globally in 2016), followed by revenues from car parking (22.9%), revenues from property and real estate (14.4%) and rental car concessions (7.6%), as shown in Chen et al. (2020).

Non-aeronautical revenues seem to play a role in driving profitability differentials between hub and regional airports. Castillo-Manzano et al. (2018) find that the likelihood that passengers make a purchase at an airport store is 1.2-1.3% higher in Spanish hub airports (Madrid and Barcelona) compared to Spanish regional airports. On average, passengers in hub airports spend €3.53 more than the passengers in regional airports, a difference which amounts to 42% of the average expenditure per passenger, which is €8.5. Several things can explain this fact: (i) passengers of longer flights usually arrive early at the airport, with longer dwell times, and spend more; (ii) regional airports are smaller, meaning that there are fewer shops and less things to buy; (iii) regional airports often serve mostly LCCs, whose passengers may have lower willingness to pay. These results are consistent with average non-aeronautical revenues per passenger in European airports, reported in ACI Europe (2023), for different classes of airports: they drastically increase with airport size, with airports below 5 million ppa reporting €4 of non-aeronautical revenues per passenger and airports with more than 40 million ppa reporting €12 per passenger.

Conversely, Zuidberg (2017) finds no effect of the share of non-aeronautical revenues in driving profitability differentials, although, as mentioned before, this study looks at within airport variations.

2.3.1.7 Ownership

Several studies have investigated the role played by the privatisation of many airports and the differential performance of privately owned and publicly owned airports, focusing on their efficiency levels. However, results are quite heterogeneous across the literature.

⁶⁵ This trend was already highlighted in Graham (2009).

Fasone et al. (2014) analyse 25 Italian airports over the 2009-2011 period, splitting them into whether the company owning them is mainly private or mainly public. Privately owned airports display significantly higher return-on-investments and return-on-sales. However, as pointed out by the authors, a reverse causality issue could be at play, as private stakeholders are more likely to invest in profitable and/or financially promising airports. Other studies finding a positive effect of private ownership are: Chen et al. (2017), who focus on 24 European and Asia-Pacific airports, from 2001 to 2013; Merkert & Assaf (2015) who focus on 30 international airports in 2013; Martini, Scotti, et al. (2020), who focus on 21 Italian airports, from 2010 to 2015.

Conversely, Martini et al. (2013) analyse the efficiency of 33 Italian airports for the period 2005–2008, finding that publicly owned airports are more efficient. Other studies finding a negative effect of private ownership on efficiency are: Assaf et al. (2014), which focus on 71 international airports in Europe, North America, and Australia, from 2003 to 2008; Curi et al. (2011), who focus on 36 Italian airports, from 2001 to 2003; Gutiérrez & Lozano (2016), who focus on 21 European small and medium-sized airports, in 2013; Scotti et al. (2012), who focus on 38 Italian airports, from 2005 to 2008.

Finally, Adler & Liebert (2014) analyse the potential impact of ownership on efficiency under different levels of competition. Overall, privately and publicly owned airports are equally efficient. However, under weak competition (defined as having at most one other airport in the same catchment area) privately owned airports are on average 60% more efficient when regulated and 15% more efficient when unregulated. When competition is higher, instead, these differences disappear, and ownership plays no role in airports' efficiency. This suggests that higher competition may provide an incentive for publicly owned airports to be more efficient, while profit-seeking airports generally do not need this extra motivation. This result is based on a sample of 48 European airports and 3 Australian airports observed from 1998 to 2007 and efficiency scores are estimated with DEA.

As summarised in Graham (2020), the empirical literature does not bring conclusive evidence on which ownership model leads to higher efficiency of airports, and other factors, such as competition and regulation, matter much more than privatisation when considering efficiency. Notice that this study includes private-public partnerships under the definition of privatisation.

2.3.1.8 Airport groups

Many airports in Europe operate within a network. For instance, all airports in Spain are owned by a single publicly owned entity, as well as all airports in Norway, Sweden and Finland. Some studies have analysed the effect of belonging to a network on airports' efficiency. For example, Adler et al. (2013) find, on a sample of 85 small airports from eight European countries over the years 2002-2009, that being part of a network significantly reduces airports' efficiency scores, roughly by 5%. One possible explanation, in line with what was argued by Fageda & Voltes-Dorta (2012), is the lack of individualised management, tailored to the specific needs/characteristics of single airports.

However, an issue arises for statistically robust identification of the effects of belonging to a network: in very few cases there have been changes in the network structure of airports, meaning that it is very rare to observe an airport changing from belonging to a network to being a standalone airport, or vice-versa. This makes econometric analysis like fixed-effects panel regressions unfeasible.

One such case is given by the separation of the airports of Edinburgh and Glasgow in 2012, which has been analysed by Pagliari & Graham (2019). They document a significant shift of relative aeronautical charges applied by the two airports after the separation (they increased in Edinburgh and decreased in Glasgow), probably due to

different price-elasticity in demand faced by the two airports, which have been more properly taken into account after the separation. Both airports experienced a reduction in unit operating costs after 2012. Also, the authors show that separation induced a divergence in route development strategies that more closely reflected underlying market characteristics. Overall, the authors suggest that separation has indeed been beneficial for the airports and their airline and passenger customers. However, it should be noted that this study only provides anecdotal evidence referring to a single episode, hence these results cannot be generalised.

2.3.1.9 Financing of security related costs

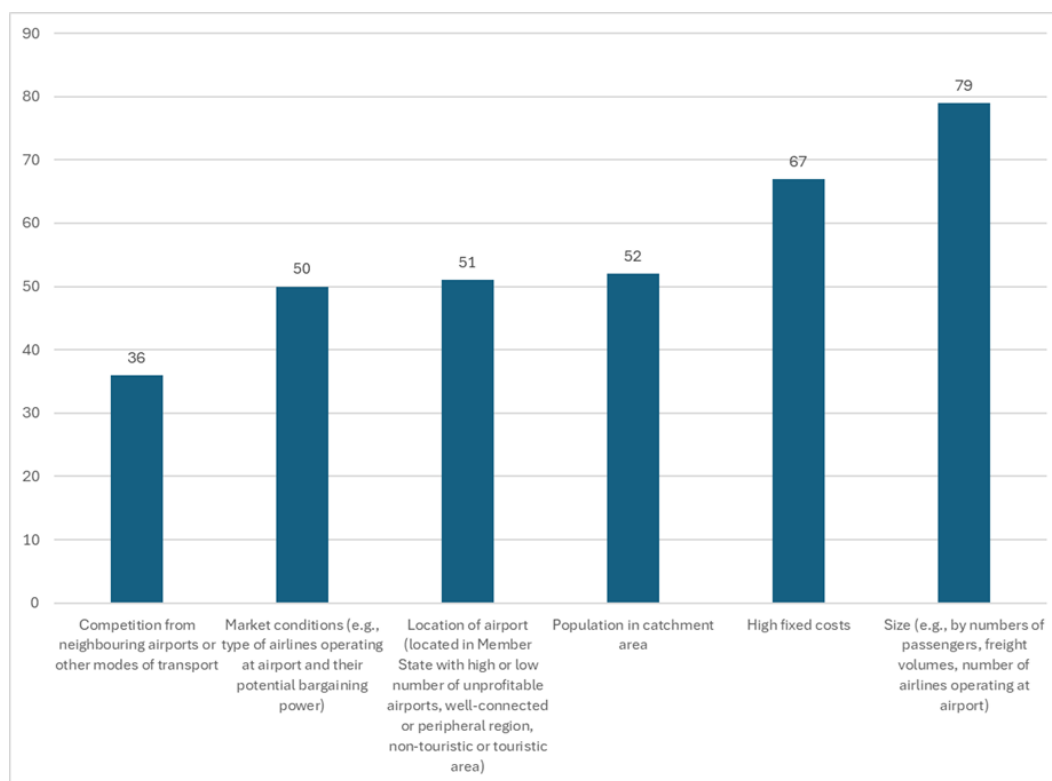
According to ACI Europe (2025), on average 20% of airport operating costs are security-related, with a significant percentage of airport staff being security-related. As shown in Gillen & Morrison (2015), European airports differ substantially in terms of per passenger security-related costs, even across airports within the same country.⁶⁶ AG acknowledge that public funding of non-economic activities, such as security measures that are a state responsibility, does not constitute State aid as long as the funding is strictly limited to compensating the costs incurred and does not unduly discriminate between airports. Therefore, across European countries, different practices are used when it comes to financing and managing security activities at airports. In some countries airport security is managed often directly by public authorities, which then apply a security fee on passengers. In other cases, airports are responsible for financing and managing security activities. Potentially, these differences may have an impact on the differences in the profitability of airports, given the important role played by the security-related operating costs. However, to the best of our knowledge no study has investigated this potential important factor.

2.3.2 Consultations

Responses to the public consultation suggest that the most common features of unprofitable regional airports are their small size (n=79) and high fixed costs (67), which limit their ability to achieve cost coverage. These elements were mentioned the most across all types of stakeholders consulted including airports, broader aviation industry associations, airlines and public authorities. Other frequently cited factors include a limited population in the catchment area (52), peripheral or less accessible locations (51), unfavourable market conditions such as airline bargaining power (50), and competition from nearby airports or alternative transport modes (36). These elements combined suggest structural disadvantages that make sustained profitability unlikely for many smaller regional airports.

⁶⁶ In 2011, security costs per passenger ranged from \$6.28 at Salzburg Airport (Austria) to \$0.73 at Sabiha Gokcen Airport in Istanbul (Türkiye).

Figure 2.2: What are the common features of unprofitable airports that are unlikely to achieve full operating cost coverage by the end of the transitional period in April 2027?



Source: Public consultation (n=96).

When asked to substantiate their responses, stakeholders provided different input. Airports repeatedly underlined that the most consistent challenge for unprofitable regional airports is insufficient passenger volumes, particularly for those handling fewer than 700,000–1 million ppa. This concern appears frequently in both the public consultation and the stakeholder survey, where stakeholders faced an open-ended question. Respondents also noted that demand and expenditure in retail and Food & Beverage are limited at smaller airports, further constraining non-aeronautical revenues, which is tightly volume dependent. Airports emphasised that these low passenger numbers are compounded by high fixed costs driven by safety, security, and regulatory obligations that are difficult to adjust in the short term, especially in low-demand environments as offering scheduled services⁶⁷ pushes operating requirements up regardless of traffic. Several airports, along with broader aviation industry associations, stressed that profitability should not be the sole criterion for assessing the value of a regional airport. They argued that airports play a critical role in supporting regional development, connectivity, cohesion, and resilience, particularly in isolated, rural, or border areas. Several airports also pointed to heavy dependence on LCCs, noting that this exposes them to the bargaining power of airlines, which can rapidly withdraw services and undermine financial stability. Seasonal traffic patterns,

⁶⁷ Flight with a scheduled timetable or additional flight resulting from extra traffic on services with a scheduled timetable/Flight that does not operate according to a fixed timetable.

competition from better-connected neighbouring airports, and alternative transport modes further erode profitability.

A regional airport association added that similar challenges apply to Nordic airports, which operate in vast, sparsely populated areas and face systematically higher operating costs due to heating and snow removal, making cost recovery particularly difficult for their traffic levels. One airline association confirmed that low passenger volumes remain a major constraint for regional airports. They also recognised that dependence on a small number of low-cost carriers significantly affects airports' financial sustainability. When these carriers withdraw routes or reduce frequencies, small airports face sudden and severe declines in revenue, with limited ability to compensate. Public authorities noted similar concerns, highlighting that limited traffic volumes and high fixed costs make many small airports structurally loss-making. Some authorities also underlined that profitability alone should not be used to assess the relevance of regional airports, given their role in ensuring connectivity, cohesion, and territorial development.

A contribution to the call for evidence from a forum of OR Presidents emphasised that geographical remoteness inherently limits passenger bases and population density, resulting in insufficient revenues to cover fixed operating costs. These costs are disproportionately high compared with mainland facilities, due to logistical constraints, difficult topography, and challenging climatic conditions. Combined with limited economies of scale and heavy dependence on tourism, this creates a persistent cost-revenue imbalance. Continued public support was therefore seen as a structural necessity to maintain essential air services and territorial cohesion.

In short, small size plus low, volatile demand and intense competition for scarce aircraft and routes make many airports located in peripheral, island, or otherwise sparsely populated areas structurally unlikely to ever achieve full operating cost coverage.

2.3.3 Data analysis

When looking at the relationship between being cost-covering and size, Table 2.6 shows that there is clearly a positive relationship between size and the ability to be cost-covering, both when including or excluding COVID-19 years (except for class 2 performing worse than class 1 if including COVID-19 years).

Table 2.6: Class size of surveyed airports by profitability status (including and excluding COVID-19 years)

Airport class (by ppa)	Total airports	Including COVID-19 years		Excluding COVID-19 years	
		Airports with an average negative EBITDA net of aid (%)	Airports with an average positive EBITDA net of aid (%)	Airports with an average negative EBITDA net of aid (%)	Airports with an average positive EBITDA net of aid (%)
Class 1: <200k	15	9 (60.0%)	6 (40.0%)	9 (60.0%)	6 (40.0%)
Class 2: [200k-700k]	24	19 (79.2%)	5 (20.8%)	16 (66.7%)	8 (33.3%)
Class 3: (700k-1M]	3	1 (33.3%)	2 (66.7%)	1 (33.3%)	2 (66.7%)
Class 4: (1M-3M]	17	4 (23.5%)	13 (76.5%)	4 (23.5%)	13 (76.5%)
Class 5: >3M	17	0 (0.0%)	17 (100.0%)	0 (0.0%)	17 (100.0%)
Total	76	33 (43%)	43 (57%)	30 (39%)	46 (61%)

Note: The average EBITDA net of aid is calculated as the unweighted mean of annual values across all available years for each airport. Airports are classified as having either positive or negative average EBITDA net of aid based on this value.

Source: Project Team based on Cirium and Survey data.

Table 2.7 shows the split per country, where clear country differences can be observed. However, the survey responses do not follow the distribution of the “universe” of airports (see Annex E.4.2 for the universe of airports, based on Cirium data, indicating that results of the survey should be interpreted with caution).

Table 2.7: Country-level distribution of surveyed airports by profitability status (including and excluding COVID-19 years)

Country name	Number of airports	Including COVID-19 years		Excluding COVID-19 years	
		Airports with a negative average EBITDA net of aid (%)	Airports with positive average EBITDA net of aid (%)	Airports with a negative average EBITDA net of aid (%)	Airports with positive average EBITDA net of aid (%)
Austria	3	0 (0.0%)	3 (100.0%)	0 (0.0%)	3 (100.0%)
Belgium	2	0 (0.0%)	2 (100.0%)	0 (0.0%)	2 (100.0%)
Czechia	1	1 (100.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)
Germany	23	10 (43.5%)	13 (56.5%)	9 (39.1%)	14 (60.9%)
Denmark	2	1 (50.0%)	1 (50.0%)	1 (50.0%)	1 (50.0%)
Finland	8	6 (75.0%)	2 (25.0%)	6 (75.0%)	2 (25.0%)
France	8	5 (62.5%)	3 (37.5%)	3 (37.5%)	5 (62.5%)
Croatia	2	0 (0.0%)	2 (100.0%)	0 (0.0%)	2 (100.0%)
Ireland	1	1 (100.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)
Italy	5	2 (40.0%)	3 (60.0%)	2 (40.0%)	3 (60.0%)
Lithuania	4	0 (0.0%)	4 (100.0%)	0 (0.0%)	4 (100.0%)
Poland	2	1 (50.0%)	1 (50.0%)	1 (50.0%)	1 (50.0%)
Romania	8	2 (25.0%)	6 (75.0%)	2 (25.0%)	6 (75.0%)
Sweden	5	4 (80.0%)	1 (20.0%)	4 (80.0%)	1 (20.0%)
Slovenia	2	0 (0.0%)	2 (100.0%)	0 (0.0%)	2 (100.0%)
Total	76	33 (43%)	43 (57%)	30 (39%)	46 (61%)

Note: The average EBITDA net of aid is calculated as the unweighted mean of annual values across all available years for each airport. Airports are classified as having either positive or negative average EBITDA net of aid based on this value.

Source: Project Team based on Survey data.

Table 2.8 shows cost-covering airports along socio-economic dimensions at the NUTS3 level. Regions that have a higher population and higher population density have better-functioning airports profit-wise. On the other hand, GDP per capita does not seem to have a positive association with profitability status.

Table 2.8: Socio-economic indicators at NUTS 3 for surveyed airports by profitability status (including and excluding COVID-19 years)

Socioeconomic indicator	Including COVID-19 years		Excluding COVID-19 years	
	Airports with a negative average EBITDA net of aid	Airports with a positive average EBITDA net of aid	Airports with a negative average EBITDA net of aid	Airports with a positive average EBITDA net of aid
Average resident population (NUTS 3, Eurostat)	450,935	578,013	443,755	573,502
Average number of employed persons (NUTS 3, Eurostat)	212,466	302,917	209,777	297,716
Average GDP per capita in EUR (NUTS 3, Eurostat)	37,004	33,582	36,474	33,731
Average population density (inhabitants per km ² , NUTS 3, Eurostat)	318	529	329	506
Number of airports (%)	33 (43%)	43 (57%)	30 (39%)	46 (61%)

Notes: The average EBITDA net of aid is calculated as the unweighted mean of annual values across all available years for each airport. Airports are classified as having either positive or negative average EBITDA net of aid based on this value. The variables Average resident population, Average number of employed persons), Average GDP per capita in EUR, and Average population density are always calculated as unweighted means—first across years for each airport, and then across airports within EBITDA net of aid groups (positive vs. negative).

Source: Project Team based on Survey data and Eurostat.

Table 2.9 below shows that cost-covering airports clearly have more airlines of all type present (total, LCCs, and FSCs).

Table 2.9: Airline presence at surveyed airports by profitability status (including and excluding COVID-19 years)

Airline presence indicator	Including COVID-19 years		Excluding COVID-19 years	
	Airports with a negative average EBITDA net of aid	Airports with a positive average EBITDA net of aid	Airports with a negative average EBITDA net of aid	Airports with a positive average EBITDA net of aid
Median number of airlines (total)	23	61	21	51
Mean number of airlines (total)	26	80	24	74
Median number of LCCs	4	12	4	12
Mean number of LCCs	6	13	5	12
Median number of FSCs	19	46	16	40
Mean number of FSCs	21	67	18	61
Number of airports (%)	33 (43%)	43 (57%)	30 (39%)	46 (61%)

Notes: The average EBITDA net of aid is calculated as the unweighted mean of annual values across all available years for each airport. The mean or median number of airlines is obtained by first computing, for each airport, the total number of airlines that operated at least one flight in the available years. These airport-level values are then aggregated as unweighted averages or medians across airports within EBITDA net of aid groups (positive vs. negative).

Source: Project Team based on Survey data & Cirium.

The descriptive results confirm that profitability strongly correlates with airport size. Hubs consistently report positive EBITDA across all years in the sample. Mid-sized airports generally achieve cost-coverage, though a non-negligible minority operate at a loss in certain years. By contrast, the majority of small regional airports recorded a negative EBITDA, and this pattern persists over time. The COVID-19 crisis amplified these differences, with the share of airports reporting losses rising sharply in 2020–2021 before partially recovering. Overall, the evidence shows that while larger airports are financially sustainable, most (smaller) regional airports struggle to cover operating costs, setting the stage for the more formal break-even analysis that follows.

2.3.4 Conclusions on factors affecting profitability

Size (as proxied by passengers or flight movements) emerges as the primary driver of profitability, due to several related factors. One reason is the cost-structure of airports, given that fixed costs are a large share of airport costs for all airports.

The literature quite consistently also shows that smaller airports are generally unprofitable not only because the industry is characterised by the presence of high fixed costs, but because they generate much lower revenues per passenger, especially non-aeronautical revenues, due to less attractive shopping areas where (low-spending) passengers spend less time in terminals and have lower spending willingness, pointing to a “scale” weakness. Furthermore, regional airports, particularly those in remote regions, often face higher operating costs due to their locations, where fuel, supplies, and airport-related services tend to be more expensive. The literature also highlights that profitability is further constrained by high seasonality fluctuations, due to low levels of utilisation of capacity in the off season, especially at smaller airports, that are highly dependent on tourist flows. In particular, in line with the finding from the OR airport case study, airports located in remote and ORs are heavily dependent on public subsidies in the long-term as they have an economically unstable character caused by structural characteristics.

There is some empirical evidence (though at least partly quite old) that more intense competition by nearby airports and other transport modes causes a reduction in airport charges, while some other contributions show it may also lead to higher cost efficiency, (which may countervail the effect on prices, but the overall effect on profitability is not assessed in any of the essays). Moreover, higher airport charges are predicted in airports with higher airport traffic, likely implying that congestion can shield airports from competitive pressures on aviation prices.

The empirical evidence on whether serving a small number of airlines affects airports' profit margins is mixed. Some studies suggest a positive effect of specialising in few airlines, while others indicate a negative effect due to higher bargaining power of airlines. However, no study in the literature addresses this topic by focusing on regional airports, where potentially this issue could be more important. Relatedly, some studies find a higher LCC share is linked to improved efficiency but find no significant effects on profitability. This might be explained by the fact that while LCC traffic may increase the ability of airports to control costs (due to a limited infrastructure and service demand from this type of airlines), the effect on profitability might be offset by lower non-aeronautical revenues recorded on LCC passengers and higher bargaining power of LCCs with the respect to airport charges. Finally, the literature finds no consistent difference in efficiency or profitability between publicly and privately owned airports.

The same factors are also emphasised in stakeholders' responses to the consultation, as relevant for profitability: size paired with the share of fixed costs, the level of non-aeronautical revenues (shops, parking, car rentals), population in the catchment area, tourist and leisure appeal, connectedness as a region, seasonal traffic patterns skewed to leisure passengers (more price sensitive), competition from neighbouring (including hub) airports or alternative transport modes, airline bargaining power linked to the number of airlines present at the airport. These factors would make many peripheral, island, or other airports in sparsely populated areas structurally unlikely to achieve full operating cost coverage. Country specific factors for Nordic countries are challenging weather conditions leading to higher operating costs (heating and snow removal) and, for Central and Eastern Europe, higher exposure to inflation or war-related disruptions.

The analysis of original airport survey data confirms that profitability strongly correlates with airport size. In particular, non-hub airports above 3 million ppa generally achieve cost coverage, though a non-negligible minority operate at a loss in certain years. By contrast, the majority of small regional airports record negative EBITDA, and this pattern persists over time, also when excluding COVID-19 years. Interestingly, class 2 airports performed worse than class 1 airports if including COVID-19 years. Moreover, looking at the outcomes of NUTS3 regions where the airports are located, regions that have a higher population and higher population density have better-functioning airports, profit-wise. On the other hand, GDP per capita does not seem to have a positive association with profitability status.

2.4 Break-even threshold and operating aid

2.4.1 Literature review

Several studies tried to estimate the minimum threshold of traffic needed for airports to financially break-even. However, the results strictly depend on the sample of airports used for the estimation.

Adler et al. (2013) computes the break-even number of passengers on a sample of small European airports. The dataset consists of a balanced panel of 85 small airports from eight European countries over the years 2002-2009. In terms of annual passengers served, the airports range from 3,000 to approximately 1.6 million. Based on the

regression analysis, the break-even point with respect to passengers increased from 200,832 in 2002 to 463,549 by 2009, due to a much larger increase in fixed costs of airports in the sample compared to variable costs. Indeed, over the period fixed costs increased by 70% while variable costs by 30%. The authors argue that the large increase in fixed costs can be partially explained by the increase in security regulations after the 9/11 terrorist attacks. Furthermore, it is estimated that more efficient airports could break-even with 166,233 passengers.

Fageda and Voltes-Dorta (2012), which analysed Spanish airports in 2010, with airports ranging from 10,000 to 50 million ppa, conclude that only airports with less than 500,000 ppa would incur losses if revenue inefficiencies (see above for a definition of revenue and cost efficiencies) would not exist, i.e. if small airports were able to generate similar revenues per passenger as large airports.

Iyer & Jain (2020) estimate the break-even number of passengers for 27 Indian regional airports (ranging from 1.3 million to 7.4 million ppa) over the 2014-2017 period, using the same method of Adler et al. (2013). The break-even point ranges from 837,000 in 2014 to 647,000 in 2017.

Fernandes et al. (2014) study 51 Brazilian airports in 2010 (ranging from 1,000 to 8 million ppa). They estimate a break-even threshold of around 2 million ppa.

The results differ substantially depending on the average size of the analysed airports, suggesting that larger airports (having higher absolute fixed costs) have a higher break-even number of passengers. The literature lacks an analysis estimating airport-specific break-even thresholds and the distribution of these thresholds across different airport categories.

2.4.2 Consultations

When it comes to break-even thresholds, the consultations show broad agreement that airports generally need at least 700,000–1 million ppa to approach break-even, with several airports and airport associations pointing to higher thresholds of 1.5–2 million ppa in light of rising costs and industry pressures.⁶⁸ While profitability prospects improve above 1 million ppa, very small airports (<500,000 ppa) are widely seen as structurally loss-making. At the same time, responses (in particular, airports and airport associations) emphasise that no single benchmark applies across all contexts: outcomes depend heavily on, for example, catchment area size, traffic mix, the level of non-aeronautical revenues, and airline dependence. Airports in peripheral, outermost and sparsely populated regions are least likely to reach cost coverage without continued public support but are considered essential for territorial cohesion.

Several submissions from airports add that context-specific pressures such as proximity to nearby hubs that attract passengers and airlines, differences in national tax regimes, public remit costs⁶⁹ which are not always covered by the State, and rising regulatory/tax burdens in particular for environmental and security purposes, cannot be easily offset by smaller airports. They further state that non-aeronautical income is tightly linked to passengers, so it cannot close the gap at low volumes. Furthermore, it is argued that

⁶⁸ 93 written responses to the public consultation and 58 responses to the stakeholder survey. Moreover, according to contributions to the call for evidence, seven airports noted that the break-even threshold is pushed upward due to inflation and increasing regulatory costs.

⁶⁹ Activities that the State normally performs in the exercise of its public powers, such as air traffic control, police, customs, firefighting, rescue flights, etc. Member States are free to decide for which of such non-economic activities airports can be compensated.

ground handling operations⁷⁰ are typically not commercially viable on a stand-alone basis below 1 million ppa, forcing airports to internalise these costs. In island/OR (repeatedly reported for Sweden), these airports are believed to be essential for cohesion yet structurally unlikely to reach operating break-even.

Overall, airports mention that with fixed or quasi-fixed costs dominating (security/safety, staffing, compliance, 24/7 readiness⁷¹ and maintenance), unit costs stay high at low scale. They also claim that given the low scale, airports often depend on one or two carriers, frequently LCCs with strong bargaining power, so attempts to raise airport charges might risk losing routes.

Box 2.1: Insights from case studies on the topic of the break-even passenger threshold for profitability

For the regional passenger airports and respective stakeholders covered by the case studies, a typical break-even threshold is reported to be around 1 million ppa.

Moreover, the case studies suggest that even where an airport reaches or exceeds 1 million ppa, full cost coverage is increasingly difficult to achieve due to rising labour and energy costs, as well as new regulatory and environmental compliance obligations (e.g. including the forthcoming entry/exit system for non-EU passengers). Stakeholders in these cases indicated that the effective threshold is being pushed upwards, in some instances towards 1.5-2 million ppa.

At the same time, the case studies also provide exceptions. In the profitable regional airport case study, the target airport reported to be consistently profitable with around 800,000 ppa (600,000 on scheduled flights). However, this was attributed to favourable local demand, in particular the very high share of outgoing business travellers (which allows the airport to keep inflation-indexed airport charges at a level consistent with full cost coverage without impairing traffic). At the same time, the airport anticipates that rising regulatory costs could push the threshold up to around 1 million ppa in the near future.

Evidence from the OR airport case study further underlines that even surpassing 1 million ppa does not guarantee full cost coverage: the airport remains partly dependent on public support, with stakeholders estimating that between 1-2 million ppa are needed to cover operating costs while also financing upcoming investments for infrastructure renewal. Higher unit costs in ORs, linked to logistics, servicing constraints, and harsher climate conditions, make profitability more challenging than in continental contexts.

Regarding operating aid, in the stakeholder survey, out of 52 responses, 27% reported that operating aid was provided under the GBER. The remaining 73% reported that no operating aid was granted, or it was granted following a notification. This was confirmed by national public authorities, as well as by EU-level and national airport associations.

Furthermore, 38% believe that the current operating aid rules in the AG help regional airports cover their temporary operating losses while trying to become self-cost-

⁷⁰ Services required by airlines to operate flights, including areas such as maintenance, fuel, and freight handling, de-icing, but also passenger check-in, catering, baggage handling and transport within the airport.

⁷¹ "24/7 readiness" refers to the requirement for an airport to maintain minimum operational capability at all times, including staffing, safety, fire and rescue services and essential technical systems.

covering, while 29% say they do not, and 34% were unsure. When it comes to the responses by stakeholder type:

- support was highest among airports and airport associations (n=20), where 45% agreed that the rules give airports the time to move towards the financial break-even point;
- among broader aviation industry associations (n=7), 43% shared this positive view;
- in contrast, among public authorities (n=17) only 24% consider the rules effective;
- similarly, airlines (n=8) were generally cautious, with just two respondents agreeing that the operating aid provisions are helping loss-making airports to improve cost coverage ability in practice.

Several airports and one broader aviation industry association criticised the operating funding gap methodology, which assesses aid amounts based on pre-2014 operating losses, as it penalises airports whose operating losses have grown since 2014, resulting in aid levels that underestimate actual needs. In addition, respondents highlighted new pressures from post-COVID-19 shifts (e.g. reduced business travel) and rising costs under Fit for 55, which further constrain the path to profitability.⁷² Finally, a public authority in the call for evidence noted that many regional airports, especially those owned by municipalities or regions, operate at persistent deficits and therefore remain insufficiently supported under the current operating-aid framework due to caps on aid intensity⁷³ (maximum permissible aid amount is 80% of the historical operating funding gap for airports up to 700,000 ppa, and maximum 50% of the historical operating funding gap for other airports up to 3 million ppa).

A strong majority of respondents support the continuation of operating aid for airports beyond April 2027 (Figure 2.3) in the AG. In the stakeholder survey (n=53), 79% were in favour, 17% were uncertain and 4% were opposed. Similarly, results from the public consultation (n=100) reveal an even stronger consensus, with 90% supporting the continuation of operating aid in the AG and only 10% opposing it. When it comes to responses by stakeholder type:

- support was most pronounced among airports and airport associations (n=75), where 85% backed prolonging operating aid beyond 2027;
- public authorities (n=43) were also broadly supportive, with 81% in favour;
- among broader aviation industry associations (n=19), support was equally strong at 82%;
- airlines (n=8), environmental NGOs (n=4) and citizens (n=4), by contrast, were more divided, with 63% of airlines and 50% of NGOs and citizens supporting continuation.

⁷² In line with this, contributions to the call for evidence from two airports argued that the rules do not reflect current economic realities, citing difficulties with long-term planning, excessive business-plan requirements, and thresholds that overlook the post-COVID context. One environmental organisation, by contrast, opposed the aid regime altogether, arguing that it sustains unprofitable and environmentally harmful activity.

⁷³ Total aid amount expressed as a percentage of eligible costs, both figures expressed in net present value terms at the moment the aid is granted and before any deduction of tax or other charges.

Figure 2.3: Do Member States and stakeholders consider that operating aid to airports should be allowed beyond April 2027?



Source: Left to right – stakeholder survey (n=53) and public consultation (n=100)

When asked to substantiate their responses, most respondents to the public consultation argued that operating aid will remain necessary beyond 2027, particularly for small and regional airports facing persistent structural challenges.

Consulted stakeholders in favour of continuing operating aid in the AG prefer either an indefinite extension (i.e. no enforced timeline to reach full operating cost coverage for regional airports), or a fixed 10-year period after which airports should aim for cost coverage. This view was widely shared among airports and associations in several Member States including Austria, France and Poland. National and regional authorities from Austria, Bulgaria, Estonia, and Finland argued that operating aid should be maintained as a permanent tool for the smallest airports, which they considered structurally unable to reach full cost coverage.

Others (several broader aviation industry associations and airports based in Denmark and Finland) suggested that the duration of aid should depend on airport size, with airports below roughly 300,000–700,000 ppa continuing to receive support indefinitely, while those in the 700,000–1 million ppa range could have aid limited to a fixed period. A few contributions proposed maintaining the eligibility of airports up to 3 million ppa, albeit with lower aid intensities.⁷⁴ Some of the airlines oppose any prolongation in the AG or would accept it only with strict green conditionalities and/or limited to SGEI airports.

Almost half of the 51 respondents to the stakeholder survey (46%) indicated that regional airports in their country could potentially qualify for aid under a SGEI if operating aid were discontinued in the AG, while around one third (35%) were uncertain. A smaller share (19%) stated that no regional airports in their country would qualify.

- Positive responses were highest among airports and airport associations (n=22), with 55% indicating that some regional airports in their country could qualify for SGEI aid.
- Among broader aviation industry associations (n=10), 50% agreed, while public authorities (n=13) were slightly less confident, with 38% responding positively.

⁷⁴ Contributions to the call for evidence from five airports asked for permanent access to operating aid for airports under 1 million ppa. Four airport associations supported prolongation, calling for reliance on a GBER-like shield for airports under 1 million ppa including exemptions from notification obligations. Two large European LCCs also supported an extension, with one proposing a phased, declining threshold: extending the current 3 million ppa limit to April 2030, then stepping down to 2.5 million ppa by 2033, 2.0 million by 2035, and 1.5 million thereafter, subject to review.

- Airlines (n=6) were more divided, with only 33% suggesting that airports qualifying potential, under the SGEI framework, exist.

When asked to substantiate their responses, airports and aviation industry associations reported that the current SGEI framework is too narrow and restrictive to effectively support regional airports. An EU-level airport association pointed out that the Altmark conditions⁷⁵ are particularly stringent, meaning only a small number of cases – mainly island airports – have been approved by the Commission so far.

Other contributions (local governments, airports) argued that the SGEI framework could, *if adapted*, play an important role in safeguarding connectivity. Respondents from Italy suggested that five regional airports, particularly in Sardinia, Sicily, and other peripheral areas, could realistically qualify due to their critical role in mobility. Finnish industry associations estimated that 5–8 regional airports might qualify, especially those in more isolated areas without viable alternatives such as HSR. They emphasised the strategic role of such airports in business travel, medical mobility, and resilience.

2.4.3 Data analysis

The central policy question in this section is whether regional airports can realistically achieve operating cost-coverage without continuous State aid. The hypothesis underlying our analysis is that there exists a passenger traffic threshold – a break-even point – above which airports can, on average, cover their operating costs from aeronautical and non-aeronautical revenues, but below which airports systematically operate at a loss. Identifying this threshold is critical for assessing the sustainability of regional airports.

We estimate regressions of EBITDA (net of operating aid) on total annual passenger volumes, with airport and year fixed effects. This statistical setup isolates the relationship between traffic levels and profitability while controlling for time shocks and persistent airport characteristics. COVID-19 years (2020–2021) are excluded because they display atypical negative profitability patterns even at high passenger numbers, and the four largest hub airports are dropped as outliers. For each airport-year observation, the number of passengers that would yield zero EBITDA is then determined, providing a break-even estimate. Averaging across airports gives a representative benchmark.

The results should be interpreted with extreme care. First, the sample is limited to airports that responded to the survey, which raises concerns about representativeness: out of more than 300 airports contacted, only 76 responded and financial reporting quality varied. Second, the regression captures correlations but may still suffer from endogeneity: airports with stronger demand prospects are more likely to expand capacity and diversify revenues, biasing the estimated break-even point downward. Third, passenger volumes are an imperfect proxy for profitability, since cost structures differ markedly across airports, depending on size, geography, and business model.

To answer *which level of traffic is typically needed, in terms of passengers/traffic, for an airport to be able to achieve full operating cost coverage*, the Team computes the

⁷⁵ The Altmark conditions are four cumulative criteria laid down by the Court of Justice of the EU (Case C-280/00 Altmark). If all four are met, PSO compensation does not qualify as State aid under Article 107(1) TFEU. The four criteria require that the airport is formally entrusted with a clearly defined public service task, that compensation is calculated through objective and transparent rules set in advance, that there is no overcompensation, and that the airport is either selected through a tender or its costs are benchmarked against a typical, well run and adequately equipped operator.

break-even number of passengers required for an airport to cover its full operating costs using the following equation:

$$\pi_{it} = \beta_1 + \beta_2 Total_pax_{it} + \omega_i + \omega_t + \epsilon_{it}, \quad \textbf{Equation 2.1}$$

where the dependent variable π_{it} is profits (EBITDA, net of aid) of airport i at time t (year) and the key independent variable is $Total_pax_{it}$, which is the total number of passengers at airports i at time t . The coefficient β_2 measures the marginal impact of passengers on profitability.

The controls are:

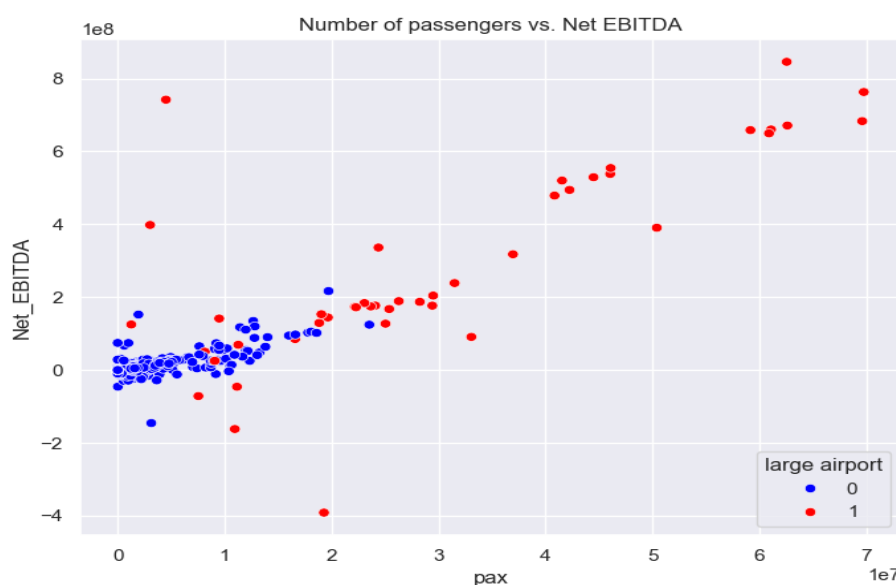
- ω_i - Airport fixed effects
- ω_t - Year fixed effects
- ϵ_{it} - Error term

There are 76 airports for which data are available from 2014 to 2024, which for our full sample leads to 793 year*airport observations.

For the estimation of the passenger break-even point, a simple regression framework was deliberately chosen instead of a specification with multiple control variables. This choice reflects the nature of the available data. The survey responses were limited in number and heterogeneous in coverage, with few airports providing consistent information across years. Adding a large set of controls would therefore risk overfitting and generating unstable coefficients, especially in light of the small effective sample size. The objective of the exercise is not to obtain a causal estimate of profitability drivers, but to derive a transparent and interpretable benchmark of the passenger threshold at which airports tend to cover their operating costs. To improve robustness, airport fixed effects are included to capture time-invariant differences across airports, ensuring that the results are not driven by structural characteristics of individual facilities. A simple regression of EBITDA on passenger numbers, combined with these fixed effects, allows us to identify the underlying relationship in the most reliable manner possible given the data constraints. More complex specifications would not materially improve accuracy, and could in fact obscure the signal in the data. The break-even analysis should therefore be viewed as the best feasible approximation with the information at hand, providing an informative, though stylised, reference point for policy discussion.

As shown in Figure 2.4 below, most observations are concentrated around airports with a small number of passengers and relatively low net EBITDA. Furthermore, there is a clear positive linear relationship between net EBITDA and passenger numbers. However, four large airports (whose yearly observations are depicted in red) appear as outliers in some years; the relationship we are fitting is linear, and therefore it will be more precisely estimated if outliers in terms of passengers are removed.⁷⁶ All observations of these four large airports are therefore excluded from the sample to avoid distorting the overall analysis.⁷⁷

Figure 2.4: Scatterplot net EBITDA vs number of passengers



Source: Project Team based on survey data.

Furthermore, as shown in Figure 2.5 below, in 2020 and 2021 (COVID-19 years) the relationship between passenger numbers and net EBITDA, unlike in normal years, turns negative, with higher passenger numbers on average associated with negative net EBITDA.⁷⁸ The inversion of the relationship between passenger numbers and net EBITDA in 2020 and 2021 is a direct consequence of the exceptional circumstances of the COVID-19 pandemic. During these years, airports faced a collapse in traffic combined with the need to maintain a minimum level of operations and fixed costs, including staff, infrastructure, and safety measures. For some airports, partial traffic recovery worsened financial outcomes, because the limited revenues generated by additional passengers were not sufficient to offset the high fixed costs of operating under pandemic restrictions. This resulted in the counterintuitive pattern visible in Figure 2.5, where

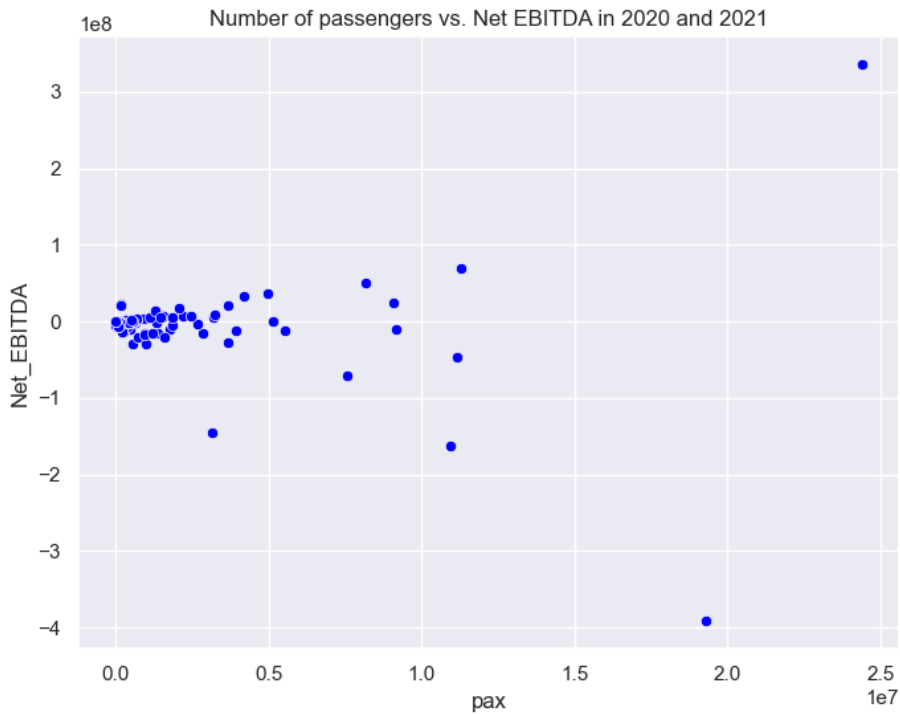
⁷⁶ Four largest airports based on the number of passengers handled.

⁷⁷ We provide in Annex E.4.2 a detailed overview of the survey respondents by size class, and compare it to the "population," based on the Cirium data. Class 5 and 4 airports are overweighted in the survey, and Class 1 respondents are underweighted. The dropping of the four largest airports remedies this discrepancy to some extent, but not to that degree that one can assume a representative sample in terms of size distribution.

⁷⁸ This is confirmed in a regression analysis, where we include an interaction effect of passengers with covid years. This interaction effect is highly significant, large and negative.

higher passenger numbers were on average associated with more negative EBITDA. Such dynamics are not representative of the underlying structural relationship between traffic and financial performance in normal market conditions. Including these years in the estimation of passenger break-even points would therefore bias the results, making airports appear less efficient than they actually are under typical circumstances. For this reason, 2020 and 2021 are excluded from the regression analysis, in order to capture the long-run relationship between passenger volumes and profitability without distortion from the pandemic shock.

Figure 2.5: Scatterplot net EBITDA in COVID-19 years vs number of passengers



Source: Project Team based on survey data.

Table 2.10 reports the regression results (excluding the four large airports and the COVID-19 years (2020 and 2021)). The final sample consists of 72 airports with a total of 606 observations. The estimated coefficient for the number of passengers is positive and statistically significant at the 5% level, indicating that increases in passenger numbers are associated with higher net EBITDA.⁷⁹

⁷⁹ Although the explanatory power of the model is modest ($R^2 = 0.093$; Adjusted $R^2 = 0.0794$), the results suggest that passenger traffic is an important driver of airport profitability. The relatively low R^2 reflects the fact that airport profitability is also due to additional factors not included in this model that we do not observe.

Table 2.10: Regression results for profits (EBITDA, net of aid)

Dependent variable: Profits (EBITDA, net of aid)	
Passengers	1.870**
	(0.707)
Constant	4.785e+06**
	(2.149e+06)
Year FE	Yes
Airport FE	Yes
Number of observations	606
Number of airports	72
R-squared	0.093
Adj.R2	0.0794
F-Stat	1.361
Prob > F	0

*Note: Clustered standard errors at the airport level in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on survey data.

This regression, in particular, the results in Table 2.10, allows us to estimate the minimum number of passengers needed for airports to break-even. Setting profits to zero for each airport/year, one obtains a corresponding number of passengers per airport/year. Taking the average over all these predictions, gives us an average break-even value⁸⁰ of 594,722 passengers, as shown in Table 2.11. The 95% confidence interval ranges from approximately 506,000 to 684,000 passengers, suggesting that the true break-even point is most likely within this band.

Table 2.11: Break-even number of passengers

Variable	Obs	Mean	Std. err.	Std. dev.	[95% conf. interval]	Min	Max
Pax - break-even	606	594,722	45,408.86	1,117,833	505,543.6 - 683,899.9	0	5,976,130

Source: Project Team.

The dispersion is very large: some airports appear able to cover costs with fewer than 200,000 ppa, while others remain unprofitable even at more than 1 million ppa. The pattern aligns with expectations: hubs are virtually always cost-covering, while most small regional airports remain structurally unprofitable.

2.4.4 Conclusions on the break-even threshold and operating aid

Overall, the evidence shows that many smaller regional airports struggle to cover their operating costs, setting the stage for a question on what is the break-even threshold, i.e. the minimum level of passengers that would allow an airport to be cost-covering.

The break-even thresholds estimated in the literature vary significantly depending on the airport sample and do not offer a reliable base for policy orientation.

⁸⁰ We assume that negative values do not exist, i.e. the minimum break-even number of passengers is set to zero if the predicted value is negative.

Overall, the stakeholder consultations show broad agreement that regional airports generally need at least 700,000–1 million ppa to approach break-even (small airports below 500,000 ppa are widely seen as structurally loss-making). Several stakeholders pointed to rising costs (increases in labour and energy costs) and regulatory/tax compliance costs (e.g. safety and security costs, including those that may fall under public remit not always reimbursed by the State, and those related to environmental EU-wide policies, such as Fit for 55 investments) that could raise the threshold (reportedly closer to 1.5–2 million ppa). According to the case studies, stakeholders believe that regional airports need typically 1 million ppa to break-even, but responses emphasise that no single benchmark can be applied universally: outcomes allegedly depend on catchment area potential and region or country-specific factors (not least taxation and levies, that differ depending on environmental taxes and unequal treatment across Member States of compensations to cover safety and security measures). For instance, in the profitable regional airport case study, the target airport is able to fully cover costs at 800,000 ppa (600,000 ppa on scheduled flights) given a very high share of its own traffic is represented by outgoing business travellers, largely insensitive to the inflation indexed airport charges. Notwithstanding that, the stakeholders interviewed in this case study envisage that rising regulatory obligations are pushing the threshold likely up to around 1 million ppa. Moreover, some outermost or peripheral regions emphasised that airports in such areas face higher unit costs even at comparable traffic levels, due to the logistics of supplying and servicing remote regions and due to more severe weather conditions. One of the case studies (focusing on an OR airport), shows that an airport that has surpassed 1 million ppa for the first time at the end of 2024 still remains partly dependent on public support.

The data analysis is based on regressions of EBITDA net of aid on total annual passenger volumes, with airport and year fixed effects. This is an improvement, with respect to the literature, that has mostly worked with cross sections of airports, even though results should be interpreted with extreme care, given data limitations. The break-even analysis should therefore be viewed as the best feasible approximation with the information at hand, providing an informative, though stylised, reference point for policy discussion. The analysis suggests an indicative break-even point of roughly 595,000 ppa, with a wide 95% confidence interval of about 506,000 to 684,000 passengers (the analysis is not restricted to regional airports though). The dispersion is very large: some airports appear able to cover costs with fewer than 200,000 ppa, while others remain unprofitable even at more than one million ppa. Several airports and airport associations emphasise that no single benchmark applies across all contexts: outcomes depend heavily on, for example, catchment area size, traffic mix, the strength level of non-aeronautical revenues (e.g. business jets, hangars, rental fees, refuelling stations), and airline dependence.

When it comes to operating aid, whether the current framework for operating aid is fulfilling its objectives is strictly related to the question on whether operating aid should be extended beyond 2027, either transitorily or permanently, for what reasons and under what conditions. Evidence relevant to these two questions can also be found in the explanations that stakeholders submitted when discussing airport profitability.

Regarding the main shortcomings, national and regional authorities from Austria, Bulgaria, Estonia, and Finland point out that the idea that structural handicaps of smaller regional airports, and especially those in ORs can be addressed with rigid degressive aid timelines is flawed, due to the factors already discussed as affecting airport profitability.

A strong majority of respondents support the continuation of operating aid for airports beyond April 2027 in the AG. Airlines were more divided: while the majority (60%) support continuation, others oppose any prolongation or would accept it only with strict

green conditionalities or when limited to SGEI airports. Supporters point to raising the GBER coverage to what they deem to be the typical break-even threshold. They also propose keeping the opportunity to access operating aid in the AG open, to all regional airports for a limited period or with decreasing aid intensities. For regional airports located in the most isolated, peripheral regions, stakeholders quite broadly suggest permanent notification-free treatment, as their structural challenges are unique. Other suggestions include updating the reference period for calculating the historical operating funding gap (currently 2009-2013) to reflect current needs; greater flexibility in defining caps to aid intensities, accounting for local conditions and consistently rising costs (driven by climate policies and geopolitical shocks) that may drive smaller airports further away from break-even.

As to the applicability of the SGEI framework, should operating aid be discontinued in the AG, several respondents consider that the current SGEI framework is too narrow and restrictive to effectively support most regional airports. At the same time, almost half of surveyed stakeholders (46%) indicated that regional airports in their country could potentially qualify for an SGEI, suggesting that the framework could become significantly more relevant if operating aid under the AG were phased out.

2.5 Investment aid

2.5.1 Consultations

80% of the 55 respondents to the stakeholder survey indicated that no airports in their jurisdiction had received investment aid since 2014 without notification, or that the support received did not require notification (because it either did not constitute State aid under Article 107(1) TFEU or was exempted under the GBER).⁸¹ However, a minority of stakeholders (20%, n=11) believe in the possibility that illegal aid cases may have occurred.

The purposes of public support were diverse but largely related to ensuring compliance with evolving regulations and improving infrastructure. Reported uses included decarbonisation measures, safety and security upgrades, expansion and modernisation of airport facilities, and renewal of infrastructure.

On the rules, one airport association recommended updated thresholds⁸² and broader eligibility to avoid possible cases of unlawful aid, though no specific figures were provided. Similarly, one airport argued that unlawful investment aid could have occurred because thresholds no longer reflect current infrastructure needs and urged a revision.

The stakeholder survey included two additional questions addressing future aid needs:

- For which investment purposes do airports consider that investment aid will be needed in the future?
- Are there any differences between airports (e.g. by size, location, or business model)?

⁸¹ Since 2017, the GBER exempts from notification obligations investment aid to airports with less than 3 million ppa, but maximum aid intensity still applies. Maximum aid is capped at 75% of eligible costs for airports with traffic up to 1 million ppa, at 50% for those up to 3 million ppa, and at 25% for those between 3 and 5 million ppa. Aid intensity can be increased by 20% in the case of OR airports or under exceptional circumstances subject to individual assessment. Airports above 5 million ppa can receive investment aid only under very exceptional circumstances.

⁸² In the call for evidence, several public authorities argued that the AG thresholds are outdated and should be raised to reflect current infrastructure and environmental needs. Some airport associations took a more cautious view, suggesting that higher aid intensities be linked to socio-economic benefits or limited to remote and island airports to avoid sustaining inefficiencies.

In total, 45 written responses were received to these questions. Across Europe, airports foresee a continued need for investment aid, mainly to modernise and maintain core infrastructure such as runways, aprons, taxiways, safety and security systems, and air traffic management facilities. Written responses include:

- National airport associations, and several airport operators put a strong emphasis on projects linked to decarbonisation, renewable energy deployment, and electrification of ground operations, in line with the EU's Fit for 55 objectives (such investment purposes are discussed in more detail in Section 7).
- National airport associations as well as several EU-level airlines also noted the importance of digitalisation (smart airport solutions, cybersecurity, biometrics), resilience measures (climate adaptation, emergency preparedness)⁸³, and accessibility improvements, especially for persons with reduced mobility and remote regions.
- Several airports in Austria also reported pressing needs linked to environmental remediation, such as removing PFAS contamination and upgrading firefighting and safety facilities.

According to the responses received, differences between airports are significant and determine the type and scale of aid required. Consulted airports noted in that respect: larger airports can rely more on private investment, non-aeronautical revenues, and economies of scale, whereas smaller regional airports, particularly in remote regions, island, or ORs face structural deficits and rely heavily on public support;⁸⁴ seasonal tourist airports often need aid for maintenance services outside peak periods, while airports with heavy business travel may require modern digital infrastructure; in regions such as the Azores, Madeira, or northern Finland, where alternative transport is limited, investment aid is critical for ensuring connectivity and regional cohesion. Several respondents stressed that a one-size-fits-all approach is thus not appropriate, and aid rules should reflect airport-specific contexts, including size, location, and business model.

2.5.2 Conclusions on investment aid

The purposes of investment aid are largely related to ensuring compliance with evolving regulations and improving infrastructure. Reported uses included decarbonisation measures, safety and security upgrades, renewal and expansion, as well as modernisation of airport infrastructure and facilities (e.g. decarbonisation measures, safety and security upgrades).

Stakeholders foresee a continued need for investment aid in the future, largely for the same purposes listed for the past, but with greater emphasis on projects linked to climate policies (as is further discussed in the context of airports' ongoing efforts to address environmental impact), digitalisation, crisis resilience, improving accessibility of the airport facilities. Differences between airports mainly depend on size, with smaller airports relying more on public support due to low scale and arguing that aid intensity caps are low.

⁸³ In the call for evidence, airport associations emphasised that SAF and hydrogen infrastructure, charging systems, and the retrofitting of terminals and airside facilities will dominate investment needs over the coming decade. They noted that these projects are often mandated by regulation yet generate little direct revenue, making public aid essential to ensure their financial viability.

⁸⁴ In the call for evidence, several (small) airports requested aid intensities of up to 100% for those handling under 1 million passengers, with proportional scaling up to 5 million, noting that without such support their profitability prospects remain weak.

3 Connectivity and economic development

This section examines the contribution of regional airports to connectivity and regional economic development, by evaluating the drivers and consequences of airport closures to that end.

It integrates three complementary strands of evidence. First, a literature review synthesises how air connectivity can be defined and measured, what determines it and its relationship with regional economic outcomes (Section 3.1). Second, Section 3.2 presents the perspectives gathered through the consultations of relevant stakeholders and provides qualitative evidence on the afore-mentioned topics. Third, Section 3.3 presents our original data analysis on the interplay between airport traffic and regional economic outcomes (employment and GDP per capita), as well as a simulation of the potential impact of airport closures on these outcomes.

Finally, Section 3.4 provides an integrated assessment of regional airports' contributions to connectivity and regional economic development, taking into account the findings of Sections 3.1 through 3.3.

Table 3.1 summarises the RQs addressed in this section.

Table 3.1: Mapping of the RQs against sections

Research questions	Section
2. To what extent do regional airports contribute to (i) regional connectivity, (ii) regional economic development?	Section 3
8. (i) How many regional airports closed since 2014? (ii) What were the reasons for those closures? (iii) What has been the impact of these closures (for example on connectivity and on regional development)?	

Source: Project Team

3.1 Literature review

The primary justification for subsidising regional airports is their potential role in enhancing regional connectivity. Improved connectivity can reduce travel times and thereby integrate remote, peripheral or otherwise badly connected regions into broader economic and social networks. This in turn may create large economic benefits in terms of job opportunities and economic development of the affected regions, making regional airports potentially essential ingredients for economic growth. In this section, the literature analysing the role of regional airports in generating (i) additional connectivity and (ii) economic growth will be reviewed.

3.1.1 Regional airports and connectivity

Connectivity is generally defined as the degree to which nodes of a network are connected to each other (Burghouwt & Redondi, 2013). When applied to the air transport network, the connection between two regions is measured by the presence or not of an available direct connection, as well as with the number of available flights and their frequency. Higher (air) connectivity means lower travel time and/or costs for consumers, higher opportunities for businesses, increased trade and productivity as well as lower risk of marginalisation for remote regions (Burghouwt, 2017). Between 2016 and 2019, overall air connectivity at the EU+⁸⁵ level substantially increased (+12%),

⁸⁵ Consists of the 27 EU Member States together with the United Kingdom, Iceland, Norway and Switzerland.

especially in Eastern and Southern Europe (EC – DG Mobility and Transport, 2021). Several studies have analysed the role played by small and regional airports in generating additional connectivity.

Two cases should be distinguished: very remote and peripheral regions. In very remote regions, hardly accessible by other modes of transport, the presence of a regional airport (with enough operated routes) is, almost by definition, improving connectivity and accessibility of the remote region.

Regional airports in ORs play a vital role in ensuring access to basic goods and services, both within the region and from the EU mainland, as these regions often face a double insularity, with limited connectivity not only to the mainland but also between islands within the same archipelago (Große et al., 2021; Tveter, 2017).

On the other hand, in peripheral but not necessarily remote regions, the resident population may have access to alternative connections (e.g. HSR or a further but larger airport), against which the additional connectivity of regional airports should be measured.

Redondi et al. (2013) focus on Europe and estimate the connectivity loss resulting from the closure of all European airports with traffic below 1 and 2 million ppa, using data referring to 2011. Out of the 379 airports in their sample, 280 airports fall within the 2 million ppa threshold. The latter accounted for 8% of total European passenger traffic in 2011. The analysis does not include Eastern European countries. Although the study is quite old, it is the only one in the literature quantifying the contribution to connectivity of all small airports in Europe. The study indicates that the connectivity loss is unevenly distributed across the regions considered. On average, they found that the average travel time for passengers would increase by 1.5% (from 540 to 548 min) if airports with less than 1 million ppa were to be closed and by 2.5% (from 540 to 554 min) if all airports with less than 2 million ppa were to be closed. In terms of travel cost for consumers, this would translate into an additional aggregate cost of €1.7 billion per year. These aggregate results hide significant regional variability, as it is explained below.

The connectivity measure used in this study is based on Redondi et al. (2011). Considering a sample of 75,000 European municipalities (covering 19 Western European countries), the authors compute the quickest travel time by airplane for each pair of municipalities (considering only pairs whose distance is at least 500 km). The travel time includes: (i) the time to reach the origin airport by car or HSR; (ii) the air travel time, including layover times at the airports in case of connecting flights; (iii) the time to reach the destination municipality from the destination airport, using car or HSR (for this, the two nearest airports to the municipality are considered, and any other airport within 200 km and offering more than 50 routes). The study uses Official Airline Guide ("OAG") data, referring to 2011. The final measure used to gauge the overall contribution of small airports to connectivity is the accessibility index, which gives, for each municipality, the population-weighted average travel time to all other municipalities.⁸⁶ One of the drawbacks of this approach is that it weights travel times by the population of destination municipalities, rather than incorporating information on the actual preferences of a certain population for reaching a certain region.

⁸⁶ Furthermore, the travel time to reach 40 major non-European airports is included in the analysis.

The increase in the accessibility index hides significant variation across airports: of the total of 280 excluded airports with less than 2 million ppa, the most relevant 50 airports contribute more than 60% of the connectivity loss at the European level. On the other hand, 60 of the excluded airports have little negative impact. This in turn implies significant variation across European regions. Very small airports are found to be very important in the Scandinavian regions and Scotland, as well as in some regions of France, Spain and Italy. The additional closure of 1-2 million ppa airports is found to affect significantly connectivity in Northern Scandinavia, Northern Spain, Luxembourg, Corsica and Northern Sardinia. Hence, for example, Finland would experience an increase in travel time of 82.8 min if all small airports were closed (an increase of approximately 12% of the mean). This means that, on average, a traveller from Finland would need to spend 82.8 min more to reach other destinations in Europe. On the other hand, some other regions would experience only a small increase in travel time, e.g. in Portugal the average increase is only 2.1 min (approx. 1%) and therefore negligible.

One of the strongest factors affecting the strength of the connectivity loss is found to be the presence of HSR: most of these areas are not served by HSR network. Furthermore, the increase in the accessibility index is greater in regions in which accessibility is already larger: the more isolated a region, the more it suffers from small airports' closure. The authors show also that, predictably, the overall increase in travel time is due to an increase in time to reach the nearest airport and to reach the final destination from arrival airport, while flight time decreases for all countries.

To the best of our knowledge, there are no other recent studies estimating the connectivity loss that the closure of small European airports would induce, as done by Redondi et al. (2013). However, the role played by small airports has been analysed from a different angle. Antunes et al. (2020) demonstrate that LCCs have significantly improved air connectivity in remote European regions by using regional airports in their initial development phase. However, this increased connectivity in one region can lead to lower levels of connectivity growth in surrounding regions, indicating a complex interplay between regional and broader connectivity effects: governments in regions with bad connectivity can exploit the good connectivity of surrounding regions and avoid investing in more connectivity, leading to this negative correlation. The study further investigates other determinants of regional connectivity, highlighting the positive effect of local GDP, population density and tourist flows.⁸⁷

Martini, Porta, et al. (2020) investigate the evolution of air connectivity and the number of available seats in European NUTS-2 regions, over the 2009-2018 period.⁸⁸ Air connectivity is measured through the average number of routes required to access all other NUTS-2 regions, across years. European regions are categorised as core, intermediate and remote. Remote regions are defined based on the Organisation for Economic Co-operation and Development ("OECD") classifications, plus islands smaller than 25,000 km² with a driving or ferry time of over four hours to the nearest European

⁸⁷ The study computes air connectivity at the NUTS-2 level (regions), using three measures that are meant to capture the distance of a region from other regions in the aviation network. The sample covers 284 NUTS-2 regions for the period 2009-2016. The aviation network is constructed using direct flight connections from OAG data, i.e. two regions are considered connected if there is at least a direct route connecting them (with at least one flight per week on average over the year). Once the network is constructed, the authors compute, for each node of the network (i.e. each region) three measures: degree, closeness and betweenness centrality. These are measures commonly used in the network literature to quantify the centrality of each node in a network. These three measures of connectivity at the region level are then employed in SAR (Spatial Autoregressive Model), to estimate the spillovers to the neighbour regions.

⁸⁸ The analysis relies on a dataset of intra-European flights for the period 2009-2018 from the OAG database.

inland city.⁸⁹ Core regions are identified based on total GDP and GDP per capita. Remaining regions are categorised as intermediate. The study shows that the number of available seats has increased across all regions, and particularly in remote and intermediate ones, primarily due to the expansion of LCCs, that not only enhanced flight frequency and aircraft capacity, but also introduced new routes, although heterogeneously across regions. Air connectivity also has improved over the period, with the most significant gains observed in remote regions. However, on average remote regions are still approximately 30% less connected than core ones and experience greater variability in air connectivity over time, highlighting less stable mobility.⁹⁰ Finally, the authors analyse the correlation between the number of available seats and air connectivity, to see to what extent changes in the former actually transmit into changes in the latter.⁹¹ In core regions, connectivity is more correlated with FSC seats availability than LCC seat availability, while the opposite is true in intermediate regions.⁹² In remote regions, the correlation is similar for the types of airlines. This suggests that while the relative greater expansion of LCC seats (in comparison to FSC seats) in intermediate regions was responsible for the opening of new routes, in remote regions this expansion was relatively more focused on increasing the number of seats on pre-existing routes.

Calzada & Fageda (2019) also focus on the role played by LCCs over the 2003-2013 period, analysing the factors driving the choice of opening new routes. Their analysis shows that LCC expansion extended the benefits of air-connectivity to regions with low GDP per capita and increased the geographical coverage of routes operated from small and medium airports. The study analyses 259 European airports with more than 250,000 ppa. Comparing the factors affecting the opening of new routes by FSCs vs LCCs, they show that while the former focused on increasing the frequency of flights between high-GDP regions, the latter increased the capacity of connections with regions with relatively lower GDP per capita.

Grimme & Pabst (2019) estimate connectivity of all NUTS-3 regions in Germany in 2010 and 2017. For each region, they estimate the shortest travel time to each NUTS-3 European region, either by car or by a combined car-air travel (for the latter, only airports within a 300 km radius are considered). Connectivity of each German region is then computed as the simple average of the shortest travel times for all of the destination regions. The comparison between 2017 and 2010 figures reveals that the regions that displayed the higher connectivity gain tend to be those with worse connectivity levels in 2010. Examples are the regions in the state of Mecklenburg-Vorpommern, due to several new routes at the airports of Rostock and Heringsdorf (two regional airports). Other regions which have gained connectivity are the areas in the vicinity of the airports of Berlin, Bremen, Nuremburg and Memmingen, due to the boom of LCCs at these airports.

In other words, the estimated loss strictly depends on the available alternative transport network, which can differ significantly from region to region and over time.

⁸⁹ Both definitions apply at the NUTS3 level. A NUTS2 region is deemed remote if more than 50% of its population resides in a remote NUTS3 area.

⁹⁰ This may be because in these regions airlines operates thin routes, which are more prone to be modified, if e.g. they do not meet a minimum demand threshold.

⁹¹ For example, an increase of seats available in a pre-existing route does not improve connectivity, according to the measure used here, while opening on new routes lead to an increase in both measures.

⁹² The LCC/FSC does not include regional airlines, although these often operate as subordinate of larger FSC. However, these studies do not mention explicitly regional airlines.

3.1.2 Regional airports and economic development

Airports impact the economy of the region where they are located. Similarly to any other enterprise, they have a direct economic impact (coming from employment and other revenues created at the airport), an indirect impact (employment and revenues created by the suppliers of the airport) and an induced impact (increased spending in the area, created by the direct and indirect impacts). Beyond that, an airport is expected to have a catalytic impact, i.e. the economic and productivity gains generated by the additional connectivity and attractiveness of the area generated by the presence of the airport. Being connected to other regions of the world may be vital for many firms and individuals, which may otherwise decide to relocate to other, more connected areas. This last type of impact is the more interesting one, as it is specific to airports, and because it is often cited as the very justification for providing aid to small airports. Notice that, for the catalytic impact to be significant, creating additional connectivity can be considered a pre-requisite. In other words, asking whether an airport has a catalytic impact boils down to asking whether this improves connectivity and whether the additional connectivity generated by an airport has a significant economic impact. Regarding regional airports in remote and OR, they are an essential element for the economic activity of the territory as they act as a business feeder ensuring the inter territorial economic exchange. In addition, they facilitate connectivity for tourism, trade, and investment, thereby supporting local development, social cohesion, and the integration of these remote regions into broader national and European markets.

While there is broad consensus in the literature that better transport infrastructure generally promotes higher economic development (see Magazzino & Maltese, 2021, for a comprehensive review), studies focusing specifically on airports reach more mixed conclusions. A key reason is the empirical challenge of disentangling causality: it is not straightforward to isolate the effect of air connectivity on economic development due to a strong reverse causality problem. Economic growth itself drives demand for air services – when a region's economy expands, consumers and firms demand more air connections, prompting airlines to open new routes and increase frequencies, thereby improving connectivity. However, many studies in the field do not fully account for this two-way relationship, which can lead to biased conclusions. Zhang & Graham (2020) review the quantitative literature on this reciprocal causality and find that, especially in developed countries, the dominant causal direction tends to run from air transport to economic growth – particularly for service-oriented sectors that benefit most from enhanced connectivity.

At the same time, a substantial body of research has explicitly addressed the reverse causality issue using rigorous statistical techniques and has found robust evidence of a positive causal effect of airports on economic development. For example, Percoco (2010) applies a propensity score matching model to Italian regions and shows that airports positively affected economic growth in 2002. Allroggen & Malina (2014) use an instrumental variable approach on data from 19 German airports (1997–2006) and demonstrate that higher air traffic leads to higher regional GDP. Brugnoli et al. (2018) exploit an exogenous shock affecting a major Lombardy airport in 2008 and estimate a significant positive effect of civil aviation on international trade. Similarly, Fageda (2017) analyses the Barcelona airport over 2002–2015 and documents that reduced travel times boosted foreign direct investment into Catalonia.

Other studies focus on regions outside of Europe, especially on the US. According to Gillen et al. (2015), connectivity affects multi-factor productivity of industries in the US, but the impact differs across industries. A positive relationship was found between connectivity (measured as the number of new destinations) and the net number of jobs and business establishments created in US metropolitan areas by Bilotkach (2015). According to Brueckner (2003), a 10% increase in passenger enplanements leads to a 1% increase in employment in service-related industries in US metropolitan areas.

Hovhannisyan & Keller (2015) report that a 10% increase in business travel results in an increase in patenting by about 0.2%, covering outward business travel from the US. Blonigen & Cristea (2015) investigate 263 US metropolitan areas over the 1969-1991 period, showing that a 50% increase in an average city's air traffic growth rate generates an additional stream of income over a 20-year period equal to 7.4% of real GDP.

However, none of the studies reported above focus specifically on small/regional airports, and some of them actually investigate samples of large airports only. Indeed, studies specifically focusing on the role played by regional airports in boosting local economic development are rare. Once again, a distinction between remote/isolated regions and other regions should be made. In fact, as far as the first ones are concerned, the existence of a significant economic effect is typically quite straightforward. By providing adequate air connectivity, the isolated region is made more attractive to maintain the population of those regions in place (Tveter, 2017). The presence of a local airport can be a key factor in driving people's decision to live or not in an isolated area, as shown by a study carried out in Norway (Halpern & Bråthen, 2011). In these areas, airports play a broader social role which is not measurable by air traffic alone, spanning issues such as crisis management, civil defence and regional development (Große et al., 2021).

When instead one includes peripheral (but not necessarily remote) regions into the picture, the empirical evidence is more heterogeneous. Recent studies focusing on small European airports include Breidenbach (2020) and Volkhausen (2022).

Breidenbach (2020) focuses on airports in Germany and finds no evidence of a spillover effect from regional airports to economic development. The study uses the single EU aviation market reform, implemented in Germany in 1997, as an exogenous treatment in a difference-in-differences setup. For various reasons, the EU reform caused an exogenous increase in the investment in regional airports (whose location is assumed to be quite exogenous to local economic development, given their previous military role), boosting their expansions. The author uses the 1993-96 period as a pre-treatment sample, and the 1997-2008 as the post-treatment sample. German counties with a regional airport are considered the treatment group. The study does not show evidence of an effect of the treatment on local GDP per capita growth. Note however that Breidenbach (2020) focuses on Germany only, which means that the absence of a significant effect could be due to (i) a lack of variability in the data and small size of the sample, and/or (ii) specificity of the German territory.

Indeed, Volkhausen (2022), extended Breidenbach's (2020) methodology to the whole European territory and found a positive impact of regional airports on regional development. The study also employs a difference-in-differences methodology, leveraging the exogenous nature of the Single EU Aviation market reform of 1997 for the identification. The study compares regions (defined at the NUTS-3 level) with and without regional airports, before (1980-1997) and after (1997-2016) the reform. Treated regions are those whose centroid lies within 25 km from a regional airport, which is defined as an airport with less than 3 million ppa. The final dataset contains around 1,000 regions observed over 37 years. They estimate that, on average, local economic activity increases between 2 and 6 percent due to the presence of a regional airport. Furthermore, an additional 1 million ppa increase local GDP on average by 2-2.7%. Population and employment are also positively affected. The total economic impact of regional airports, in terms of incremental GDP at the regional level, is estimated to range between 146 and 214 million Euros on a per NUTS-3 level.

Another study investigating the issue is Pot & Koster (2022), which performs a Granger-causality analysis.⁹³ Several studies in the literature use this methodology, but these results should be interpreted with caution, as such an analysis is not informative of the direction of true causality. Rather it can inform into whether air traffic is predictive of future economic development, or vice versa. The authors use a panel sample of 274 European NUTS-2 regions for the period 2000-2018 and estimate a panel vector error correction model. They show that Granger causality goes from air accessibility to regional GDP for large airports (with more than 5 million ppa), while for small airports (with less than 1 million ppa), the opposite is true. These results could be driven by a different ability of the large vs the small airports in predicting future regional economic growth, thus adjusting their supply of air traffic in advance, rather than by the actual economic effect of airports. Air accessibility of a region is measured by the weighted sum of the number of passengers handled by the airports that can be reached from that region, weighted by inverse of the cost of reaching each airport. The authors also argue that the regions where the economic benefit of small airports is estimated to be larger are those with higher population density, lower share of employment in manufacturing, less rail infrastructure and lower GDP per capita level. However, once again, these results should be taken with caution, given the lack of a proper structural causality identification.⁹⁴

Other older studies which are indirectly related to small airports are Rey et al. (2011) and Graham & Dennis (2010), which investigate the effect of air transport on tourism. These studies focus on the effect of LCC expansion, which has been knowingly relying on small airports in its first phase. Rey et al. (2011) observe that the expansion of LCC activity in Spain between 2000 and 2009 had a strong, positive effect on the number of tourist arrivals in the affected regions. Graham & Dennis (2010) find that new LCC operations incentivised by the Maltese government in 2006 increased air traffic tourism from the UK to Malta. In particular, LCCs attracted younger, more affluent, and first-time visitors. The magnitude of the effect however was not clearly identified by the authors.

3.2 Consultations

3.2.1 Regional airport impact on connectivity and economic development

Respondents to the stakeholder survey and public consultation were asked to indicate the extent of regional airports' contribution to regional connectivity and regional economic development. Both the stakeholder survey (n=77) and the public consultation (n=103) confirm that regional airports are widely perceived to make a strong contribution to regional connectivity and economic development. In both sources, the largest share of respondents rated the contribution of regional airports in these two areas as significant or considerable.

⁹³ In a nutshell, Granger-causality analysis consists in estimating a regression of a time series on past values of another variables, thereby testing whether past values of one time series contain information that improves the prediction of another series.

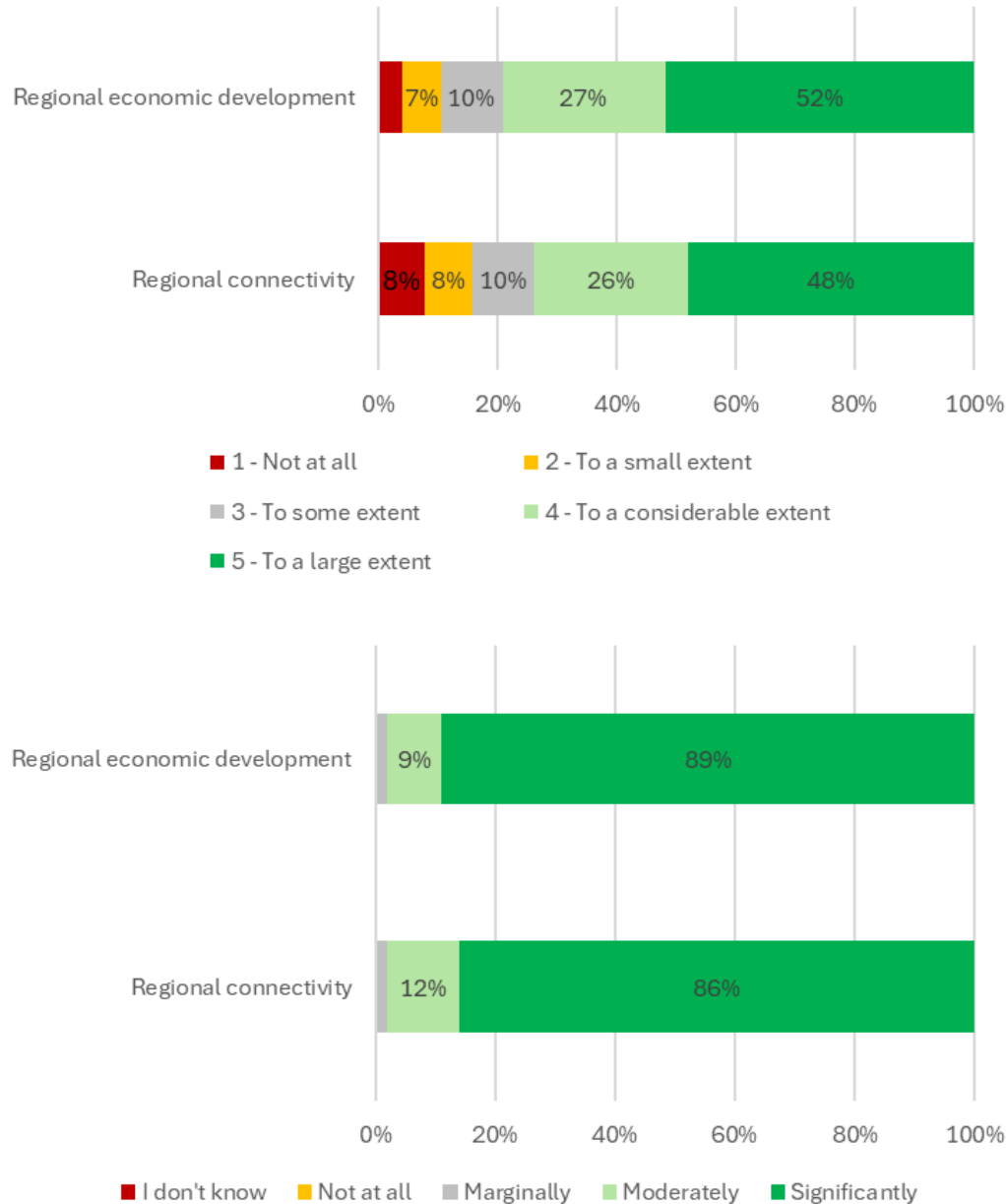
⁹⁴ Other older studies performed Granger-causality analyses. Van De Vijver et al. (2016) study air traffic and economic development in 112 NUTS-2 European regions, finding that in most cases air traffic "Granger causes" economic growth, rather than the opposite. Mikkala & Tervo (2013) also perform a Granger-causality analysis, suggesting instead that only in remote regions air traffic "Granger causes" economic development, while the opposite is true for core regions.

For regional economic development, nearly 90% of public consultation respondents and over half of stakeholder survey respondents selected the highest rating, suggesting broad consensus around the economic benefits of regional airports.

When it comes to the responses by the stakeholder type:

- Support was nearly universal among airports and airport associations (n=92), with 90% indicating that regional airports contribute to a large or considerable extent in both areas.
- Public authorities (n=42) also largely agreed, with 80% selecting the highest ratings.
- Among broader aviation industry associations (n=24), views were similarly positive though slightly more varied, with 78% assessing the contribution as large or considerable.
- Airlines (n=14) were more mixed, with 60% recognising a major contribution to regional connectivity and economic development.
- Finally, Environmental NGOs (n=2) and citizens (n=5) were also largely positive, with four of the five citizens and both NGOs indicating that regional airports contribute considerably or to a large extent to both connectivity and regional development.

Figure 3.1: On a scale from 1 to 5, to what extent do regional airports contribute towards (i) regional connectivity, (ii) regional economic development?



Source: Stakeholder survey (n=77) and public consultation (n=103).

When asked to substantiate their responses, respondents from various types of industry organisations and Member States noted the crucial role of regional airports in providing essential connectivity for peripheral, rural, island and OR particularly where other transport options, such as rail, are limited or unavailable. Several respondents noted that regional airports act as critical enablers of economic activity, tourism, labour mobility and business travel (as part of its contribution to the call for evidence, one airport in Northern Ireland quantified this impact, noting that while it incurs annual operating losses of £3.5 million, it generates a net regional impact of £35 million per year). Others observed that the impact of regional airports tends to vary based on geographical context, population density and the availability of other infrastructure.

Overall, the qualitative evidence suggests that regional airports are broadly seen as key drivers of regional development and cohesion.

Box 3.1: Insights from case studies on impact of regional airports on connectivity and economic development

The OR airport case study confirms that in ORs, aviation is indispensable because no alternative may exist or be as efficient in ensuring connectivity. For access to the mainland and to international destinations, air services are often the only viable mode, since commercial maritime links are either non-existent or not adapted to passenger demand.

Within the region itself, ferry connections are limited to short-haul⁹⁵ corridors and subject to strong seasonality. Some islands lack any maritime link altogether, meaning that year-round mobility for residents and tourists relies exclusively on air transport.

3.2.2 Airport closures since 2014

Most of the respondents to the stakeholder survey were unable to provide data on the regional airports closed since 2014. One EU-level association, representing around 130 regional airports, estimated that around five airports, representing around 5% of their members, became bankrupt since 2014.

The most commonly cited reasons for closures included airport bankruptcy, loss of importance due to competition from nearby airports, and the reallocation of traffic. Additional factors mentioned included high operating costs relative to passenger volumes, COVID-19-related disruptions, and the lack of public aid. Examples include Frankfurt-Hahn and Lugano which went through structured bankruptcies, and other airports that were affected by airlines ceasing operations at those locations.

When it comes to the impact of these closures, the survey results⁹⁶ show that nearly half of respondents⁹⁷ (exclusively regulatory bodies, local, regional governments and some industry associations as well as an airport) considered the closures to have had no impact at all on connectivity and regional development in their country. Around 15% (several industry associations and one regional, local government) reported they had been affected to a small extent, while 30% (exclusively broader aviation industry associations and one local government) felt the impact to some extent. Only a small minority (one regulatory body, regional government, and airport association) reported a large extent of impact.

3.3 Data analysis

3.3.1 Impact of regional airports on employment level and GDP per capita

A key policy question is whether and *to what extent regional airports contribute to regional economic development*. The hypothesis is that higher passenger traffic at regional airports supports local employment and income by facilitating connectivity, tourism, and business activity. If this is the case, then increases in passenger volumes

⁹⁵ Transport of passengers or goods over long/medium/short distances (typically more than six hours, between 3 and 6 hours, less than 3 hours, respectively).

⁹⁶ Source: Stakeholder survey, 26 responses.

⁹⁷ Precisely, 49%.

should be associated with higher employment levels and GDP per capita in the regions where these airports are located.

To test this hypothesis, regressions at the NUTS-3 regional level are estimated, linking annual employment and GDP per capita to total passenger numbers at regional airports. Year fixed effects control for common macroeconomic shocks, and NUTS-3 fixed effects absorb time-invariant regional characteristics. Standard errors are clustered at the region level. The coefficients are interpreted as semi-elasticities, i.e. the percentage change in employment or GDP per capita associated with changes in passenger volumes.

Passenger volumes are obtained from Cirium at the airport–year level and aggregated to NUTS-3 regions. Economic outcomes are taken from Eurostat regional accounts, covering employment and GDP per capita. The final dataset for these regressions covers more than 200 NUTS-3 regions over the period 2014–2023, including those without airports.

Note that the analysis is observational and cannot establish a strict causality. Passenger numbers may themselves be influenced by local economic conditions, raising endogeneity concerns through reverse causality. The specification does not control for all possible confounding factors, such as infrastructure investment, industrial composition, or tourism shocks. Measurement error is also possible, both in Cirium traffic data for small airports and in regional accounts for sparsely populated areas. Finally, the effects identified are average associations and may mask substantial heterogeneity across regions and types of airports.

To assess the relationship between regional airports and regional development, the following regression is estimated:⁹⁸

$$\log(Y_{rt}) = \beta_1 + \beta_2 \text{RegionType}_r + \beta_3 \text{Total_pax_regional}_{rt} + \omega_t + \omega_{R(r)} + \epsilon_{rt}, \quad \text{Equation 3.1}$$

where the dependent variable Y_{rt} is the employment level or GDP per capita in region r (NUTS3 level) in year t . The key independent variable in this regression is $\text{Total_pax_regional}_{rt}$ which is the total number of passengers at regional airports in region r in year t . We include $\text{Total_pax_regional}$ because the goal is to estimate the marginal contribution of regional airports to regional economic development.

The controls are:

- RegionType_r - Categorical variable indicating the region type. Regions are classified as:
 - Those regions with no airport;
 - Those with at least one regional airport (this includes regions with both larger airports and a regional airport);
 - Those with at least a hub or a mid-size airport but no regional airport.
- ω_t - Year fixed effects.
- $\omega_{R(r)}$ - are fixed effects at the NUTS2-region R that contains NUTS-3 region r .⁹⁹

⁹⁸ Note that many regions do not have regional airports, which means the total number of passengers is zero in those cases. Consequently, a log–log specification cannot be used.

⁹⁹ We include NUTS2 fixed effects rather than NUTS3 fixed effects because, due to the small number of observations, using NUTS2 captures more airports and provides greater within-unit variation for the fixed effects.

- ϵ_{rt} - Error term.

Table 3.2 shows the results for employment. Coefficient β_3 captures the marginal effect of an increased passenger traffic at regional airports in regions that have a regional airport. In regions with a regional airport, an increase of 2,511 passengers (5% of the mean passengers in regional airports) is associated with a 0.095% increase in employment ($(\exp(3.78e-07 * 2,511) - 1) * 100 = 0.095$).¹⁰⁰

Table 3.2: Regression results for employment level

Dependent variable: log (Employment level)	
Regions with airport but no regional airport	1.046***
	(0.0206)
Regions with regional airport	0.318***
	(0.0154)
Total passengers of regional airports	3.78e-07***
	(4.10e-08)
Constant	11.64***
	(0.00549)
Region FE (NUTS 2 level)	Yes
Year FE	Yes
Number of observations	12,925
R-squared	0.757
Adj.R2	0.751
F-Stat	1038
Prob > F	0

Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Project Team based on Cirium and Eurostat.

Table 3.3 shows the results for GDP per capita. In regions with a regional airport, an increase of 2,511 passengers (equal to 5% of the mean passenger volume in regional airports) is associated with a 0.046% increase in GDP per capita (because $(\exp(1.83e-07 * 2,511) - 1) * 100 = 0.046$).¹⁰¹

¹⁰⁰ In regions with a regional airport, an increase of 10,000 passengers is associated with a 0.378% increase in employment (because $(\exp(3.78e-07 * 10,000) - 1) * 100 = 0.378$).

¹⁰¹ In regions with a regional airport, an increase of 10,000 passengers is associated with a 0.183% increase in GDP per capita.

Table 3.3: Regression results for GDP per capita

Dependent variable: log (GDP per capita)	
Regions with airport but no regional airport	0.258***
	(0.0101)
Regions with regional airport	0.0670***
	(0.00756)
Total passengers of regional airports	1.83e-07***
	(2.00e-08)
Constant	10.02***
	(0.00268)
Region FE (NUTS 2 level)	Yes
Year FE	Yes
Number of observations	13,099
R-squared	0.876
Adj.R2	0.873
F-Stat	289.4
Prob > F	0

*Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium and Eurostat.

To analyse the specificity of ORs, regression (Equation 3.2) is estimated, incorporating an interaction term to capture the differential effect for OR airports. We do not perform the regression separately for OR as there is insufficient variation within the OR sample.

We estimate the following equation:

$$\log(Y_{rt}) = \beta_1 + \beta_2 OR_r + \beta_3 (\text{Inner region}_r * \text{Total_pax_regional}_{rt}) + \beta_4 (OR_r * \text{Total_pax_regional}_{rt}) + \omega_t + \omega_{c(r)} + \epsilon_{rt}, \quad \text{Equation 3.2}$$

where the dependent variable Y_{rt} is the employment level or GDP per capita in region r (NUTS3 level) at time t . The key independent variable in this regression is $OR_r * \text{Total_pax_regional}_{rt}$ which is the total number of passengers at regional airports in OR region r at time t in ORs. We include $\text{Total_pax_regional}$ because the goal is to estimate the marginal contribution of ORs airports to regional economic development.

- OR_r : Dummy variable equal to 1 if the region is classified as OR, 0 otherwise.¹⁰²
- ω_t - Year fixed effects.
- $\omega_{c(r)}$ - Country fixed effects, where $c(r)$ denotes the country that contains region r .¹⁰³
- ϵ_{rt} - Error term.

¹⁰² See Annex E.1 for the definition of ORs and inner regions.

¹⁰³ Since the regression is estimated at the regional level, and one of the covariates is the dummy ORs defined at that same level, there is almost no variation within regions that can be exploited by NUTS3 fixed effects. In addition, the number of ORs is quite limited, which further reduces the within-variation captured by regional fixed effects. Using country fixed effects preserves more variation in the data, while still controlling for broad country-level unobservable.

We use country fixed effects rather than NUTS2 fixed effects because the number of ORs within each NUTS2 is too small to allow for estimating effects. Table 3.4 shows the results for employment in ORs. Coefficient β_4 captures the marginal effect of passenger traffic at ORs with a regional airport.

In the first row we find that, on average, the employment level in ORs is significantly lower as compared to inner regions. In ORs with regional airports, the number of passengers has a positive impact on employment. Specifically, an increase of 3,930 passengers (equal to 5% of the mean passenger volume in regional airports in ORs) is associated with a 0.333% increase in employment ($\exp(8.46e-07 * 3,930) - 1) * 100 = 0.333$).¹⁰⁴

Table 3.4: Regression results for employment in ORs

Dependent variable: log (Employment level)	
Outermost regions	-1.279***
	(0.0849)
Inner regions*Total passengers of regional airports	5.66e-07***
	(4.51e-08)
Outermost regions*Total passengers of regional airports	8.46e-07***
	(1.29e-07)
Constant	11.30***
	(0.0415)
Country FE	Yes
Year FE	Yes
Number of ORs	14
Number of ORs with a regional airport	14
Number of observations	12,925
R-squared	0.423
Adj.R2	0.422
F-Stat	299.5
Prob > F	0

*Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team

Table 3.5 shows the results for GDP per capita in ORs. As shown in the first row, on average, GDP per capita is lower in ORs compared to inner regions. However, no significant effect of passenger traffic in ORs with a regional airport on GDP per capita is found.

¹⁰⁴ An increase of 10,000 passengers is associated with a 0.849% increase in employment.

Table 3.5: Regression results for GDP per capita in ORs

Dependent variable: log (GDP per capita)	
Outermost regions	-0.288***
	(0.0370)
Inner regions*Total passengers of regional airports	1.26e-07***
	(1.95e-08)
Outermost regions*Total passengers of regional airports	8.92e-08
	(5.61e-08)
Constant	10.06***
	(0.00294)
Country FE	Yes
Year FE	Yes
Number of ORs	14
Number of ORs with a regional airport	14
Number of observations	12,925
R-squared	0.423
Adj.R2	0.422
F-Stat	299.5
Prob > F	0

*Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team

The regression results show a robust positive association between passenger traffic at regional airports and regional economic outcomes. These effects are statistically significant and consistent across alternative specifications. The results suggest that regional airports correlate with local economic performance, though the magnitudes are modest in absolute terms. Taken together, the evidence indicates that regional airports can play a supportive role in regional development, but they are not transformative drivers of growth on their own. Their contribution should therefore be seen as one element in a broader regional economic ecosystem rather than as a stand-alone source of prosperity.

3.3.2 Closure of airports in the EU and their impact on regional development

A recurrent concern for regional policy is what happens when airports close—whether permanently or by ceasing scheduled commercial services. The policy question is whether such closures harm regional economic development by reducing connectivity and access to air transport. The hypothesis tested is: if regional airport closures matter for local economies, then removing the passenger traffic associated with those airports should lead to measurable declines in regional employment and GDP per capita.

To test this, the baseline regression framework is used to link passenger volumes at regional airports to economic outcomes at the NUTS-3 level. For each airport that closed between 2014 and 2024, the average passenger share that airport contributed to its region's total traffic during its operating years is calculated. We then simulate a counterfactual by subtracting this share from the observed passenger volumes, re-estimating predicted employment and GDP per capita, and comparing these counterfactual outcomes with the baseline. This yield estimates of the closure effect, expressed as percentage differences in regional economic outcomes.

For this part of the analysis, Cirium data is used on airport-level passenger volumes to identify closures and quantify the traffic lost, combined with Eurostat regional accounts (employment and GDP per capita at NUTS-3 level) as the dependent variables. The operational definition of “closure” and the list of airports covered are provided in Annex H of the report.

These results should be interpreted with care. The simulation assumes that passenger losses from closed airports were not absorbed by other nearby airports, and that the estimated regression fully captures the relationship between passengers and economic outcomes. In reality, substitution¹⁰⁵ and wider general equilibrium effects may soften or amplify the observed impacts. Moreover, the reasons for closure (financial distress, airline exit, infrastructure issues) are not observed, and could themselves be correlated with local economic trends. As such, the results should be seen as indicative of potential economic costs of closures, rather than definitive causal estimates.

The results are presented by country, airport class, and passenger size. Since 2014, a total of 35 regional commercial airports in the EU, the UK, and Türkiye have ceased operations, divided into 1 permanent closure and 34 airports that lost scheduled commercial services. From Table 3.6, the majority are class 1 airports (<200,000 passengers).

Table 3.6: Closed airports by class

Class	Number of Airports
Permanently closed airports since 2014	
Class 1: < 200,000 pax	1
Total	1
Airports no longer operating scheduled passenger flights since 2014	
Class 1: < 200,000 pax	33
Class 2: 200,000–700,000 pax	1
Total	34

Source: Project Team based on Cirium and Desk Research.

Geographically, closures are spread across countries, but France (11 airports) and the UK (8 in total across both categories) are particularly affected (see Table 3.7). As shown in Annex H, 1 closed airport is located in an island, while none are in the ORs.

¹⁰⁵ Substitution means a shift in passenger or airline behaviour from one airport or route or transport mode to another, often due to differences in price, convenience, or availability.

Table 3.7: Closed airports by country

Country	Number of Airports
Permanently closed airports since 2014	
United Kingdom	1
Total	1
Airports no longer operating scheduled passenger flights since 2014	
France	11
United Kingdom	7
Germany	4
Sweden	3
Finland	2
Türkiye	2
Croatia	1
Ireland	1
Italy	1
Latvia	1
Romania	1
Total	34

Source: Project Team based on Cirium and Desk Research.

To assess the impact of regional airport closures on regional development, counterfactual scenarios are simulated using regression (Equation 3.1) estimated in Section 3.3.1. For convenience, the estimation specification is repeated here:

$$\log(Y_{rt}) = \beta_1 + \beta_2 \text{RegionType}_r + \beta_3 \text{Total_pax_regional}_{rt} + \omega_t + \omega_{R(r)} + \epsilon_{rt}, \quad \text{Equation 3.3}$$

where the dependent variable Y_{rt} is the employment level or GDP per capita in region r (NUTS3 level) at time t . The key independent variable in this regression is $\text{Total_pax_regional}_{rt}$ which is the total number of passengers at regional airports in region r at time t . The controls are:

- RegionType_r - Categorical variable indicating the region type. Regions are classified as
 - Those with no airport;
 - Those with an airport but no regional airport;
 - Those with at least one regional airport (this includes regions with both larger airports and a regional airport).
- ω_t - Year fixed effects.
- $\omega_{R(r)}$ - Region fixed effects (at the NUTS2 level).
- ϵ_{rt} - Error term.

To simulate the impact of closures on regional development, for each airport that closed between 2014 and 2024, the yearly share of total regional passengers accounted for by each closed airport during its active years in that region is computed. We then reduce the observed passenger variable by this share to simulate the closure and predict the dependent variable with this new passenger number. The difference between the baseline predictions and counterfactual predictions provides an estimate of the closure effect. This difference is translated into percentage changes, which are then averaged

over the years when the airport was active. By doing so, the impact of airport closures on employment and GDP per capita is approximated.

The simulation results in Table 3.8 and Table 3.9 indicate that regional airport closures have a negative impact on both employment and GDP per capita. On average, employment levels are estimated to fall by 0.36% relative to the baseline predictions, with effects ranging from zero to -5.26% in the most affected cases. GDP per capita shows a smaller but still negative average effect of -0.18%, with a maximum decline of -2.59%. These findings suggest that while the overall impact of closures is relatively modest on average, certain regions may experience large economic losses.

Table 3.8: Simulation impact of closed airports on employment level

Employment level	Obs	Mean	Std. dev.	Min	Max
Percentage difference between simulated and predicted	90	-0,36%	0,0071686	-5,26%	0,00%

Source: Project Team

Table 3.9: Simulation impact of closed airports on GDP per capita (for the airports that have been effectively closed)

GDP per capita	Obs	Mean	Std. dev.	Min	Max
Percentage difference between simulated and predicted	90	-0,18%	0,0035141	-2,59%	0,00%

Source: Project Team

The analysis indicates that the closure of regional airports is associated with measurable declines in local economic outcomes. Simulations suggest that, on average, for the 35 airports for which the effect has been analysed, employment falls by around 0.36% and GDP per capita by about 0.18% in the regions affected, with substantially larger losses in some cases. These results underline the role that airports can play in sustaining regional economic activity, particularly in areas with limited alternative transport options. At the same time, the estimates reflect potential rather than definitive causal effects, since substitution to nearby airports and broader economic dynamics are not fully captured. Overall, the evidence points to the conclusion that airport closures can impose tangible economic costs on regions, reinforcing the importance of carefully evaluating such decisions in a regional development context.

3.4 Conclusions on connectivity and economic development

The literature shows that airports generally provide significant connectivity benefits. However, the impact of regional airports on connectivity has been found to vary widely across Europe, and the key driver of this variability seems to be the availability of other transport modes. Although there is an inherent issue of reverse causality in estimating the economic impact of airports, numerous studies employing appropriate statistical methodologies have demonstrated the generally positive effect of airports on regional economic development, particularly within service-related sectors.

As to stakeholders, regional airports are widely perceived to make a large or significant contribution to regional connectivity and economic development, with many emphasising their crucial role when other transport options, such as rail, are limited or unavailable. This tends to be the case in peripheral, rural, island and ORs, where regional airports are considered to be critical enablers of economic activity, tourism, labour mobility and business travel and thus key drivers of regional development and cohesion. The OR airport case study provides anecdotal evidence that air transport is indispensable, as no alternative may exist or be as efficient to connect to other areas.

Original data analysis confirms a robust positive association between passenger traffic at regional airports and regional economic outcomes. The results suggest that on average regional airports do contribute to local economic performance, though the magnitudes are modest in absolute terms, suggesting that regional airports can play a supportive role in regional development, but they are not transformative drivers of growth on their own. The average effect may hide however a heterogeneous impact based on the characteristics of the areas where regional airports are located.

The closure of regional airports can be associated with measurable declines in local economic outcomes. Typical reasons of airport closures indicated by representatives from airports, airlines and broader aviation industries included airport bankruptcy, loss of importance due to competition from nearby airports and subsequent reallocation of traffic.

Data collected for the purpose of this study shows that since 2014, a total of 35 regional airports in the EU, the UK, and Türkiye have ceased operations, divided into one permanent closure and 34 airports that lost scheduled commercial services; all but two of these airports were quite small in scale, below 200,000 ppa. Data simulations suggest that, for the 35 airports analysed, on average, in the regions affected employment may fall by around 0.36% and GDP per capita by about 0.18%. However, whether and to what extent these “potential” effects materialise depends on alternatives available in the area, in the form of other airports or other modes of transport, being able to capture their former demand, since simulations do not account for reallocation of traffic to other airports or transport modes. Most stakeholders indicated that the closures that occurred since 2014 have had no or little impact, though a few local/regional authorities in peripheral regions noted moderate impacts, confirming the interpretation that this type of areas is bound to suffer the most from airport closures.

4 Competition and market dynamics

This section analyses the structure and dynamics of competition taking into account that airports compete with each other both for passengers and airlines, and examines how regulatory instruments, such as start-up aid, influence market behaviour.

Section 4.1 examines the definition and practical relevance of airport catchment areas, which form the geographic basis for assessing competition between neighbouring airports for passengers. It reviews the evidence on how passengers choose between airports, evaluates whether the current AG 's definition of a catchment area, typically within 100 km or 60 min travel time¹⁰⁶, adequately captures competitive pressures from neighbouring airports, whether the degree of competition varies by airport types, and how these relationships change when moving beyond standard boundaries in terms of both travel distances and travel times. It then analyses the degree to which regional airports exert competitive pressure on major EU hub airports, and the intensity of competition among regional airports themselves. Section 4.2 investigates factors affecting the creation of new routes by airlines, the flexibility of airlines in opening new routes and whether they change between airlines' business models. It sheds light on the airline market dynamics over the last decade, describing trends in LCC's development and the effects their route decisions can have on airports. The section then provides new evidence on the use and effectiveness of start-up aid measures that are meant to support route development. Finally, Section 4.3 considers the role of integrated airline and airport groups. It assesses stakeholder views on cross-subsidisation¹⁰⁷ within groups of both airports and airlines which might distort competition, and it estimates how the presence of major airline groups influences overall passenger volumes and competitive pressure across airports.

Table 4.1 summarises the RQs addressed in this section.

¹⁰⁶ "(12) 'catchment area of an airport' means a geographic market boundary that is normally set at around 100 km or around 60 min travelling time by car, bus, train or high-speed train; however, the catchment area of a given airport may be different and needs to take into account the specificities of each particular airport.". See [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02014XC0404\(01\)-20140701](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02014XC0404(01)-20140701), page 11.

¹⁰⁷ A financial arrangement within a group of airports where profitable airports subsidize loss-making ones, commonly within a multi-airport operating company group.

Table 4.1: Mapping of the RQs against sections

Research questions	Section
31. Is the definition of the 'catchment area' in the current AG fit for purpose? Could further criteria be considered in order to make the 'catchment area' assessment more reflective of reality? How would such changes affect the practicability of the assessment?	Section 4.1
9. To what extent do regional airports (i) exercise competitive pressure on major EU hub airports? (ii) compete with one another?	Section 4.1
16. How many airlines currently operate in the EU? Main statistics, relevant typology (e.g. business model)? What has been the trend in recent years and what is the outlook? How many new airlines started operating in the EU in the last 10 years? How many airline bankruptcies have there been in the last 10 years?	Section 4.2
17. What costs do airlines incur when setting up new routes? How flexible are airlines in setting-up new routes? Are there differences between airline types (flag carriers vs low-cost carriers)?	
18. How many start-up aid measures for airports have been approved by the Commission since 2014, representing which amount? Split by Member State and between individual ad hoc aid measures and aid schemes?	
19. Has start-up aid to airlines been granted without notification by Member States? Why were those measures not notified to the Commission?	
20. How effective are start-up aid measures? How many new routes have been opened thanks to start-up aid compared to new routes opened without start-up aid? How many of those routes remained open (in the medium to long term)? What was the impact on the airports involved?	Section 4.3
33. What is the extent and effect of networks of airports and airlines on the market (for example, companies operating multiple airports, degree of cross-subsidisation between airports/airlines of the same group)? Should networks of airports and of airlines be considered when applying the AG?	

Source: Project Team

4.1 Competition for passengers

4.1.1 Literature review

Many studies have focused on understanding the shape and the determinants of airports' catchment areas, showing how challenging this exercise can be. Indeed, although in some contexts simple definitions/rules of thumbs can be desirable, such as two hours driving time defining the border of catchment areas, these should not be seen as a fixed characteristic of an airport; rather, they are a function of several factors, including the routes offered at the airport, the presence of alternative airports nearby and the behaviour of consumers in that specific area.

As explained in EC's merger decisions (e.g. Case COMP/M.7333—ALITALIA / ETIHAD, 2014, recitals 82-83), to assess the size of an airport's catchment area a variety of factors could be considered, including travel time and costs, flight schedules and the quality of service. Passenger choice is influenced by a combination of these elements. From this, it follows that "airport substitutability cannot be assessed in the abstract but can only be determined taking into account the characteristics of the passengers travelling on the routes at stake" (Case COMP/M.7333—ALITALIA / ETIHAD, 2014, recital 86).

Lieshout (2012) specifies a model for the choices of passengers in order to measure the catchment area of the Amsterdam Schiphol airport. Relevant factors analysed are the cost of travelling by car to the airport, flight fares, the time for reaching the airport and

the duration of the flights.¹⁰⁸ The study estimates the market share of the airport, for each route offered, across NUTS-3 regions, for 2011. For each destination, its catchment area is defined as including all regions where the market share is above 1%. Results show that the catchment area can vary considerably depending on the destination/the length of the route. For example, the catchment area for the route to Xiamen is at least twice as large as the one for the route to Malaga. This implies that the catchment area can be wider for passengers travelling further away (e.g. long-haul passengers). Furthermore, Lieshout (2012) compares the shape of catchment areas for business versus other passengers, finding no large difference. Although this study is quite old, it is reasonable to assume that these results are quite structural and consistent over time, thus informing on today's travellers' preferences as well.

Morton & Mattioli (2023) focus on the region of London and estimate the catchment areas of the four airports operating therein (Heathrow, Gatwick, Stansted and Luton) and the relevant factors shaping them. The methodology used¹⁰⁹ allows to understand how passengers decide which airport to use when they have several options to choose from. The study uses data from surveys of passengers conducted at the airports, containing information including the origin of their travel to access the airport. Predictably, the study shows that travel time plays a prominent role and that passengers have a strong preference for the closest airport. Interestingly, the negative estimated relationship between the number of passengers and access travel time is steeper up to 2-3 hours of travel time and flatter afterwards. This suggests that, for consumers, travelling three hours instead of two implies a larger cost compared to the cost implied by travelling five hours instead of four. Furthermore, the number of routes available at the airport also affects passengers' choice, showing that airports can expand their catchment areas by offering more travel opportunities.

Zijlstra (2020) shows that factors other than distance and travel time may affect passengers' behaviour. The study analyses data from a survey of more than 4,000 adults from Germany, the Netherlands and Belgium and analyses the factors behind their choice of airport for their most recent flight.¹¹⁰ The study documents a significant border effect: people have a strong preference for departing from an airport in their own country. Passengers are willing to travel a longer time to reach an airport in their own country and estimates show that without this border effect the share of passengers in the sample using an airport abroad would go from 7.7% to 18.7%. Authors suggest that a general preference for domestic products is the reason behind this effect, and that more frequent and experienced travellers are less affected.

Other studies, instead of defining competing airports *a priori*, based on the presence of overlapping catchment areas and other factors, have also proposed another approach, which is based on assessing the level of competition between airports by directly estimating the extent to which airports' behaviours affect candidate rival airports. The three studies cited in this paragraph make use of spatial econometric models. Karanki & Lim (2023) analyse 59 hub airports in the US over the 2009-2019 period and find that airports' output (measured by aircraft movements, number of passengers and cargo volumes) is negatively affected by the corresponding output of neighbouring¹¹¹ airports,

¹⁰⁸ This study uses a multinomial logit model, where candidate factors are specified as inputs in the passengers' utility function.

¹⁰⁹ The study uses a spatial-interaction model.

¹¹⁰ Relevant factors are identified using a logit regression model.

¹¹¹ To define neighbouring airports, cutoffs of 150, 200 and 250 miles (approximately 240, 320 and 400 km) are employed. In all specifications the effect is found to be significant.

suggesting some degree of competition.¹¹² A similar exercise has been carried out by Bergantino et al. (2021), who focus on the efficiency scores of 206 airports worldwide, observed in 2015, finding that airports' efficiency levels are positively affected by the efficiency of neighbouring airports (defined using various cut-off distances, ranging from 100 km to 350 km), suggesting again the presence of a competitive environment. Wu et al. (2024) focus instead on 34 major airports in China, over the 2007-2019 period, and estimate a negative spatial coefficient, meaning that airports' passenger traffic is negatively affected by neighbouring airports, showing competition and substitutability. For airports far apart (at least 1,500 km) the coefficient becomes however positive, suggesting some level of complementarity.

4.1.2 Consultations

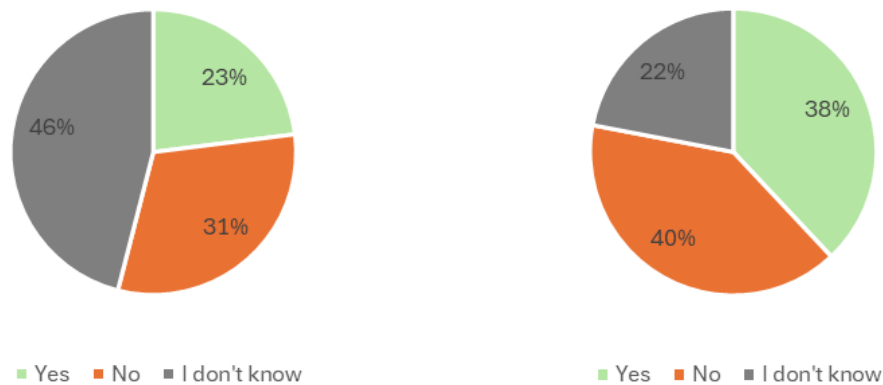
In the stakeholder survey (n=56), when asked whether the definition of the catchment area in the current AG is fit for purpose, almost half of respondents (46%) indicated uncertainty, while 31% said the definition is not fit for purpose, and 23% considered it appropriate. Responses in the public consultation (n=96) suggests an almost equal split between finding the rules inadequate (40%) and finding them appropriate (38%), while 22% were unsure.

When it comes to the responses by the stakeholder type:

- Airports and airport associations (n=81) were the most divided. 37% judged the definition as not fit for purpose, 33% considered it appropriate, and 30% were uncertain.
- Among airlines and airline associations (n=12), six (50%) considered the definition appropriate.
- Among public authorities, including national, regional, and local governments (n=40), about 44% considered the definition fit for purpose, 33% said it was not, and 23% were uncertain.
- Among broader aviation industry associations (n=9), 45% said the definition is not fit for purpose, 33% found it appropriate, and 22% were uncertain.
- Environmental NGOs and citizens (n=10) were mostly sceptical or uncertain: around 50% said the definition is not fit for purpose, 25% found it appropriate, and 25% were uncertain.

¹¹² Interestingly, all these airports in the US are publicly owned and managed, hence the study indirectly shows that private ownership is not a necessary condition for effective competition.

Figure 4.1: Is the definition of the catchment area in the current Aviation Guidelines fit for purpose?



Source: Left to right – stakeholder survey (n=56) and public consultation (n=96)

When it comes to the substantiated responses by the stakeholders, several airports and airport associations shared the view that the current distance rule is overly rigid and oversimplifies the complexity of airport competition, as proximity alone does not determine substitutability. Several airports proposed that additional factors should be considered, including road quality, weather conditions, economic geography, and whether nearby airports serve the same routes.

Some airports suggested extending the threshold to around 90 min or 200 km for leisure and non-time-sensitive travel. Others recommended introducing add-on indicators, such as demand overlap by route, capacity and congestion levels, differences in ownership or business models, environmental and “green conditionality” considerations, and socio-economic metrics like regional GDP per capita or population expectations in cohesion regions.

Airports that supported maintaining the current rule highlighted that the AG already allows for case-by-case flexibility and that the approach has proved practical and transparent where overlapping catchment areas are limited. This was also echoed by public authorities. They valued the presence of a clear, consistent baseline while maintaining room for a tailored assessment.

Broader aviation industry associations suggested that the definition of competition should also take into account industry segments, ownership structure, airport size, and infrastructure, which better reflect competitive realities than a fixed distance or time thresholds.

Several regional and local authorities proposed that outermost and remote regions should receive differentiated treatment, with adjusted thresholds or exemptions to account for territorial discontinuity.

Overall, the feedback points to keeping a clear reference point but enrich it with structured, context-sensitive criteria to better mirror how airport competition works in practice.

Box 4.1: Insights from the case studies on the catchment area definition

The case studies suggest that the current AG definition of catchment areas, based on a 100 km/60-min travel time, does not capture the reality of the airports studied. Multiple stakeholders, both target airports and airlines, believe that catchment areas extend beyond these limits, often up to 90–120 min of travel time, particularly where ground transport connections are good and passengers are willing to trade longer travel times for better fares, schedules, or destinations.

For example, a regional airport explained that the recent infrastructure developments in its proximity (and in the country in general) have significantly reduced travel times and facilitated passenger mobility, thereby intensifying competitive dynamics by bringing a wider set of airports within reach for passengers. The airport indeed identified competitors up to 120 min travel time (or slightly above) from its premises.

The case studies also suggest that catchment areas are not only determined by distance and time, but also by cross-border dynamics and by the profile of destinations offered.

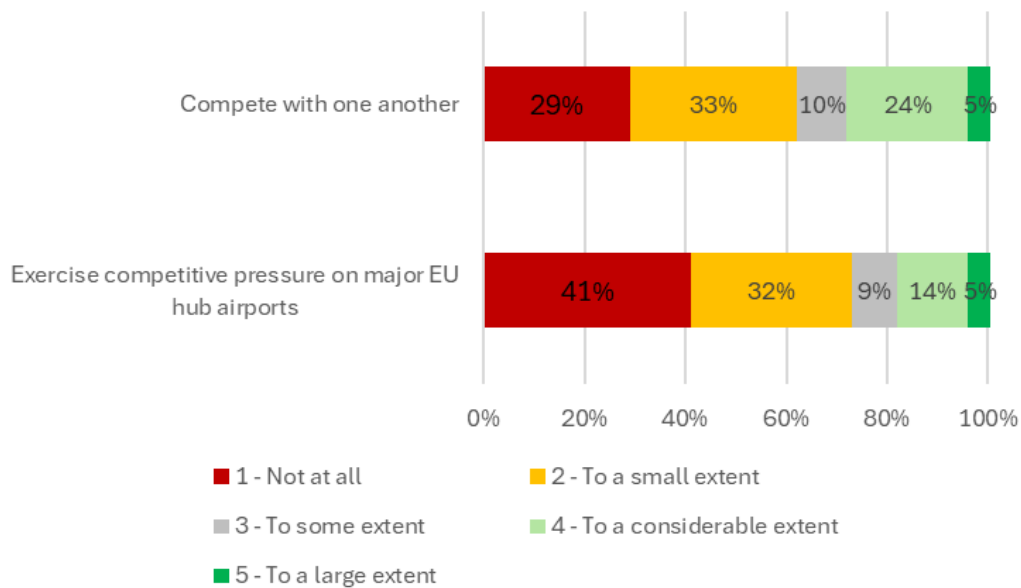
For example, an airline explained that airports located near national borders can compete directly with airports in neighbouring countries, as can be seen in the examples of German travellers using Prague Airport or Dutch travellers at Frankfurt Hahn Airport. Moreover, an LCC explained that airports serving, e.g. leisure holiday routes or long-haul flights, may attract passengers from a wider area on such routes.

Overall, according to the stakeholders interviewed, extending the travel time to 90–120 min, and having more flexibility in defining catchment areas, by considering factors such as cross-border competition and the nature of destinations served, would make the assessment more reflective of actual market conditions. However, case study evidence also points to the need to balance flexibility with practicability. A more nuanced approach could increase the complexity of the assessment and reduce legal certainty if not applied consistently.

Furthermore, when it comes to the extent of regional airports' competitive pressure on hubs and on one another, responses suggest that regional airports generally exert limited competitive pressure on major hub airports, with 73% stating they do so either "not at all" or only "to a small extent". Note that only airport industry associations and airlines answered this question.

In contrast, respondents note that competition among regional airports is somewhat more pronounced: one-third still see only limited competition, another third (only airport industry associations) report moderate to strong competition, suggesting a more dynamic interplay. While airports and airport associations tend to perceive stronger competitive pressure from regional airports on major hubs, airlines generally downplay such competition, mostly suggesting only limited or no impact.

Figure 4.2: On a scale from 1-5, to what extent do regional airports: i) compete with one another, ii) exercise competitive pressure on major EU hub airports?



Source: Stakeholder survey (n=41)

When asked to substantiate their responses, airport industry associations (n=17) suggested that regional airports exert limited competitive pressure on major hub airports, as they often serve complementary roles by feeding passengers into the hub network rather than diverting them.

Overall, while regional airports seem to engage in more intense competition for passengers among themselves, they likely exert only marginal influence on the hub market, reinforcing their primarily complementary role in Europe's aviation system.

4.1.3 Data analysis

4.1.3.1 Competition of rival airports on focal airports

The definition of airport catchment areas is central to assessing both competition between airports and the potential effects of State aid. The underlying policy question is whether passengers consider airports within a certain geographic or temporal range as substitutes. The hypothesis is that airports located within shorter distances or travel times of each other should show stronger substitution in passenger flows, while airports further apart serve largely distinct markets.

To test this, regressions of passenger volumes at focal airports (independently of their size) on passenger volumes at rival airports of different size (i.e. regional, mid-size and hub airports), located within different catchment bands are estimated. Two approaches to define catchment areas are used: driving distance bands (0–100 km, 100–200 km, 200–300 km) and travel-time bands (0–60 min, 60–120 min, 120–180 min) based on Google Maps API. By comparing substitution patterns across these definitions, it is possible to evaluate whether distance and time yield consistent pictures of airport competition.

Passenger volumes are drawn from Cirium at the airport–quarter level for the period 2014–2023. Both driving distances and travel times are derived from Google Maps data. Rival airports are categorised as hubs, mid-size, or regional to distinguish the nature of

substitution. LCC presence is included as a control, given its role in driving passenger traffic.

We caution that both distance and travel-time thresholds are stylised and may not fully capture actual substitution patterns, which depend on factors like ticket prices, intermodal connections, and regional demographics. Moreover, the regression design is observational and cannot fully rule out confounding factors such as macroeconomic shocks or airline network strategies. Travel times were collected at a specific point in time and may not reflect historical conditions, while passenger data are subject to reporting gaps for smaller airports.

To analyse the *competitive pressure of rival airports on focal airports*, the following regression is estimated^{113, 114}:

$$\log(\text{Pass}_{iat}) = \beta_1 + \sum_2^4 d_j \beta_j \text{Regional}_{at,j} + \sum_5^7 d_k \beta_k \text{Mid-size}_{at,k} + \sum_8^{10} d_l \beta_l \text{Hub}_{at,l} + \beta_{11} \text{LCC Share}_{iat} + \beta_{12} \text{Focal_Hub}_{ia} + \omega_r * \omega_t + \epsilon_{iat}, \quad \text{Equation 4.1}$$

where the dependent variable Pass_{iat} denotes the number of passengers at focal airport i in area a at time t , where t is a year-quarter within 2014-2023. The variables $\text{Regional}_{at,j}$, $\text{Mid-size}_{at,k}$, and $\text{Hub}_{at,l}$ represent the number of passengers of rival airports of different types (regional, mid-size and hub airports) within distance d . The indicator d denotes distance bands, 0–100 km, 100–200 km, and 200–300 km, or travel times, 0–60 min, 60–120 min, and 120–180 min. These are our control variables:

- LCC Share_{iat} is the share of LCCs at the focal airport i in year-quarter t ,
- Focal_Hub_{ia} is a dummy equal one if the focal airport is a hub,
- $\omega_r * \omega_t$ are NUTS 3 region-year-quarter fixed effects,
- ϵ_{iat} is the error term.

Further explanation is provided on the use of this exact specification. First, several distance and time bands are investigated in the analysis, as the “catchment areas” currently used by the EC of 100 km distance and 60 min travel time are being reassessed. A specification using all relevant 526 focal airports is employed.¹¹⁵ Third, the share of LCCs at the focal airport is included as a control, as the presence of LCCs increases the number of passengers independent of competition (by increasing demand). Moreover, this variable also helps absorbing airport-specific effects, acting as a proxy for airport fixed-effects. We also include a dummy for whether the focal airport is a hub, since hubs differ structurally from regional and mid-size airports and are less sensitive to local demand. Moreover, this variable also helps absorb airport-specific effects, acting as a proxy for airport fixed-effects.

The significance and size of coefficients β_2 – β_{10} indicate the competitive impact of rival airports on the focal airports in catchment area a . Note that, instead of including

¹¹³ In the current analysis, we assess the overall impact of rival airports (which are differentiated by type of airport) on focal airports (which are not differentiated by type) without differentiating their type.

¹¹⁴ The log-level model was chosen because it simplifies interpretation—coefficients represent approximate percentage changes in passenger numbers. We use a log-level specification to address the large number of zeros in the independent variables observed in some catchment areas.

¹¹⁵ We refer to Annex F.1 where we explain in more detail what airports are used for the regression analysis. Note: while the original dataset contains 527 focal airports, the regression sample is restricted to 526 focal airports due to missing information at NUTS3 level.

demographic variables directly, NUTS3 region × year-quarter fixed effects are used, which absorb all time-varying regional characteristics such as population density and GDP per capita. We include NUTS3 region × year-quarter fixed effects to capture regional factors that might influence air traffic. As regional characteristics do not change much over time, including them directly does not add much explanatory power.

The regression results suggest that competition effects are present, with a lower impact the further away rival airports are located, independently of whether this is measured by distance in km or time (see Table F.4 and Table F.5 in Annex F.4.1).¹¹⁶

Table 4.2 shows the quantitative impact of an increase in the passenger numbers at the rival airports—categorised by airport type (hub, mid-size, and regional)—within various distance ranges (in km) on the number of passengers at the focal airport. We show changes of 100,000, 10,000 and 5% from the mean, where the last metric is the most general as it is relative, and thus, the focus will be on this interpretation (highlighted in blue).

If rival hub airports within a 100 km radius experience an increase of 5% around the mean, the number of passengers at the focal airport is expected to decrease by approximately 13.58%, by 9.95% within 100-200 km and by 2.77% within 200-300 km. For rival mid-size airports, an increase of 5% around the mean within 100 km leads to an 8.76% decrease in passengers at the focal airport, and 3.68% decrease for the 100–200 km band. The negative impact remains notable at 200–300 km, with a 2.22% decrease. Finally, a 5% increase around the mean within 100 km at a rival regional airport is associated with a 1.29% decrease at the focal airport. Even at 100–200 km, the focal airport still sees a 0.52% decline. That impact turns positive, however, for the widest distance (200-300 km), at 0.91%.

To summarise, based on distance in km, the impact of a 5% change from the mean on the passenger level at the focal airport is strongest for rival hubs, then mid-size airports and least strong for regional airports, reflecting that regional airports are much smaller and therefore, relative changes involve smaller absolute numbers.

¹¹⁶ For rival regional airports, however, their impact is positive for the widest distance range (i.e. 200-300 km); see further below, where we look specifically at the impact of rival airports. Also, based on travel time, the furthest away hubs show no impact on focal airports.

Table 4.2: Catchment area interpretation results by rival airport types (distance)

Catchment area	Coefficient	% change in + 10,000 pax	% change in + 100,000 pax	% Change in pax per +5% mean
Rival hub airports				
100 km (number of pax)	-9,24E-07	-0,92	-8,83	-13,58
100-200 km (number of pax)	-6,63E-07	-0,66	-6,41	-9,95
200-300 km (number of pax)	-1,78E-07	-0,18	-1,76	-2,77
Rival mid-size airports				
100 km (number of pax)	-2,42E-06	-2,39	-21,49	-8,76
100-200 km (number of pax)	-9,90E-07	-0,99	-9,43	-3,68
200-300 km (number of pax)	-5,93E-07	-0,59	-5,76	-2,22
Rival regional airports				
100 km (number of pax)	-5,19E-06	-5,06	-40,49	-1,29
100-200 km (number of pax)	-2,07E-06	-2,05	-18,70	-0,52
200-300 km (number of pax)	3,59E-06	3,66	43,19	0,91

Note: Mean (sd) for hub airports: 3,160,024 (2,535,393), mean (sd) for mid-size airports: 757,960 (794,360), regional airports: 50,220 (75,905.1)

Source: Project Team

Table 4.3 shows the quantitative impact of an increase in passenger numbers at rival airports – categorised by airport type (hub, mid-size, and regional) – within various travel times (in min) on the number of passengers at the focal airport. The same tendencies and order of magnitudes can be seen as for distance (in km), with the difference that the 120-180 min band for hubs is not statistically significant here and the same band for rival regional airports is negative, and not positive as was the case for distance (in km). Thus, comparing the results for catchment areas defined in terms of distance and travel time, the overall patterns are broadly similar: the competitive impact is strongest for nearby rival airports and declines with distance or time. However, there is a difference: for regional airports, the distance-based measure shows a positive effect in the widest band (200–300 km), while the time-based measure remains negative even at 120–180 min. This suggests that the choice of distance versus time definitions of catchment areas can matter, particularly for regional airports as rivals.

Table 4.3: Catchment area interpretation results by rival airport types (time)

Catchment area	Coefficient	% change in + 10,000 pax	% change in + 100,000 pax	% Change in pax per +5% mean*
Rival hub airports				
60 min (number of pax)	-1,02E-06	-1,01	-9,70	-14,88
60-120 min (number of pax)	-6,28E-07	-0,63	-6,09	-9,45
120-180 min (number of pax)	Not statistically significant	Not statistically significant	Not statistically significant	Not statistically significant
Rival mid-size airports				
60 min (number of pax)	-3,38E-06	-3,32	-28,68	-12,02
60-120 min (number of pax)	-1,06E-06	-1,05	-10,06	-3,94
120-180 min (number of pax)	-1,02E-06	-1,01	-9,70	-3,79
Rival regional airports				
60 min (number of pax)	-1,39E-05	-12,98	-75,09	-3,43
60-120 min (number of pax)	-3,61E-06	-3,55	-30,30	-0,90
120-180 min (number of pax)	-2,65E-06	-2,62	-23,28	-0,66

Note: Mean (sd) for hub airports: 3,160,024 (2,535,393), mean (sd) for mid-size airports: 757,960 (794,360), regional airports: 50,220 (75,905.1)

Source: Project Team

4.1.3.2 Competition between airports: focus on regional airports

4.1.3.2.1 The extent to which regional airports exercise competitive pressure on hubs

Apart from defining catchment areas, a recurring policy concern is whether specifically regional airports constrain the market power of nearby hubs, or whether they primarily serve complementary roles in the wider network. Understanding this competitive pressure is important, since it affects outcomes, and ultimately whether State aid to regional airports promotes or distorts competition. The testable hypothesis is straightforward: if regional airports exert competitive pressure, then higher passenger volumes at those airports should be associated with fewer passengers at nearby hubs; if they are complements, the relationship should be positive.

To test this hypothesis, similar regressions as above for catchment areas are employed: regressions of hub passenger numbers on passenger volumes at regional airports within different catchment areas are estimated, defined by both distance (0–100 km, 100–200 km, 200–300 km) and travel time (0–60 min, 60–120 min, 120–180 min).¹¹⁷ Cirium passenger data at the airport–quarter level allows us to capture both short-run variation and longer-term trends. We control for LCC presence, which directly affects demand, and for regional economic shocks via NUTS2-by-quarter fixed effects. This structure enables us to isolate how passenger growth at regional airports translates into changes in hub traffic across varying degrees of geographic proximity.

We caution again that the approach cannot fully address potential endogeneity: the development of regional airports may itself respond to hub congestion, airline strategies, or regional demand conditions. The distance and time thresholds are stylised measures that may not perfectly reflect passengers' substitution patterns. Results should therefore

¹¹⁷ See Section 2.1 for a detailed definition of hub and regional airports.

be viewed as evidence of associations consistent with competitive or complementary relationships, rather than precise causal effects.

We run the following regression^{118, 119}:

$$\log(Pass_{iat}) = \beta_1 + \sum_{j=2}^4 d_j \beta_j \text{Focal_Hub}_{ia} * \text{Regional}_{at,j} + \beta_5 \text{LCC Share}_{iat} + \beta_6 \text{Focal_Hub}_{ia} + \omega_r * \omega_t + \epsilon_{iat}, \quad \text{Equation 4.2}$$

where the dependent variable $Pass_{iat}$ denotes the number of passengers at airport i in area a at time t , and t is a quarter within 2014–2023. The variable $\text{Regional}_{at,j}$ represents the number of passengers at rival regional airports within area a . The indicator d_j denotes distance bands, 0–100 km, 100–200 km, and 200–300 km, or travel times, 0–60 min, 60–120 min, and 120–180 min. These are our controls:

- LCC Share_{iat} is the share of LCCs at the focal airport i in year-quarter t ,
- Focal_Hub_{ia} is a dummy equal to one if the focal airport is a hub,
- $\omega_r * \omega_t$ are NUTS 2 region-year-quarter fixed effects,
- ϵ_{iat} is the error term.

The significance and size of the coefficients $\beta_2, \beta_3, \beta_4$ indicate the competitive impact of regional airports on the focal hub compared to focal mid-size and regional airports in catchment area a .¹²⁰

Furthermore, broader NUTS 2 region-time fixed effects are used for these regressions (and not NUTS 3) because the number of hubs per region is generally lower at the NUTS 3 level. In fact, only one NUTS 3 region has more than one hub. This limited variation at the NUTS 3 level makes fixed-effect estimations less reliable.

Table F.6 in Annex F.4.2 reports the effect of regional rival airports on hubs across distance bands. Within 100 km, regional airports reduce hub activity, consistent with direct competition. Beyond 100 km, the relationship becomes positive and remains so up to 300 km (though weaker), suggesting that more distant regional airports act as complements by feeding or stimulating traffic that connects through the hub. These findings align with our catchment-area results but are more precise, as they isolate the impact of rival regional airports.

Table F.7 in Annex F.4.2 shows regression results for travel times, focusing solely on the results of interest, i.e. the impact of regional rival airports on hubs. We see that their relationship is negative for the within 60 min area and 60–120 min areas, but positive for the 120–180 min area. These findings suggest again that, as with travel distances, regional airports located somewhat further away are more likely to act as complements, feeding or stimulating traffic that eventually connects through the hub.

¹¹⁸ Note that we will answer to what extent do regional airports compete with one another, separately below as the estimation setup is different.

¹¹⁹ As before, we rely on a log-level model because it simplifies interpretation—coefficients represent approximate percentage changes in passenger numbers. Note that several regions do not have regional airports, which means that the total number of passengers is zero in those cases. As a result of these zeros, a log-log specification cannot be used.

¹²⁰ See Section 2.1 for a detailed definition of hub and regional airports.

Table 4.4 shows a quantitative interpretation of these results for travel distances. We report % changes for + 10,000 passengers and + 100,000 passengers at a rival regional airport but focus again on the % change when changing 5% around the mean of rival regional airports, as this is the most universal interpretation of our results. We see that 5% more passengers around the mean at rival regional airports are associated with a decrease in passengers at the hub airport of -2.70% for the 100 km area, but a 1.81% increase for the 100-200 km area, and a 0.57% increase for the 200-300 km areas.

Table 4.4: Catchment area interpretation results for focal hub airports and rival regional airports (distance)

Catchment area	Coefficient	% change in + 10,000 pax	% change in + 100,000 pax	% change in pax per +5% mean*
Focal hub airports				
<i>Rival regional airports</i>				
100 km (number of pax)	-1,09E-05	-10,33	-66,38	-2,70
100-200 km (number of pax)	7,15E-06	7,41	104,42	1,81
200-300 km (number of pax)	2,28E-06	2,31	25,61	0,57

Note: *Mean (sd) for regional airports: 50,220 (75,905).

Source: Project Team

Table 4.5 shows a quantitative interpretation of the results for travel times. Focusing again on changing 5% around the mean of rival regional airports, it is observed that more passengers at rival regional airports are associated with a decrease of -1.13% in passengers at the hub airport for the 60 min area, a -1.18% decrease for the 60-120 min area, and a 1.86% increase for the 120-180 km areas.

Table 4.5: Catchment area interpretation results by focal hub airports and rival regional airports (time)

Catchment area	Coefficient	% change in + 10,000 pax	% change in + 100,000 pax	% change in pax per +5% mean*
Focal hub airports				
<i>Rival regional airports</i>				
60min (number of pax)	-4,52E-06	-4,42	-36,36	-1,13
60-120min (number of pax)	-4,72E-06	-4,61	-37,62	-1,18
120-180min (number of pax)	7,32E-06	7,59	107,92	1,86

Note: *Mean (sd) for regional airports: 50,220 (75,905).

Source: Project Team

The analysis suggests that the presence of regional airports in proximity to hubs does not systematically erode hub traffic. At very short distances (within 100 km), some evidence of substitution emerges, consistent with regional airports drawing passengers who might otherwise use the hub. At greater distances, however, the relationship tends to be neutral or even positive, indicating complementarity rather than competition. In particular, regional airports in the “outer donuts” (100–200 km and 200–300 km) appear to expand overall traffic in a region, serving demand that would not easily be captured by the hub alone. A similar pattern emerges when looking at travel-time: within one hour of a hub, substitution is most visible, but beyond 60–120 min, regional airports more often seem to complement hub activity, potentially by attracting distinct passenger flows. This suggests that such airports can play a constructive role in

broadening connectivity and supporting regional mobility without undermining the viability of nearby hubs. Overall, the findings indicate that regional airports can influence hub traffic, taking into account the caveats that are explained at the beginning of the subsection.

4.1.3.2.2 Competition among regional airports

Beyond their relationship with hubs, regional airports may also compete directly with one another for passengers. This is an important issue for policy, since State aid to one regional airport could shift traffic away from another nearby facility, rather than generate net growth in connectivity. The hypothesis tested is therefore: if regional airports compete, then higher passenger volumes at one regional airport should be associated with fewer passengers at other regional airports within the same catchment area.

To assess this, we use the same empirical strategy and data as above where we estimate the impact of regional airports on hubs.

We use the following regression:

$$\begin{aligned} \log(\text{Pass}_{iat}) = & \beta_1 + \sum_{j=2}^4 d_j \beta_j \text{Focal_Regional}_{ia} * \text{Regional}_{at,j} \\ & + \sum_{k=5}^7 d_k \beta_k \text{Focal_regional}_{ia} * \text{Hub}_{at,k} \\ & + \sum_{l=8}^{10} d_l \beta_l \text{Focal_regional}_{ia} * \text{Mid-size}_{at,l} \\ & + \beta_{11} \text{LCC Share}_{iat} + \beta_{12} \text{Focal_Hub}_{ia} + \omega_r * \omega_t + \epsilon_{iat}, \end{aligned} \quad \text{Equation 4.3}$$

where the dependent variable Pass_{iat} denotes the number of passengers at airport i in area a at time t , and where t is a year-quarter within 2014-2023. The indicator d_j denotes the distance bands, 0–100 km, 100–200 km, and 200–300 km, or travel times, 0–60 min, 60–120 min, and 120–130 min. In this specification $\text{Regional}_{at,j}$, $\text{Hub}_{at,k}$, $\text{Mid-size}_{at,l}$ represent the number of passengers at each rival airport (regional, hub and mid-size) within area a .

These are our control variables:

- LCC Share_{iat} is the share of LCCs at the focal airport i in year-quarter t ,
- Focal_Hub_{ia} is a dummy equal to one if the focal airport is a hub,¹²¹
- $\omega_r * \omega_t$ are NUTS 3 region-year-quarter fixed effects,
- ϵ_{iat} is the error term.

This specification is motivated by several factors. We examine multiple distance and time bands, and we control for the share of LCCs at the focal airport, since LCC presence raises passenger numbers independently of competition. We also include a hub dummy, as hubs differ structurally from regional and mid-size airports by serving substantial connecting traffic that is less sensitive to local rivals. The significance and magnitude of

¹²¹ We control in this estimation for hubs, because hubs are structurally different from other airport types. We do not add a separate dummy for regional airports, as the interaction terms capture what matters: the slope effect of rival regional airports on focal regional airports. A dummy for regional airports would only shift the intercept relative to mid-size airports, whereas the interaction terms directly identify the competitive effect.

β_2 , β_3 , and β_4 then capture how regional airports affect focal regional airports relative to mid-size and hub airports in catchment area a .

In Annex F.4.2, Table F.8 produces the results for distance, focusing on focal regional airports (highlighted in blue), whereas Table F.9 produces the results for time. For distance, it can be observed that for regional airports, rival regional airports have a negative impact on the number of passengers, and this at a monotonously declining rate in function of distance. However, for the last donut, i.e. 200-300 km, the presence of rival regional airports has a positive impact on passenger traffic at the focal regional airport.

For time (see Table F.9 in Annex F.4.2), regional rival airports have a negative impact on the number of passengers at the focal regional airport, and this at a monotonously declining rate in function of time.

Table 4.6 shows the quantitative impact on regional airports of an increase in passenger numbers at rival regional airports — within various distance ranges (in km) on the number of passengers at the focal regional airport. Focusing again on changing 5% around the mean of rival regional airports, it can be observed that the number of passengers at the focal regional airport is expected to decrease by approximately by 1.69% within 100 km, by 1.05% within 100-220 km and increase by 0.80% within the 200-300 km bracket.

Table 4.6: Catchment area interpretation results for focal regional airports (distance)

Catchment area	Coefficient	% change in + 10,000 ppa	% change in + 100,000 ppa	% Change in pax per +5% mean
Focal regional airports				
<i>Rival regional airports</i>				
100km (number of pax)	-6,78E-06	-6,56	-49,24	-1,69
100-200km (number of pax)	-4,19E-06	-4,10	-34,23	-1,05
200-300km (number of pax)	3,17E-06	3,22	37,30	0,80

Note: Mean (sd) for regional airports: 50,220 (75,905.1).

Source: Project Team based on Cirium

Table 4.7 shows the impact on regional airports of an increase in passenger numbers at rival regional airports — within various distance ranges (in time) on the number of passengers at the focal regional airport. Focusing again on changing 5% around the mean of rival regional airports, it can be observed that the number of passengers at the focal regional airport is expected to decrease by approximately 3.94% within 60 min, by 1.24% within 60-120 min and by 1.08% within the 120-180 min catchment area.

Table 4.7: Catchment area interpretation results for focal regional airports (time)

Catchment area	Coefficient	% change in + 10,000 ppa	% change in + 100,000 ppa	% Change in pax per +5% mean
Focal regional airports				
<i>Rival regional airports</i>				
60min (number of pax)	-1,60E-05	-14,79	-79,81	-3,94
60-120min (number of pax)	-4,98E-06	-4,86	-39,23	-1,24
120-180min (number of pax)	-4,32E-06	-4,23	-35,08	-1,08

Note: Mean (sd) for regional airports: 50,220 (75,905.1).

Source: Project Team based on Cirium

The analysis indicates that there is competition among regional airports, but the intensity varies with proximity. When airports are located very close—within roughly 100 km or one hour travel time—traffic volumes are negatively related, showing that nearby regional airports do compete directly for passengers. In the 100–200 km band the effects are weaker and largely neutral, while in the 200–300 km band the relationship becomes positive, suggesting complementarity at greater distances as airports serve distinct catchment areas. By contrast, when measuring proximity by travel time, such positive effects at longer ranges is not found, which implies that time-based measures capture more persistently substitution. Overall, the results suggest that regional airports tend to compete with one another, particularly when located in close proximity, alongside complementarities only emerging at larger distance bands, with the caveats on interpretation explained at the beginning of the subsection.

4.1.4 Conclusions on competition for passengers

4.1.4.1 Relevance and size of catchment area

The literature review shows that airports' catchment areas can be influenced by multiple factors and can vary significantly. When passengers assess available travel options, their choice is influenced by a combination of elements including travel distance, travel time and costs, flight schedules and the quality of service. Travel time to reach the airport remains the most important factor for defining the catchment area of an airport, but passengers may be willing to travel more than the time used in the AG definition.

Consultations with stakeholders did not yield a clear-cut response to whether the current catchment area definition is adequate, as stakeholders are broadly divided. They agree, however, that a clear reference point to the catchment area should be maintained in the AG. Apart from that, views are split between those who find the current benchmark broadly workable and want to avoid impractical complications, and those who regard it as inadequate. Stakeholders supporting change ask to enrich it with structured, context-sensitive criteria to better mirror how airport competition works in practice. For instance, they call for taking into account airports' business models, route overlaps, size and capacity/congestion (since they argue that airports may serve distinct populations), road quality, weather, and cross-border catchments, noting that many regional airports attract passengers from neighbouring Member States. Contributors from outermost, island, remote and sparsely populated regions asked for tailored treatment.

The stakeholders interviewed for the case studies align with those that believe that catchment areas can often extend up to 90–120 min of travel time, particularly where ground transport is good; similarly, they believe that the catchment area size may vary by the profile of destinations offered (e.g. leisure holiday or long-haul routes may attract passengers from a wider area).

The results of the regression analysis suggests that airport competition is broader in scope than the baseline catchment area definition of the AG implies. Substitution effects, that must be interpreted as negative correlations, decline with distance and persist in the 100–200 km range. For the 200–300 km distance band, results are more mixed. By contrast, the time-based analysis shows substitution that remains significant up to 120 min, although beyond that competition weakens.

Overall, the conclusion is that the catchment area concept remains relevant, but its size and shape appear heterogeneous and, considering correlation-based estimates, the current definition may be too narrow, as there are indications of substitutability at least up to 120 min or 200 km.

4.1.4.2 The extent to which regional airports exercise competitive pressure on hubs and compete with each other

Feedback from the consultations suggests that regional airports generally exert limited competitive pressure on major hub airports, while competition among regional airports is perceived as more pronounced among stakeholders. Interestingly, airports and airport associations tend to perceive the pressure of regional airports on hubs as slightly stronger, while surveyed airlines downplay such competition, reinforcing the primarily complementary role of regional airports from the point of view of airlines in serving distinct market segments.

The data analysis tested both hypotheses, whether regional airports exert competitive pressure on hubs and on each other. The regression results suggest that the presence of regional airports in proximity to hubs does not systematically erode hub traffic. At very short distances within 100 km and 60 min, some evidence of substitution emerges while, at greater distances, regional airports seem to complement hub activity.

On the other hand, regression analysis confirms that regional airports compete with one another. When rival regional airports are located very close, both in travel distance and travel time, traffic volumes are negatively related. Results suggest complementarity at greater travel distances measured in km while, by contrast, travel time-based measures of proximity capture more persistently substitution. Overall, the results point to a localised rivalry when regional airports are close together. We caution that the approach cannot address potential endogeneity, and results should be purely viewed as evidence of associations consistent with competitive or complementary relationships.

4.2 Airlines, new routes and start-up aid

4.2.1 Literature review

Airport competition is shaped, among other factors, by the behaviour of airlines, which constitute one of the two sides of the two-sided market in which airports operate.

This section reviews the literature studying the factors affecting the creation of new routes by airlines in the EU's aviation industry, including the additional costs involved and the strategic considerations made by airlines.

As explained in Section 4.1.1, each route (or better, each origin-destination pair¹²²), should be considered as a separate market. Therefore, for an airline, to open a new route means to enter a new market. Entry decisions have been largely studied in the

¹²² The origin-destination approach relies on the idea that relevant market for airlines should be defined by the entire journey between a passenger's start and end points (e.g. London-Madrid), regardless of the number of connections used and the airports used (see, for instance, Case M.11071 Deutsche Lufthansa / MEF / ITA, 2024, recitals 78.79).

industrial economics literature (Berry & Jia, 2010; Berry, 1992; Ciliberto et al., 2021; Ciliberto & Tamer, 2009), that shows how these decisions are the result of a complex interaction of several factors that feed into the strategic considerations of airlines. S. T. Berry (1992) emphasizes the fact that airlines with a large presence at an airport can enjoy significant economies of scale and increase entry barriers for other airlines to enter the markets (routes) they dominate. Furthermore, airlines differ in their suitability for different markets: some firms may find certain routes more profitable than others, and LCCs may be better suited for price-sensitive markets, which partly explain LCCs' growth over the last decades (Berry & Jia, 2010). Ciliberto & Tamer (2009) also emphasise the importance played by airlines' heterogeneity (especially along the FSC/LCC dichotomy) in shaping the competitive structure of the aviation sector. Ciliberto et al. (2021) identify three main types of costs when airlines establish new routes: (i) airport costs, i.e. leasing gates and hiring personnel at both endpoints, which are fixed costs; (ii) flight costs, which depend on the number of flights and aircraft size, such as fuel costs, and crew wages (these are variable costs with respect to flight frequency, but are still fixed with respect to the aircraft passenger load; (iii) passenger costs, i.e. marginal costs per passenger, including ticketing, in-flight services, and insurance. LCCs and FSCs may differ significantly in their cost structure, and this difference may vary from route to route, which also explains why a route may be profitable for one airline but not for another.

Depending on their business models, airlines employ different strategies to create a network of routes that allow them to efficiently use their fleet, maximising revenues and minimising costs. The EU aviation industry is currently at a very mature stage and most profitable routes are already highly exploited (Efthymiou & Christidis, 2023). Several studies have however investigated the factors driving the expansion of the European air network over the last decades, focusing on the different behaviour of LCCs and FSCs.

Calzada & Fageda (2019) perform an empirical examination of the main factors driving the creation of new routes over the 2002-2013 period, using a dataset of all potential routes between the 259 airports in Europe (defined as European Economic Area ("EE Area") + Switzerland) with more than 250,000 ppa in 2013. The authors focus on identifying the factors affecting both the opening/closing of routes as well as the capacity created, i.e. flights' frequency and size of the airplanes. The authors find that the expansion of routes over the period is mainly driven by LCCs. Interesting different patterns are found for LCCs and FSCs. Both tend to open routes connecting richer regions; however, the marginal effect of regions' GDP per capita is higher for FSCs meaning that this factor is relatively more important for the latter, which prefer to operate routes where passengers have a higher willingness to pay. LCCs opened more routes, while FSCs focused on domestic ones. Furthermore, network airlines focused on increasing their presence in hub airports they already dominate. Both types of airlines displayed a lower probability of opening routes in contexts of higher competition, i.e. where HSR is an available alternative and in multi-airport cities. Finally, while FSCs tend to increase capacity by increasing the frequency of the connections, LCCs increased capacity by using larger planes, without offering more frequent flights.

Efthymiou & Christidis (2023) investigate the factors driving the network development of Ryanair, using information from both interviews of industry experts and an empirical analysis of network developments over the 2000-2021 period. They summarise the main distinction between FSCs and LCCs' development model: while the former follows a bottom-up model, optimising their network to serve destinations from a limited number of bases, LCCs use a top-down model aimed at optimising the use of their aircraft fleet, by adding bases and destinations to their network. The LCC model prioritises high aircraft utilisation rates but leads to higher instability for the destinations served. To be efficient, LCCs have to create an optimal combination of aircraft type, flight duration and connection frequency, thus limiting the type of connection that they can serve.

Efthymiou & Christidis (2023) explain that the most successful routes for Ryanair have been those serving leisure destinations which previously lacked a reasonably priced air service.

Many factors are found in the literature to drive LCCs' airport choices. In an old but seminal study on this, Warnock-Smith & Potter (2005) find that the demand/catchment area is the most important factor, followed by convenient slot times, quick turnaround facilities and low aeronautical charges. They also find a preeminent role for forecasts of business and tourism, for cost-conscious airport management, level of competition, good surface access and spare airport capacity. Immigration patterns are also considered by LCCs in their network design.

The differential behaviour of LCCs and FSCs in route decisions can have heterogeneous effects on airports of different size, as shown by the literature exploring the impact of LCCs' development on the distribution of routes among European airports. Suau-Sanchez et al. (2016) analyse the impact of liberalisation and LCC growth on the spatial concentration of air traffic in Europe. They show that, as far as intra-EU traffic is concerned, over the 1990-2009 period, a de-concentration of seat capacity is observed, meaning that the available network became more spread across more airports, leading to an increasing connectivity of smaller airports. The authors argue that this phenomenon can be attributed to the behaviour of a small number of airlines, spearheaded by Ryanair. In other words, LCCs' increased use of smaller secondary/regional airports in this period gave these airports higher leverage for competing with hubs. On the contrary, extra-EU seat capacity displayed an increase in spatial concentration over the period, meaning a lower number of airports offering intercontinental flights.

The topic is also studied in Jimenez & Suau-Sanchez (2020), which provides a longitudinal analysis of LCCs' development and its interconnection to the development of airports of different size, using data on all scheduled airlines in all European airports during the 2001-2019 period. The paper uses the following categorisation of airports: (i) primary airports are defined as the largest airports in metropolitan areas with several airports, and airports acting as the main or only gateway in large urban areas and cities; (ii) secondary airports are those that have significant commercial traffic, but are not the largest in multi-airport systems; (iii) regional airports are peripheral to the main urban and metropolitan regions and have a relatively small size. Airlines are categorised into mainline and LCC. Data suggests that LCC development is characterised by two distinct periods. During the first phase (2001-2008), underutilised secondary and regional airports provided the basis for LCCs' initial growth. Although this is not true for all airlines (e.g. EasyJet and Vueling concentrated their capacity in large airports from the very beginning), this phase contributed to seat capacity de-concentration away from primary airports. This effect is mainly driven by the strategy adopted by Ryanair. The pattern is confirmed by looking at the evolution of airports' HHI, which on average displays a sharply decreasing trend up to 2008, especially when computed by using only seats allocated in the LCC segment. The 2007-2008 global financial crisis, with the subsequent seat capacity reduction at large airports by network carriers, provided an opportunity for LCCs to turn to major airports more easily. This pattern is observed in many different cases. Consequently, the HHI over the 2009-2019 period remained substantially stable.

A particular type of new route creation is characterised by an airline switching from one airport to a competitor. Understanding the costs involved is important in this kind of operation as it affects the degree of competition between airports. IATA (2013) and Wiltshire (2018) explain the costs that airlines have to bear to switch between airports arguing that they are typically very high. This is true especially for FSCs, but LCCs typically face very high costs as well. Switching costs may include: (i) relocation of assets to the new airport, including sunk costs of the investment in facilities at the

previous airport; (ii) staff cost including relocation, recruitment or redundancy; (iii) breaking long-term commitments with the airports; (iv) loss of economies of scale if operations are split between airports; (v) marketing of the new route. Marketing costs may be particularly significant and are often partially covered by the airport. Furthermore, airlines may also expect to initially obtain lower yields when routes are launched, and this transitory period may last up to 2-3 years.

4.2.2 Consultations

42 stakeholders responded to qualitative questions about the flexibility of airlines in setting up new routes, the differences between airline types, and how these aspects affect competition between airports.

- Several airport associations and airport operators characterised airlines as highly adaptable, citing frequent “route churn”.¹²³ Several airports noted that roughly 20–40% of routes can open or close within a given year or season, reflecting a willingness by airlines to experiment and rapidly adjust their networks. This was framed as part of the competitive dynamic between airports, with carriers shifting capacity to maximise returns.
- By contrast, regional airlines and public authorities from more peripheral regions noted clear limits to flexibility. These actors emphasised that launching new routes, for example on islands, often involves significant upfront costs, such as marketing investment, specialised crew training, or compliance with airport-specific operational requirements. In smaller or geographically constrained airports, this makes route development more complex and financially risky. Several local and regional authorities added that airlines tend to be more responsive to any opportunities at smaller or regional airports where risks are shared, for example, through joint marketing campaigns, incentive schemes, or reduced airport charges. Without such mechanisms, they saw airlines prioritising high-volume routes and established hubs.
- According to two broader aviation industry associations, regional airports compete aggressively at industry events to secure limited capacity from a small number of powerful airline groups. This has created what some described as a highly competitive, sometimes cut-throat environment among regional airports for airline services. A contribution to the call for evidence from one airport operator further suggests that regional airports face increasing pressure from airlines, in particular LCCs’ ability to shift capacity swiftly across routes and airports. This mobility allows airlines to exploit the competitive environment among regional airports to negotiate lower charges, resulting in what the airport operator described as a “race to the bottom” in airport charges.¹²⁴

On differences between airline types, a strong majority across aviation industry associations, regulators and airport operators reported that LCCs are substantially more “footloose”. Their point-to-point business model¹²⁵ allows them to enter unserved or underserved markets quickly, often driven by the availability of incentives, lower fees,

¹²³ The frequent opening and closing of air routes, particularly by LCCs, that focus on high demand point-to-point routes, in response to market demand and route profitability.

¹²⁴ The same airport operator reported being unable to increase its passenger charge (approximately €8 per passenger) for over two decades despite inflation. It explained that the combination of regulatory caps and the growing bargaining power of airlines has constrained its ability to increase its charges to cover costs or fund investment.

¹²⁵ A network model, also called a direct network or line network, in which flights are operated directly between destinations, instead of routing through a central hub (typical of LCCs).

or favourable conditions. However, the same flexibility means LCCs can also exit without notice if profitability falls, creating volatility for airports and regions that rely on them. FSCs, by contrast, were described by an airline, five broader aviation industry associations and several public authorities as more constrained by their hub-and-spoke systems¹²⁶, with decisions tied to network optimisation, slot availability at congested airports, and feeder traffic.¹²⁷ This makes them slower to react to short-term opportunities, but also more stable in maintaining established connections.

These dynamics emphasise that competition between airports can also be shaped by airline decision-making. For example, if an LCC offers an attractive fare on a popular route from a regional airport rather than the main hub, passengers may be drawn to the regional option. Overall, the responses indicated that airports compete not only for new services but also for the retention of capacity on existing routes, since airlines regularly rebalance seat volumes and frequencies in response to shifting industry conditions. This competition plays out differently depending on airline type, with LCCs driving volatility, FSCs offering stability, and regional airlines ensuring resilience on thin routes.

In the public consultation, when asked about the effectiveness of the current rules on start-up aid for airlines, 60% of respondents did not consider the current rules on start-up aid for airlines to be effective, while 22% believed they were effective and 18% were unsure. When it comes to the responses by the stakeholder type:

- The strongest criticism came from airlines (n=6), of which 67% answered that they do not consider the current rules on start-up aid for airlines to be effective.
- Public authorities (n=23) expressed similar scepticism, with 61% rejecting the effectiveness of the rules.
- Among airports and airport associations (n=44), 57% shared this view.
- Half (50%) of broader aviation industry associations (n=8) also considered the rules ineffective.
- None of the citizens (n=3) or the single environmental NGO (n=1) viewed the rules as effective.

In the stakeholder survey, when asked whether the start-up aid provisions should be maintained in the revised AG, the majority of respondents (51%) were in favour of retaining the start-up aid provisions in their current form, while 21% opposed their inclusion. A significant share (28%) reported uncertainty, suggesting that while support is relatively strong, there remains some hesitation or lack of clarity among stakeholders. The responses were similar across different types of stakeholders that answered this question including airlines, airports, broader aviation industry associations and public authorities.

When asked to substantiate their opinions, respondents that consider current start-up aid rules to be ineffective argued that the rules are too rigid and ill-suited to practical realities.

- Several airlines reported that the current rules provide a useful foundation but lack flexibility on cost eligibility criteria. They stressed that aid should also account for

¹²⁶ A network model in which an airline typically designates one central hub airport (and potentially also secondary regional hubs) to serve as transfer point for passengers travelling to their final destinations, with several smaller airports (spokes) feeding traffic into the hub(s).

¹²⁷ Traffic flows from regional airports that connect to longer-haul flights via hub airports. Feeder traffic supports the hub-and-spoke airline model.

environmental and operational costs, including marketing expenses. Other shortcomings included the three-year limit on support. An airline in the public consultation proposed extending eligibility to routes outside the EU to strengthen international connectivity. Several consulted airlines argued that these features discourage actual use. Three airlines also citing limited awareness of start-up aid rules within the sector, which may also explain their low uptake despite potential benefits.

- Several airports and airport associations confirmed that start-up aid provisions remain important, especially for small regional airports and those in remote or OR, where connectivity gaps persist. However, they noted that the current rules are too rigid, citing very limited use since their introduction. The three-year limit was seen as insufficient for new routes in peripheral or weaker regions to reach financial sustainability.¹²⁸ Several airports reported that, given current start-up aid limitations, they prefer local rebate or incentive schemes that in their view fall outside the State aid definition and are, therefore, more flexible. Some airports also called for better alignment with EU climate goals, supporting aid for zero-emission aircraft, sustainable fuels, or intermodal connections. A few, however, described positive experiences, noting that start-up aid can help share risks when opening new routes in small or remote markets.
- Broader aviation industry associations echoed airports' concerns about the rules' rigidity and short duration. They proposed greater flexibility in duration and scope, especially for regions where demand matures slowly and suggested passenger-based, degressive aid models¹²⁹ differentiated by airport size to provide clearer incentives for airlines.
- Regional and local authorities supported extending start-up aid beyond three years in slower-growing markets. However, several stated that such instruments had not been used in their jurisdictions, leaving them unable to assess their effectiveness. Others pointed out that low awareness among airlines and administrative complexity may explain the limited uptake despite potential benefits.¹³⁰

Overall, respondents called for the provisions to be simplified, modernised, and made more adaptable, drawing inspiration from temporary COVID-19 schemes to ensure they can effectively support connectivity, regional development, and the competitiveness of EU aviation.

Box 4.2: Insights from case studies on the role of airlines in airport competition

Airlines face a mix of direct operational costs, such as aircraft repositioning, crew, fuel, ground handling, and airport-related costs, including landing fees, passenger charges, and other airport service fees, as well as marketing costs. For smaller or geographically constrained airports, additional costs may arise from limited infrastructure or slot availability, which can increase turnaround times and reduce efficiency.

¹²⁸ Two regional airports further reported that many routes supported by start-up aid were discontinued once incentives expired, as underlying demand was still considered too weak.

¹²⁹ A system where aid is calculated as a lump sum per passenger rather than as a percentage of airport charges, typically degressive over time and differentiated by airport size.

¹³⁰ In addition to this, contributions to the call for evidence from three public authorities (two in Eastern and one in Western Europe) justified the very little adoption of start-up aid, as due to administrative complexity, restrictive eligibility criteria, and low aid intensity, which together have discouraged applications.

Stakeholders from peripheral and island regions emphasised that route development in such markets is both more complex and financially riskier. Thin demand and limited capacity mean that the financial burden of route establishment is heavier, with airports often highly dependent on one or two carriers. This increases exposure to sudden route withdrawals, amplifying the risks for both airports and regional economies.

Case study evidence also shows that while airports may offer start-up aid to support new routes, its impact is relatively limited. Airlines' decisions are shaped more by strategic network considerations (e.g. fleet availability, base allocation, competitive positioning) than by temporary financial incentives. LCCs, in particular, can mitigate start-up costs by negotiating long-term agreements with airports that secure lower charges and favourable conditions, enabling them to switch or open routes with higher flexibility compared to other airline types.

In contrast, FSCs and regional airlines tend to have less flexibility in opening or closing routes, as they are more constrained by their hub-and-spoke strategies, slot holdings, and obligations to maintain feeder traffic to hubs. For them, route development decisions are less about marginal cost calculations and more about maintaining network integrity and connectivity.

Regional airports interviewed for the case studies highlighted that strategic choices made by airlines about opening or closing routes (in particular LCCs) drive competitive pressures that regional airports exercise on major EU hub airports or on each other, as routes attract passengers. For example, the regional airport close to a hub, in the context of the eponymous case study, competes with the hub mainly through competition for LCCs. The LCC interviewed for the purposes of the same case study initially operated at the regional airport but then switched to the hub due to the unfavourable competitive landscape at the regional airport. The LCC explained that historically, they focused on regional airports to minimise costs, but they have increasingly diversified their airport portfolios by including selected hubs as well. In some rare cases, LCCs even operate simultaneously from a hub and a neighbouring regional airport. This is possible due to LCCs' broadening of customer base: while they were originally targeting low-cost passengers only, the customer base has recently broadened to business and other higher-cost segments as well. Thus, competition between regional airports and hubs in such cases is shaped by competition for LCCs. When it comes to competition between regional airports, the same airports view the ability to attract and retain LCC operations as a key driver to compete. Evidence from multiple case studies suggests that regional airports often compete by negotiating favourable cost conditions, offering incentives, and seeking long-term commitments from carriers. Since LCCs are flexible in their airport choices, regional airports not only seem to compete with their immediate neighbours but also with other airports further away (including those in other countries) that provide comparable facilities and market potential.

4.2.3 Data analysis

4.2.3.1 Some statistics on airlines operating in the EU

A clear understanding of how many airlines operate in the EU, and of their business models, is central to assessing the competitive environment in which airports function. Entry and exit—especially by LCCs—shape competitive pressure on routes and influence whether State aid may be warranted or distortive. Our aim is descriptive: if competition has intensified, we would expect more active carriers and a continued strong role for LCCs, despite consolidation or bankruptcies.

Using Cirium data for all airlines operating within and to/from the EU over 2014–2023, we report trends in the number of active airlines, distinguish LCCs from other models,

and track market entries and exits. These descriptive statistics convert the research question directly into quantitative evidence on whether the EU aviation sector has become more fragmented or more consolidated. Airlines are identified through IATA/ICAO codes, their routes, and passenger traffic; variable definitions and classification criteria are detailed in Annex E.1.

Because the analysis is descriptive, it does not explain underlying drivers such as regulation, fuel costs, or consumer preferences, and it may underrepresent very small or short-lived carriers. Counting airlines also ignores differences in size or market share (see our analysis on airline groups in Section 4.3), so the results indicate broad trends rather than competitive intensity.

Airlines “operating to/from the EU” are defined as those with at least one EU-27/UK/Türkiye endpoint; airlines “within the EU” operate between two such airports. Table E.11 (Annex E.1.3) shows a gradual increase in the number of airlines over the decade, with only a temporary dip during COVID-19. LCC numbers also rise modestly, with their overall share remaining in the low teens. Figure E.6 (Annex E.1.3) visualises these trends. Table E.12 (Annex E.1.3) shows that market concentration (HHI) stayed moderate, dipping during COVID-19 and returning to pre-pandemic levels thereafter.

4.2.3.2 Routes and start-up aid

One of the core justifications for allowing State aid to airlines is that it may stimulate the creation of new routes that would not otherwise be commercially viable, thereby enhancing regional connectivity. The policy concern, however, is whether such aid genuinely leads to additional and sustainable routes, or whether it merely subsidises activities that would have taken place anyway. The testable hypothesis is: if start-up aid¹³¹ is effective, then airports hosting routes benefiting from approved start-up aid to airlines¹³² should show an increase in the number of total and new routes in the years immediately following the aid, and a lower rate of route cancellations, compared to similar airports that did not receive aid.

To test this, State aid case-related data is combined with Cirium data on routes operated at the airport–quarter level between 2014 and 2023. We identify both total routes and newly established or discontinued routes, and link them to whether airports received approval for start-up aid, thus potentially benefiting from it. Where possible, a distinction is made between aid granted under general aid schemes and aid supporting routes at specific airports.¹³³

We estimate regressions where the dependent variable is the number of total, new, or cancelled routes, and the key explanatory variable is whether an airport hosted start-up aid, including lags to capture delayed effects. Airports eligible for start-up aid, but not receiving approval, serve as a control group, allowing us to distinguish between effects of aid and general trends among small or remote airports. Controls for passenger volumes and LCCs presence are included to account for demand and structural factors.

We caution that the analysis faces several constraints. The number of observed aid cases is small, particularly for individual aid, which reduces statistical power. Other forms of incentives offered to airlines to support the opening of new routes are not

¹³¹ There is no information on what airlines received aid, but only what airports were allowed by the Commission to work with start-up aid. Therefore, the analysis can only be done at the airport level.

¹³² While technically the beneficiaries of start-up aid are airlines, the majority of aid schemes approved focus on airlines operating at a certain airport.

¹³³ The construction of the State aid dataset is described in Annex E.3.

observed and might distort the picture. Moreover, it is not fully observable which airports/routes eligible within an aid “scheme” finally implement the measure. This unobservable outcome creates measurement error in treatment status. Finally, the approach captures short- to medium-term route dynamics, but not whether subsidised routes are financially sustainable in the long run. Results should therefore be seen as suggestive evidence on the effectiveness of start-up aid, rather than conclusive proof.

The State aid information comes from data provided by the EC or publicly available (from the Competition Case Search Database and the Transparency Database). It must be noted that these cases are only cases that are known to the EC and do not cover unreported cases and unnotified aid; this is further discussed below. Until 2025, 26 start-up aid measures have been approved by the EC, as can be seen from Table 4.8 (split per country).¹³⁴

Table 4.8: Number of individual and scheme start-up aid decisions by country since 2014

Country	Number of individual aid measures approved	Total amount (€)	Number of aid scheme measures approved	Total amount (€)	Number of total Start-up aid measures approved	Number of airports eligible for any aid ¹³⁵
Netherlands	1	-	0	-	1	1
Slovakia	0	-	1	-	1	6
Slovenia	0	-	1	-	1	3
United Kingdom ¹³⁶	0	-	1	-	1	38
Lithuania	0	-	2	-	2	4
France	1	-	2	-	3	56
Spain	0	-	3	2,596,000	3	8
Romania	5	-	1	1,276,848	6	10
Italy	5	146,000	3	3,000 ¹³⁷	8	15
Total	12	146,000	14	3,875,848	26	141

Note: Amount refers to actual expenditure, based on the Competition Case Search and the Transparency Aid Database, and may differ from the maximum approved aid. Figures represent total aid spent under the scheme, across all relevant decisions for the country, where data is available (in one case only the approved amount was used). The number of eligible airports is defined in the decision text. In a few cases, where airports are not explicitly identified, the Project Team reconstructed them based on the eligibility criteria provided in the decision

Source: Project Team based on EC Competition Case Search and EC Transparency Award Module

¹³⁴ The dataset includes measures approved under the 2005 Aviation Guidelines (Communication from the Commission — Community guidelines on financing of airports and start-up aid to airlines departing from regional airports, OJ C 312, 9.12.2005, pp. 1–14). These guidelines were applicable from 2005 until 3 April 2014, and the dataset includes also measures approved under the 2005 Aviation Guidelines before 2014, but that apply in and beyond 2014 as well.

¹³⁵ Number of airports eligible for aid under individual measures or aid schemes approved by the EC.

¹³⁶ Since the UK left the EU in 2020, no notification was required thereafter.

¹³⁷ The EC Competition Case Search reports an expenditure of 0.003 million euro. However, amount corresponding to the maximum budget approved by the Commission in decision SA.46709 equals € 11,852,000.

The Project Team analyses the impact of start-up aid at the airport level by looking at the number of total routes, new routes, and cancelled routes (see Annex G.1 for a detailed definition of routes). In particular, the following regression is estimated:

$$\# Routes_{it} = \beta_1 + \beta_2 Start\ up\ Aid_{it} + \beta_3 Start\ up\ Aid_{it-4} + \beta_4 Start\ up\ Aid_{it-8} + \beta_5 LCC\ Share_{it} + \beta_6 Total_pax_{it} + \omega_i + \omega_t + \epsilon_{it}, \quad \text{Equation 4.4}$$

where the dependent variable $\# Routes_{it}$ denotes either the total number of routes, new routes, or cancelled routes in airport i in year-quarter t . In practice, the regression is estimated separately for each of these three variables.

The dummy $Start\ up\ Aid_{it}$ is set to one if airport i potentially hosted routes benefiting from start-up aid approval in year-quarter t (see Annex E.3 for more details on how State aid cases are allocated to airports). The model also includes lags of this dummy (for $t-4$ and $t-8$, corresponding to one and two years, respectively), since the effects of aid may appear with a delay, for example, when airlines open new routes in the years following the initial aid.

The analysis is separately performed on individual State aid cases and cases that were part of a scheme.

These are the controls variables:

- $LCC\ Share_{it}$ is the share of LCCs at airport i in year-quarter i .
- $Total_pax_{it}$ the total number of passengers handled at airport i in year-quarter t .
- ω_i are airport fixed effects.
- ω_t are year-quarter fixed effects.
- ϵ_{it} is the error term.

The variable $LCC\ Share_{it}$ control for airport specificity, through the time varying relative importance of LCCs. Airports with a higher LCC share typically experience more frequent route entry and exit regardless of start-up aid. Moreover, the inclusion of $Total_pax_{it}$ controls airport size, as larger airports with more passengers naturally tend to sustain more routes.

The regression is estimated using as control group those airports that were eligible for start-up aid, but were not granted aid, according to our information. Specifically, the control group is defined as those airports that did not host routes receiving aid and (i) have fewer than 3 million passengers per annum, or (ii) are located in remote regions, irrespective of their size. This allows us to compare the treated group (airports operating routes for which start-up aid was granted to airlines) with the control group (airports without routes for which start-up aid was granted). There are 12 treated airports and 396 airports in the control group.

Table 4.9 reports the impact of individual aid on the number of routes. The coefficient on the start-up aid dummy (highlighted in blue) is negative but not significant, suggesting that airports hosting routes supported by individual start-up aid reported a smaller change in the number of total routes than comparable eligible airports that did not receive start-up aid, after the aid was approved. The coefficients on the one- and two-year lags are also not significant, indicating that there is no evidence of a delayed effect. Among the controls, the total number of passengers is strongly positive and significant, confirming that larger airports sustain more routes, the share of LCCs is negative but not significant, suggesting no relationship between LCC presence and the overall number of routes.

We give a further interpretation of this result after the reporting of the impact on new and cancelled routes on overall airports.

Table 4.9: Impact of Individual Start-up Aid on the Total Number of Routes

Dependent variable: total number of routes	(1)
<i>Start up Aid_{it}</i>	-0.375 (0.467)
<i>Start up Aid_{it-1}</i>	0.131 (0.477)
<i>Start up Aid_{it-2}</i>	-0.408 (1.094)
LCC Share	-0.830** (0.391)
Total number of passengers	6.73e-06*** (2.04e-06)
Constant	8.435*** (0.323)
Airport FE	Yes
Year-quarter FE	Yes
Number of focal airports	396
Number of observations	10,029
R-squared	0.977
Adj.R2	0.976
F-Stat	10.94
Prob > F	0

Note: Clustered standard errors in parentheses at the airport level, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Project Team based on Cirium and state-aid data.

Table 4.10 reports the impact of individual aid on new routes. The coefficient of the start-up aid dummy is negative and not significant, and the lagged coefficients are also small with the first lag showing only a weakly significant effect. This suggests that granting individual start-up aid did not lead to an increase in new routes compared to airports operating routes without aid, either in the year of the aid or in the following years. The coefficient on the total number of passengers is negative and highly significant, indicating that larger airports tend to add fewer new routes, consistent with the idea that their structures are more established therefore offering less scope for expansion. The share of LCCs is positive but not significant.

Table 4.10: Impact of Individual Start-up Aid on the Total Number of New Routes

Dependent variable: total number of new routes	(1)
<i>Start up Aid_{it}</i>	-0.144 (0.110)
<i>Start up Aid_{it-1}</i>	0.1257* (0.102)
<i>Start up Aid_{it-2}</i>	-0.348 (0.256)
LCC Share	0.00304 (0.109)
Total number of passengers	-1.87e-06*** (2.72e-07)
Constant	0.679*** (0.0871)
Airport FE	Yes
Year-quarter FE	Yes
Number of focal airports	396
Number of observations	10,029
R-squared	0.397
Adj.R2	0.371
F-Stat	12.27
Prob > F	0

*Note: Clustered standard errors in parentheses at the airport level, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium and state-aid data.

The impact of individual aid on cancelled routes is in Annex G.2. A limitation of this empirical design is the limited number of treated observations. Only 12 airports are identified as supporting routes for which individual start-up aid was granted, compared to 396 airports in the control group. Furthermore, the treatment sample is unlikely to be exhaustive, as it is based on reported cases of aid, which likely capture only a small subset of the true population of airports supporting routes with different other support measures. Additionally, it is unclear in how many of the cases the aid was actually used, despite the initial approval. This partial observability raises concerns about selection into the treatment and control group: the observed treated airports may systematically differ from the unobserved treated population in ways correlated with outcomes of interest. As a result, the estimated treatment effect may be subject to selection bias, and the (external) validity of the estimates is restricted.

Overall, the results on total, new and cancelled routes indicate that start-up aid had no measurable impact on routes creation, although interpretation remains subject to the same limitations as before, namely the small number of treated airports and potential selection bias in the allocation of start-up aid.

Next, the analysis turns to the impact of start-up aid schemes. The treated group in this case includes those airports that fulfilled the eligibility criteria of the schemes. As it is not fully observable which airports eligible within an aid "scheme" finally implement the measure, we refer to the identified airports as "potentially treated" airports, which in total are 98 airports. The potential treatment unobservability has an impact on the interpretation of results, as further explained below.

The results show no significant effect of start-up aid schemes on the total number of routes (Table 4.11). For new routes, the contemporaneous and two-year coefficients are insignificant, while the one-year lag is marginally negative (Table 4.12). For cancelled routes, no significant effects are observed (see Table G.9 in Annex G.2).

Table 4.11: Impact of Start-up Aid by Scheme on the Total Number of Routes

Dependent variable: total number of routes	(1)
<i>Start up Aid_{it}</i> (Scheme)	-0.464 (0.448)
<i>Start up Aid_{it-1}</i> (Scheme)	0.260 (0.327)
<i>Start up Aid_{it-2}</i> (Scheme)	0.235 (0.177)
LCC Share	-0.832** (0.389)
Total number of passengers	6.72e-06*** (2.04e-06)
Constant	8.812*** (0.349)
Airport FE	Yes
Year-quarter FE	Yes
Number of focal airports	401
Number of observations	10,089
R-squared	0.978
Adj.R2	0.977
F-Stat	10.39
Prob > F	0

*Note: Clustered standard errors in parentheses at the airport level, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium and State aid data.

Table 4.12: Impact of Start-up Aid by Scheme on the Total Number of New Routes

Dependent variable: total number of new routes	(1)
<i>Start up Aid_{it}</i> (Scheme)	0.0257 (0.116)
<i>Start up Aid_{it-1}</i> (Scheme)	0.0923 (0.0882)
<i>Start up Aid_{it-2}</i> (Scheme)	-0.0773 (0.0652)
LCC Share	0.00239 (0.109)
Total number of passengers	-1.86e-06*** (2.68e-07)
Constant	0.657*** (0.0909)
Airport FE	Yes
Year-quarter FE	Yes
Number of focal airports	401
Number of observations	10,089
R-squared	0.396
Adj.R2	0.370
F-Stat	11.98
Prob > F	0

Note: Clustered standard errors in parentheses at the airport level, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Project Team based on Cirium and State aid data.

Start-up aid approved through schemes did not generate a significant increase in total number of routes, on new routes or on cancelled routes. This result should be treated with caution, however. As in the case of individual aid, it is not known with certainty for which of these airports the aid was actually used. As a result, the treatment status is measured with error, and our sample of “potentially treated” airports may confuse treated and untreated units. This misclassification not only has an impact on estimated effects, but also complicates the interpretation of the treatment coefficient, which no longer corresponds to a well-defined causal parameter. Combined with the fact that the observed number of confirmed treated cases is small, and that reporting may be selective, our estimates may be biased if the likelihood of disclosure or observability is correlated with unobserved airport characteristics. Hence, the treatment effects identified in this setting should be interpreted with caution.

4.2.4 Conclusions on airlines, new routes and start-up aid

Descriptive statistics of commercial data show that, despite consolidation and bankruptcies, the share of passenger traffic accounted for by LCCs has increased. FSCs continue to dominate hub operations, but their number has decreased. While the number of airlines active in the EU is relatively high, the evidence suggests that a low number of airlines account for a large share of passenger traffic; some LCCs in particular seem to enjoy a significant degree of market power.

The literature shows that when setting up new routes airlines face several types of costs: for airport facilities, personnel hiring, crew and fuel costs, passenger costs such as ticketing, in-flight services, insurance and, not least, marketing costs. The literature

argues that also switching costs between airports are typically very high, especially for FSCs. Switching costs include asset relocation, loss of economies of scale, marketing expenses for new routes, and potential penalties from breaking long-term airport agreements. Several studies indicate that LCCs are generally more flexible than traditional FSCs in setting up new routes as they frequently re-optimize smaller bases and destinations to maintain high load factors (supporting cost efficiency) throughout the network, leading to higher instability of routes. The literature also shows that the evolution of competition between airports in the last decades has been shaped significantly by LCCs decision-making, which still focus on regional airports for their development even though they also entered large airports in their consolidation phase.

This aligns with stakeholder reports that regional airports compete fiercely not only for new routes but also for the retention of existing routes. This competition plays out differently depending on airline type, with LCCs driving volatility, FSCs offering stability, and regional airlines ensuring resilience on thin routes (i.e. routes that do not generate enough passengers to fill the large aircraft that major airlines typically operate). Case studies featured major LCCs and one regional carrier whose behaviour largely aligns with the above categorisation with respect to the opening of new routes, and type of costs faced when opening/switching routes, as well as with regard to LCCs gradual differentiation of their airport portfolio which now includes selected larger airports and hubs.

The State aid public information, which covers notified measures, shows that as of 2025, only 26 start-up aid measures have been approved by the Commission across 10 different Member States.¹³⁸ Even though about half are collective measures with multiple eligible airports (aid schemes), they remain limited in number.

On the other hand, several types of stakeholders from the consultations (airports, airports associations, airlines and public authorities and other aviation industry associations from the stakeholder survey) explained that elements such as short duration, cost eligibility restrictions, administrative complexity have deterred applications; and many airports prefer more flexible, locally managed solutions of granting rebates and incentive that fall outside the State aid definition and are overall more attractive. Case studies provided evidence of little to no adoption, respectively, by the regional airline and LCCs. Reportedly, this is also due to the same critical features emerged in the consultations. LCCs seem to be able to secure better deals by directly entering into bilateral agreements with airports, with capacity commitments counterbalanced by flexibility on route menus.

Only in a very few instances, airport associations and public authorities report uncertainty about whether notification of certain measures granted by airports to airlines to start-up new routes should have been notified under the AG.

On the general question of the effectiveness of start-up aid framework, all stakeholder groups repeatedly highlighted little use and little relevance of start-up aid measures. Shortcomings identified are the rigid three-year cap and fixed aid intensity constant over time, linked to airport charges. In addition, some airports called for better alignment with EU climate goals, supporting aid for zero-emission aircraft, sustainable fuels, or intermodal connections. There is a minority of more positive experiences,

¹³⁸ The dataset also includes measures approved under the 2005 Aviation Guidelines (Communication from the Commission — Community guidelines on financing of airports and start-up aid to airlines departing from regional airports, OJ C 312, 9.12.2005, pp. 1–14). These guidelines were applicable from 2005 until 3 April 2014, and the dataset includes also measures approved under the 2005 Aviation Guidelines before 2014, but that apply in and beyond 2014 as well.

suggesting reforms such as longer aid durations in structurally weaker regions and simplified notification requirements.

The majority of stakeholders are in favour of retaining the start-up aid provisions, while a significant share indicates uncertainty and a minority are opposed to continuing it. Several airports and broader aviation industry associations claim that start-up aid provisions remain important especially where connectivity gaps persist, even though there is criticism about a lack of flexibility in current provisions, impracticality and discouraging actual usage, recalling the same shortcomings that have emerged under the other questions on the topic.

Using original regression analysis, the Study tests the hypothesis that start-up aid linked to a given airport should be associated with an increase in the number of total and new routes at the same airport in the years immediately following the aid approval, and a lower rate of route cancellations, compared to similar airports that did not benefit from aid measures. To test this, start-up aid public information are combined with Cirium data on routes operated at the airport–quarter level.

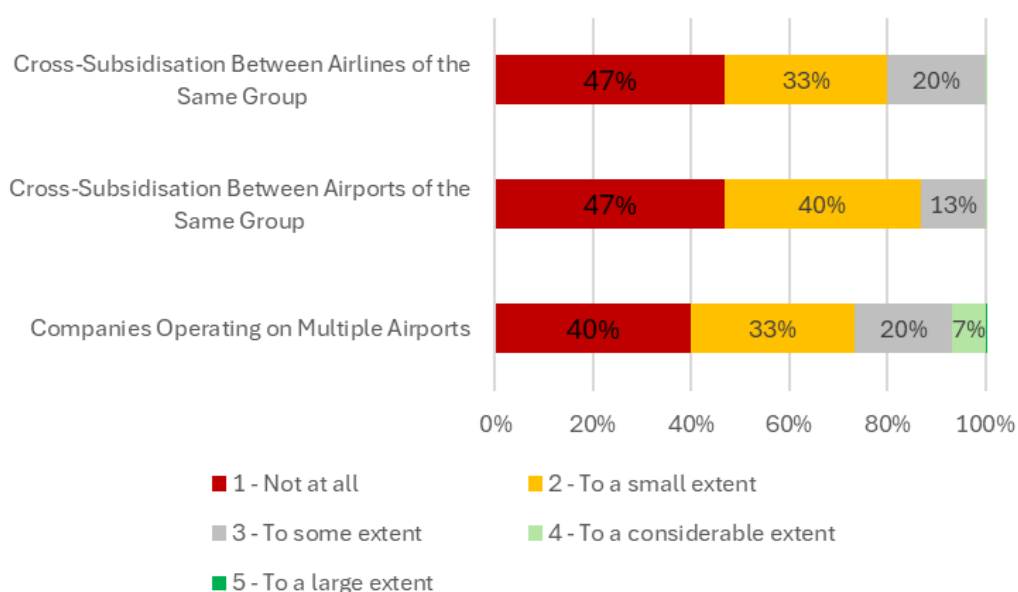
The analysis does not identify any robust evidence of a significant effect of start-up aid on total, new or cancelled routes. However, this result cannot be seen as a conclusive proof of the (in-)effectiveness of start-up aid because of the data limitations, namely the small number of treated airports which reduces statistical power (only 12 airports concerned by individual start-up aid in our data, compared to 396 airports in the control group) and other forms of incentives offered to airlines to support the opening of new routes which are not observed and might distort the picture.

4.3 The influence of airline and airport groups

4.3.1 Consultations

In the stakeholder survey, responses indicate a very low to low market impact of airline and airport groups on companies operating on multiple airports, on cross-subsidisation between airports within the same group, and on cross-subsidisation between airlines within the same group. The results were similar across different types of stakeholders including airlines, airports and public authorities.

Figure 4.3: To what extent do networks of airports and airlines affect the market?



Source: Stakeholder survey (n=38).

Even though most of the consulted stakeholders reported a low impact of networks of airlines and airports, in their substantiated responses, two broader aviation industry associations and a public aviation authorities emphasised that networks of airports and airlines can create significant industry imbalances if left unaddressed. Large groups have the capacity to cross-subsidise, bundle services, and exert disproportionate bargaining power, potentially undermining fair competition. These respondents suggested that recognising these dynamics would better reflect the realities of the sector and ensure competitive neutrality, especially where close cooperation models already exist (e.g. close collaboration between airlines and airports, such as the minority shareholder model used at Munich Airport). They further pointed out that cross-subsidisation is already happening within airport networks and can be positive for connectivity, provided it does not give undue advantage to specific airlines.¹³⁹ As part of its contribution to the call for evidence, one Italian public authority highlighted the benefits of integrated airport systems, particularly for smaller regional airports with limited traffic volumes: economies of scale, knowledge sharing, and demand diversification. It gave the specific example of micro-feeder flights¹⁴⁰ within networks which can improve accessibility, promote tourism to less congested regions, and support the deployment of new-generation sustainable aircraft. Overall, the debate points to a need for clearer competition rules that balance competitive neutrality with the potential connectivity benefits of network arrangements.

4.3.2 Data analysis

In this section, we assess the question whether the presence of airline groups at an airport—particularly through LCCs and dense route offerings—translates into higher passenger volumes and, as a result, intensifies competition between airports within the same catchment area. The hypothesis is that if airline groups expand passenger traffic at one airport, they increase competitive pressure on other airports located within the same catchment area (see Section 4.1.3).

The data come from Cirium at the airport–quarter level for 2014–2023. For each airport, the number of active airlines, their routes, and passenger volumes are observed. Airlines are classified into groups.¹⁴¹ For each group, indicators of presence are constructed (dummy variable if at least one airline from the group operates at the airport in a given quarter).

It should be noted that the classification of airlines into groups is necessarily stylised and does not capture hybrid models or strategic shifts over time. The presence of an

¹³⁹ In its contribution to the call for evidence, one airline network noted that cross-subsidisation within large airline groups is also widespread and should be explicitly addressed in the AG.

¹⁴⁰ Micro-feeder flights are very short regional air services that provide connectivity from small or remote airports to a nearby hub airport, typically with low passenger volumes and short stage lengths. They are usually operated to feed passengers into the wider network rather than to serve point to point demand.

¹⁴¹ The Team performed desk research to identify airline groups. These have been linked to airports using <https://www.eurocontrol.int/directory/airline-groups-lookup>. The following airline groups are included in the analysis: Air France Group, British Airways Group, Lufthansa Airlines, SWISS Group, Aer Lingus Group, Eurowings Group, Iberia Group, KLM Group, Luxaviation Group, Air Arabia Group, AEGEAN Group, Amelia Group, Airbus Group, LATAM Group, Alitalia Group, DHL Group, Braathens Group, TUI Group, Avincis Group, Axis Aviation Group, Corendon Group, Smartwings Group, DAT Group, Emerald Group, easyJet Group, Nordic Aviation Group, Freebird Group, PLAY Group, Icelandair Group, HiSky Group, Norwegian Group, Ryanair Group, Avion Express Group, West Atlantic Group, TAP Group, SAS Group, SkyUp Group, Turkish Airlines Group, Wizz Air Group.

airline at an airport does not always reflect the scale of its operations, since a single seasonal route counts in the same way as a year-round base unless intensity measures are applied. Moreover, the econometric framework captures correlations in passenger volumes but cannot fully isolate causal effects, since airline network decisions could themselves be influenced by local demand conditions, regulatory factors, and State aid measures.

We extend the baseline regressions of passenger volumes by including variables that capture the scale and structure of airline groups. This allows us to quantify the role of airline groups as a mechanism through which competition operates.

To analyse the effect of airlines belonging to the same group on the number of passengers, the following log-linear equation is used:

$$\log(\text{Pass}_{iat}) = \beta_1 + \sum_2^4 d_j \beta_j \text{Regional}_{atj} + \sum_5^7 d_k \beta_k \text{Mid-size}_{atk} + \sum_8^{10} d_l \beta_l \text{Hub}_{atl} + \beta_{11} \text{LCC Share}_{iat} + \beta_{12} \text{Airport_Type}_{ia} + \beta_{13} \text{Airline Group}_{ia} + \beta_{14} \text{Airport_Type}_{ia} * \text{Airline Group}_{ia} + \omega_r * \omega_t + \epsilon_{iat}, \quad \text{Equation 4.5}$$

where the dependent variable Pass_{iat} denotes the number of passengers at focal airport i in area a at time t , where t is a year-quarter within 2014–2023. The key independent variable is $\text{Airline Group}_{ia}$, which is a dummy set to one if there is an airline group present in airport i .¹⁴² This dummy is interacted with a dummy Airport_Type_{ia} , which denotes whether the focal airport i is regional, mid-size or hub.

The control variables are:

- The variables Regional_{atj} , Mid-size_{atk} and Hub_{atl} represent the number of passengers at rival airports of different types (regional, mid-size, hub) within distance d , d_j, d_k, d_l at distance bands, 0–100 km, 100–200 km, and 200–300 km, or travel times, 0–60 min, 60–120 min, and 120–130 min.
- LCC Share_{iat} is the share of LCCs at the focal airport i in year-quarter t .
- ω_r are NUTS 3 region fixed effects.
- ω_t are year-quarter fixed effects.
- ϵ_{iat} is the error term.

The regression controls for the share of LCCs at the focal airport, as the presence of LCCs generally increases demand. Moreover, this variable also helps absorb airport-specific effects, acting as a proxy for airport fixed-effects.

Regional airports and hub airports (with and without the group) are compared to mid-size, non-group airports, which serve as the reference group.¹⁴³ The results in Table 4.13 show that being part of a group has a significantly positive effect on the number of passengers. The interaction terms are positive and significant. This indicates that airline groups strengthen the position of both hub and regional airports, but the effect is much stronger at hubs than at regional airports.

¹⁴² The Team performed desk research to identify airline networks. These have been linked to airports using <https://www.eurocontrol.int/directory/airline-groups-lookup>.

¹⁴³ Because the dependent variable is the log of passengers, we exponentiate each coefficient (using $\exp(\beta)$) to obtain the multiplicative effect on passenger counts.

Table 4.13: Regression results for alliances

Dependent variable: log (total number of passengers)	(1)
LCC Share	3.265*** (0.138)
Focal hub airports	0.141 (0.224)
Focal regional airports	-2.975*** (0.0830)
Airline group	1.004*** (0.0776)
Focal hub * airline group	1.630*** (0.215)
Focal regional * airline group	0.222*** (0.0823)
Rival hub airports:	
100km (number of pax)	-1.67e-07*** (1.33e-08)
100-200km (number of pax)	7.02e-08*** (8.98e-09)
200-300km (number of pax)	2.99e-08*** (6.84e-09)
Rival mid-size airports:	
100km (number of pax)	-6.35e-08** (2.57e-08)
100-200km (number of pax)	-7.09e-08*** (1.44e-08)
200-300km (number of pax)	1.11e-07*** (1.35e-08)
Rival regional airports:	
100km (number of pax)	-2.39e-06*** (1.97e-07)
100-200km (number of pax)	-9.10e-08 (1.13e-07)
200-300km (number of pax)	3.04e-07*** (9.99e-08)
Constant	11.69*** (0.217)
NUTS3 FE	Yes
Year-quarter FE	Yes
Number of focal airports	526
Number of observations	17,125
R-squared	0.787
Adj.R2	0.783
F-Stat	221.6
Prob > F	0

*Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium

4.3.3 Conclusions on the influence of airline and airport groups

Stakeholder consultation indicates a very low to low market impact of airline and airport groups on groups of companies operating on multiple airports, cross-subsidisation between airports within the same group, and cross-subsidisation between airlines within the same group. Data analysis has dealt with the presence of airline groups as a driver of competition between airports. The tested hypothesis is that if airline groups expand passenger traffic at one airport, they increase competitive pressure on other airports located within the same catchment area. The regression results confirm that airline groups seem to amplify the passenger base of regional airports (albeit to a lesser extent than for hubs) and thereby increase competitive pressure on other airports within the same catchment area, with intensity varying by airport type and distance.

5 Impact of COVID-19

This section examines the effects of the COVID-19 pandemic on the financial situation and resilience of airports. It analyses how the pandemic affected airport revenues, indebtedness and cost coverage, and explores the structural adjustments that have since reshaped market dynamics and recovery prospects. The section first provides a literature review describing the magnitude of the shock and the measures implemented in the aviation sector in response (Section 5.1). It then presents stakeholders' perspectives on the scale of the disruption and the effectiveness of the measures adopted in response (Section 5.2). Section 5.3 uses descriptive data analysis to illustrate the evolution of traffic, routes, and profitability between 2014 and 2024. Finally, the concluding Section 5.4 consolidates the evidence presented throughout the section, providing an integrated assessment of the impact of the COVID-19 pandemic on the aviation sector.

Table 5.1 summarises the RQs addressed in this section.

Table 5.1: Mapping of the RQs against sections

Research questions	Section
7. To what extent did COVID-19 impact the financial situation of airports ((i) level of indebtedness, (ii) medium term ability of airports to achieve full operating cost coverage)?	Section 5
32. According to stakeholders, are there any lessons from the COVID-19 pandemic to be considered in the reflection on State aid in this sector?	

Source: Project Team

5.1 Literature review

The COVID-19 pandemic represented the most severe shock in the aviation industry since World War II (IATA, 2020a). Eurostat reports a 73% decline in passenger traffic between 2019 and 2020 in the EU, reverting passenger traffic to 1995 levels (ACI Europe, 2021a). The subsequent crises, such as the war in Ukraine and the energy crisis in the EU, further deepened the industry's challenges. The war in Ukraine has notably impacted European aviation. Airspace closures for EU airlines over Russia, Ukraine, and Belarus have led to longer flight times and increased costs, particularly affecting routes between Europe and Asia (Chu et al., 2024).

A full recovery of passenger traffic in the EU was recorded in 2024, with levels 1.8% higher than pre-pandemic 2019 figures (ACI Europe, 2025). The recovery has been driven by international traffic, while domestic traffic has remained below 2019 levels (-6.3%), largely because of the shift to HSR for domestic travel (ACI Europe, 2025). Despite the overall growth in passenger traffic, small airports (with less than 1 million ppa), remained at -34.5% below 2019 levels in 2024 (ACI Europe, 2025). Furthermore, freight traffic stood at +11.8% in 2024 compared to 2019 levels (ACI Europe, 2025). In terms of the number of flights, 2024 closed at 96% of 2019 levels, with differences from country to country (Eurocontrol, 2025). Southern European countries, notably Spain and Italy, experienced significant growth due to strong tourism demand recovery. By contrast, several countries (including Germany, France, and the UK) continued to record fewer flights in 2024 than in 2019.

The following section examines the impact of the COVID-19 pandemic on airports' financial situation and the measures implemented to address the crisis.

5.1.1 Financial situation of airports and measures implemented during the COVID-19 pandemic

IATA (2022) stressed that airports demonstrated greater resilience during the pandemic than both airlines and air navigation service providers, as evidenced by their relative smaller losses during the crisis. Concerning revenues, EC - DG Mobility and Transport (2023), relying on evidence gathered through stakeholder consultations, finds that all airports experienced relatively similar losses, with no clear correlation between the extent of revenue reduction and airport size or type. ACI Europe (2023b) further argues that the variation in airports' losses was primarily driven by heterogeneous national travel restrictions rather than airport size or characteristics.

However, findings on this are mixed. Mueller (2022), in analysing the impact of the pandemic on the European air transport network, finds that non-hub airports were more heavily affected by the crisis. Indeed, during periods of network shrinkage, airlines focus cuts on non-hub city-pairs and airports mainly operated by LCCs are more easily disconnected from the network with respect to those operated by FSCs, hence relatively more affected. The European Parliament (2021) highlights how regional airports, mainly relying on international tourism traffic, experienced the greatest challenges during the pandemic. At the same time, Oxera (2024) conducted an analysis of air traffic and profitability based on a small sample of 14 airports and found that regional airports experienced a quicker recovery from the crisis, primarily driven by the partial restoration of leisure and intra-EU traffic after the easing of travel restrictions. However, the recovery of the smallest regional airports was far slower.

The EC - DG for Mobility and Transport (2023) study presents insights regarding the financial impact of the pandemic on airports. The crisis impacted significantly both aeronautical and non-aeronautical revenues. However, aeronautical revenues, which are strongly linked to traffic volumes, have been hit relatively more, while non-aeronautical revenues, being often secured through concession contracts, have experienced a relatively smaller decline. As regional airports are less able to rely on non-aeronautical revenues, they suffered a relatively larger decline in turnover than larger airports.

Additionally, the pandemic has not affected all the sectors in the same way: freight traffic at EU airports declined far less than passenger traffic and, in specific cases, even increased. For instance, Liège Airport experienced a growth in freight activity, as reported by European Parliament (2021).

Several measures have been adopted by airports to face the crisis. EC - DG for Mobility and Transport (2023) finds that to contain negative effects of COVID-19, airports took measures to reduce operating costs, mainly limiting staff costs (often thanks to furlough schemes implemented by Member States), though in the short term they have only limited options available to do so. Additionally, they postponed planned capital expenditures.

EC - DG for Mobility and Transport (2023) further explains how airports also implemented liquidity preservation measures, increasing the proportion of cash held relative to operating expenses. Additionally, airports raised their debt during the pandemic, apparently independently of their characteristics. The pandemic impacted airport credit ratings only to a limited extent and less severely compared to airlines, hence no stakeholder raised concerns on the sustainability of these debts.

Lastly, the voluntary initiatives started by airports and airlines for net carbon zero, in the context of the Green Deal and the Fit for 55 proposals, already represented a considerable size and challenge in green investments. The pandemic increased the financial burden on airports' ability to sustain such investments. According to EC - DG

for Mobility and Transport (2023), postponed investments will likely still take place, albeit later than planned.

5.1.2 Effects of the pandemic in the aftermath period

Beyond the temporal disruption caused, the pandemic has significantly transformed key aspects of the aviation sector, and some of these changes may be permanent. According to ACI Europe (2023b), LCCs, and especially ultra LCCs¹⁴⁴, have expanded their market share, thereby potentially increasing their bargaining power in negotiations with regional airports. Both ACI Europe (2023b) and Oxera (2024) highlight how the pandemic has shifted passenger traffic toward leisure and Visiting Friends and Relatives (“VFR”) travel¹⁴⁵, accompanied by a substantial decline in business travel, which is expected not to return to pre-pandemic levels (Julsrud & Kallbekken, 2025). Leisure traffic is characterised by a higher degree of seasonality, thus increasing this source of stress for airports’ revenues.

During the pandemic, many airports offered (additional) incentives to airlines, through discounts on airport charges. This trend is described by Oxera (2024), which finds that consulted airports expect these incentives to remain consistently higher than pre-pandemic ones. One airport explains this emerging trend as generated by the higher bargaining power of LCCs with respect to regional airports. According to EC - DG for Mobility and Transport (2023), smaller airports aiming to attract airlines and stimulate traffic might maintain low airport charges or offer discounts, whereas larger airports, especially those requiring significant investments, are more likely to raise charges, potentially to a substantial degree. ACI Europe (2023b) stresses that this trend of low airport charges together with, as previously discussed, a limited ability to raise non-aeronautical revenues, may harm especially smaller airports.

Oxera (2024) also examines profitability on a per-passenger basis within its sample, finding that most airports do not demonstrate an upward trend in EBITDA per passenger, even when excluding the years 2020 and 2021. While EBITDA per passenger levels are recovering from the pandemic, some smaller airports continue to experience losses that exceed those recorded in the pre-pandemic period. Oxera (2024) concludes that these losses are not solely attributable to the temporary decline in passenger numbers during the COVID-19 pandemic. Instead, airports in the sample themselves recognise facing challenges in gradually improving profitability on a per-passenger basis over time, also in light of the rising operating expenses after the pandemic, mainly due to the energy crisis and the surge in inflation (Oxera, 2024).

5.2 Consultations

Stakeholder survey results indicate that COVID-19 had a pronounced negative impact on airports’ financial situations, both in terms of indebtedness and the ability to achieve full operating cost coverage. For indebtedness, 29% of the 55 responses rated the impact as “to a large extent” and 22% as “to a considerable extent,” while a further 9% noted impacts “to some extent”. Only 4% felt there was no impact at all. Smaller proportions reported more limited effects, with 16% selecting “to a small extent,” and 20% answered “I don’t know”. For cost coverage, the effect was even more marked: 36% rated the impact as “to a large extent”, 22% as “to a considerable extent”, and

¹⁴⁴ An ultra LCC operates like a more extreme version of a standard LCC, offering even lower base fares by further reducing operating costs and unbundling nearly all services – charging extra for baggage, seat selection, and other add-ons.

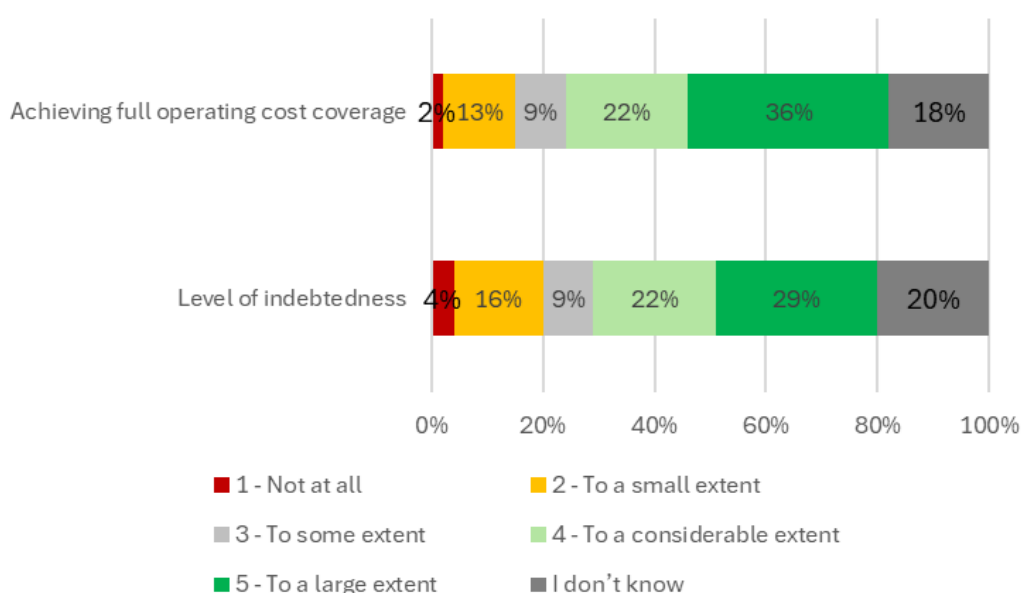
¹⁴⁵ VFR travel refers to trips where the main purpose is to visit friends or family members.

9% “to some extent”. Only 2% felt there was no impact, while 13% selected “to a small extent” and 18% were uncertain.

When looking across types of respondents:

- Airports and airport associations (n=28) reported the most severe effects, with more than half indicating that indebtedness and cost coverage were affected to a large or considerable extent, and only a small minority noting limited impacts.
- Public authorities (n=15) also widely recognised the strain, though views were more diverse: 42% rated the impact as large or considerable, while about one-quarter considered it small or moderate.
- Airlines (n=6) tended to confirm substantial effects too, though with slightly more variation—two-thirds considered the impact on airports’ finances to be large or considerable.
- Broader aviation industry associations (n=6) showed a similar pattern, with half selecting “to a large extent”, while the remainder were divided between “considerable” and “some extent”.

Figure 5.1: To what extent did COVID-19 impact the financial situation of airports?



Source: Stakeholder survey (n=57).

When asked to substantiate their responses, many respondents (mainly local and regional governments, national aviation authorities, and airport industry associations) underlined that passenger volumes remained well below pre-pandemic levels for years, leaving airports unable to reach full operating cost coverage and forcing them to rely on borrowing or State aid to remain operational, especially where fixed costs such as maintenance and staffing could not be reduced.

Several airlines and airport industry associations highlighted that small regional airports were hit hardest, with some governments and national aviation authorities reporting traffic losses of more than 60% during 2020–2021 and still 30–35% below 2019 levels by 2024, underscoring their continued vulnerability. According to an airline and airport industry association, larger airports and those with diversified income streams were

generally seen as more resilient, recovering profitability faster and, in some cases, increasing charges to cover losses.

Contributions to the call for evidence further illustrated these difficulties. An airport association noted that, alongside falling traffic volumes, unit costs to airlines have risen sharply, driven by higher infrastructure fees and national aviation taxes. Two airports reported that declining demand¹⁴⁶ combined with increasing operating costs has directly eroded their profitability, while high debt levels and limited investment capacity now cast doubt on their ability to achieve profitability in the medium-term. Contributions from two public authorities noted that, as a further result of the pandemic, the EU airline market has undergone consolidation and became increasingly concentrated, which has led some smaller regional airports to lose traffic or become increasingly dependent on a limited number of carriers.

Regarding lessons learned from COVID-19, out of 92 respondents in the public consultation, 74% agreed that lessons from the COVID-19 pandemic should be considered in revising the AG, 12% disagreed, and 14% were uncertain. The responses were similar across different types of stakeholders including airports, airlines, public authorities and environmental NGOs.

The 87 detailed written responses obtained in the public consultation reinforced the need for greater flexibility and rapid response mechanisms during crises, the importance of maintaining staff and critical infrastructure, the necessity of State aid to support furlough schemes and operational costs, and the need for simplified and accelerated decision-making processes during emergencies.

Airlines and their associations supported the reintroduction of temporary frameworks to allow faster, more flexible crisis support with clearer eligibility criteria and simplified procedures. They stressed that aid should be targeted to the most affected actors, particularly small regional airports, while maintaining transparency and accountability.

Several airports, in particular airports based in Sweden, advocated for greater flexibility and rapid-response mechanisms in times of crisis. They underlined the importance of maintaining staff, critical infrastructure, and 24/7 readiness, particularly for medical transport and emergency logistics. Airports also highlighted that the COVID-19 temporary framework¹⁴⁷ proved effective in mitigating impacts and called for similar tools in future crises. Several noted that the pandemic exposed financial vulnerabilities of smaller airports and called for targeted aid supporting digitalisation, environmental upgrades, and sustainable recovery.

Several local and regional governments and one ministry stressed regional airports' critical role in connectivity and crisis management, notably for emergency and medical operations. They called for integrating regional airports into national crisis strategies and for simpler, faster decision-making during emergencies. Several national public authorities also pointed to geopolitical risks, such as the war in Ukraine, arguing that

¹⁴⁶ The two airports provided concrete figures: in Germany, passenger traffic remains 11.9% below pre-crisis levels, and flight movements are still 18.7% lower in 2024.

¹⁴⁷ The COVID 19 Temporary Framework refers to the European Commission Communication "Temporary Framework for State aid measures to support the economy in the current COVID 19 outbreak" (C(2020) 1863 final, adopted on 19 March 2020 and subsequently amended). The Framework allowed Member States to provide rapid liquidity support, compensation for exceptional occurrences and other targeted measures to affected sectors, including airports and airlines. More information available at: https://competition-policy.ec.europa.eu/state-aid/coronavirus/temporary-framework_en.

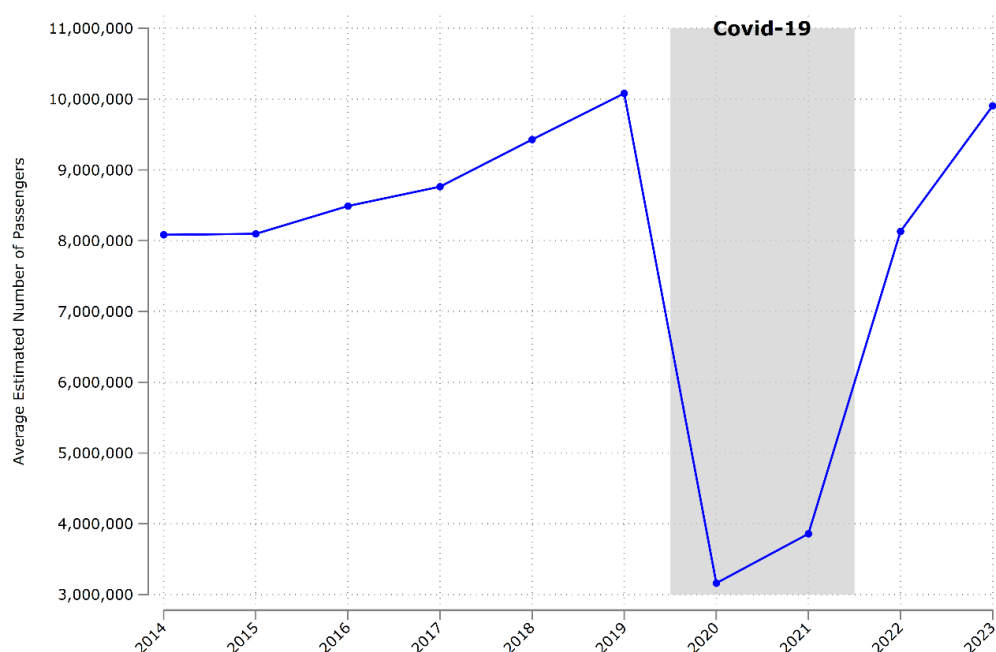
security and regional cohesion considerations should be explicitly reflected in the AG, given the overlap between civil and defence infrastructure.

5.3 Data analysis

The COVID-19 pandemic created an unprecedented collapse in air travel, with passenger numbers dropping dramatically in 2020 and only partially recovering in 2021. The purpose of this section is not to test a formal hypothesis, but to illustrate—through descriptive evidence—the scale and timing of this shock across regional and hub airports. The guiding question is whether regional airports experienced different patterns of decline and recovery compared to larger hubs, and how these patterns fit into the broader economic effects observed in other parts of the report, which also show trends around the COVID-19 years.

The COVID-19 years 2020 and 2021 stand out across all descriptive statistics presented in this report. In terms of traffic, the sharp decline is clearly visible in Figure 5.2. Passenger volumes on flights to and from the EU, Türkiye and the UK fell to almost 3 million (a decline of around 70%) and then recovered only gradually during 2021. By the end of 2022, traffic volumes had returned close to their pre-COVID-19 levels. As regards route structure, Figure 5.3 shows that the total number of routes had already returned to pre-COVID-19 levels in 2023 (and see Annex E.1.3 for a focus on LCCs).

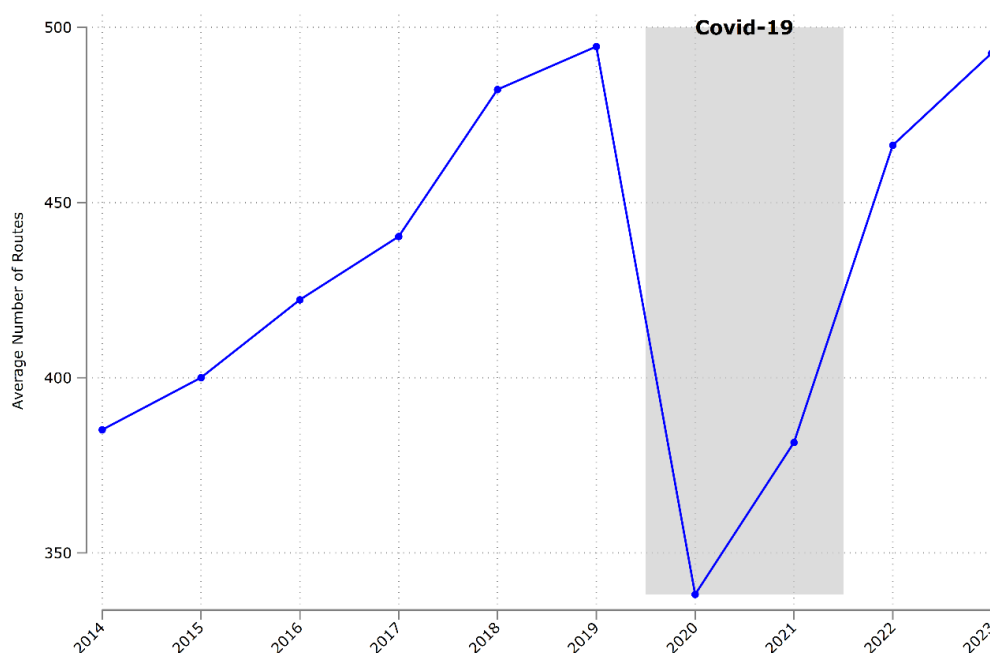
Figure 5.2: Passenger volumes on flights to and from the EU, Türkiye and the UK across all airports



Note: Averages are calculated across airport-year, weighted by route within each airport.

Source: Project Team based on Cirium

Figure 5.3: Average number of routes across all airports in the EU, Türkiye and the UK



Note: Averages are calculated across airport-year, weighted by route within each airport.

Source: Project Team based on Cirium

Table 2.5 shows that the proportion of cost-covering regional airports that were surveyed for the purpose of this Study declined to 19% in 2020 and 37% in 2021, compared to around 50%-60% in most other years; the proportion recovered to around 54% in 2024. In the scatterplots of Figure 2.4 and Figure 2.5, 2020 and 2021 also appear as clear outliers: higher passenger numbers were associated with more negative EBITDA, the inverse of the normal relationship.

The descriptive statistics on airlines reinforce this picture. Table E.11 (Annex E.1.3) shows that the number of active airlines fell temporarily in 2020 and 2021, before recovering again in 2022 and 2023. The share of LCCs remained broadly stable throughout, around 10%-15%, suggesting resilience of this business model despite the pandemic shock. Table E.10 and Figure E.5 document that several bankruptcies occurred during the crisis, including carriers such as Montenegro Airlines, Ernest Airlines, Norwegian units, and Air Antwerp, highlighting the pressure on smaller or less diversified operators (but not only, as also Air Italia went bankrupt during that time).

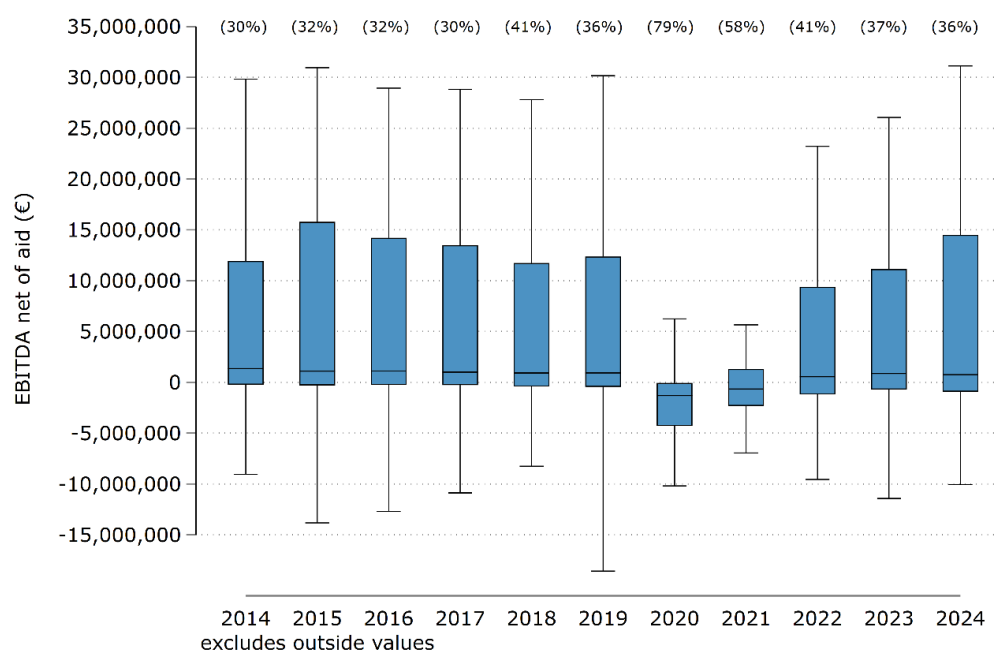
Descriptive survey data reported in Annex E.4.3 confirms that over 80% of regional airports faced negative EBITDA in 2020, illustrating the widespread financial stress during the crisis.

Figure 5.4 shows the evolution of EBITDA (net of aid) for all surveyed airports between 2014 and 2024.¹⁴⁸ Prior to 2020, EBITDA values were generally positive, with a wide interquartile range but a median close to or above zero, indicating that many of the surveyed airports were profitable. In contrast, during the COVID-19 years (2020–2021),

¹⁴⁸ Note that in this section the analysis takes into account all surveyed airports. For a focus on regional airports refer to Section 2.2.3 (e.g. see Table 2.5 where loss making regional airports are a larger share).

the boxplots shift significantly downwards, with the median EBITDA becoming negative and the distribution much narrower, indicating a limited variance across airports. Airports, however, recovered rather quickly post-COVID in the sense that the patterns in the years after COVID-19, resemble the pre-COVID years (we note again that the survey is not representative though).

Figure 5.4: Yearly distribution of EBITDA net of aid for all surveyed airports



Note: the numbers in parentheses indicate the percentage of unprofitable surveyed airports, measured by EBITDA net of aid. Extreme values lying outside the interquartile range have been excluded in order to present a clearer view of the yearly distribution.

Source: Project Team based on Survey data

Taken together, the descriptive evidence shows that 2020 and 2021 represented a systemic shock for the aviation sector. Traffic collapsed, profitability turned strongly negative, and a number of smaller airlines exited the market. At the same time, operational quality improved temporarily due to reduced congestion. From 2022 onwards, a partial to near-full recovery can be observed.

5.4 Conclusions on COVID-19

The literature review indicates that regional airports were hit harder by the pandemic than larger airports due to their reliance on leisure travel. However, they generally rebounded more quickly, though this recovery was slower for smaller regional airports. The post-pandemic shift from business to leisure travel has increased exposure to traffic seasonality, adding financial pressure on airports, given the lack of stable revenues throughout the year. Also, greening and digitalisation investments were halted by airports during the pandemic to preserve liquidity.

This view is widely shared among stakeholders and confirmed by the data analysis. The consultations highlight that regional and smaller airports were generally negatively affected by the pandemic, particularly due to reduced or increasingly seasonal demand and rising costs.

Descriptive evidence from the data analysis shows that the COVID-19 years 2020 and 2021 represented a systemic shock for the aviation sector, with only a small share of all surveyed airports being cost-covering during these years (19% and 37% in 2020 and 2021 respectively). From 2022 onwards, a partial to near-full recovery can be observed in terms of passenger volumes and operated routes, while the number of flights is still slightly below pre-pandemic levels in 2024. Data on financial performance of airports suggests a return to pre-crisis profitability patterns in 2024). When focusing on the subsample of surveyed regional airports, as in Section 2.2.3, the evolution over time is similar, although the share of loss making airports is greater.

Consulted stakeholders including public authorities, airports, airlines and broader aviation industry associations highlighted that key lessons from the COVID-19 pandemic include the need for more flexible and rapid State aid mechanisms during crises, streamlined decision-making, and targeted support to maintain staff, critical infrastructure, and airport readiness, particularly for smaller regional airports.

6 Air cargo

This section analyses the distinct characteristics of air cargo operations and their implications for airport profitability, investment needs, and State aid policy. While previous sections focused primarily on passenger transport, air freight constitutes an important component of airport activity. The section first provides a literature review on the main structural features of the cargo segment: trends, operational models (pure versus mixed cargo), and key differences from passenger transport (Section 6.1). It also discusses a possible harmonised metric to integrate passenger and freight volumes when assessing airport activity. It then presents stakeholders' perspectives on whether freight operations warrant specific treatment under the AG (Section 6.2). Finally, the concluding Section 6.3 consolidates the evidence presented throughout the section, providing an integrated assessment of the specific characteristics of air cargo operations.

Table 6.1 summarises the RQs addressed in this section.

Table 6.1: Mapping of the RQs against sections

Research questions	Section
30. In what respect do (pure or mixed) air cargo activities differ from passenger air transport (e.g. in terms of profitability, investment needs, regulation etc.)? Can air transport of cargo be treated similarly to the transport of passengers or the mixed cargo-passenger transport? If yes, is there a suitable approach to convert freight and passengers into a common indicator to assess thresholds in the AG	Section 6

Source: Project Team

6.1 Literature review

So far, the focus of this Study has mainly been on analysing how airports compete for passengers and airlines. However, airports also generate revenue from cargo operations, a market which differs significantly from the passenger one.

The air cargo segment has grown substantially over the years: the total freight carried by air globally more than doubled between 1990 and 2015, from almost 20 million tonnes to more than 50 million tonnes (IATA, 2020b). Traditional airlines have seen cargo as a straightforward way to expand their portfolios in response to declining yields in the passenger segment (Asch et al., 2019). Moreover, although only 1% of the total volume of world trade concerns air-cargo, this is oriented towards high value products, resulting in a share of almost 35% of the international trade by value of goods transported (IATA, 2020b). Considering its speed and reliability, typical air cargo goods include pharmaceuticals, perishable goods, electronics, urgent shipments, high-value goods and time-sensitive e-commerce orders (Asch et al., 2019).

Air cargo activities are typically divided into two categories: pure and mixed. The former involves airlines which carry out flights for the sole purpose of transporting goods. The latter refers to transporting goods in the belly space of passenger aircraft. Pure air cargo transport involves more sophisticated processes than passenger transport (Feng et al., 2015). Cargo involves many market players: shippers, freight forwarder, carriers (airlines) and airports.

Key differences, from the point of view of both airlines and airports, between pure air cargo and passenger transport are explained in Feng et al. (2015):

- Higher uncertainty for airlines in terms of capacity availability. While for passenger transport the risk of reservations being cancelled is typically quite modest, many bookings in air cargo are cancelled, rebooked, and cancelled again. Cargo operations

require flexibility; hence airlines typically do not charge for changing reservations, implying high volatility in the process.

- Higher complexity in capacity forecasting. Passenger transport capacity is measured simply by the number of seats available for an equal number of passengers. In air cargo transport, capacity depends on the volume and weight of freight, as well as the types of containers used, making capacity management more complex.
- Higher flexibility, as air cargo carriers are more flexible in using the air network. While, for passengers, indirect flights and too many transits are costly and often unacceptable, cargo activities can flexibly adapt to the available network and freight can be transhipped via several intermediate airports from the origin to the destination to meet the delivery time.

Some studies (e.g. Coto-Millán et al., 2016; Oum et al., 2006) have highlighted that airports with a higher share of air cargo activities tend to be more efficient/productive. For example, Coto-Millán et al. (2016) measure the efficiency levels of 35 Spanish airports over the 2009-2011 period and, using a regression, illustrate that the proportion of cargo traffic over total traffic, predicts higher efficiency levels of airports.¹⁴⁹ There are at least two possible explanations for this result. First, as explained in Coto-Millán et al. (2016), cargo activities are more capital intensive than passenger activities, which pushes up labour productivity. Second, handling cargo generates economies of scope for airports, which increase their efficiency by lowering average total handling costs.

Competitive dynamics between airports in the cargo segment display substantial quantitative and qualitative differences with respect to those in the passenger segment. Bombelli et al. (2020) and Boonekamp & Burghouwt (2017) show that catchment areas for cargo operations are much larger than those for passengers and can extend to 12 hours driving time radius, making competition among airports in this segment potentially fiercer. Moreover, the network of cargo operations is much more concentrated than that for passenger transport, i.e. there are fewer crucial hubs, and a smaller number of airports is involved. This is a consequence of the lower need for direct flights in the cargo segment and the fact that there are entry barriers for airports given that they have to build the necessary infrastructure to handle cargo activities. This last feature makes competition potentially weaker.

Several studies have focused on understanding the factors driving the choice of airports by cargo airlines. Asch et al. (2019) summarize the main characteristics, identified in the literature, that drive the competitiveness of airports with respect to cargo, which are reported in Table 6.2.

¹⁴⁹ DEA is used in this Study to measure efficiency. See Section 2.3.1 for details on this methodology.

Table 6.2: Factors driving the attractiveness of airports for air cargo operators

Category	Factors
Cargo Market Place	- Presence of freight forwarders (companies arranging transport and logistics) - Presence of integrators (logistics companies with their own transport networks) - Presence of wide-body aircraft (used for long-haul cargo capacity) - Presence of full-freighter aircraft (dedicated cargo planes)
Product Differentiation	- Reputation for reliable freight handling - Active marketing and promotion of cargo services - Availability of specialised infrastructure (e.g. cargo handling equipment, storage)
Territory	- Strategic location (close to production or distribution hubs) - Strong local demand for air cargo services
Airport Operations	- 24/7 operational capabilities - Competitive operating costs - Sufficient airport capacity to handle cargo - Good connectivity (air routes and airline networks) - Easy accessibility (via highways, rail, and other transport links)

Source: Asch et al. (2019)

Kupfer et al. (2016) perform an experiment based on interviews of 26 airlines carrying out air cargo activities in Europe in 2011. Although the evidence from this study is dated and the relative importance of the different factors may have evolved over the last 15 years, this study still gives a flavour of the main variables affecting cargo airlines' choices. Interviewed airline managers are asked to simulate the choice of an airport from a list. For each airport, some key characteristics are displayed. The choices made by the interviewed managers are then analysed to identify the most important factors driving them. Five main factors are identified as the most important ones: the presence of forwarders in the airport, the experience of airports with cargo activities, airport charges, origin-destination demand and the absence of night-time flight restrictions. Origin-destination demand concerns airports which do not act as hubs, but are rather fully dependent on the local market, both in terms of supply of goods (origin) and demand of goods (destination). It is important for these airports to be located close to an economic cluster. One example is Milano Malpensa. Interestingly, the marginal utility of having no night-time restrictions is much higher for carriers which typically fly to regional airports than for those who serve main airports. Likely, this is because these airlines are generally smaller, with a smaller network and thus lower flexibility: night-time flights are essential for optimising their operations and their network configuration. Furthermore, it makes it easier for them to deal with possible delays due to e.g. extra-maintenance. Also, the importance of the presence of forwarders is highly heterogeneous across airlines.

When considering the environmental impact of air travel, there are subtle distinctions between cargo and passenger operations. Cargo aircraft tend to be older because they are flown less frequently each day, allowing airlines to use them for longer before replacing them (EASA, 2025). Older planes are generally less fuel-efficient, which can result in higher greenhouse gas ("GHG") emissions for cargo transport. Additionally, cargo operators often prefer to schedule flights at night. This operational preference can lead to increased noise pollution during the most sensitive hours for communities.

Air cargo activities are often viewed as a way to boost underutilised regional airports. This topic is explored by Babagolzadeh et al. (2022), for Australia, where air cargo activities play a larger role compared to other countries due to its geographic isolation, vast size, and dispersed population centres. The authors analyse different subsidy schemes that can be used to move air freight from large metropolitan airports to regional airports. This shift would be expected to reduce congestion at the main airports, leading to efficiency gains for airports and carriers as well as reducing pollution in densely populated areas. Furthermore, since half of regional airports in Australia do not break-even and receive public support, incentivising the volume shift toward them can boost their revenues and reduce the need of existing operating subsidies. The analysis shows that, absent a subsidy scheme, air cargo carriers prefer using main airports for

logistics reasons. On the contrary, it is shown that several types of public subsidy schemes could efficiently achieve the objective of the shift to under-utilised regional airports.

Since airports combine passenger and cargo activities, it is sometimes necessary to employ a common indicator to measure the effective size of an airport. A widely accepted method to combine passenger and freight traffic into a single indicator is the Workload Unit ("WLU"). One WLU is equal to one passenger or 100 kilograms of freight, allowing for a standardised assessment of airport activity (ACI, 2021). For example, Adolfo Suárez Madrid-Barajas Airport, Spain's busiest airport, recorded in 2024 a total of 66,196,984 passengers and 766,818 tonnes of freight movement. The two figures combined imply a total of approximately 74 million WLU.

6.2 Consultations

In the stakeholder survey, stakeholders were asked about the extent to which (pure or mixed) air cargo activities differ from passenger air transport. Among the 44 survey respondents, a clear majority (73%) answered "Yes", indicating that they perceive significant differences between the two segments. A small minority (5%) responded "No", suggesting they do not see substantial distinctions. Meanwhile, nearly a quarter of respondents (23%) selected "I don't know", highlighting some uncertainty or lack of direct experience with cargo operations. Results are similar across different types of stakeholders, including airports, airlines and public authorities, with the majority agreeing that air cargo activities differ from passenger air transport.

When asked to substantiate their responses, respondents who considered cargo activities distinct from passenger air transport (almost all broader aviation industry respondents and half of the public authorities) pointed to several important differences.

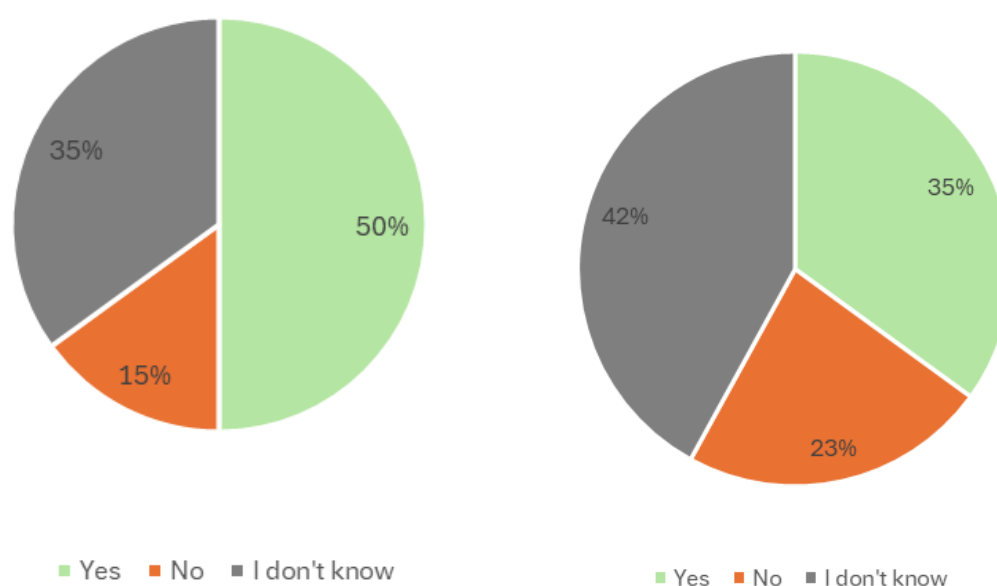
- An airline and a regulatory body highlighted that cargo profitability is strongly linked to global trade cycles and can be more volatile, yet in times of high demand (e.g. during the pandemic or e-commerce growth) it can also be highly profitable.
- Two regulatory bodies, several airport industry associations as well as an airline discussed that cargo operations typically require dedicated infrastructure such as freight terminals, sorting facilities and multimodal connections, as well as specialised aircraft and handling procedures.
- Two regulatory bodies and an airline noted that the regulatory requirements also differ, particularly around customs, safety, and the transport of dangerous or high-value goods.
- An airport industry association emphasised that cargo tends to be concentrated in a few large hubs, which necessitates significant investment but also limits flexibility.
- An airline, two industry associations and a regulatory body noted differences in the business model: passenger services are consumer-oriented, while cargo transport is primarily business-to-business, with more flexible schedules, frequent night operations and a higher degree of footloose competition between airports.

Together, these observations reinforce the perception that air cargo has distinctive dynamics, investment needs and regulatory challenges compared to passenger aviation.

Regarding views on whether the AG should foresee special rules for State aid to freight transport and carriers, in the stakeholder survey (n=40, left), 50% of respondents answered "Yes", supporting the introduction of specific provisions, while 15% said "No" and 35% were uncertain. In the public consultation (n=91, right) only 35% agreed on the need for special rules, while 23% opposed, and the largest share (42%) selected "I don't know". When it comes to the responses by the types of stakeholders across both surveys:

- Broader aviation industry associations (n=16) were the strongest supporters, with 65% in favour.
- Airports and airport associations (n=63) and public authorities (n=36) showed moderate support overall, with 40% and 45% favouring the introduction of special rules for freight transport and carriers.
- Half of environmental NGOs (n=4) and citizens (n=4) supported this initiative, while 38% of airlines (n=8) supported the introduction of special rules for freight.

Figure 6.1: Should the AG foresee special rules for State aid to freight transport / carriers?



Source: Left to right – stakeholder survey (n=40) and public consultation (n=91)

When asked to substantiate their responses, across comments, respondents stressed that freight has distinct economics and operations from passenger traffic. Cargo demand is tied to global trade cycles and crisis shocks, relies on specialised infrastructure (warehousing, cold-chain, screening, express sorting), and often flies at night or on variable schedules. Supporters of potential special rules for State aid to freight transport (ministries, a civil aviation agency and an airport) noted structural features that raise unit costs on thin routes e.g. one-way flows and “empty legs,” especially to ORs or remote regions as well as importance of freight transport to global trade cycles, crisis situations, and supply chain resilience, thus, overall justifying the introduction of special rules for State aid to freight transport under AG. By contrast, opponents of introducing specific State aid rules for freight transport, including several airports, two broader aviation industry associations, and national authority, cautioned that air cargo activities are highly concentrated at large hub airports where operations are often commercially viable without public support. They argued that freight markets are more footloose, exposed to strong inter airport and intermodal competition, and able to relocate relatively quickly in response to incentives, thus, overall, not requiring blanket support.

For a State aid approach, airports and airport associations and regional public authorities suggested objective eligibility indicators and performance conditions rather than broad exemptions. Examples included:

- Freight-specific traffic bands (e.g. minimum annual tonnage, with higher aid intensities for smaller operations below set thresholds and safeguards above high-volume levels), WLU (treating 100 kg freight $\approx$ 1 passenger for handling effort), and essential-connectivity criteria for remote or strategic routes.
- Several airports favoured a funding-gap test to evidence industry failure, time-limited support with periodic reviews, and non-distortion safeguards (open, non-discriminatory access). The idea was that support should only be granted where an applicant can demonstrate that the expected revenues over a defined period fall short of covering operating and investment costs necessary to launch or sustain cargo operations.
- Airports and airport associations suggested green Key Performance Indicators ("KPIs") including CO₂ per tonne-km reductions, minimum sustainable aviation fuel ("SAF")¹⁵⁰ shares, uptake of low-emission ground assets, and energy-efficiency gains in warehouses. Suggested conditions to access aid included traffic or workload thresholds (e.g. tonnes handled or WLUs), the same environmental KPIs such as CO₂ reductions or minimum SAF use, and essential-connectivity criteria for remote or time-critical routes (which may work as aid conditionalities).
- By contrast, a contribution from an environmental organisation contributing to the call for evidence pointed out that intra-EU air freight generates up to 25 times higher GHG emissions per tonne-km than trucking. It argued that cargo operations often benefit from cross-subsidies (where passenger revenues or State aid indirectly cover the costs of freight through underpriced cargo fees) and should therefore not be eligible for State aid, particularly in cases where efficient road or rail alternatives exist.

Overall, the consultation reveals mild support for freight-specific State aid rules, relatively higher among airports and broader aviation industry associations, while public authorities, NGOs and citizens were more cautious or divided. The results suggest that any future revision would need to be carefully targeted, with objective eligibility criteria and safeguards to avoid overcompensation. Most respondents agreed that special rules could be justified where freight services are essential for resilience, regional cohesion, or decarbonisation, but there was little appetite for a broad or unconditional aid regime.

Box 6.1: Insights from case studies on the specificities of air cargo competition

Competitive dynamics in the international cargo market

Evidence from the cargo airport case study, conducted with a regional cargo airport, a cargo airline, and a regional authority, shows that regional cargo airports compete through the provision of specialised services, such as the availability of night flights and sufficient infrastructure capacity to accommodate freighter fleets and associated logistics. Night operations are considered a decisive competitive advantage, particularly for express freight and e-commerce, where delivery times are critical. The absence of night flight bans at certain regional airports allows them to capture significant volumes of freight that are displaced from larger airports which are subjected to stricter restrictions.

¹⁵⁰ *Alternative and non-conventional (fossil derived) fuel reducing CO₂ emissions from air transportation.*

The cargo airport and airline interviewed highlighted that competition in the cargo market is inherently international, with airports located in different countries often considered substitutes. Airlines select airports based on infrastructure availability, cost structures, and regulatory conditions rather than geographical distance alone. In this context, multimodal integration is a central determinant of competitiveness.

Different airline business models also shape the infrastructure requirements of airports. Smaller regional airports often attract airlines seeking lower cost structures, including reduced airport charges, lower staffing costs, fewer noise taxes, and streamlined infrastructure. However, these advantages can be offset by the limited ability to support more complex logistics operations when compared to large hubs.

Catchment area definition

The evidence gathered through the case study suggests that the current definition of catchment area based solely on distance and travel time is unsuited for cargo activities. Cargo demand is driven primarily by factors such as time sensitivity, specialised handling requirements, access to logistics infrastructure, and total transport costs. Cargo hubs often rely on long-distance road feeder services that extend beyond typical catchment definitions applied for passenger operations.

Structural financial challenges

The case study also highlights structural financial challenges faced by regional cargo airports. Over-reliance on a single major airline emerges as a significant vulnerability, particularly given its high bargaining power and the difficulty of diversifying demand.

Long-term fixed-price contracts without adjustment mechanisms exacerbate these financial pressures. While such contracts are designed to mitigate investment risk, they constrain airport profitability when cost conditions worsen, as prices cannot be adapted to reflect operating or opportunity costs.

Airports located in regions with limited passenger demand (due to modest local income levels and high price sensitivity among passengers) also face difficulties in developing belly freight operations. In addition, smaller airports frequently lack the infrastructure and skilled staff required for high-value cargo operations, making it challenging to attract major freight forwarders.

Impact of COVID-19

While cargo operations proved essential during the COVID-19 pandemic supporting the large-scale transport of medical equipment, vaccines and other time-sensitive goods, this activity did not compensate for the collapse in passenger traffic. Stakeholders underlined the importance of “green lanes”¹⁵¹ for essential cargo and personnel, temporary authorisation waivers for non-EU charters, and harmonised rules emergency contexts.

¹⁵¹ border crossings open to all freight vehicles carrying goods where any checks or health screenings should take no more than 15 min.

Investment needs and the role of aid

Both the cargo airport and the airline emphasised that cargo operations require substantial, highly specific investments, in order to run efficiently and to attract new airlines. These investments are particularly important for smaller regional airports, where the establishment and expansion of cargo activities can generate stronger regional economic impacts than passenger traffic by linking local economies to global supply chains. Cargo airports thus create direct employment through airlines and freight forwarders, as well as indirect impacts on surrounding firms, manufacturers, and other businesses that integrate airport services into their supply chains. Clustering effects, in which logistics providers and related businesses co-locate near airports, amplify these benefits.

Priority investment areas identified include cargo handling infrastructure, compliance and security requirements for critical infrastructure, and environmental measures to reduce emissions, placing financial pressures on airports. The cargo airline stressed the importance of supporting airports through public funding for decarbonisation-related infrastructure. Both airport and airline argued that State aid for such projects should ultimately be passed on to users to reduce operating costs and strengthen competitiveness.

Stakeholders emphasised that greater harmonisation of customs rules would support international cargo growth, while more consistent public compensation of non-economic public remit obligations would level the playing field across Member States. Without such measures, some regional airports may face competitive disadvantages compared to peers in jurisdictions with more permissive support arrangements.

Finally, both the cargo airport and regional authority expressed concerns regarding the current AG. They noted that the framework lacks clarity on the eligibility of cargo-specific activities for aid and that the current rules may not sufficiently reflect the strategic role of cargo in economic development. The three-year limit for start-up aid is considered insufficient, as new routes often take longer to become profitable. The local authority advocated broadening the scope of eligible costs to include variable costs and operating losses in the initial years of operation. Both also call for raising aid thresholds to reflect the growing economic contribution of regional airports.

6.3 Conclusions on air cargo

Air cargo activities differ markedly from passenger air transport in several respects: this view emerges unambiguously from the available literature and is widely shared among stakeholders.

Regulatory bodies, several airport industry associations as well as an airline highlighted that cargo operations require dedicated infrastructure and therefore costly investment; they are subject to specific regulatory requirements; profitability is more volatile and more sensitive to the global trade cycles compared to passenger services. Moreover, the preferences of cargo customers dictate more flexible schedules and frequent night operations, which relatively few airports are able to accommodate due to regulatory constraints. Cargo flights are more flexible in routing and scheduling as goods can be transhipped via several intermediate airports. In contrast, passengers are less tolerant of indirect routes and long layovers. Stakeholders interviewed for the case studies suggest that profit margins from cargo can be thin or negative at both small and large scales; and that this is even more relevant for remote regions and OR, where unit costs are higher due to one-way flows and “empty legs”, limiting the economic viability of operations in these areas.

This results in very different competitive dynamics compared to passenger services. For passenger services, airports act as platforms in two-sided markets, seeking to attract

both airlines and passengers, which is not the case for cargo, where airports primarily need to attract airlines. The catchment area approach would appear to have no relevance for cargo, as competition between airports takes place at a much larger geographic scale: cargo customers attach value to time sensitivity, specialised handling needs, road access and proximity to logistics infrastructure; as long as these needs are met, they can be flexible in their choice of airport, adapting the rest of their logistics chains accordingly, and taking full advantage of inter-modality. In this way, airports located hundreds of kilometres away can end up competing to secure the same long-term cargo customer.

Following the literature, mixed cargo generates economies of scope when combined with stable passenger traffic flows, while pure cargo operations benefit to a lesser extent of such advantages. Therefore, in presence of spare capacity or of stable passenger flows, expanding pure/mixed cargo operations may be desirable, but both require heavy investments, in the face of a more flexible and volatile demand and of competitive pressures over longer catchment distances from other airports and modes of transports (and thin profit margins based on evidence from the case studies).

Coming to the scope of State aid in cargo, a granting authority interviewed in the case studies stressed the importance of public support to redeploy a logistic infrastructure following a structural change in cargo demand, and for decarbonisation-related infrastructure investments, taking into account the relevance of the airport for the regional economy. The stakeholder consultations, on the other hand, reveal non-majority support for revising the AG to introduce freight-specific State aid rules which may distort competition. Most respondents agreed that special rules could be justified where freight services are essential for resilience, regional cohesion, or decarbonisation, but there was no call for a broad or unconditional aid regime.

Last, the literature has identified a metric – WLU – to combine passengers and cargo volumes, based on a constant ratio, into one metric, mostly apt to capture capacity utilisation. However, the fundamental differences between cargo and passenger services, based on the available evidence, would not support a joint evaluation of passenger and cargo activities for the purpose of assessing thresholds in the AG using simple metrics such as conversion ratios, as their relationship to profitability is likely more heterogeneous.

7 Greening of aviation

This section analyses how airports and airlines are addressing environmental and climate challenges and how the AG could better support the sector's transition toward decarbonisation. The section first assesses how environmental concerns are currently addressed within the aviation industry, with particular attention to decarbonisation pathways, the deployment of SAF, and technological innovation in aircraft and ground operations and considers stakeholders' perspectives on whether the current State aid framework provides sufficient support for the sector's green transition, or whether additional instruments are required (Section 7.1). The section then examines how environmental performance is measured and verified, reviewing both mandatory and voluntary reporting frameworks (Section 7.2). The final parts of the section extend the discussion to the spatial and modal dimensions of aviation's environmental performance. They assess the potential environmental effects of redistributing flights between hub and regional airports (Section 7.3), and analyse how improved intermodality (particularly between air transport and HSR) could contribute to reducing overall emissions and other externalities (Section 7.4).

Table 7.1 summarises the RQs addressed in this section.

Table 7.1: Mapping of the RQs against sections

Research questions	Section
22. (i) How do airports and airlines currently address environmental concerns, such as carbon emissions, noise pollution, and other types of environmental impact?	Section 7.1
23. The current AG do not provide for specific aid measures to mitigate airports' and airlines' impact on climate and the environment. According to stakeholders, beyond the existing possibilities offered in particular by the CEEAG and RDI State aid guidelines, would there be a need for additional tools/incentives to promote the decarbonisation of the aviation sector under the revised AG in order to reach applicable climate targets?	
22. (ii) Are there any industry standards or best practices to measure airports' actions and if so, what are these?	Section 7.2
24. How can the environmental performance of airport and airlines be assessed? How can compliance with possible green conditionality of State aid measures be ensured?	
2. To what extent do regional airports contribute to (iii) combatting traffic congestion of major EU hub airports?	Section 7.3
27. Does distributing flights between hub airports and regional airports have an overall positive environmental impact?	
25. What is the competitive impact of State aid to airports on other modes of transport, such as high-speed rail?	Section 7.4
26. If the AG include specific provisions to allow support in favour of intermodality, would this be effective in order to decrease overall emissions and other negative externalities?	

Source: Project Team

In 2019, aviation was responsible for about 2.4% of global annual carbon emissions and is estimated to have contributed to 4% of total observed human-induced global warming (Klöwer et al., 2021). Total CO₂ emissions produced by aviation increased steadily over the last century and even faster over the last 10-20 years, despite a drop in the pandemic years (Bergero et al., 2023). Furthermore, for reasons that will be explained below, the aviation sector is one of the hardest to decarbonise (IATA, 2024; Ritchie, 2024), hence its global emissions share is projected to increase dramatically, as other sectors will start to decarbonise in the next decades. For instance, "in 2022, the

Intergovernmental Panel on Climate Change¹⁵² 6th Assessment Report noted that immediate, rapid and large-scale reductions in GHG emissions are needed to limit warming to 1.5°C and that the aviation sector is still in the earlier stages of adaptation to increased climate hazards” (EASA 2022, p. 11). Beyond the effect on global warming, the environmental impact of aviation includes noise pollution, air pollution and waste production, among others.

Reducing the overall environmental impact of aviation requires coordinated action by several stakeholders, primarily airlines, airports, aircraft manufacturers, and air traffic network managers. Most of GHG emissions of the aviation sector come from fuel burn (i.e. in-flight emissions), while airport operations only contribute marginally to the GHG emissions of the sector. The main obstacle to full decarbonisation of aviation has to do with the design of aircraft engines. Unlike other means of transport (e.g. cars), for which electrification is feasible and well underway, decarbonisation of airplanes poses huge technological challenges. As explained in IATA (2024), three main factors constrain aviation’s options to mitigate its climate impact:

- aircraft have long service lives, hence the fleet renewal process is slow and long-lasting;
- aircraft have long development cycles, further delaying the implementation of technological advancements;
- aircraft can only function with energy storage solutions that can provide high energy-to-weight ratios.

Nonetheless, as will be discussed below, there are viable and economically feasible pathways to decarbonisation (Timmons & Terwel, 2022). While the Fit for 55 package does not establish aviation-specific GHG emission reduction targets, it introduces measures—such as the Regulation (EU) 2023/2405 of the European Parliament and of the Council of 18 October 2023 on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation), which sets targets for the uptake of SAF that are expected to contribute to emission reductions in the sector. In addition to regulatory developments, the aviation industry has launched its own voluntary initiatives. Notably, five major European aviation stakeholder associations – representing aircraft manufacturers, airlines, airports, and air navigation service providers – collaborated to launch the Destination 2050 initiative. This initiative aims to reduce net CO₂ emissions from intra-European flights by 55% by 2030 (compared to 1990 levels) and to achieve net zero CO₂ emissions for all flights within and departing from the EU by 2050, aligning with the broader climate objectives outlined in the EU's Fit for 55 framework (Royal Netherlands Aerospace Centre & SEO Amsterdam Economics, 2021).

As explained by European Regions Airline Association (2020), the strategy followed by the airline sector to reduce in-flight emissions can be summarised by the following key actions: (i) increasing the use of SAF, (ii) improving technology, (iii) enhancing infrastructure and operations and (iv) implementing market-based measures such as the EU’s Emissions Trading System (“EU ETS”).

SAF are renewable or waste-derived fuels designed to replace traditional jet fuel, reducing GHG emissions while maintaining a similar performance. They are widely considered a key enabler for decarbonising the aviation sector, as they allow emissions to be reduced without replacing the existing aircraft fleet or airports’ infrastructure. In this context, the role of airports is relatively limited (the role of airports is discussed in

¹⁵² United Nations body that assesses the scientific, technical, and socioeconomic information relevant to understanding climate change, and options for adaptation and mitigation.

more detail later in Section 7.1), and effective implementation of the regulation requires the collaboration of at least aviation fuel suppliers and aircraft operators. Indeed, SAF can be blended with traditional fuels and used in currently operating engines, making it a near-term, scalable option. Several types of SAF exist, which differ in their level of sustainability, e.g.: biofuels from feedstock, plant-based oil or fat; advanced biofuels produced from wastes and residues; synthetic fuels produced from renewable hydrogen and captured carbon, as well as Recycled Carbon Fuels derived synthetically from non-biological waste. In 2024, SAF accounted for 0.2% of total jet fuel used globally (Reuters, 2024). In 2023, the EU issued the ReFuelEU Aviation (within the Fit for 55 package), aimed at increasing the share of SAF used by aviation. The regulation imposes increasing SAF quotas to be used in fuelling air jets in EU airports: 2% by 2025 and 70% by 2050. Furthermore, it imposes sub-quotas for synthetic aviation fuel (produced from renewable hydrogen and captured carbon): 1.2% by 2030 and 35% by 2050. Despite the fundamental role given to SAF in aviation decarbonisation, some studies have pointed to the uncertainty around their real carbon footprint, e.g. Jeswani et al. (2020), which show that the actual reduction in GHG emissions strictly depends on land-use changes implied by the increased production of SAF: for instance, if forests are destroyed to produce SAF out of corn, the net environmental benefits are debatable. For this reason, SAF production from food and feed crops is not allowed by the ReFuelEU Aviation. Furthermore, several stakeholders point to the current lack of SAF supply necessary to meet EU quotas (Reuters, 2024).

The second pillar of the aviation industry's decarbonisation strategy is based on technological advancements, which play a crucial role in reducing emissions. Airlines are investing in more fuel-efficient aircraft and engines (EUROCONTROL, 2022). In this regard, recently the ICAO Committee for Aviation Environmental Protection, reached an agreement which establishes a comprehensive set of new binding standards for aircraft fuel efficiency, to take effect from 2032, and noise levels for new aircraft, set to come into force from 2029. This new generation of aircraft will be around 35% more efficient compared to 2000 models (EU Commission, 2025c). Furthermore, manufacturers are developing hydrogen and electric propulsion technologies.

Electric aircraft are expected to enter into service for short regional routes, where current technological capabilities and infrastructure requirements are more manageable, in the 2025-2030 period and expand in the short-haul market in the 2030-2040 period. On the hydrogen front, Airbus has revised its ambitious plan to launch a hydrogen-powered, zero-emissions aircraft by 2035. Due to technical challenges and the slow growth of hydrogen infrastructure, the company has extended the timeline by up to a decade, now targeting the late 2030s or 2040s for potential entry into service. Meanwhile, the Alliance for Zero-Emission Aviation ("AZEAA") initiated by the EC has set an ambitious objective: by 2050, between 36% and 68% of intra-EU flights could be operated by hydrogen- and electricity-powered aircraft (AZEAA, 2024). Specifically, AZEAA (2024) predicts that approximately 5000 electric and hydrogen aircraft will be delivered for operating European short routes, leading to a baseline scenario of 12% reduction in CO₂ emissions from short and medium-haul flights.

Eurocontrol (2024) expects small electric aircraft with 9 to 17 seats to enter into service between 2025 and 2030, 30- to 40-seater hybrid -electric aircraft around 2030 and hydrogen-powered aircraft between 2040 and 2050. Furthermore, Eurocontrol (2024) estimates that electric and hydrogen aircraft will constitute between 1.7% and 8.3% of the total number of flights in 2050.

EASA (2025) provides an indicative expected timeline for the expansion of electric and hydrogen aircraft into the different segments of air transport, which is reported in Table 7.2. These new technologies will take time to be operational due to the long lifespan of aircraft (typically around 20-30 years) and the necessary infrastructure to operate these

new types of aircraft (EASA, 2025). Table 7.2 only reports the year by which the technologies are expected to be commercially available, though not necessarily widely used throughout the fleet. For instance, as reported by EASA (2025), H2FLY conducted the world's first piloted flight of a liquid hydrogen powered electric aircraft in September 2023. Other notable examples include ZeroAvia's Dornier 228 test using its prototype engine and Beyond Aero's recent achievement of France's first crewed, fully hydrogen-electric flight. While most attention has focused on fuel cell-powered tests, progress in hydrogen combustion is also evident, with Rolls-Royce, Safran, and GE all completing successful ground trials (EASA, 2025). ATAG (2021) predicts that, by 2060, hydrogen and electricity will account, respectively, for 33% and 3% of the global energy demand of aviation.

Airports will also be involved in this process, by providing the necessary infrastructure for hydrogen fuelling and recharging of electric engines. According to Transport & Environment (2023), the necessary investments in European airports' infrastructure to allow hydrogen fuelling and storage will imply a total cost of approximately €36 billion over the 2025-2050 period.¹⁵³

Table 7.2: Indicative expected timeline of deployment of low-emission aircraft.

Segment	2020	2025	2030	2035	2040	2045	2050
Commuter >> 9–19 seats >> < 60 min flights >> <1% of CO ₂	SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF
Regional >> 50–100 seats >> 30–90 min flights >> ~3% of CO ₂	SAF	SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF	Electric or Hydrogen fuel cell and/or SAF
Short haul >> 100–150 seats >> 45–120 min flights >> ~24% of CO ₂	SAF	SAF	SAF	SAF, potentially some Hydrogen	Hydrogen and/or SAF	Hydrogen and/or SAF	Hydrogen and/or SAF
Medium haul >> 100–250 seats >> 60–150 min flights >> ~43% of CO ₂	SAF	SAF	SAF	SAF	SAF, potentially some Hydrogen	SAF, potentially some Hydrogen	SAF, potentially some Hydrogen
Long haul >> 250+ seats >> 150 min flights >> ~30% of CO ₂	SAF	SAF	SAF	SAF	SAF	SAF	SAF

Source: EASA (2025).

Improving infrastructure and operational efficiency is another important channel through which emissions can be reduced. Air traffic management is largely involved in

¹⁵³ This estimated figure is a total of both capital expenditure and operating expenditure. The calculation includes the incremental costs for building and operating: (i) specialised cryogenic storage, distribution, and fuelling facilities for liquid hydrogen; (ii) on-site liquefaction facilities at airports where hydrogen is delivered in gaseous form. This infrastructure is assumed to be rolled out incrementally across the 100 largest European airports throughout the assessment period.

this process, with the objective of using optimal routes to the largest extent possible and reduce excess emission due to flight inefficiency (EASA, 2022). In this context, the adoption of the Single European Sky 2+ ("SES2+") initiative in 2024 further supports more efficient and integrated airspace management across Europe. We will analyse in more detail below the role played by airports in this process. Furthermore, ReFuelEU Aviation limits the so-called 'tankering' practices employed by airlines to save on fuel costs. They consist e.g. in flying with extra amount of fuel to avoid refuelling in airports where the price of fuel is higher, thus saving on total costs but at the same time increasing carbon emissions.

Market-based measures play a complementary role alongside other strategies in addressing aviation's GHG emissions. Since 2012, airlines operating intra-European Economic Area ("EEA") flights have been included in the EU ETS. This system sets a cap on total emissions across all covered sectors, which decreases over time, and allocates a limited number of emission allowances ("EUAs") that can be traded among regulated entities. The resulting carbon price creates ongoing financial incentives to reduce emissions. Between 2013 and 2023, airlines purchased approximately 206 million EUAs, equivalent to 206 million tonnes of CO₂, contributing to emissions reduction investments in other sectors (EASA, 2025). Fageda and Teixidó (2022) estimate that the EU ETS led to a 4.7% reduction in aviation emissions on regulated routes compared to a counterfactual scenario, amounting to a total saving of 21 million tonnes of CO₂.

Importantly, the allocation of free allowances to airlines under the EU ETS will be fully phased out by 2026. By July 2026, the Commission will carry out an assessment of whether the Carbon Offsetting and Reduction Scheme for International Aviation ("CORSIA") has been strengthened and whether the level of participation in it is sufficiently high. Subject to the outcome of this assessment, the Commission will make a legislative proposal that could revise the scope of the EU ETS and extend it to all flights departing from the EEA, or maintain the current scope. Introduced by the ICAO in 2016 and launched in 2021 with a three-year pilot phase, CORSIA applies to international flights between ICAO member states participating in CORSIA. From January 1, 2026, 130 ICAO member states—including all EU member states—have voluntarily committed to participating in CORSIA (ICAO, 2025). Under the EU ETS Directive, as amended by the Directive 2023/958, CORSIA applies only to flights between the EEA and non-EEA countries, while more stringent emissions measures already apply to flights within Europe.¹⁵⁴

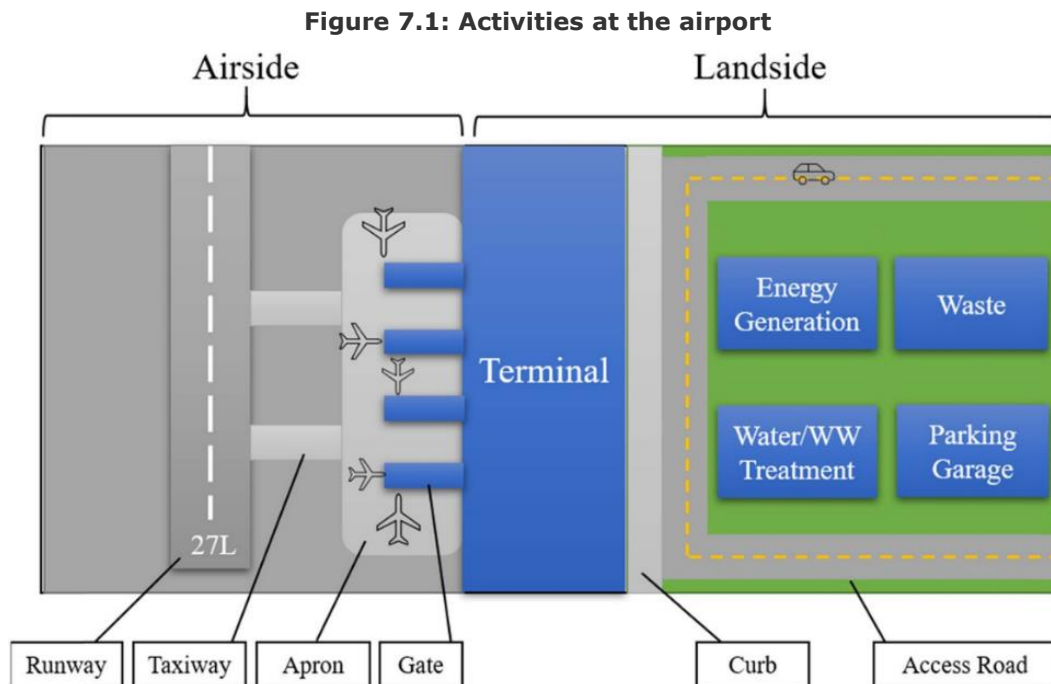
7.1 Addressing airports' environmental impact

7.1.1 Literature review

While airports directly account for only 2% of the total emissions of the aviation sector (Airportco2.Org, 2022) they are nonetheless involved in the process of greening of the sector, playing a fundamental role in providing the necessary infrastructure for aircraft operators to reduce flights' emissions. Furthermore, airports produce negative environmental impacts beyond GHG emissions. An airport's negative environmental

¹⁵⁴ Directive (EU) 2023/958 (which amends the ETS Directive) explicitly names "the Carbon Offsetting and Reduction Scheme for International Aviation ('CORSIA') of the International Civil Aviation Organisation ('ICAO') in its recitals and explanatory material. Moreover, in several articles it provides the legal basis to coordinate ETS compliance considering CORSIA participation and empowers the EC to adopt implementing and delegated acts for the purpose of implementing the ICAO's global market-based measure on all routes covered by it" (e.g. Articles 25a and 28c).

externalities arise as a result of both airside and landside operations, as depicted in Figure 7.1 taken from Greer et al. (2020).



Source: Greer et al. (2020).

As explained in Harley et al. (2020), p. 3: "Despite airport operators having little direct ownership of many of the sources of environmental impact within the airport system, they have a unique role in their management and a significant role in affecting change (for example by setting operational procedures and targets)". For instance, several airports started to modulate airport charges in relation to the environmental impact of airlines. Examples are airports managed by Swedavia in Sweden: Swedavia modulates charges based on airlines' CO₂ emissions, following a requirement introduced by the Swedish government (Swedavia airports, 2025), in order to incentivise the use of more efficient aircraft. Swedavia's CO₂ charge modulation operates such that aircraft emitting more CO₂ than an average benchmark for their segment pay a penalty. Emission is measured by CO₂ per seat or CO₂ per maximum take-off weight ("MTOW")¹⁵⁵, and three aircraft segments are used: small passenger traffic (≤ 175 MTOW), small other traffic (≤ 175 MTOW), large all traffic (>175 MTOW). Similar initiatives have been implemented, for instance by the Dublin Airport (which has proposed a system of discounts on runway charges for airlines operating the most environmentally friendly aircraft), by the Brussels airport (which introduced in 2023 a modulation of charges to NO_x emission¹⁵⁶), by the Amsterdam Schiphol Airport (which also modulates to NO_x emission and plan an overall increase in charges whose revenues are used to incentivize the use of SAF by airlines), and by the Zurich Airport (which also modulates to the efficiency of aircraft). The next paragraph will review the literature studying the

¹⁵⁵ The maximum weight at which an aircraft is certified for take-off.

¹⁵⁶ NO_x emission refers to the release of nitrogen oxides, mainly nitric oxide (NO) and nitrogen dioxide (NO₂), into the atmosphere, typically produced during fuel combustion at high temperatures. These gases contribute to air pollution, smog, and the formation of acid rain.

practices used by airports to address their direct environmental impact, their effectiveness as well as industry best practices.

The different types of negative environmental externalities produced by an airport can be classified into nine broad categories (Gómez Comendador et al., 2019; Harley et al., 2020): (i) air pollution; (ii) biodiversity impacts; (iii) GHG emissions; (iv) land take; (v) landscape; (vi) noise; (vii) water pollution; (viii) water use; (ix) waste.

Annex C provides Table C.1, taken from Gómez Comendador et al. (2019), which links each activity performed by an airport to each type of environmental impact. It gives an indication of the degree of multidimensionality of the issue. For each of these activities, airports can implement actions to mitigate their impact. For instance, access to airport by train instead of car can reduce its impact related to air pollution and climate change; efficient design of passenger terminals can reduce their land take; etc.

Greer et al. (2020) provides a systematic review of the literature studying solutions towards greening of airports' activities. Table C.2 reports the summary of the strategies proposed to reduce environmental impacts in four other studies.

Chapter 5 of EASA (2025) offers a comprehensive and detailed report of the role of airports in the process of greening of aviation, the current stage of the process, expected pathways and recommendations.

Management of noise pollution around airports is regulated by two European measures: (i) the Environmental Noise Directive and (ii) the Noise Regulation which implements the ICAO Balanced Approach¹⁵⁷ into European legislation. The Environmental Noise Directive does not set limit or target values for environmental noise, nor does it prescribe the measures to be included in the action plans to mitigate it, leaving the competent Member State authorities to decide. Nevertheless, every five years Member States are required to prepare the strategic noise maps and action plans for major airports with more than 50,000 take-offs or landings a year, including small aircraft and helicopters. Member States shall ensure that the public is informed during the process and consulted about proposals for action plans, given early and effective opportunities to participate in the preparation and review of the action plans (Directive 2002/49/EC, 2002). The Noise Regulation (EU Regulation No 598/2014, 2014) establishes rules and procedures with regard to the introduction of noise-related operating restrictions at EU airports. Beyond monitoring, assessing the situation and defining objectives, airports can, as a last resort mechanism, set operational restrictions on aircraft.¹⁵⁸ In a recent survey by ACI Europe, 79% of European airports indicated that they employ various measures (e.g. restrictions on noisier aircraft, night flight restrictions, runway restrictions, noise budgets and movement caps). The scope of operating restrictions varies on an airport-by-airport basis and the aircraft noise certification basis. (EASA, 2022, p. 100). Airports are also involved in the implementation of the Performance Based Navigation ("PBN")¹⁵⁹ regulation, which fosters a more efficient use of airspace, reducing significantly the environmental impact of flying. More specifically, PBN aims to: (i) avoid noise-sensitive areas around airports, i.e. more densely populated areas, or alternate flight paths to give temporary relief from noise pollution to communities living nearby the airport; (ii) use smoother and more efficient climbs and descents for

¹⁵⁷ The Balanced Approach is the ICAO's global strategy for managing and reducing aircraft noise at around airports. It was adopted in 2011.

¹⁵⁸ These are legally enforced limitations on when or how an aircraft can be operated in an airport, e.g. limit or prohibit the use of noisier aircraft.

¹⁵⁹ Aircraft's capability to navigate using performance standards.

aircraft near airports¹⁶⁰; (iii) enable shorter routes between origin and destination airports (EASA, 2025). The implementation of PBN (required by EU regulation 2018/1048 by June 2030) has shown a positive trend in the recent years; indeed, 75% of instrument runways¹⁶¹ are now compliant with PBN requirements (EASA, 2025).

While airports are not directly involved in the production of SAF, they play a facilitating role in their uptake by airlines, as required under the ReFuelEU Aviation Regulation which obliges larger EU airports to ensure that aircraft operators have non-discriminatory access to aviation fuels containing minimum shares of SAF. However, as explained in EASA (2025), the main policy actions aimed at increasing the use of SAF are directed at airlines and SAF producers, suggesting that, in practice, the role played by airports in this process is marginal compared to that of fuel suppliers and airlines.

Furthermore, in a longer term, airports will have to build the necessary infrastructure for hydrogen-based aircraft, which may significantly vary depending on factors like the demand for hydrogen, the airport's location and its distance from the hydrogen source, the amount of space available on-site, and the ease of accessing feedstock for hydrogen production. This process will take time. Moreover, using sustainable electrified taxiing (transporting airplanes within the airport by an electric vehicle instead of by using airplanes' engines) is expected to be a standard by 2030 (EASA, 2022).

Among voluntary initiatives by the industry, the Sustainability Strategy launched by ACI-Europe in June 2019 stands out (ACI Europe, 2019, 2021b). As part of this strategy, over 500 European airports committed to net zero CO₂ emissions from airport operations fully within their own control by 2050 at the latest, reducing absolute emissions to the furthest extent possible and addressing any remaining emissions through carbon removal and storage. ACI Europe (2023a) provides airports with guidelines and roadmaps on measures and actions needed to reach the net zero objective. According to ACI Europe, 16 airports have already reached the net zero objective.¹⁶² According to the latest manual provided by ACI Europe (ACI Europe, 2023c), emissions from the following activities are considered as being under full control of the airports:

- Scope 1 emissions, i.e. direct emissions produced by operations owned or controlled by the airport (mobile sources, i.e. vehicles and machinery operated by the airport; stationary sources, i.e. boilers, furnaces, emergency generators, etc.; process emissions, i.e. waste treatment, refrigerant losses from airport-owned heating, ventilation, and air conditioning systems, fugitive emissions from de-icing chemicals).
- Scope 2 emissions, i.e. indirect emissions from purchased energy (purchased electricity and purchased heat, steam or cooling from external providers).

As shown in Section 2.3.1, smaller airports are typically less efficient, while large airports can benefit from superior economies of scale. Carlucci et al. (2018) links efficiency to environmental sustainability, arguing that an efficient use of resources translates into better environmental performance. For instance, for a given number of passengers, an airport able to operate with a smaller runway length (a typical input in airport efficiency analysis) will have lower land use (a typical category of environmental impact). In this sense, a small and inefficient airport may be less sustainable, all other

¹⁶⁰ Such as Continuous Descent Operations, CDO, and Continuous Climb Operations, CCO.

¹⁶¹ An instrument runway is a type of runway equipped to support landings and takeoffs using instrument flight rules (IFR).

¹⁶² ACI Europe publish an updated list of airports which achieved or are committed to achieve the net zero objective (<https://www.aci-europe.org/netzero>).

things equal, than a large and efficient one. However, this is only one of the main possible factors driving differential environmental performances between airports of different sizes.

Harley et al. (2020) examine the research question from a different perspective and analyse the possible factors influencing the adoption of environmental practices in small European airports. They highlight the fact that the adoption of environmental practices by small airports is relatively limited and identify several possible reasons: cost constraints, lack of resources (e.g. high-skill workforce), technological environment and unwillingness to engage with tenant companies on site.¹⁶³ Leveraging information from a questionnaire distributed to all European airports under 5 million ppa, the authors highlight the important role played by the lack of resources/technological environment, rather than simply cost constraints. Responses also show a widespread idea that adopting environmental practices may bring relative advantage, by enhancing airports' reputation.

7.1.2 Consultations

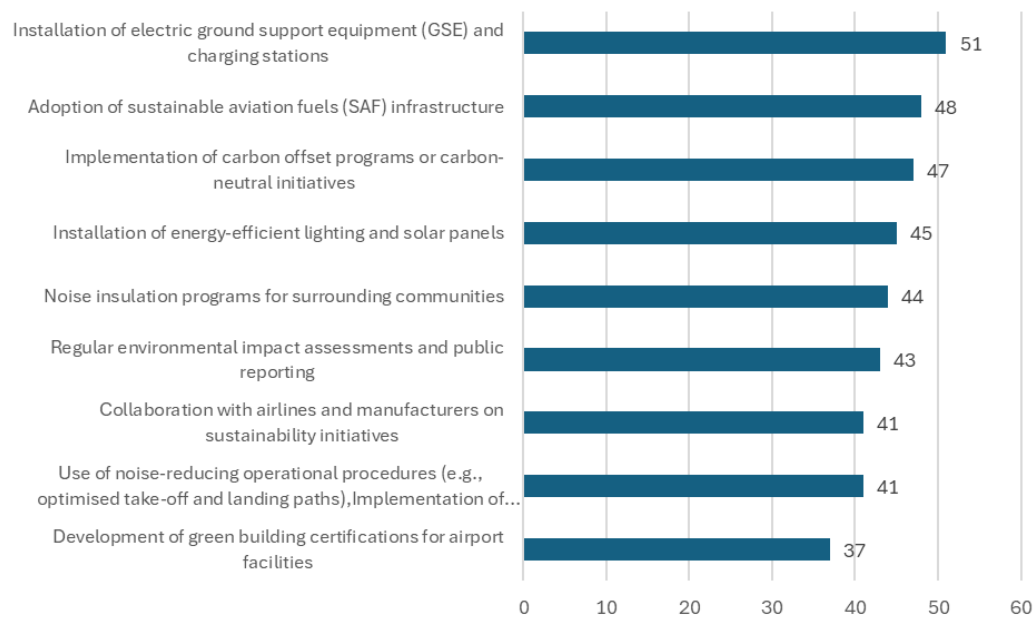
The Figure 7.2 shows the results from the stakeholder survey indicating measures most commonly adopted by airports and airlines to address environmental concerns. The most frequently cited actions are the installation of electric ground support equipment ("GSE")¹⁶⁴ and charging stations (51 responses), adoption of SAF infrastructure (48), and implementation of carbon offset or carbon-neutral initiatives (47). Other widely used measures include energy-efficient lighting and solar panels (45), noise insulation for surrounding communities (44), and regular environmental impact assessments and public reporting (43). Collaboration with airlines and manufacturers (41) and noise-reducing operational procedures (41) are also significant, while the development of green building certifications for airport facilities (37) is reported slightly less often. The responses are similar across different types of stakeholders (airlines, airports and airport associations, broader aviation industry associations and public authorities).

Contributions to the call for evidence from four airlines further indicate that their main measures to reduce emissions include fleet renewal, scaling up the use of SAF, and improving operational efficiency. However, not all contributions to the call for evidence aligned with this technology-focused approach to decarbonising the sector. One environmental organisation criticised reliance on e-fuels, arguing that their very high electricity demand undermines their climate benefits, and instead advocated for reducing overall air traffic volumes as the most effective way to limit aviation's environmental footprint.

¹⁶³ "For example, environmental practices which involve modifying a third party's operations (for example, airlines or concessionaires) are often avoided by smaller airports for fear of alienating customers and losing revenue" (Harley et al., 2020, p. 6).

¹⁶⁴ Equipment used at airports to service aircraft between flights. Services include refuelling, towing airplanes or luggage/freight carts.

Figure 7.2: How do airports and airlines currently address environmental concerns, such as carbon emissions, noise pollution, and other types of environmental impact?



Source: Stakeholder survey (n=71). Multiple selections available.

Box 7.1: Insights from case studies on sustainability measures

Evidence from the regional airport/greening case study targeting a regional airport network operator shows that the company frames its environmental policy within a group-wide sustainability framework guided by long-term climate objectives. Decarbonisation programme is implemented at network level, rather than through quotas for individual airports, considering each airport's unique features and characteristics (e.g. energy demand profile, infrastructure condition, geographical location, and technical feasibility). For example, smaller or insular airports with limited infrastructure capacity may face additional constraints in deploying large-scale renewable systems, and these factors are integrated into the company's prioritisation and sequencing of investments.

From the perspective of an airline interviewed as part of the regional airport close to a hub case study, SAF is regarded as the most immediate decarbonisation tool. However, they underline high prices, limited supply and unclear EU-level incentives as key barriers to its uptake. The airline also noted that broader reforms, such as air traffic management improvements under the Single European Sky initiative, could deliver substantial emissions reductions.

It is important to note that the primary sources of aviation GHG emissions stem from jet fuel burnt during flights stages, largely beyond the direct control of airports.¹⁶⁵ According to the regional airport network operator, these emissions can only be addressed through fleet renewal (including hydrogen- and electric-powered propulsion in the longer term) and through SAF adoption. The stakeholder emphasised that existing fuelling systems (designed for conventional jet fuel) are compatible with SAF and that the key bottlenecks lie in the production and distribution capacity, as well as policy coordination at national and EU-level.

Both stakeholders and public consultation respondents strongly support the introduction of additional State aid tools and incentives to address environmental and climate impacts in aviation. In the stakeholder survey (n=53), 65% answered "Yes", while 13% said "No" and 22% were unsure. The results from the public consultation (n=101) are even clearer, with 78% supporting additional measures, only 10% opposing, and 12% uncertain. When it comes to the responses by the stakeholder type:

- Support was highest among airports and airport associations (n=76), with 88% in favour, followed by public authorities (n=46), with 70% supporting.
- Among broader aviation industry associations (n=17), 59% expressed support, while airlines and airline associations (n=9) recorded 56% in favour.
- Among NGOs (n=2) and citizens (n=4), 58% supported the introduction of additional environmental measures.

¹⁶⁵ <https://blog.aci.aero/environment-and-sustainability/the-role-of-airports-in-reducing-aviations-carbon-emissions>.

Figure 7.3: Beyond the provisions and the possibilities offered by the State aid rules in place dealing with environment and climate, do you see a need for additional State aid tools/incentives?



Source: Left to right – stakeholder survey (n=53) and public consultation (n=101)

When asked to substantiate their responses, most respondents across all respondent types agreed that additional aviation-specific State aid tools are needed on top of the CEEAG and RDI guidelines to reach climate goals.

Several airlines supported the creation of additional aviation-specific State aid tools to help reach climate goals. They proposed dedicating a larger share of ETS revenues to the production and uptake of SAF, enabling book and claim systems, and aligning EU rules with CORSIA to prevent carbon leakage.

Several airports and their associations reported that the CEEAG framework is difficult to access or too restrictive and called for a single, coherent reference point within the revised AG.¹⁶⁶ An EU-level airport association and several airports, particularly from France, suggested that the AG should clearly allow support for the investments needed to achieve the objective of zero emission aviation, across both landside and airside operations, including electric ground support equipment, hydrogen or electric refuelling and recharging infrastructure. They especially underlined the need for support to cover electricity grid upgrades, energy efficient terminal retrofits, and grid connection works that currently fall outside eligible cost definitions. Several airports proposed allowing higher aid intensities, in some cases up to 100% for charging, hydrogen, or photovoltaic investments, and extending eligibility to manufacturers of innovative or zero emission aircraft. A few also recommended adding green conditionality to PSOs.

Several broader aviation industry associations together with several public authorities proposed shifting more green aviation support under GBER to reduce notification burdens and accelerate implementation. Nordic associations particularly emphasised the importance of domestic SAF production for energy security and resilience.

A local authority from a peripheral or OR emphasised that the framework must reflect permanent structural constraints and maintain affordable connectivity. Several public authorities also supported broader eligibility than the current CEEAG allows, notably to

¹⁶⁶ In the call for evidence, airports (3) and airport associations (3) argued that the AG insufficiently cover climate-related investments, calling for explicit eligibility for charging infrastructure, hydrogen and SAF facilities, as well as non-aeronautical projects aimed at improving overall profitability. Public authorities (4) likewise stressed the need for long-term stability and higher aid intensities for climate investments, noting that many of these measures stem from regulatory obligations that airports cannot avoid.

include grid connection projects and energy efficiency improvements in airport terminals. Nordic ministries also stressed the importance of domestic SAF production for both security and resilience.

NGOs shared mixed views. Some agreed that additional tools could be beneficial, particularly to support start up initiatives producing synthetic fuels for aviation as a short to medium term solution to reduce emissions. Others considered that the current instruments are sufficient when complemented by mechanisms such as price guarantees for SAF to improve market stability.

Overall, there is strong consensus that additional aviation-specific State aid tools are needed to address the environmental and climate impacts in aviation. Stakeholders consistently call for clearer, more flexible and streamlined rules ideally anchored in the revised AG and partly moved into the GBER to reduce notification burdens. The main priority is targeted support for SAF production and deployment, alongside eligibility for the wider decarbonisation chain at airports (hydrogen and electric infrastructure, grid upgrades, energy-efficient terminals). While a small minority believe existing tools suffice, the overwhelming view is that without dedicated instruments, climate objectives will not be reached, especially for small, regional, and peripheral airports.

Box 7.2: Insights from case studies on the need for additional tools/incentives to promote the decarbonisation of the aviation sector under the revised AG

Evidence from a regional airport network operator (in the regional airport/greening case study) emphasised the significant technical and financial barriers to implementing sustainability measures, noting that these challenges are particularly acute for small, remote and island airports.

The regional airport network operator explained that despite current financial health, the scale of required decarbonisation investments involves substantial upfront investments that cannot be financed internally. Airports are therefore compelled to seek external support, including EU and national grants and loans. In this respect, the AG are regarded as an important framework for ensuring that State aid can be directed towards sustainability projects. Nonetheless, the operator called for clearer eligibility criteria and greater flexibility to reflect the unique constraints faced by regional and island airports.

Evidence gathered from case studies targeting a regional airline and a regional airport close to a hub reinforced these concerns with a focus on SAF. All interviewed stakeholders (two LCC, a regional airline and a regional airport) agreed that public support is essential to make SAF a viable option at scale. The regional carrier argued that investment aid should extend to the purchase of new, fuel-efficient aircraft, not just replacements. One of the LCCs stressed that its point-to-point model, combined with consistently high load factors, already ensures comparatively low emissions per passenger, but acknowledged that large-scale adoption of SAF would still require substantial public intervention.

Moreover, the regional airport network operator expressed a concern that the burden of decarbonisation costs on airport charges could undermine the affordability of air travel, a particularly serious issue for island regions that are dependent on aviation for essential connectivity. While PSOs can shield residents by passing higher costs onto tourists, such a mechanism may put at risk tourism attractiveness. This, in turn, could negatively affect both the financial sustainability of airports and the broader tourism-based economies of regions where air transport is a critical driver of development.

Finally, the regional airport network operator explained that, in some small and/or remote islands in which they operate, land constraints can limit the deployment of ground-mounted photovoltaic systems, while rooftop installations may be infeasible due to structural limitations. Some airports do not have reliable connections to the national grid, reliance on diesel generators is present, further raising costs and emissions. In addition, the unit costs of renewable energy investments on islands are typically higher than at mainland airports, making projects less efficient and more expensive to implement. These conditions combine to increase the cost of decarbonisation, reduce overall efficiency and delay implementation timelines.

7.1.3 Conclusions on addressing airports' environmental impact

The literature shows that the transition toward a greener aviation sector is driven by a combination of voluntary industry initiatives and public regulations. While airports themselves contribute directly to only a small share of total aviation GHG emissions, they play a crucial role in enabling infrastructure that supports airlines in reducing in-flight emissions. A majority of consulted stakeholders indicate that measures most commonly adopted by airports and airlines, listed in decreasing order of prevalence, include installation of electric ground support equipment and charging stations, adoption of SAF and implementation of carbon offset or carbon-neutral initiatives, installation of energy-efficient lighting and solar panels, noise insulation for surrounding communities,

and regular environmental impact assessments and public reporting. Widespread decarbonisation efforts to reach net zero targets aim in general, on the airport side, at increasing reliance on electrification and renewable energy sources. Airlines are also investing in more fuel-efficient aircraft and engines, but effects of fleet renewal and of development of new aircraft technologies will materialise only in the very long run. An environmental organisation opposed technology-led solutions, instead calling for reduced air traffic as the most effective climate measure.

The literature reveals the challenges faced by small airports in addressing environmental concerns: being typically less efficient and having lower access to high-skill workforce, they struggle more than large airports in this regard. The regional airport/greening case study further illustrates that some smaller, remote, or island airports may face additional constraints due to their specific circumstances, such as lack of national grid connections and limited space for large-scale renewable energy systems, highlighting the need for specific financial support or, as suggested by some stakeholders, exemptions or proportionality in the application of environmental standards.

The need for additional support appears to be shared by most consulted stakeholders: the support currently envisaged by the CEEAG and RDI guidelines is generally not considered to be sufficient, and they call for, inter alia, introducing “green aviation” support into the GBER, targeted support for SAF and green conditionality to PSOs.

Consulted stakeholders including airport associations, airports, and public authorities argued that future EU investment aid should focus on decarbonisation projects (e.g. SAF production and deployment, hydrogen, charging systems), with some calling for 100% aid intensity for very small airports. Several public authorities also highlighted the need to update thresholds of investment aid¹⁶⁷ and extend its eligibility to non-aeronautical investments, to support profitability. Some airport associations however opposed broad subsidies, suggesting limiting support to remote/island airports only.

7.2 Measuring airports’ and airlines’ environmental performance

7.2.1 Literature review

Measuring the overall performance of airports in terms of their environmental sustainability is not an easy task, given the multidimensional nature of airports’ environmental impacts (Gómez Comendador et al., 2019).

The EU Corporate Sustainability Reporting Directive (“CSRD”)¹⁶⁸ requires airports to report on their environmental impact, including their carbon footprint, air pollution, and impact on biodiversity. Airports must assess and report how airport operations affect the environment, and how sustainability issues (like climate change) impact airport operations and finance.

The most prominent voluntary industry led initiative is the Airport Carbon Accreditation (“ACA”) programme, launched in 2009 by ACI Europe. It includes now 267 European airports (ACA, 2025), to which an independent board assigns an environmental certification level (there are 7 levels: 1,2,3,3+,4,4+,5). The programme provides airports’ operators a multi-step path to carbon neutrality, and it is based on international standards in the reporting and accounting of GHG emissions. However, the programme does not include impacts other than GHG emissions (Gómez Comendador et al., 2019).

¹⁶⁷ See footnote 81.

¹⁶⁸ EU Directive 2022/2464.

Several studies have addressed the issue of measuring airports' environmental performance. Kılış & Kılış (2016) introduce a composite indicator approach for benchmarking airport sustainability performance, encompassing 25 indicators across five dimensions, with a particular focus on environmental sustainability. Kucukvar et al. (2021) construct four different DEA models using input-oriented modelling with multiple undesirable environmental inputs (energy, carbon, water, and waste) and desirable outputs (revenue, passengers, and employment) to compare sustainability performance levels of 30 major international airports in various contexts. However, there seems to be a lack of consensus in the scientific community about the scope of environmental impact that should be included when measuring airports' performance (Greer et al., 2020). Greer et al. (2020) also point out that: "One common tendency is for airports to adopt a perceived 'best practice' based upon another airport's successful implementation. But progress is needed to ensure that every airport considers all relevant environmental sustainability indicators systematically to account for regional and supply-chain effects rather than simply follow others' actions".

Finally, Gómez Comendador et al. (2019) propose a comprehensive model aimed at evaluating and certifying the environmental performance of airports by addressing the full scope of aviation-related environmental impacts. Its primary objective is to provide a more complete assessment framework that goes beyond carbon emissions to include critical factors such as noise pollution, water management, biodiversity, land use, and waste. This approach requires coordination among various airport stakeholders - such as operators, airlines, air navigation service providers, and ground handlers - encouraging shared accountability and collaborative action to minimise environmental harm. Unlike the ACI ACA System, which focuses specifically on CO₂ emissions from airport operations, the proposed model expands the environmental scope significantly: this holistic model addresses both construction and operational phases, providing a much broader and airport-tailored evaluation.

In terms of assessing compliance, the model proposed by Gómez Comendador et al. (2019) proposes a structured credit-based certification system that evaluates environmental performance across categories such as noise, emissions, energy, materials, water, land use, and biodiversity. This system was tested and validated by experts from AENA, one of the world's largest airport operators, demonstrating its practical feasibility. An example of compliance assessment is noise management. In the model, airports can earn points by enforcing measures like night flight restrictions or limiting engine testing. To qualify, they must provide evidence of having an effective system for noise measurement.

7.2.2 Consultations

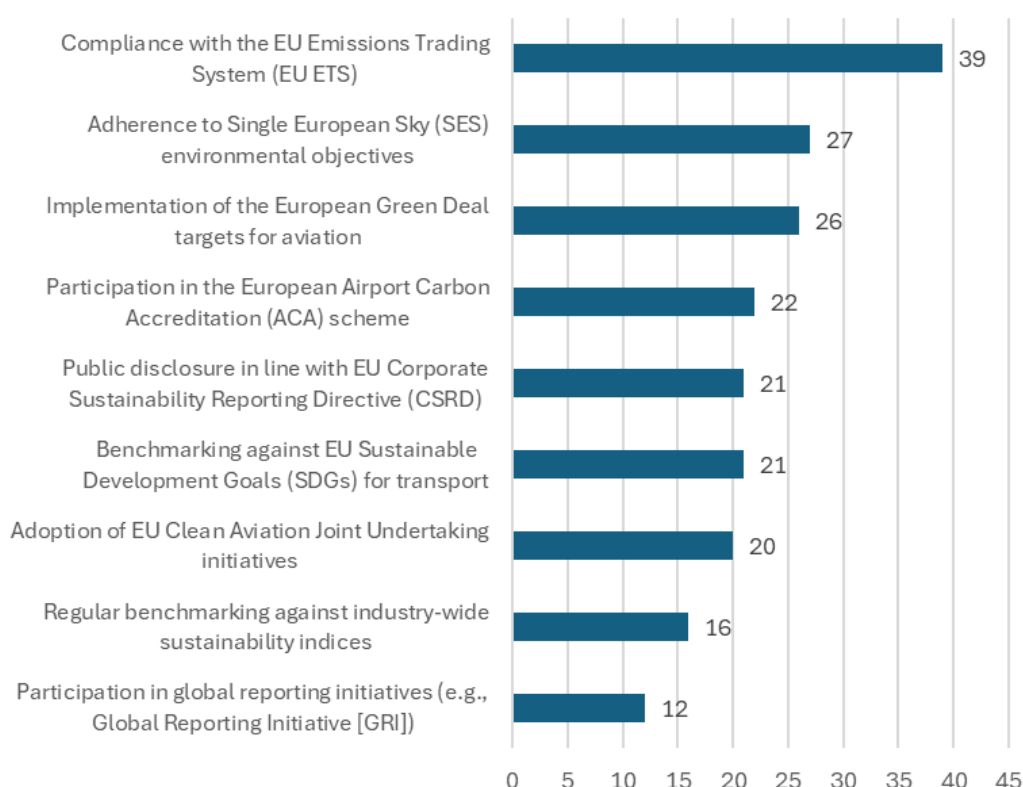
In the stakeholder survey, respondents were asked to compare practices used to measure the environmental actions of airports and airlines. The graph shows that compliance with the EU ETS is the most widely used practice, cited by 39 respondents. Other significant references include adherence to the Single European Sky ("SES")¹⁶⁹ environmental objectives (27) and the implementation of the European Green Deal for aviation, with the view to contributing to a reduction in transport emissions by 90% by 2050 (compared to 1990 levels) (26).¹⁷⁰ Participation in the European ACA scheme (22),

¹⁶⁹ SES is a holistic framework to harmonise and improve the performance of ATM in terms of safety, capacity, cost-efficiency and the environment. SES2+ is the second phase of the SES initiative, a set of regulations that came into force in late 2024 to reform Europe's ATM.

¹⁷⁰ Note that there are no mandated emission reduction targets for the aviation industry, but can be seen as a best practice.

as well as public disclosure under the EU CSRD and benchmarking against EU Sustainable Development Goals ("SDGs")¹⁷¹ (both 21), were also mentioned. Less frequent practices include adoption of EU Clean Aviation Joint Undertaking initiatives (20), regular benchmarking against industry-wide sustainability indices (16), and participation in global reporting initiatives such as the Global Reporting Initiative ("GRI")¹⁷² (12). The responses were similar across different types of stakeholders (airport and airport associations, broader aviation industry associations, airlines and airline associations and public authorities).

Figure 7.4: Are there any practices used to measure the environmental actions of airports and airlines? If so, what are these?



Source: Stakeholder survey (n=70). Multiple selections available.

In the stakeholder survey, 48 respondents provided a response to open question on how the environmental performance of airport and airlines can be assessed and how compliance with possible green conditionality of State aid measures can be ensured. The key suggestions include:

- Carbon intensity per passenger (1 national aviation authority and 1 airline) and total emissions (1 NGO, 1 national aviation authority, 5 airports);

¹⁷¹ Set of goals established in 2015 by the international community as part of the United Nations 2030 Agenda for Sustainable Development through which countries of the world collectively pledged to eradicate poverty, find sustainable and inclusive development solutions, ensure everyone's human rights, and generally make sure that no one is left behind by 2030.

¹⁷² Independent and nonprofit international organisation providing standards for sustainability reporting for companies.

- Energy use (2 national aviation authorities) and share of renewables (1 national aviation authority);
- Air-quality pollutants (NO_x, particulate matter ("PM")) (1 NGO, 2 national aviation authorities, 5 airports);
- Certified programmes (e.g. ACA) (1 national aviation authority);
- Water, waste and biodiversity management (2 national aviation authorities);
- Noise footprints (1 NGO, 2 national aviation authorities, 5 airports) and community insulation schemes.
- Performance should also reflect concrete transition plans renewable generation on-site, electrified GSE, charging and hydrogen refuelling, SAF storage/distribution, and better public-transport access (mentioned by 2 NGOs).
- Two broader aviation industry associations want aid frameworks to reward airports and Original Equipment Manufacturers¹⁷³ that enable these shifts, to allow higher intensities where overall environmental impacts fall, and to reinvest ticket-tax proceeds into sectoral decarbonisation.
- Regional airports are seen as ideal testbeds for disruptive technologies, but a regional government calls for safeguards, such that better alignment with the Green Deal does not impose disproportionate burdens on remote or OR.¹⁷⁴

As to the public consultation, out of 103 respondents, 43% supported introducing green conditionality of State aid to incentivise sustainable practices at airports, 41% opposed it, and 17% were unsure. In concern to the results by the stakeholder type:

- Support was strongest among NGOs (n = 5, 71%) and broader aviation industry associations (n = 11, 45%), followed by airports and airport associations (n = 51, 44%).
- Public authorities (n = 25) showed lower support (38%), while airlines (n = 7) and citizens (n = 4) expressed the least support (33% each).

When it comes to the substantiated replies and comments, the proponents (including several ministries of EU Member States, airport operators and NGOs) stress the need to accelerate decarbonisation, align with EU/ICAO net zero targets, and ensure that public funds drive measurable outcomes (e.g. SAF uptake, transition to renewable energy, charging/hydrogen ("H₂") refuelling, energy-efficient buildings, waste and water management, and noise mitigation). Two national public authorities, two airports, and two EU-level airport associations propose higher aid intensities or premiums for green investments, transition plans from airports, and incentives like reduced charges for zero-emission aircraft. One broader aviation industry association, and a business creating zero-emission airplanes also argues that conditionality could enable pilot projects and help scale novel technologies.

A substantial group (mainly airlines, airports, some (regional, local) governments, one EU citizen) opposes conditionality especially for operating aid, warning it could raise costs, add bureaucracy, duplicate existing regulatory and voluntary schemes (CEEAG, ReFuelEU, ETS, ACA), and disproportionately burden small, regional and OR airports

¹⁷³ Company producing aircraft or aircraft component.

¹⁷⁴ Contribution to the call for evidence from, a forum of OR Presidents argued that any assessment of environmental performance must consider the specific geographic isolation of ORs. It cautioned against applying uniform conditionalities that could penalise OR airports and stressed the need for proportionality and flexibility to safeguard essential connectivity.

with limited resources and influence over airlines' emissions. These stakeholders prefer positive incentives, clearer, sector-specific rules, or broader financing for SAF production and infrastructure; several emphasise exemptions or proportionality for remote/island regions and stress that connectivity and safety investments must not be jeopardised.

Box 7.3: Insights from case studies on environmental performance assessment

Evidence from the regional airport/greening case study targeting a regional airport network operator highlighted the use of a dedicated emissions monitoring software tool developed by the company, which calculates emissions based on data such as electricity consumption, fuel usage and the national energy and fuel mix. This ensures a standardised approach across all airports to monitor emissions of each airport belonging to the group, and ensure compliance at group-wide level.

In addition, the operator participates in the ACA programme, which benchmarks emissions performance, and reports under the CSRD, which requires transparent disclosure of Scope 1 and Scope 2 emissions.

Beyond carbon emissions, the operator monitors a broader set of environmental indicators, including air quality, noise, wastewater management and biodiversity conservation.

7.2.3 Conclusions on measuring airports' sustainability performance

Survey responses showed that the main drivers for airports and airlines to reduce their environmental and climate impacts are EU ETS compliance, followed by SES objectives, Green Deal strategy¹⁷⁵, and participation to ACA, with additional though less frequent references to CSRD, SDGs, Clean Aviation initiatives, sustainability indices, and global reporting frameworks like GRI.

The literature shows that airports' environmental impact spans multiple dimensions, including noise, emissions, energy, materials, water, land use and biodiversity. The literature offers various methodologies for measuring these impacts, and measures differ depending on how many of these dimensions are included in the assessment. For example, the ACA programme, led by ACI Europe, assigns airports to different certification levels based on their progress towards carbon neutrality. This system is based on international standards for reporting and accounting GHG emissions. However, ACA focuses mainly on CO₂ emissions and does not cover other environmental impacts. Gómez Comendador et al. (2019) suggest a credit-based system where airports earn points for implementing specific environmental measures (such as night flight restrictions or noise monitoring). Stakeholders broadly agree on robust tools to assess the environmental performance of airlines and airports. Survey responses highlight a range of relevant metrics, including as CO₂ per passenger-km, SAF use, fleet renewal, air quality, noise, waste, and certified schemes.

Green conditionality refers to making State aid contingent on meeting specific environmental or sustainability criteria. This implies verifying that airports and airlines actually fulfil these requirements in practice for receiving State aid. Many consulted stakeholders (43%) support linking State aid to measurable green outcomes like decarbonisation plans, SAF uptake, and renewable infrastructure. Support for green conditionality is highest among NGOs, and airports and airports associations. Opponents, including airlines, public authorities but also many airports, argue that aid

¹⁷⁵ Note that there are no mandated emission reduction targets for the aviation industry.

frameworks should account for the structural constraints faced by remote and isolated areas when setting conditions for State aid in green projects. Without dedicated instruments tailored to these specific contexts, climate objectives could remain out of reach. Some ministries, airports, and NGOs see green conditionality as crucial to accelerate the transition, while others, especially small, regional, and OR airports, warn that it could raise costs and threaten connectivity. Stakeholders nearly unanimously call for proportionality, flexibility, and safeguards for remote regions.

7.3 Distributing flights between hub and regional airports

7.3.1 Literature review

There is little literature directly addressing the topic of how distributing flights between hub and regional airports may influence the environmental impact of aviation.

However, some studies focus on a different but related question, i.e. on comparing the environmental performance of hub-and-spoke networks versus point-to-point networks.¹⁷⁶ Indeed, all other things equal, in a point-to-point network passengers are more equally distributed across all airports, while in the hub-and-spoke network large airports, beyond serving their catchment areas, serve as hubs, drastically increasing the number of passengers handled in these airports.

On this, the literature shows mixed results. Sun et al. (2021) show that the point-to-point network implies higher environmental cost, with almost 3 times higher average GHG emissions per passenger. This result is due to the different load factor of airplanes in the two networks: in the hub-and-spoke one, airlines can use fewer but larger airplanes, reducing the environmental cost per passenger. Conversely, the point-to-point network requires a larger number of smaller airplanes, with some segments having low load factors, i.e. flying with empty seats, which increase the environmental costs.¹⁷⁷ This study, however, does not take hub airports' congestion into account. Also, the study focuses on the Chinese aviation market, which may have different structural characteristics compared to the EU market. On the other hand, Pels (2021) provides a review of the literature comparing the two types of networks, pointing to several studies that suggest a higher environmental impact of hub-and-spoke networks. O'Kelly (2012), for instance, shows that an optimal network (chosen by minimising fuel consumption), would require many smaller regional jets operating direct flights and high degree of connectivity, i.e. a point-to-point network. Clearly, such a network would require a higher usage of smaller airports to avoid the increased congestion derived from the higher number of airport operations. One of the reasons for the opposite results found in the different studies has to do with environmental economies of scale of new aircraft: improvements in fuel efficiency has been mainly affecting small body short range aircraft in the last decades on the 20th century, making large airplanes relatively less environmentally efficient. The more recent introduction of wide body aircraft like Boeing 787 and Airbus A350 may have changed this conclusion, due to the increased efficiency

¹⁷⁶ A hub-and-spoke network connects flights through central hubs, where passengers often transfer to reach their destination. This reduces the number of direct routes but can increase travel time. A point-to-point network, on the other hand, offers direct flights between cities without a central hub, minimizing travel time but requiring more routes.

¹⁷⁷ It should be emphasised that these findings derive from a theoretical comparison of network structures and may not fully reflect current business models of airlines, which operate in a context where the two types of network overlap. In practice, LCCs typically operate aircraft with high load factors on dense point-to-point routes, whereas network carriers often combine smaller regional aircraft for feeder services with large aircraft on long-haul segments. This distinction suggests that the environmental implications of different network configurations depend also on airline strategies and market characteristics.

of these types of aircraft (Pels, 2021). These recent developments make most recent estimates to suggest that the hub-and-spoke network, which relies more on fewer large airplanes, is relatively more environmentally friendly.

Point-to-point networks necessarily translate also into a reduced congestion of hub airports which may have non-negligible environmental effects, beyond the obvious local environmental externalities (e.g. air pollution and noise pollution). Indeed, as explained in EASA (2022), traffic congestion significantly affects operational efficiency in airports and the air traffic network. Reducing these inefficiencies is a potential pathway towards lower GHG emissions. The XFB indicator (Excess Fuel Burnt due to operational inefficiencies) is shown to have decreased significantly during the COVID-19 period, thanks to the reduced congestion of the network (see EASA, 2022, p. 89). Continuous Climb Operations and Continuous Descent Operations are promising practices for fuel savings in the climb and descent phase. During the COVID-19 period, a drastic improvement in the usage of these practices is observed at the 40 busiest airports, suggesting again that the reduced congestion allowed to implement more fuel-efficient operations. Irvine et al. (2016) study a highly capacity-constrained airport, London Heathrow, and quantify the impact of congestion on CO₂ emissions, suggesting that delays and consequent holding patterns¹⁷⁸ at this airport only (the study refers to 2015) caused a 0.2% increase in CO₂ emissions for the total UK aviation industry, a small but not insignificant amount. Furthermore, the study finds that extra NO_x emissions due to congestion to be around 801 tonnes per year, around half of the amount of NO_x typically emitted by aircraft on the ground for this airport.

7.3.2 Consultations

In the stakeholder survey, the role of regional airports in combatting congestion at major EU hub airports is viewed as limited. Looking at responses by the stakeholder type:

- Among airports and airport associations (n=92), views were slightly more positive than average, with about 35% indicating that regional airports contribute considerably or to a large extent, while 65% considered their impact limited.
- Public authorities (n=43) were more sceptical, with only one in four (26%) assigning a moderate or higher contribution.
- Broader aviation industry associations (n=24) expressed similarly cautious views, with 30% recognising a noticeable contribution and the rest rating it as small or negligible.
- 40% of airlines (n=14) acknowledged some contribution and 60% perceived little or none.
- Environmental NGOs (n=2) and citizens (n=5) largely shared the view that the role of regional airports in alleviating hub congestion is limited, with only one citizen assigning a “considerable” rating.

When asked to substantiate their responses, on the positive side, airports, airlines and broader aviation industry associations note that regional airports can reduce congestion at hubs, lower emissions from taxiing and holding patterns, and offer shorter, more direct journeys that avoid unnecessary detours. They can also cut passengers’ road travel to distant hubs if good public transport connections exist. Regional airports may

¹⁷⁸ Airplanes forced to wait in the air before landing, due to congestion.

facilitate the uptake of emerging low-emission technologies such as electric or hybrid aircraft, and ensure connectivity for OR where rail alternatives are not viable.

At the same time, several drawbacks were raised by airlines, governments and NGOs. Shifting flights to regional airports could increase noise and air pollution in previously unaffected areas, require additional infrastructure with long-term environmental impacts, and risk lower load factors on smaller aircraft, which emit more CO₂ per seat. Environmental NGOs and several national public authorities argued that hubs are more efficient as they maximise the use of aircraft capacity, thus limiting the amount of emissions per passenger compared to flights to/from regional airports with aircraft with lower load factors.

Figure 7.5: On a scale from 1 to 5, to what extent do regional airports contribute towards



Source: Stakeholder survey (n=77) and public consultation (n=103)

7.3.3 Data analysis

One of the key motivations for supporting regional airports is the idea that they might relieve congestion at Europe's main hubs. Congestion matters for passenger experience and airline efficiency, and it is one of the economic justifications for State aid to regional airports.

Two related research questions deal with this idea in this Project. One is whether regional airports help combatting congestion at hubs (Section 7.3.3.1). The other is whether redistributing traffic between hubs and nearby regional airports can improve local environmental outcomes (Section 7.3.3.2).

7.3.3.1 The impact of regional airports on congestion at hubs

If regional airports effectively absorb excess demand, then an increase in passenger traffic at regional airports located near a hub should be associated with fewer departure delays at that hub. This forms the central hypothesis tested.

To investigate this, Cirium flight-level data is used to construct average departure delays at airports and link them to passenger volumes at nearby regional airports within a 100 km catchment area. The regression controls for the presence of LCCs, which influences traffic levels, and for regional economic conditions through NUTS2-by-quarter fixed effects. The specification is designed to exploit variation across more than 500 airports, while identifying the marginal effect of nearby regional capacity on hub congestion.

We caution that the analysis relies on departure delays as a proxy for congestion, which may also be driven by factors unrelated to airport capacity (e.g. weather, air traffic control). The limited number of hubs in the dataset reduces statistical power, and the 100 km threshold is a stylised definition that may not capture the full geographic scope of substitution between airports. As such, the results should be interpreted as indicative patterns rather than definitive causal estimates.

We run the following regression: ¹⁷⁹

$$\log (Congestion_{iat}) = \beta_1 + \beta_2 Focal_Hub_{ia} * Regional_{at} + \beta_3 LCC\ Share_{iat} + \beta_4 Focal_Hub_{ia} + \omega_r * \omega_t + \epsilon_{iat}, \quad \text{Equation 7.1}$$

where the dependent variable $Congestion_{iat}$ is the average delay per flight (in min) at the focal airport i and year-quarter t . The literature (see e.g. Brueckner, 2022) proxies congestion with delayed flights.¹⁸⁰ Our variable $Congestion_{iat}$ is defined as the average departure delay, that is the difference (in min) between scheduled and observed departure times per flight, based on Cirium data (see Annex E.1 for details). The variable $Regional_{at}$ represents the number of passengers of regional airports in area a , defined as a catchment area of 100 km, and represents the way the impact of regional airports is captured.

These are the controls:

- $LCC\ Share_{iat}$ is the share of LCCs at the focal airport i in year-quarter t ,

¹⁷⁹ The log-level model was chosen because it simplifies interpretation—coefficients represent approximate percentage changes in passenger numbers. Note that several regions do not have regional airports, which means that the total number of passengers is zero in those cases. As a result of these zeros, a log-log specification cannot be used.

¹⁸⁰ Brueckner, Jan K. "Airport congestion when carriers have market power." *American Economic Review* 92.5 (2002): 1357-1375.

- Focal_Hub_{ia} is a dummy equal to one if the focal airport is a hub t ,
- $\omega_r * \omega_t$ are NUTS 2 region-by-year-quarter fixed effects,
- ϵ_{iat} is the error term.

Further explanation is provided for the use this exact specification. First, the analysis is limited to 100 km because, as shown in Table F.6 in Annex F.4.2, when taking into account the impact of regional airports on hubs, the relevant area is 100 km. Second, this specification is designed to work with a limited number of hubs. Indeed, given the low number of observations for hubs, a specification is employed that uses all relevant 526 focal airports, but work with a dummy as independent variable Focal_Hub_{ia} , set to one if the focal airport on the left-hand side is a hub.¹⁸¹ Third, the share of LCCs at the focal airport is included as a control, as the presence of LCCs increases the number of passengers (by increasing demand) which can affect congestion. Moreover, this variable also helps absorb airport-specific effects, acting as a proxy for an airport fixed-effect. The significance and size of coefficient β_2 denotes thus the impact of regional airports on the congestion at the focal hub relative to midsize and regional airports.

Furthermore, instead of including demographic variables directly, NUTS2 region $\times$ year fixed effects are used, which are meant to absorb all time-varying regional characteristics such as population density and GDP per capita. We include NUTS2 region per year fixed effects because they better capture regional factors that might influence air traffic. Regional characteristics do not change much over time and including them directly does not add much explanatory power. Furthermore, NUTS 2 region-time fixed effects are used for these regressions (and not NUTS 3) because the number of hubs per region is generally lower at the NUTS 3 level. In fact, only one NUTS 3 region has more than one hub. This limited variation at the NUTS 3 level makes fixed-effect estimations less reliable.

Table 7.3 shows the results of this estimation, where the blue part of the table is the relevant part, as it shows the estimated coefficient β_2 . This impact is not significant, which translates into regional airports having no impact on hubs in terms of congestion.

¹⁸¹ We refer to Annex F.1 where we explain in more detail what airports are used for the regression analysis. Note: while the original dataset contains 527 focal airports, the regression sample is restricted to 526 focal airports due to missing information at NUTS2 level.

Table 7.3: Regression results for congestion

Dependent variable: log (average delay)	(1)
LCC Share	4.082*** (0.680)
Focal hub airport	3.550*** (1.177)
Focal hub airports:	
<i>Rival regional airports:</i>	
100km (number of pax)	4.80e-07 (5.77e-06)
Focal mid-size and regional airports:	
<i>Rival regional airports:</i>	
100km (number of pax)	-2.69e-06 (2.14e-06)
Constant	-1.758*** (0.3392)
NUTS2 FE * year-quarter FE	Yes
Number of focal airports	526
Number of observations	14,943
R-squared	0.696
Adj.R2	0.295
F-Stat	10.41
Prob > F	0

*Note: Clustered standard errors at the airport level in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium.

The regression results provide no consistent evidence that regional airports reduce congestion at nearby hubs. The estimated effects of regional airport passenger volumes on hub departure delays are small and statistically insignificant. This suggests that, in practice, shifting passengers to regional airports has not measurably eased congestion pressures at major hubs. Any substitution that does occur appears too limited to register in average delay statistics. The findings therefore indicate that congestion at Europe's hubs is driven by structural capacity and operational constraints rather than by the presence or absence of nearby regional airports.

7.3.3.2 *The impact of regional airports on pollution*

A central policy question is whether redistributing traffic between hubs and nearby regional airports can improve local environmental outcomes. If regional airports diffuse ground-level emissions and traffic externalities otherwise concentrated around hubs, then—holding total air traffic constant within a region—a higher share of passengers handled by regional airports should be associated with lower ambient NO₂ and PM_{2.5} in that region. This is the empirical hypothesis being tested.

The analysis uses annual NUTS-3 measures of air quality (NO₂ and PM_{2.5}) and relate them to two key aviation variables at the same regional level: total passengers and the share of those passengers processed at regional airports (to identify the redistribution effect). Year fixed effects absorb EU-wide shocks, and basic socio-economic controls (e.g. population density, income) proxy for underlying differences in emissions sources

and exposure. We restrict to regions that contain at least one hub so that the share is well defined, and a functional form is used to accommodate zero shares.

The design is observational and cannot fully exclude endogeneity (e.g. airport placement, routing choices, or unobserved industrial activity may co-vary with pollution). Passenger counts are estimates, pollution is measured with error, and spatial spillovers across adjacent regions are not modelled. Results should therefore be read as associations consistent with the hypothesis, not as causal effects.

To examine whether distributing flights between hub and regional airports has an overall positive environmental impact, the following regression model is estimated:

$$\log(P_{rt}) = \beta_1 + \beta_2 Total_pax_{rt} + \beta_3 Share_regional_{rt} + \beta_4 X_{rt} + \omega_t + \epsilon_{rt} \quad \text{Equation 7.2}$$

where the dependent variable P_{rt} is pollution (measured in micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$)) in region r (NUTS3 level) in year t .¹⁸²

- $Total_pax_{rt}$: Total number of passengers at all airports in region r in year t .
- $Share_regional_{rt}$: Share of passengers at regional airports in term of number of passengers in region r in year t .
- X_{rt} : Vector of control variables in region r in year t (i.e. population density and GDP per capita).
- ω_t : Year fixed effects.
- ϵ_{rt} : Error term.

The variable $Share_regional_{rt}$ is a proportion, ranging from 0 to 1. The sign of β_3 denotes whether shifting more air traffic to regional airports (relative to hubs) helps or harms air quality (pollution) in the region. Moreover, by including both total number of passengers at all airports ($Total_pax_{rt}$) and share of passengers at regional airports ($Share_regional_{rt}$), it is possible to estimate whether, for a fixed number of total passengers, shifting more of them to regional airports affects pollution levels (positively or negatively).

Moreover, the analysis is restricted to regions that have at least one hub airport, regardless of whether they also have regional airports. As a result, many regions have a zero share of passengers, since no regional airport is present. For this reason, a log-log specification cannot be used.

The results in Table 7.4 shows that a 0.1 percentage point increase in the share of regional passengers (equivalent to shifting about 12,935 passengers on average from hub to regional airports) is associated with a 1.48% decrease in NO_2 .¹⁸³ Given an average NO_2 level of 12.9, this translates into a reduction of approximately 0.19 units in NO_2 (measured in micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$)).

¹⁸² See at the end of this section some sum stats on CO_2 as well, where our data on CO_2 is not suitable for regression analysis.

¹⁸³ This value is calculated by applying the 0.1 percentage point increase to the average total number of passengers across all airports in a region. Specifically: $0.001 \times 12,935,220 = 12,935$. This represents the number of passengers who would need to be shifted from hub airports to regional airports in order to increase the regional passenger share by 0.1 percentage points, assuming total passenger volume remains constant.

Table 7.4: Regression results for pollution NO₂

Dependent variable: log (NO₂)	(1)
GDP per capita	-1.62e-06 (1.23e-06)
Population density	0.000145*** (2.29e-05)
<i>Total_pax_{rt}</i>	1.31e-08*** (3.28e-09)
<i>Share_regional_{rt}</i>	-14.85*** (1.698)
Constant	2.406*** (0.110)
Year FE	Yes
Observations	190
R-squared	0.520
Adj.R2	0.487
F-Stat	15.97
Prob > F	0

*Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium and EEA data

Similarly, Table 7.5 presents the regressions results using PM2.5. The results shows that a 0.1 percentage point increase in the share of regional passengers is associated with a 0.74% decrease in PM2.5. Given an average PM2.5 level of 10.3, this translates into a reduction of approximately 0.076 units in PM2.5 (measured in micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$)).

Table 7.5: Regression results for pollution PM2.5

Dependent variable: log (PM2.5)	(1)
GDP per capita	-8.67e-06*** (9.59e-07)
Population density	0.000121*** (1.65e-05)
<i>Total_pax_{rt}</i>	-1.46e-09 (2.92e-09)
<i>Share_regional_{rt}</i>	-7.367*** (1.156)
Constant	2.768*** (0.0798)
Year FE	Yes
Number of observations	169
R-squared	0.578
Adj.R2	0.546
F-Stat	17.81
Prob > F	0

Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Project Team based on Cirium and EEA data

We further show some descriptive statistics on the average CO₂ per passenger for flights departing from hub and regional airports.¹⁸⁴ Looking at all airports in the dataset (Table 7.6), flights departing from hubs and regional airports have broadly similar mean emissions per passenger (234 kg vs. 247 kg), though the variance is higher for regional airports.

Table 7.6: CO₂ emissions per passenger (kg)

	Obs.	Mean	Std. Dev.	Min	Max	Median
All airports	717,600	224.19	723.34	1.77	98971.2	123.17
Hub airports	233,928	234.42	471.91	2.75	30588.8	126.64
Regional airports	157,744	247.2	717.25	1.77	66360	121.12

Note: The CO₂ emissions refer to total flight emissions (for each route–airline–quarter observation) as operated by airlines and correspond to flights departing from hub or regional airports.

Source: Project Team based on Cirium

¹⁸⁴ According to Cirium, the variable is defined as the total CO₂ emissions per route-airline-quarter, calculated by summing all flights operated in that period for each route-airline combination. These emissions are Scope-1 CO₂ from jet fuel combustion, derived from modelled fuel burn per flight. The modelling framework incorporates: (i) aircraft and engine characteristics (e.g. type, age, winglets, engine series, weight); (ii) flight-specific data (actual flight and taxi times, headwinds, holding patterns); (iii) load and payload estimates (based on seating configuration, cabin layout, an average passenger weight of 100 kg including baggage, and cargo assumptions); and (iv) a nonlinear fuel burn model that accounts for the different stages of flight—taxi, climb, cruise, descent.

Note though that flight distance is not observed in our data, and differences in average route length cannot be accounted for. This has as implication that the numbers on hubs and regional airports cannot really be compared.

Furthermore, regressing airport-level CO₂ per passenger would be misleading: without route distance, stage-length bias means the metric mostly reflects each airport's unobserved route mix. Also transfer counting and operational differences that drive fuel burn can skew hubs. Finally, the hub status is endogenous and co-determines distance mix and occupancy, risking ecological fallacy.

7.3.4 Conclusions on distributing flights between hub and regional airports

The literature review shows that congestion of large airports has a non-negligible environmental impact, as shown in the 2015 case study on the London Heathrow airport. Higher congestion impairs the implementation of a more efficient air traffic network, causing extra GHG and air pollutant emission. Furthermore, there is an open debate in the literature on whether the hub-and-spoke or the point-to-point network is the more environmentally efficient network system. Some research finds hub-and-spoke networks more efficient due to higher load factors on larger aircraft, while others argue point-to-point networks, with smaller regional jets, can reduce congestion and associated emissions. Recent aircraft efficiency gains (e.g. Boeing 787, Airbus A350) have strengthened the environmental case for hub-and-spoke systems. However, evidence from the literature also shows that congestion at major hubs contributes to excess fuel burn and emissions, with reduced traffic during COVID-19 enabling more fuel-efficient practices like continuous climb and descent. Overall, environmental outcomes depend on the trade-off between aircraft economies of scale and the congestion externalities of concentrated hub operations.

Regional airports are not generally seen by consulted stakeholders as having a considerable or significant role in easing congestion at major EU hubs, with concerns raised about the environmental sustainability of expanding regional services and calls for closer alignment with transport and climate objectives. Survey responses on the environmental impacts of shifting flights between hubs and regional airports were divided, with about a third supportive, a third opposed, and a third uncertain. Supporters highlighted potential benefits such as reduced hub congestion, lower taxiing emissions, shorter journeys, better local access, and readiness for low-emission aircraft. Critics, however, warned of increased pollution and noise in new areas, inefficient use of smaller aircraft, infrastructure impacts, and stressed that true sustainability requires fewer flights, stronger rail alternatives, and widespread availability of low-carbon fuels.

If regional airports effectively absorb excess demand, then an increase in passenger traffic at regional airports located near a hub should be associated with fewer departure delays at that hub. This forms the central hypothesis tested by original data analysis. Regression results show no significant evidence that regional airports reduce hub congestion, indicating that delays at major EU hubs stem from structural and operational limits that are largely unrelated to the absence of nearby regional airports.

Through original data analysis, this Study also tested whether shifting passenger traffic from hubs to regional airports can reduce local air pollution (NO₂ and PM_{2.5}) by dispersing emissions and externalities across a wider area. Results indicate that shifting passengers to regional airports modestly improves regional air quality (lower NO₂ and PM_{2.5}). Descriptive statistics show that flights departing from hubs and regional airports have broadly similar average CO₂ emissions per passenger (234 kg vs 247 kg) implying regional airports may ease local air pollution without reducing aviation's global climate impact. However, flight distance is not observed in our data, so possible differences in average route length mean that these averages CO₂ emissions for hubs and regional airports are not truly comparable.

7.4 Air-HSR competition, inter-modality and environmental effects

7.4.1 Literature review

Air travel is practically the only feasible mode of transport for travellers in certain long-haul routes. However, for short-to-medium routes, air travel naturally competes with other modes of transport, namely rail and road transport. Aid to airports, therefore, may have indirect effects on the modes of transport with which air travel directly competes. This section focuses on HSR, by far the closest substitute for air travel in terms of travel time. The rather recent development of HSR in Europe has attracted the interest of several studies in the literature, which analyse its relationship with the aviation market from several aspects. We will review the literature addressing three main topics: (i) competition between air travel and HSR for the connection of European cities; (ii) inter-modality and the possibility of substituting legs of indirect flights with HSR; (iii) other possible effects of inter-modality on the competition between hub and regional airports.

Many studies have found that, on a given route, higher competition from HSR has exerted a downward pressure on airfares, flight frequencies, and air traffic, as well as inducing a decrease in airlines' market power. HSR has a strong competitive advantage with respect to air travel as, all other things equal, it offers a better travel experience to passengers thanks to key characteristics as higher travel comfort (enabled by less security controls), higher punctuality (it is less exposed to weather events/congestion) and typically higher frequency of connections which gives the passenger more options (ALG, 2024).¹⁸⁵ ALG (2024) however shows that the key factor driving the choice of HSR over air travel is the door-to-door travel time. On rather short routes (e.g. London-Paris or Madrid-Barcelona), despite the longer pure travel time, HSR travel typically requires less time for passengers to reach the departure station compared to reaching the airport, and less time to reach the final destination from the station than from the airport. The study shows that the market share of HSR on a sample of city-to-city connections is highly correlated with the difference between average door-to-door travel time for the two modes of transport. Albalade et al. (2015) analyse the effects of HSR development on air travel, using a sample of 180 routes (in France, Italy, Spain and Germany), over the 2002-2010 period. They estimate a regression of the number of seats and frequency offered on the routes in the sample on a variable measuring the presence of competition by HSR on the same route. They find that, on average, in response to facing competition by HSR on the same route, airlines reduced the number of seats offered but not the frequency of the offered connections. This happened probably because airlines are often required to maintain high frequency of services to remain competitive with HSR services. These results, however, hide some heterogeneity across countries: e.g. in Spain the HSR variable significantly affects both the number of seats and the frequency. In other cases, airlines may decide to directly exit from a route, as recently done by Vueling for the Barcelona-Madrid route (Hoskins, 2025).

In certain routes, despite the huge advantage of HSR in both door-to-door travel time and average prices (e.g. Madrid-Valencia with a 40 min difference and 78% lower prices, and Paris-Bordeaux with a 40 min difference and 82% lower prices), airlines continue to operate a number of flights, with air travel keeping market shares around 10% (ALG, 2024). Air services on these routes are maintained by the hub status of the airports

¹⁸⁵ The competitive advantage may also result from consumers higher willingness to pay for a more environmentally friendly option; the literature, however, has shown that comfort, cost and travel time are the more important factors in shaping consumers' demand (Nurhidayat et al., 2023).

(e.g. Madrid and Paris), providing connections for long-haul trips not directly accessible from the origin cities (ALG, 2024). In this regard, inter-modality, i.e. the connections of airports to the HSR network, could make it possible for passengers to substitute at least one leg of a long-haul trip from air to train travel. Indeed, in the examples above (i.e. Madrid-Valencia and Paris-Bordeaux), an HSR line connecting Valencia and Bordeaux to the hub airports is missing. As explained in ALG (2024), for this process to take place, not only should airports be accessible with HSR, but a full inter-modal experience for passengers will be also required, e.g. as far as ticket purchasing and handling baggage are concerned.¹⁸⁶

The substitution of air travel with HSR can have significant environmental benefits, because HSR involves less marginal per-passenger environmental damage than air travel (Givoni and Dobruszkes, 2013). Avogadro et al. (2021) estimate a potential 4.7% reduction in total European aviation's CO₂ emissions from a policy that would ban all short-to-medium flights for which there is a feasible HSR alternative. Furthermore, Janic (2011) emphasises the de-congestion effect that the substitution of short-haul flights with HSR can have on hub airports, which in turn can produce relevant environmental benefits. The study focuses on the London Heathrow airport and estimate a reduction of approximately 12.5 tonnes of CO₂ emissions for each short-haul flight substituted with HSR. On the other hand, as pointed out by Albalade et al. (2015), the increased inter-modality of hub airports could stimulate the growth of long-haul flights, whose environmental impact is typically larger than short-to-medium flights. This potential indirect negative environmental effect, however, has not been yet quantified in the literature. Furthermore, D'Alfonso et al. (2015) show that new HSR services may also generate additional demand for traffic overall, thus reducing the net environmental benefits from air-HSR substitution.

A crucial stream of the literature (mainly theoretical) focuses on the effects of connecting the HSR network to airports on the competition between airports, and the possible redistribution of flights and market power from hubs to small airports, or vice versa. It suggests that, due to HSR development, air traffic might become more evenly distributed among airports in certain cases; in other cases, traffic may become more concentrated at a few major airports (Zhang et al., 2019). The overall effect crucially depends on the characteristics of the network and is expected to be different case by case. Zhang et al. (2019) explain that there are at least three possible mechanisms at play, which could produce different outcomes. First, HSR, as a substitute mode of transport for air travel should produce a loss of traffic across all airports. However, short routes, on which small airports typically rely more than hubs, are expected to be affected more than long routes, implying a relatively larger loss of traffic for small airports. Second, HSR can create feeding effects, whereby improved accessibility of airports by HSR and inter-modality induces an increase in air traffic. In this case, airports with better HSR accessibility (which typically are the large ones, at least in the initial phases) can gain over the others from more inter-modality. Third, HSR and inter-modality cause airports' catchment areas to be larger, thus increasing competition among airports. With increased competition, larger airports are expected to benefit, as larger airports with better connectivity are likely to win traffic over the weaker ones.

¹⁸⁶ One example of a collaboration between airlines and train operator leading to a full inter-modal experience is the one between SWISS airline and SBB railways, which allows passengers to reach the Zurich airport by train for the second leg of the trip. According to ALG (2024), since the partnership's launch in 2022, passenger demand at SBB Zurich Airport station has risen 66%, compared to a 27% network average. Despite this, SWISS still operates short-haul flights on routes covered by the HSR partnership, like Geneva-Zurich. The airline says it is discussing upgrades to the Air Rail service, including improved baggage handling, which, alongside growing adoption and environmental concerns, is expected to further boost demand.

Nevertheless, if the larger airports are highly congested, unsatisfied travel demand may spill over to the smaller airports which can be easily accessed by HSR, as diseconomies of scale arise. Xia et al. (2019) develop a model through which they show that improving accessibility of small airports through inter-modality and air-HSR cooperation can substantially improve social welfare by diverting traffic from congested to not-congested airports. However, they show that this cooperation may not arise automatically as it may not be profitable for airports and HSR. Zhang et al. (2019) suggest that this may induce policymakers to incentivise inter-modality at small airports especially. Note that the literature on the overall environmental effects of inter-modality lacks empirical investigations and remains largely theoretical.

7.4.2 Consultations

In the stakeholder survey, respondents were asked to indicate competitive impact of State aid to airports on other modes of transport, such as HSR. 15 out of 23 respondents (including five airports and/or airport associations, three airlines and three aviation industry associations, two business industry associations and two NGOs in the field of climate change) mention that State aid to airports has little to no competitive impact on HSR.¹⁸⁷ The reason these stakeholders appoint is that in some parts of the EU, HSR coverage is limited or absent especially in Sweden, Finland, rural areas, and OR. In these remote places regional air links complement, and do not compete with rail. The reason being that regional air provides basic accessibility where journey times by surface transport are uncompetitive. Several airports, airlines and aviation industry associations note that even where alternatives exist, passengers naturally shift to rail when trips are under ~3.5 hours, so extra regulation is unnecessary. One industry association in France cites France's spending scale €100–200 million/year for airports versus €15–20 billion/year for rail as evidence that airport aid is small; another points to Eurocontrol estimates that planned HSR and night trains would cut EU air demand by only ~0.3–0.4% by 2050, implying limited cross-mode effects.

Some environmental NGOs argue airport aid can distort modal competition by lowering the cost of flying, slowing investment in HSR, and sending the wrong price signals given rail's lower environmental footprint. They warn subsidised air services especially on short/medium-haul corridors can draw riders from rail and undermine climate goals, urging a more balanced policy that avoids disadvantaging the most sustainable modes. A few NGOs suggest considering air-maritime intermodality in OR and, more broadly, aligning aid with decarbonisation objectives to prevent incentives that work against long-term rail development.

The consultation results indicate mixed views on whether the inclusion of provisions in the AG to support intermodality (e.g. direct rail connections at airports) would effectively reduce emissions and environmental impacts. As illustrated in Figure 7.6, in the stakeholder survey (n=60, left chart), a clear majority of 61% responded "Yes," while 25% said "No" and 14% were uncertain. Responses from the public consultation (n=98, right chart) were more divided: 41% supported the measure, 24% opposed it, and 35% indicated uncertainty. When it comes to the responses by the stakeholder type:

- Support was strongest among environmental NGOs (n = 8), of which 63% answered "Yes".
- Broader aviation industry associations (n = 12) were also relatively supportive, with 58% in favour.

¹⁸⁷ This reflects the perspective of stakeholders primarily from the aviation sector, which may influence how the impact is perceived.

- Airports and airport associations (n = 52) were more evenly divided: about 42% supported, 36% opposed, and 22% were uncertain.
- Among public authorities (n = 18), 39% expressed support, 22% opposed, and 39% were uncertain.
- Airlines and airline associations (n = 6) were split, with 33% in favour and 50% against.
- Finally, citizens (n = 2) showed mixed opinions, with one in favour and one opposed.

Figure 7.6: Would including provisions in the Aviation Guidelines that allow support in favour of intermodality i.e. integration with other modes of transport like rail connections be effective to decrease overall emissions and other negative environmental impacts



Source: Left to right – stakeholder survey (n=60) and public consultation (n=98)

Several airline associations in the public consultation viewed intermodality as effective mainly where high frequency rail or efficient bus and maritime links can replace short feeder flights without compromising travel time or comfort. Airlines that responded to both consultations also called for seamless multimodal products, including combined ticketing, through-checked baggage, aligned compensation rules, and integration through Multimodal Digital Mobility Services (MDMS). They stressed that these measures are essential to make rail and air truly complementary rather than competing options.

Several airports and airport associations explained that multimodal infrastructure is often planned and funded by regional authorities, not by airports, and that aid conditionality should not require intermodality when it lies outside the airport's control. Some airports also warned against premature regulation, pointing out that EU initiatives on multimodal passenger rights and MDMS remain under development. They noted concerns that mandatory data sharing could be introduced before clear rules exist, creating asymmetric obligations across transport modes. In addition, several airports pointed to local opportunities such as airport rail links (for example, Brussels Airport and Munich Airport) that could shift ground access from cars to public transport, offering immediate benefits for congestion and emissions.

Several regional public authorities mentioned that in outermost and island regions, maritime-air connections and shared renewable or SAF logistics are more relevant than rail due to limited production and storage capacity, which makes joint infrastructure for aviation and shipping more efficient. Some regional public authorities from sparsely populated or rail-poor regions in the Nordics, Baltics, and Eastern Europe stressed that aviation remains the only viable mode in many cases, cautioning that intermodality provisions must not penalise remote accessibility. Several national public authorities also supported the idea that customer centric thresholds, such as a three-hour door to door rail journey, could guide the shift to intermodal alternatives, provided services

remain reliable and frequent and passengers are protected in case of missed connections.

Several NGOS considered intermodality most effective where high frequency rail or bus connections can substitute short feeder flights while maintaining passenger convenience. They also highlighted the importance of environmental and social benefits, emphasising that well-designed multimodal systems can substantially reduce emissions without lowering travel quality.

Overall, across both consultations views on adding intermodality provisions to the AG are divided. While many stakeholders, in particular, environmental NGOs, see intermodality as a key tool for decarbonisation particularly where strong rail or bus alternatives exist, some airports and industry associations stress that airports cannot deliver intermodality on their own if wider transport networks are not already in place, pointing to feasibility limits, governance gaps and risks for regions without viable substitutes. The debate therefore centres less on principle than on practical implementation, with calls to balance ambition on emissions reduction with flexibility for different regional contexts.

7.4.3 Conclusions on air-HSR competition, inter-modality and environmental effects

Based on the available literature, it appears that State aid to airports can affect competition with HSR. The existence of substitutability creates the conditions for a distortive impact of State aid to airports on inter-modal competition. By supporting airports, State aid could dampen the natural substitution effect toward HSR, potentially tilting competition in favour of air travel and limiting rail's market share growth, especially if aid preserves marginal short-haul connections where HSR is more efficient both economically and environmentally. Some stakeholders (environmental NGOs) share this concern and caution that such aid can distort competition by making flying artificially cheaper, slowing HSR investment, and undermining climate goals. Most stakeholders, however, consider State aid to airports to have little competitive impact on HSR, noting limited HSR coverage in some parts of the EU, the complementary role of regional air links in OR, and passengers' natural preference for rail on journeys under ~3.5 hours.

The literature shows that even in routes where the travel time advantage of HSR is consistent, air travel retains market shares due to the presence of connecting flights for long haul routes. Allowing State aid for intermodality, and in particular linking airports to HSR networks could foster emissions reduction by enabling substitution of short-haul flights with rail legs, provided that seamless intermodal services (ticketing, baggage handling, scheduling) are ensured. Studies estimate meaningful CO₂ savings if short-to-medium flights with HSR alternatives were curtailed, and inter-modality could also relieve congestion at hubs, improving operational efficiency and lowering fuel burn. However, evidence also cautions that better airport-HSR integration may stimulate demand for long-haul flights or generate new traffic overall, reducing net environmental benefits. The effectiveness of such provisions would therefore depend on careful design: targeting routes with viable HSR alternatives, ensuring alignment with broader climate goals, and prioritising integration at congested hubs and selected regional airports where inter-modality can genuinely reduce emissions without spurring offsetting traffic growth.

The consultation results indicate mixed views on whether the inclusion of provisions in the AG to support intermodality (e.g. direct rail connections at airports) would effectively reduce emissions and environmental impacts. Several national public authorities and airports argue for explicit sections in the AG on multimodality/intermodality (including buses and maritime links, not just rail), citing benefits such as fewer short-haul flights,

reduced car trips to access airports, and better resource use. Intermodality is seen as most effective where high frequency HSR (or efficient bus/maritime links) can replace short feeders without penalising travel time or comfort. Airports and airlines call for seamless products such as combined ticketing, baggage through-check, aligned compensation regimes, and MDMS-enabled distribution to make the rail/air alternative truly attractive.

8 AG clarity, burdensomeness and compliance

This section examines the clarity, burdensomeness and compliance of the AG focusing on two key questions: whether the AG are sufficiently clear in their definitions and scope, and whether their procedural and administrative requirements impose disproportionate burdens on stakeholders. The section draws on qualitative insights gathering stakeholders' perspectives (Section 8.1). The first part examines the clarity of the AG with particular attention to the interpretation of key definitions and concepts as well as their alignment with other State aid frameworks (Section 8.1.1). The second part analyses the administrative application of the AG, focusing on the procedural steps involved in aid notification, verification, and compliance. It explores the extent to which these requirements are proportionate or whether they impose excessive administrative and financial burdens (Section 8.1.2). Finally, the concluding Section 8.2 consolidates the evidence presented, providing an integrated assessment of the specific characteristics of the clarity, burdensomeness and compliance of the AG.

Table 8.1 summarises the RQs addressed in this section.

Table 8.1: Mapping of the RQs against sections

Research questions	Section
28. Are the AG sufficiently clear (definitions, application of tests, etc) and if not in which regard?	Section 8.1.1
29. Are the AG overly burdensome and if so, in which regard?	Section 8.1.2

Source: Project Team

8.1 Consultations

Of the 95 respondents to the public consultation, 36% consider the AG sufficiently clear in terms of definitions, application and interpretation, while 46% find it unclear. The remaining 18% are uncertain. The results on the clarity of the AG are similar across different stakeholder types (airports, airlines, aviation industry associations, public authorities).

In the stakeholder survey, most respondents find most aspects of the AG to be either "clear" or "very clear" (about 65-75%). The lowest level of clarity is reported for the intensity of aid and types of costs allowed which are cornerstones of the State aid notification process, while the catchment area definition, criteria for receiving aid, and duration/review of aid aspects, receive slightly higher clarity ratings overall. Here again, airports and their associations find the rules less clear.

8.1.1 Clarity

Table 8.2: Clarity of the Aviation Guidelines

	Very Clear (5)	Clear (4)	Somewhat Clear (3)	Not Clear (2)	Not Clear at All (1)
Findings from stakeholder survey					
Criteria for receiving aid	35%	40%	20%	5%	0%
Types of costs allowed	30%	35%	20%	15%	0%
Intensity of aid	25%	35%	20%	15%	5%
Catchment area and market definition	35%	35%	20%	10%	0%
State aid procedure and notification	30%	35%	25%	10%	0%
Duration and review of aid	30%	40%	20%	10%	0%
Operating aid for regional airports	30%	40%	20%	10%	0%
Investment aid	30%	40%	20%	10%	0%
Start-up aid to airlines	30%	40%	25%	5%	0%
Findings from public consultation					
	Yes		No	I don't know	
<i>Are the Aviation Guidelines overall, sufficiently clear (definitions, application and interpretation of tests in practice etc.)?</i>	36%		46%	18%	

Source: Stakeholder survey (n=52) and public consultation (95).

When asked to substantiate their responses, several airports and a EU-level airport association cite ambiguous or inconsistent definitions of what exactly counts as “airport infrastructure”, “eligible costs”, “reasonable profit”, a “remote region” or “catchment area”, and how to treat security/sovereign services. One airport in Ireland even reported relying on workshops and national guidance to interpret the rules. Several airports and national-level airport associations also highlight overlaps or conflicts with other State aid frameworks, especially the CEEAG, which create uncertainty about which rules prevail. Several provisions were seen as outdated or ill-suited to current realities: the planned phase-out of operating aid by 2027, funding-gap baselines anchored in 2009–2013, post-COVID-19 shifts in demand and higher fixed costs, aid-intensity caps and GBER thresholds, and limits on start-up aid durations. Airports also asked for clarification on the treatment of non-economic activities such as security, perimeter protection, or dual-use/defence investments. In addition, several airports and an EU-level airport association argued that the AG should specify how SAF, electric and hydrogen aircraft, and related charging/refuelling and energy infrastructure are treated for aid purposes, rather than only referring to the “emergence of zero-emission technologies”.

When distinguishing further between stakeholder types, smaller airports and municipalities in particular, stress that the rules are too complex and burdensome, while airlines highlight distortions created by rigid provisions such as the Market Economy Operator Principle (“MEOP”)¹⁸⁸ approach and other start-up aid rules. The core criticism is on the need for clearer definitions, streamlined procedures, alignment with CEEAG

¹⁸⁸ MEOP is a test used to assess the existence of State aid in cases of public investments in the form of capital injections. To determine whether a public investment constitutes State aid, the public operator must examine whether, in similar circumstances, a private investor of a comparable size operating in normal market economy conditions would have made the same investment.

and other frameworks, and more flexible tools that reflect today's conditions, crisis impacts, and decarbonisation needs.

Overall, the consultation shows that some stakeholders find the AG unclear, with concerns focusing on ambiguous definitions, overlaps with other State aid frameworks, and methodologies that no longer reflect current realities.

8.1.2 Burdensomeness

The majority of respondents to the stakeholder survey find most aspects of the AG mostly manageable (around 50-56%). A significant share perceives the AG as slightly burdensome (around 22-28%), and a smaller but notable proportion considers them quite burdensome (14-23%). Only a minority finds the AG very burdensome (around 4-6%). The most burdensome areas relate to the computation of permitted aid amount based on intensity of aid and State aid procedure and notification, with the highest percentages in the "quite" and "very" burdensome categories. The results are similar across different stakeholder types (airports and airport associations, airlines and public authorities).

Table 8.3: Burdensomeness levels of Aviation Guidelines

Aspect	Mostly manageable (%)	Slightly burdensome (%)	Quite burdensome (%)	Very burdensome (%)
Criteria for receiving aid	54%	28%	14%	4%
Types of costs allowed	53%	26%	17%	4%
Intensity of aid	46%	27%	22%	5%
Catchment area and market definition	53%	22%	21%	4%
State aid procedure and notification	44%	28%	23%	5%
Duration and review of aid	53%	23%	18%	6%
Operating aid for regional airports	56%	23%	15%	6%
Investment aid	55%	23%	16%	6%
Start-up aid to airlines	53%	25%	18%	4%

Note: Stakeholder survey (n=48).

According to the stakeholders consulted, criteria for receiving aid and cost definitions often demand extensive legal and financial interpretation, as distinguishing between economic and non-economic activities, and between eligible and non-eligible costs is not straightforward. Preparing detailed business plans, funding gap analyses, and counterfactual scenarios places a heavy workload on airports with limited resources. Notification and approval processes were widely described as too lengthy, costly, and bureaucratic, with consultancy and legal fees sometimes exceeding the value of the aid. This is particularly burdensome for small regional airports lacking legal expertise. In Sweden, municipalities and regional airports repeatedly stress that administrative and legal costs are "huge" relative to the aid, that requirements are hard to meet for lean organisations, and propose simpler small-scale or pilot initiatives including a lighter notification regime for low-impact measures. The lack of flexibility in adapting aid duration or reviewing measures when market conditions change, such as slower-than-expected route recovery, was seen as discouraging for long-term planning.

Contributions to the call for evidence also highlighted administrative burdens in the current framework. Several public authorities called for clearer categorisation of airports and activities and for streamlined thresholds with greater reliance on the GBER. Airports and associations alike considered notification and verification procedures disproportionate, particularly for smaller operators, and proposed exemptions to ease access to aid. One environmental organisation added that demonstrating the incentive

effect often requires unrealistic counterfactuals that small airports cannot reasonably provide.

Airlines and industry bodies in the stakeholder survey add competition and usability concerns. The current MEOP/incremental-margin approach can distort competition by favouring new entrants over incumbents and by ignoring total-cost coverage; they also warn against benchmarking that is impossible to apply consistently (similarly, one airline network in the call for evidence criticised the application of the MEOP as creating uncertainty and difficult to apply in practice). One airline deems the start-up-aid provisions inflexible and, thus, under-utilised by Member States. Several contributors ask for explicit recognition and easier support for SAF, electric/hydrogen aircraft, and green airport infrastructure within a coherent, predictable framework.

Suggested improvements converge on:

- clearer, harmonised definitions (including for regional/border/outermost areas, security/sovereign tasks, and eligible costs);
- alignment and consolidation with other State aid regimes (CEEAG, Clean Industrial Deal), with explicit “conflict-of-rules” guidance;
- updated baselines for funding gaps (e.g. 2019–2023) and tools that can flex during crises;
- standardised templates, checklists, and digital portals to reduce red tape, alongside transparent assessment criteria and a public (dedicated) case database;
- higher or tiered aid intensities for small/peripheral airports (e.g. proposals from Sweden and Poland to lift investment/operating-aid ceilings for <1 million ppa), and in some cases longer operating-aid windows where airports provide essential connectivity;
- explicit eligibility for joint marketing, route promotion, and reasonable profit;
- and a dedicated chapter for OR referencing Article 349 TFEU.

8.2 Conclusions on clarity, burdensomeness and compliance of the AG

Across both consultations, the results point to a significant share of stakeholders encountering difficulties with core elements of the AG. In the stakeholder survey, around 30% of respondents rate key provisions such as intensity of aid, types of eligible costs, catchment area definition and State aid procedure and notification as either unclear or only somewhat clear. Similarly, 46% of the respondents to the public consultation consider AG rules unclear. When looking at burdensomeness, one-fourth of surveyed stakeholders find these same provisions quite or very burdensome, with the intensity of aid rules and the State aid notification process generating the highest levels of difficulty. Taken together, these results suggest that around one-third of respondents struggle with the most critical provisions of AG, indicating that clarity and usability issues remain significant for a notable share of stakeholders.

Clarifications are required for example on the treatment of non-economic activities such as security, perimeter protection, or dual-use/defence investments. Smaller airports and municipalities in particular, stress that the rules are too complex, while airlines highlight distortions created by rigid provisions such as the MEOP approach and other start-up aid rules. Airports also cite the need for streamlined procedures, alignment with CEEAG and other frameworks. Regional public authorities pointed out that certain provisions such as the three-year limit on start-up aid, are not flexible enough for certain regions with structural disadvantages, such as remote and OR (see Section 4.2.2). They call for the three-year limit to be extended or made more adaptable to regional circumstances, to better support long-term development and resilience.

On burdensomeness, according to the stakeholders consulted, aid eligibility criteria and cost definitions often demand extensive legal and financial interpretation. Preparing detailed business plans, funding gap analyses, and counterfactual scenarios places a heavy workload on airports with limited resources lacking legal expertise. Notification and approval processes were widely described as too lengthy, costly, and bureaucratic, with consultancy and legal fees sometimes exceeding the value of the aid. In particular regional authorities and airports, repeatedly stress that administrative and legal costs are “huge”, that requirements are hard to meet due to their capacity constraints. The lack of flexibility in adapting aid duration or reviewing measures when market conditions change is seen as discouraging. Many call for greater reliance on GBER.

Annex A Methodology and fieldwork of the case studies

A.1 Methodological approach

The case study workstream carried out six case studies. Each case study was structured to investigate one specific topic or a specific perspective on the topics of interest of the Study. The six case studies examine:

- the relationship between a regional airport and a hub, focusing on the point of view of a secondary regional airport located near a hub airport, and examining the nuances of competition and complementarity;
- the ability of a regional airport to be profitable without State aid, examining the conditions under which this actually occurs in practice;
- the situation of an outermost region (OR) airport, examining its contribution to regional connectivity, its financial constraints, and the need for State aid;
- the operations of a specialised cargo airport operations, to better understand the differences between passenger and cargo operations at airports in terms of competition, profitability, investment needs;
- the efforts of a regional airport toward the greening of aviation and related environmental challenges;
- the functioning and relevance of start-up aid from the point of view of a regional airline.

Case studies are based on one-hour online interviews with a “target” stakeholder (primary interviews), which constitute the core evidence for each case study. These are supplemented with desk research and, where possible, with one-hour interviews with one or more additional stakeholders (secondary interviews).

The “target” stakeholder was either an airport or its managing company, or an airline, depending on the topic. The number of secondary interviews varied across case studies. The selection of additional stakeholders for these secondary interviews followed two main principles:

- stakeholder type: depending on the topics covered, interviews could include other airports/airlines, public authorities, regulators, or other market actors;
- nexus to the target: secondary stakeholders were chosen not only for their general knowledge of the case study topic but also for their direct relationship with the target airport or airline. This ensured that their insights were grounded in the specific operational and regulatory environment of the case study.

This methodological approach allowed the case studies to capture both the internal perspective of airports and airlines and the external perspective of stakeholders directly interacting with them, in order to triangulate perspectives and validate findings.

It should be noted that the case study findings reflect the views and inputs provided by the interviewees. Desk research has been limited to: (i) inform the selection of the targets and of secondary stakeholders; (ii) collect information and data useful for drafting broad and detailed agendas for the interviews; (iii) complete, provide context or refine, where necessary, the information exchanged during the interviews, in order to support the drafting of the minutes and the case study reports.

A.2 Case study process

The Project Team adopted the same methodology in each case study, consisting of the steps outlined in this section.

The first stage involved initial desk research, which was used to identify potential targets and assess their relevance to the topics and research questions in line with the case study focus. This research also served to identify secondary stakeholders with relevant connections to each potential target, ensuring that those ultimately approached would not only have general expertise but also specific, contextual knowledge of the case study focus. After identification, targets and stakeholders were ranked and prioritised according to their relevance to the research questions. At this stage, efforts were also made to avoid duplication across case studies by setting priorities and ensuring that each selected entity would contribute distinct and complementary insights.

To maximise the likelihood of successful engagement, relevant contacts were identified within each organisation, focusing on roles directly connected to legal/regulatory affairs or other relevant functions (depending on the topic of the case study), thereby avoiding generic communication channels.

Following the identification of the case study target and relevant stakeholders, the Project Team initiated outreach efforts. The primary objective was to secure an interview with the target airport or airline, which constituted the anchor of the case study. Only once these primary interviews had been confirmed did the Project Team expand the outreach to secondary stakeholders. Where initial contacts declined or did not reply to repeated follow-ups, alternative candidates were identified and contacted.

The initial contact email included a comfort letter provided by the EC, a clear description of the Study's objectives and a commitment to confidentiality regarding the information to be exchanged. This proved important for encouraging detailed responses, particularly in areas involving commercially sensitive information. In several cases, multiple follow-up emails and phone calls were required, including instances in which the EC supported outreach by transmitting invitations directly to prospective interviewees.

Upon confirmation of participation, interviews were scheduled with one to two weeks' notice to allow sufficient preparation time. This involved additional desk research on the interviewees, conducted with the objective of gaining a deeper understanding of their background, operations, and institutional context. The insights obtained through this research informed the formulation of interview questions, ensuring their specificity and relevance. A list of proposed topics was then circulated in advance to the interviewees, in order to align expectations and provide clarity regarding the scope of the discussion. Based on this, a detailed agenda was prepared for each interview, tailored to the circumstances of the target and the stakeholder.

Interviews were then conducted, typically in the form of one-hour online sessions with the primary targets and followed, where possible based on availability, by interviews with stakeholders.

Following the interviews, detailed minutes were prepared and shared with the interviewees for review, so as to confirm their accuracy and completeness. Where necessary, follow-up contacts were made when clarifications or additional data were required. In only one case, upon request of the interviewee, the online interview did not take place and was replaced by a written questionnaire.

The timeline of outreach and interviews spanned from early February to mid-September 2025.

Overall, 13 targets were initially contacted, of which 6 primary interviews were ultimately conducted, covering each case study (one airline and five airports). The remaining 7 targets either declined to participate or did not respond despite multiple follow-up attempts.

In addition to the targets, 16 stakeholders were approached for secondary interviews, ranging from airlines, nearby airports, and local authorities to high-speed rail operators.

Of these, 7 interviews were successfully completed, with the remainder either declining to participate or not replying to repeated outreach attempts.

The final stage of the process consisted in delivering case study reports and integrating the relevant evidence into the Study. First, the minutes of the interviews were combined with the results of the desk research to produce the case study reports. This ensured that each case study brought together insights gathered during interviews with quantitative and qualitative public information obtained from desk research. Second, the evidence from the case study reports has been incorporated into the sections of the Study where the evidence from all stakeholders' consultations is discussed, where it proved relevant to add insights on the topics discussed.

Table A.1 shows the type of target and of secondary stakeholder(s) that have been ultimately engaged for each of the six case studies.

Table A.1: Case studies stakeholder mapping

Primary or Target interview	Stakeholder 1 interview	Stakeholder 2 interview
Cargo airport	Cargo air carrier operating at the target	Regional public authority
Regional airline	Low-cost carrier competing with the target on certain routes	Granting authority that has been involved in start-up aid for new routes secured by the airline at one or more airports across Europe
Regional airport operator (greening of aviation)		
Regional airport located near a hub	Low-cost carrier serving the hub and/or the regional airport	
Regional airport that is profitable without aid	Main airline operating at the target	
Outermost region airport	Regional government	

Source: Project Team

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Annex C Literature review – Tables of airports' environmental impact

Table C.1: Airport activities and types of environmental impact

Functional element	Air pollution	Biodiversity impacts	GHG emissions	Land take	Landscape	Noise	Water pollution	Water use	Waste
Airport access	X	X	X	X	X				
Parking	X	X	X	X	X	X	X	X	X
Passenger terminals		X	X	X	X	X	X	X	X
Control tower		X	X	X	X	X	X	X	X
Aeronautical office buildings		X	X	X	X	X	X	X	X
Vehicles maintenance facilities		X	X	X	X	X	X	X	X
Hangars		X	X	X	X	X	X	X	X
Runways and taxiways		X	X	X	X	X	X		X
De-icing equipment for aircraft	X		X				X		X
Tanks with antifreeze		X		X	X		X		
Aircraft parking drainage pipes		X		X	X		X		X
Tracks de-icing equipment	X		X				X		
Tanks with antifreeze liquid		X		X	X				
Aircraft refuelling equipment	X		X						
Tanks for fuel storage		X		X	X		X		X
Fuel for the maintenance team	X		X	X			X		X
Urban waste									X
Hazardous waste		X		X	X				X
Buildings water, heating, ...			X						X
Aircraft maintenance test	X	X	X			X			
Aircraft take-off and landing	X	X	X		X	X			

Source: Gomez Comendador et al., 2019

Table C.2: Summary of environmental practices identified in the literature

Citation	Energy and atmosphere	Comfort and health	Water and wastewater	Site and habitat	Materials and resources
(Gómez Comendador et al., 2019)	- Control emissions of NOx, Sox, CO, PM, VOCs, CO₂; Limit use of air power units and ground power units - Use ecological cars - Offer infrastructure to support biofuels use - Manage energy consumption - Use renewable energy - Control air conditioning equipment for energy conservation - Use efficient indoor lighting	- Create noise map & mitigation plan - Take steps to isolate community buildings from noise pollution - Acoustic efficiency (number of people exposed per annual number of aircraft movements) - Restrict engine testing during certain time periods - Monitor indoor air quality	- Control water consumption - Reduce indoor/outdoor water consumption - Reduce water consumption in handling - Manage stormwater runoff - Treat wastewater	- Integrate with public/private transport - Select a site that meets aeronautical safety requirements - Measure soil quality - Protect native flora & fauna - Reduce light pollution - Reduce heat island effect	- Treat hazardous waste from maintenance activities - Recycle waste - Implement a construction/maintenance/demolition plan for infrastructure - Choose green building materials
(Lu et al., 2018)	Carbon emission reduction & energy conservation	Prevention and monitoring of noise			
(Chao et al., 2017)	- Conserve energy in buildings - Use ground power units over auxiliary power units - Use low-emission vehicles - Use energy-savings control devices - Use renewable energy - Monitor air quality - Shorten runways to reduce queuing time	Monitor noise	- Install water-saving devices - Use recycled water - Recycle wastewater	Practice ecological conservation	- Use green building materials - Engage in waste reduction, reuse, & recycling
(Ferrulli, 2016)	- Design airside layout to minimise aircraft emissions - Design infrastructure & buildings to minimise CO₂ emissions - Reduce building-level energy consumption - Reduce outdoor energy consumption - Use alternative & renewable energy	- Design airside layout to reduce noise impact - Provide physical mitigation barriers between operating areas & surroundings	- Landscape & design to reduce water use - Design for water efficient use - Design to maximise water harvesting, recycling, reuse - Design to reduce stormwater quantity - Design to improve stormwater quality	- Reduce parking footprint - Integrate infrastructure for public transport - Avoid destruction of sensitive habitats - Avoid attracting certain species - Design to reduce heat island effect - Design to reduce light pollution	- Design for storage & collection of recyclables - Design for deconstruction, reuse & recycling - Use recycled, bio-based, & rapidly renewable materials - Use materials with a high design service life

Source: Greer et al., 2020

Annex D Methodology and fieldwork of the surveys

D.1 Original sample selection

D.1.1 Stakeholder survey

Based on the requirements set by the ToR in terms of overall number of responses, geographical span and types of stakeholders, the Project Team constructed a long list of stakeholders to be contacted for the survey. To ensure representativeness, the stakeholder survey sample was developed using a stratified approach. The strata were defined by:

- the 15 countries referenced in the ToR: Cyprus, Finland, France, Germany, Greece, Italy, Lithuania, the Netherlands, Poland, Portugal, Romania, Slovenia, Sweden, the UK and Türkiye as well as organisations from ORs in the EU;¹⁸⁹
- stakeholder types (granting authorities, airports and airlines and their associations, regulatory bodies, audit bodies and NGOs).

Minimum quotas were set for each country and stakeholder type in order to collect the diverse views of all interested parties. The list of stakeholders was three times larger than the target set in the minimum quotas, to reflect an expected 1:3 response rate. In addition to national stakeholders, EU-level and international organisations (e.g. EASA, ACI, A4E, ERA, IATA, ICAO, EUROCONTROL, BEUC, T&E) were also included. This approach ensured a balanced and representative consultation sample across countries and stakeholder types. The survey invitations for the stakeholder survey were sent to 493 stakeholders.

D.1.2 Airport survey

The main aim of the airport survey was to collect data that would not be available from other sources, mainly on past and expected financial performance, on State aid received, and on ownership and management structure.

The sample of airports contacted for the airport survey was mainly designed to include airports eligible for start-up aid approval under the AG (but in a later stage also sent to a larger sample to increase the sample of respondents). To this purpose, based on the provisions of the AG, the Project Team has compiled a database using State-aid data from the following sources:

- the EC's Competition Case Search Database;
- the EC'S Transparency Database;
- the EC's State aid records (information shared by the EC).

The eligibility criteria for start-up aid under the AG included: (i) airports with fewer than 3 million passengers per year; (ii) airports located in remote regions, regardless of size; and (iii) exclusion of airports where there is another airport in the same catchment area operating under the same conditions.¹⁹⁰

¹⁸⁹ More information available at: https://ec.europa.eu/regional_policy/policy/themes/outermost-regions_en.

¹⁹⁰ Note that the 2014 State Aid Guidelines also mention high speed rail destinations to define compatibility of start-up aid on a certain route; this element, however, will not be included when constructing our sample, as it is outside the scope of this Study to include high speed rail destinations. Furthermore, the third condition on catchment areas will initially not be considered as it this stage we do not yet know what eligible airports effectively have received aid.

From these sources, in some cases the aid concerns a specific airport, while in others it is granted as part of a national or regional aid scheme. For example, the case SA.46709 pertains to start-up aid for new routes from/to airports within the Region of Calabria. In such instances where aid applies to a broader region, the Project Team reviewed the details of the decision to identify the specific airports eligible for the aid. Following this approach, the database captures both airports linked to the approval of individual start-up aid measures and those qualifying under aid schemes. Moreover, the survey sample selection included also: all airports that are located in ORs (as per the EC request); and a number of larger airports beyond the scope of start-up aid, according to the wider coverage of the RQs envisaged by the ToR.

Statistics on the airport survey responses are illustrated in Annex E.4.

D.2 Surveys dissemination

The questionnaires for the stakeholder and for the airport surveys have been designed based on the RQs envisaged in the ToR. After review, the two questionnaires have been approved by the EC.

The airport and the stakeholder surveys were both launched, after a pilot phase, on 24 February 2025, and extended until 30 September.

Throughout the cycle of the project, the team was outreaching to both airports and stakeholders to encourage participation. This outreach focused on those who had not yet completed the surveys and those who had partially completed the surveys.

In addition to the initial dissemination of the survey questionnaires, and apart from usual follow ups, several actions have been undertaken to increase participation. More details are described below.

In the case of airport survey, survey requests were sent to 358 airports. The total includes also 18 additional airports that have been contacted following their participation to the public consultation run by the EC.¹⁹¹ In the course of the project, the Project Team has contacted several airport managing companies, EU-level and national level airport associations, inviting them to participate in the surveys and to share the survey invitation with their members. To obtain the minimum financial data required for the data analysis (see Section 1.1.3), an Excel template was sent in early July 2025 to all airports that had not yet responded to the survey or had not provided financial information in their submissions of the survey questionnaire. The data request was also disseminated to airport members by ACI. For the number of responses received to the airport survey, whose results have been integrated in the data analyses, see Annex E.4.

In the case of the stakeholder survey, survey requests were sent to a total 493 stakeholders. This set includes also 60 entities contacted only after the EC shared the results of the public consultation. In May 2025 the Project Team launched an interview programme, to supplement the number of stakeholder survey responses. Responses to the public consultation run by the EC have been leveraged to expand the sample and the coverage of the research questions, leveraging responses from both the consultations, as described in Section 1.1.2.2. The number of responses received to the stakeholder survey and to the public consultation are displayed in Table D.1. When the same stakeholder responded both to the stakeholder survey and to the public consultation, to avoid double counting, Table D.1 includes the response only in the former.

¹⁹¹ A description of the public consultation is provided in Section 1.1.2.

Table D.1: Responses to stakeholder survey and public consultation

Survey type	Responses
Stakeholder survey	73 complete and 33 partial (106 total responses)
Public consultation	81 complete and 25 partial (106 total responses) ¹⁹²
Total	154 complete and 58 partial responses (target: 150 complete responses)

Source: Project Team elaboration of survey responses

Table D.2 shows the distribution of stakeholder types.

Table D.2: Distribution by stakeholder type of responses to stakeholder survey and public consultation

Stakeholder group	Stakeholder survey	Public consultation (*)	Combined
Airport, airport managing body or airport association	18%	(47%) 56%	37%
National or regional granting authority	39%	(29%) 21%	30%
Broader aviation industry association ¹⁹³	17%	(8%) 7%	12%
Environmental NGOs	16%	(5%) 5%	10%
Airline or airline association	10%	(7%) 6%	8%
Citizens	--	(4%) 5%	3%

Note: (*) For the public consultation, in brackets we provide the percentages before the elimination of the 30 stakeholders that also responded to the stakeholder survey and are therefore already represented in the preceding column.

Source: Project Team elaboration of survey responses

¹⁹² Excluding 30 responses from the stakeholders that participated in the stakeholder surveys and public consultation.

¹⁹³ Broad-based industry associations that bring together stakeholders with diverse (and at times conflicting) interests and cannot be identified with any single stakeholder group. These may combine airlines, airports, aircraft manufacturers, cargo associations, workers in the aviation industry, or national business associations that also work in the general field(s) linked to aviation.

Annex E Data Description

E.1 Commercial Aviation Data

E.1.1 Cirium Data Description

Cirium offers detailed datasets aligned with the project's technical requirements, including variables that capture operational, financial, and environmental metrics at the airline-route level. In particular, the dataset includes route-airline specific data at the level of individual legs, and this at a quarterly frequency from 2014 to 2023, covering the EU, UK, and Türkiye. Key variables in this dataset include:

- Identifier data: departure and destination airport identifiers, airline identifiers, quarter and year.
- Traffic and capacity data: individual flights, number of available seats, estimated number of passengers.
- Operational metrics: load factor, departure and arrival delays, and CO₂ emissions (estimated based on aircraft configurations).

While most of the analysis will be done at the airport level, the route specific data is necessary for studying start-up aid's influence on route-specific factors, including route entries and exits.

The Cirium dataset covers flights within the EU, UK, and Türkiye, initially consisting of 2,944,204 observations. The dataset initially includes 4,023 unique departing airports and 3,911 arrival airports. For most of the empirical analysis of the Study, we focus on routes departing from airports located in the EU, UK, and Türkiye. However, for size definitions - based on number of passengers - we consider both departures and arrivals. To ensure data quality, we exclude observations with missing values and those corresponding to unscheduled flights after 2018 (unscheduled flights before 2018 have been reclassified as scheduled for consistency with Cirium's historical categorisation). We then only keep scheduled flights (scheduled passenger flights and scheduled charter flights) with positive passenger numbers in at least one quarter. Within this refined sample, there are 569 unique departing airports located in the EU, UK or Türkiye.

The key variables contained in the Cirium dataset, as well as those constructed from the data, and which will be used for the empirical analysis, are defined in Table E.1.

This dataset includes details of airlines, departure and arrival airports, identified by their respective IATA and ICAO codes. The unit of observation is at the airline-route-quarter-year level.

Since our analysis employs NUTS (Nomenclature of Units for Territorial Statistics) level 3 and level 2 for both departure and arrival airports, we followed a multi-step approach to assign NUTS codes:

- Geospatial matching: We use the airport latitude and longitude data (from *OurAirports*) along with the GISCO statistical unit dataset from the European Commission to identify the relevant NUTS codes.
- Municipality matching: We match airports to their municipalities (from *OurAirports*) using the Eurostat dataset on the system of Local Administrative Units (LAUs), which is compatible with NUTS codes.
- Manual verification: For any remaining missing NUTS codes, we conduct desk research to ensure complete coverage.

Table E.1: Variable definitions based on Cirium data

Variables	Definition
Provided directly by Cirium	
Number of passengers	Historical airline traffic data are used to compute monthly average load factors per airline. These factors are then applied to current flights using machine learning techniques for near real-time predictions. Missing data is filled using these estimates, ensuring average monthly passenger counts.
Average departure (resp. arrival) delay (in min)	Difference in minutes between the scheduled departure (resp. arrival) time and the observed departure (resp. arrival) time per flight. The average delay at departure (resp. arrival) for the airline-airport pair is calculated by grouping the flight data based on the airline's IATA code, the departure airport code, and the arrival airport code.
CO ₂ Emissions	<i>The variable is defined as the total CO₂ emissions per route-airline-quarter, calculated by summing all flights operated in that period for each route-airline combination. These emissions are Scope-1 CO₂ from jet fuel combustion, derived from modelled fuel burn per flight. The modelling framework incorporates: (i) aircraft and engine characteristics (e.g. type, age, winglets, engine series, weight); (ii) flight-specific data (actual flight and taxi times, headwinds, holding patterns); (iii) load and payload estimates (based on seating configuration, cabin layout, an average passenger weight of 100 kg including baggage, and cargo assumptions); and (iv) a nonlinear fuel burn model that accounts for the different stages of flight—taxi, climb, cruise, descent.</i>
Low-cost carrier (LCC)	Low-cost carriers (LCCs) are defined based on ICAO's classification and cross-checked with Cirium data, using the latest LCC list from ICAO to ensure accuracy.
Constructed by the Team	
Hub airport	Based on the following criteria: (i) >10% of transfer passengers at the airport on average between 2014-2024, (ii) and/or >1% of total transfer passenger volume on average between 2014-2024, (iii) and/or mentioned by main FSC as hub and airport of > 5 million ppa. 32 airports qualify as major hubs in the dataset (see list below). ¹⁹⁴
Regional airport	Airport with annual passenger traffic volume of up to 3 million. ¹⁹⁵
Mid-size airport	Airport that is neither categorised as a hub airport nor as a regional airport.
Airport Class size	Class size is defined by using the estimated number of passengers, provided by Cirium, by taking the maximum of yearly total number of passengers (departures and arrivals) for each airport across the sample (2014 to 2023). The classes are as follows: ▪ Class 1: Airports with 200,000 or fewer passengers. ▪ Class 2: Airports with passenger numbers ranging from 200,001 and 700,000 passengers. ▪ Class 3: Airports with passenger numbers ranging from 700,001 to 1,000,000. ▪ Class 4: Airports with passenger numbers between 1,000,001 and 3,000,000. ▪ Class 5: Airports with 3,000,001 passengers or more.
Airport in Outermost Region (OR)	Based on the assignment of NUTS3 codes to airports (see text above), the Team allocates airports in an Outermost Region.
Airport in inner region	If an airport is not assigned to an OR, it is assigned to be in an inner region.
Route	Combination of departure-airport and arrival-airport. All route measures in the analysis are based on departures (unless otherwise stated). A route is defined as being present for at least two consecutive periods at least once in our sample period. ¹⁹⁶
LCC route	An LCC route is defined as being present for at least two consecutive periods at least once in our sample period, plus contains at least one LCC airline.
Seasonal route	A seasonal route is a route that meets both of the following criteria:

¹⁹⁴ List based on Eurostat data and desk research. Definition and list of hub airports provided by the European Commission.

¹⁹⁵ Although not the primary focus of the Study, we have also constructed an intermediate category of airports to include as control variables in the analysis: those that are not hubs, nor regional airports.

¹⁹⁶ This means that, once established, the route may subsequently appear in only one period and still be considered a valid route.

Variables	Definition
	- It is present in fewer than three of the quarters Q2, Q3, and Q4 within a year.¹⁹⁷ - This pattern must occur in at least two different years for the same route.¹⁹⁸
Regular route	A regular route is a route (as defined above) that does not meet the criteria for being seasonal.
Entry	A route appears for the first time in time period t (quarter) but was not there in the previous time period t-1.
Exit	A route is not present in time period t (quarter), but was present in the previous time period t-1.

Source: Project Team based on Cirium

Table E.2 lists the hubs in our sample, ordered alphabetically.

¹⁹⁷ Seasonal routes are typically not operating in the winter season (Q1) and typically operate at most half of the year (i.e. two quarters).

¹⁹⁸ This condition is set in place to isolate seasonal routes from regular routes.

Table E.2: List of hub airports

Airport name
Adolfo Suarez Madrid-Barajas Airport
Amsterdam/Schiphol Airport
Ankara/Esenboga Airport
Berlin Airport ¹⁹⁹
Brussels Airport
Bucuresti/Henri Coanda Airport
Dublin Airport
Duesseldorf Airport
Frankfurt/Main Airport
Helsinki-Vantaa Airport
Istanbul/Istanbul Havalimani Airport ²⁰⁰
Istanbul/Sabiha Gokcen Airport
Izmir/Adnan Menderes Airport
Kobenhavn/Kastrup Airport
Lisboa Airport
London Gatwick Airport
London Heathrow Airport
Lyon Saint-Exupery Airport
Manchester Airport
Muenchen Airport
Nice-Cote D Azur Airport
Paris-Charles De Gaulle Airport
Paris-Orly Airport
Riga Airport
Roma/Fiumicino Airport
Stockholm/Arlanda Airport
Warszawa/Chopina Airport
Wien-Schwechat Airport

Source: Project Team based on Eurostat

E.1.2 General summary statistics

In this section, the Team provides some summary statistics of the Cirium data. One must keep in mind that the Cirium data are based on flight data, i.e. “supply” data. This means that the data contain information based on the actual airplanes flown. The passenger information is an estimate of how many passengers are on those airplanes (see Table E.1 for the exact definition).

There are 1,009,298 observations for passengers across airline-route-quarter-year. The mean number of passengers for a given airline on a route in a quarter-year amounts to

¹⁹⁹ Schoenefeld and Tegel airports before 2020.

²⁰⁰ Atatürk Airport before 2020.

7,052 passengers. The smallest number is zero, whereas the largest number reaches 284,720 passengers.

Data on average departure delay has good coverage (1,000,005 observations), as this is easy to track with flight data. The mean delay is 12 min. Data coverage is highest for average load factor (1,009,298 observations).

Furthermore, roughly 45% of our observations are LCCs; see also further below a more detailed breakdown of types of flights.

Finally, about 17% of the observations are departures from regional airports.

Table E.3: Key summary statistics of Cirium data

Variables	Obs	Mean	Std. Dev.	Min	Max
Number of passengers	1,009,298	7,052.43	13,136.87	0	284,720
Average departure delay (min) ²⁰¹	1,000,005	12	17.54	-103	131
Average load factor (%)	1,009,298	79.68	13.97	0	100
CO ₂ Emissions (Kg)	599,006	1,109,159	3,553,511	189.6	155,746,912
Low-cost carrier	Freq.	Percent	Cum.		
0	552,833	54.77	54.77		
1	456,465	45.23	100.00		
Hub					
0	644,888	63.89	63.89		
1	364,410	36.11	100.00		
Regional					
0	834,518	82.68	82.68		
1	174,780	17.32	100.00		
N	1,009,298				

Note: Period: 2014–2023 (inclusive). Unit of observation: quarterly records at airport-pair (origin–destination) × flight-category level. Summary statistics across airline-route-year-quarter. Mean/Median report the average and 50th percentile of these quarterly per-pair counts; Standard deviation captures dispersion across airport-pair-quarter observations; Min/Max are the lowest/highest quarterly per-pair values observed.

Source: Project Team based on Cirium

Table E.4 breaks up our summary statistics per year. The number of passengers in an airline-route combination continuously drops from the beginning of our sample (9,793 in 2014), where the COVID-19 years (2020–2021) see a further steep drop (going from a mean of 7,480 in 2019 to 4,294 in 2020 and 4,405 in 2021), after which the last years

²⁰¹ We applied a z-score methodology to detect and omit outliers in the average departure delay variable. For each data point, the z-score was calculated by subtracting the sample mean and dividing by the sample standard deviation. Observations with an absolute z-score greater than 3 — that is, falling outside ± 3 standard deviations from the mean under the assumption of a normal distribution — were classified as outliers and excluded from the dataset.

see again an uptick. Furthermore, average delays are markedly lower during COVID-19 years (around 3 min, whereas for the other years it is more than 6 min).

Table E.4: Key summary statistics of Cirium data, per year

Year	Average number of passengers	Average Departure Delay (min)
2014	9,793.38	6.79
	(16,313.07)	(11.96)
2015	9,205.09	6.53
	(15,804.02)	(11.08)
2016	9,411.11	7.81
	(15,444.57)	(11.42)
2017	5,606.57	9.08
	(10,708.32)	(12.99)
2018	7,450.18	14.27
	(13,817.69)	(17.50)
2019	7,479.54	14.24
	(14,282.24)	(18.79)
2020	4,294.31	6.20
	(8,656.70)	(18.47)
2021	4,405.90	8.86
	(8,394.86)	(17.96)
2022	6,579.08	18.47
	(12,009.64)	(21.24)
2023	7,397.56	18.25
	(13,394.89)	(20.03)

Note: Summary statistics have been computed across airline-route-year-quarter. Standard deviation in parenthesis.

Source: Project Team based on Cirium

Table E.5 shows the commercial scheduled flight categories in the data. Flights fall into four categories: scheduled passenger, unscheduled passenger, scheduled charter, and unscheduled charter. Scheduled passenger flights operate on a fixed timetable with set departure and arrival times, while unscheduled passenger flights run on demand. Charter airlines provide flights booked for specific purposes by for instance tour operators, businesses, government agencies, or individuals. Scheduled charter flights follow a regular schedule like commercial airlines, whereas unscheduled charter flights operate only as needed.

Unsurprisingly, scheduled passenger flights account for approximately 97% of the sample. Cargo flights are considered part of a separate relevant market and are therefore excluded from the analysis.

Table E.5: Summary statistics on flight categories

Flight Category	Freq.	Percent	Cum.
Scheduled Charter	33,211	3.29	3.29
Scheduled Passenger	976,087	96.71	100.00
Total	1,009,298	100.00	

Note: Summary statistics across airline -route-year-quarter.

Source: Project Team based on Cirium

E.1.3 Summary statistics on LCC and airlines

Table E.6 shows some summary statistics for LCCs' share of the number of passengers. LCCs carry across different regions quite similar shares, ranging from 46.64% for inner regions to 44.37% for ORs. Hub airports carry a smaller share than regional airports (28.35% versus 47.71%, respectively). When looking into different size classes, the smallest class has the lowest share (21.77%), followed by class 2 (43.29%).

Table E.6: Summary statistics for LCCs' share of passengers (%)

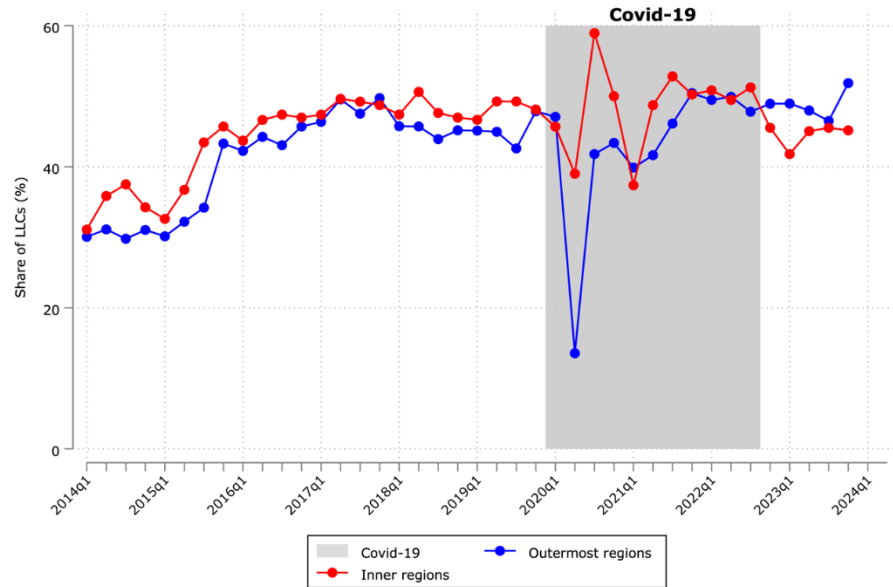
Share of Low-Cost Carriers (%)	Obs.	Mean	Std. Dev.	Min	Max
All regions	1,009,298	46.54	27.75	0	100
Outermost regions	46,831	44.37	22.90	0	82.99
Inner regions	962,467	46.64	27.96	0	100
Hub airports	364,41	28.35	22.14	0	100
Regional airports	174780	47.71	31.58	0	100
Class size					
Airport class 1	16,582	21.77	34.27	0	100
Airport class 2	38,21	43.29	35.39	0	100
Airport class 3	15,069	53.13	25.71	0	100
Airport class 4	104,919	52.64	27.98	0	100
Airport class 5	834,518	46.29	26.87	0	100

Note: Period: 2014–2023 (inclusive). Unit of observation: airport × year-quarter. Summary statistics are calculated across airport-year-quarter observations. The variable "Share of Low-Cost Carriers (%)" measures the proportion of passengers carried by low-cost carriers at each airport in a given quarter. "Obs." reports the number of quarterly airport observations. The Mean shows the average quarterly LCC passenger share across airports, while the Standard Deviation captures variation across airports and quarters. Min and Max represent the lowest and highest quarterly LCC shares observed in the sample.

Source: Project Team based on Cirium

The following figures report evolutions over time (outermost vs inner regions in Figure E.1; hub vs regional airports in Figure E.2). It can be seen in Figure E.1 that the share of LCCs was initially higher in inner regions in the first years of the sample. ORs experienced a sharp drop in LCC share during the first COVID-19 pandemic. However, by the end of the sample period, the share of LCCs had become higher in ORs than in inner regions, and the share in inner regions declined.

Figure E.1: Share of low-cost carriers, outermost vs inner regions

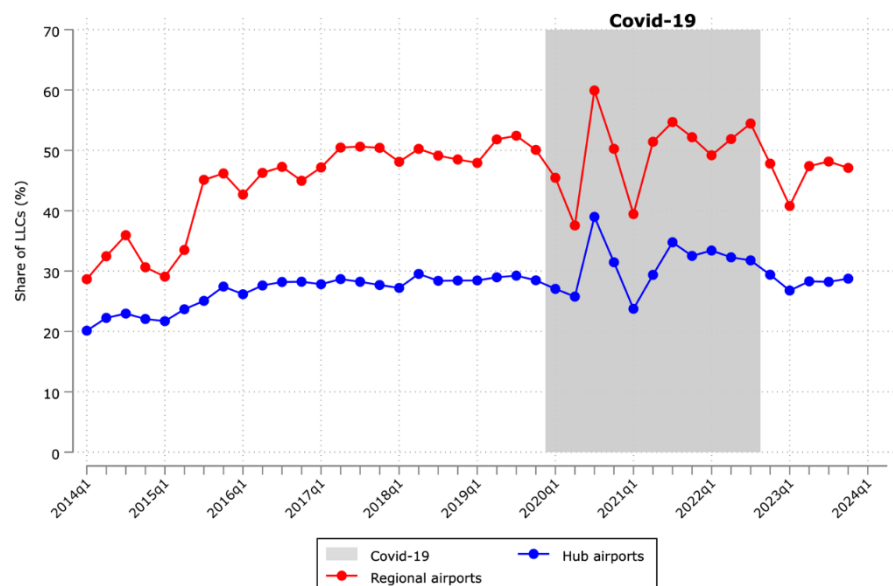


Note: Summary statistics are across airline-year-quarter. Averages are calculated across airport-year-quarter, weighted by route within each airport.

Source: Project Team based on Cirium

When comparing the share of LCCs in hubs versus regional airports (see Figure E.2), regional airports always have a higher share, but the difference has decreased over time.

Figure E.2: Share of low-cost carriers, hub vs regional airports



Note: Summary statistics are across airport-year-quarter. Averages are calculated across airport-year-quarter, weighted by route within each airport.

Source: Project Team based on Cirium

Furthermore, while catchment areas are defined via their competition for passengers, it might also be that they compete for airline companies' presence. While it is outside the scope of the current Study to analyse in detail, we provide summary statistics on airlines' presence at airports along time/geographic dimensions. Table E.7 presents the top 20 airlines in terms of number of passengers carried, ranked from largest to smallest in terms of the number of departing airports. The top two airlines are LCCs: Ryanair and easyJet, where in a given year-quarter Ryanair is present in 96 regional airports and 16 hubs. EasyJet, on the other hand, is present in 38 regional airports and 18 hubs, on average. Turkish Airlines, Lufthansa and Air France complete the top5. Out of the 20 top airlines, 8 are LCCS.

Table E.7: Top 20 airlines' presence at airports

Rank	Airline	Hub/Regional				
			Mean	Std. Dev.	Min	Max
1	Ryanair LCC	Regional airports	96	18	11	114
		Hub airport	16	2	12	19
2	EasyJet LCC	Regional airports	38	10	3	58
		Hub airport	18	3	5	22
3	Turkish Airlines Inc.	Regional airports	48	5	34	56
		Hub airport	27	1	19	28
4	Lufthansa	Regional airports	24	10	11	45
		Hub airport	25	1	22	26
5	Air France	Regional airports	23	7	14	42
		Hub airport	21	1	18	22
6	British Airways	Regional airports	14	5	2	23
		Hub airport	23	2	15	24
7	Vueling LCC	Regional airports	24	8	3	43
		Hub airport	21	3	8	24
8	Wizz Air LCC	Regional airports	39	6	28	55
		Hub airport	12	3	6	15
9	Pegasus LCC	Regional airports	29	3	21	35
		Hub airport	19	2	11	22
10	KLM Royal Dutch Airlines	Regional airports	7	5	1	16
		Hub airport	21	2	17	23
11	SunExpress LCC	Regional airports	40	6	25	48
		Hub airport	16	3	9	20
12	Iberia	Regional airports	12	6	2	23
		Hub airport	13	3	6	19
13	Scandinavian Airlines System	Regional airports	28	9	13	48
		Hub airport	18	2	10	21
14	Malta Air	Regional airports	45	20	10	65
		Hub airport	12	2	7	15
15	Jet2 LCC	Regional airports	10	5	3	20
		Hub airport	7	2	1	11
16	TAP Portugal	Regional airports	4	2	2	8
		Hub airport	19	3	1	21

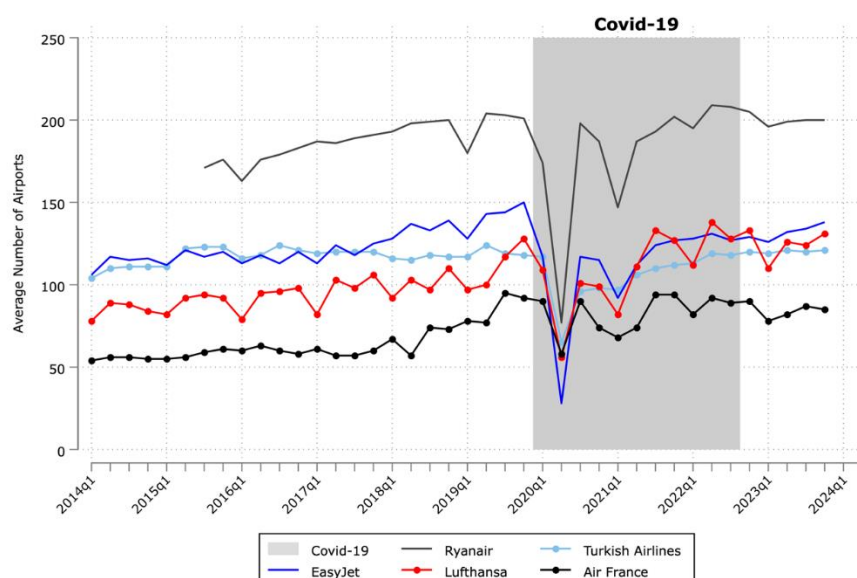
Rank	Airline	Hub/Regional	Mean	Std. Dev.	Min	Max
17	Austrian Airlines AG	Regional airports	21	9	3	36
		Hub airport	15	5	1	19
18	Aegean Airlines	Regional airports	14	5	5	24
		Hub airport	22	3	14	25
19	Aer Lingus Limited	Regional airports	6	3	1	12
		Hub airport	18	3	7	21
20	Eurowings GmbH LCC	Regional airports	22	11	4	44
		Hub airport	17	2	11	21

Note: Period: 2014–2023 (inclusive). Summary statistics are across airline-year-quarter. Unit of observation: airline × year-quarter. For each airline and quarter, we count the number of airports served in that quarter, reported separately for hub and regional airports. The Mean is the average quarterly count of airports served; Std. Dev. captures dispersion across airline-quarter observations; Min and Max are the lowest and highest quarterly counts observed for that airline within the period.

Source: Project Team based on Cirium

Figure E.3 shows the evolution over time for the top 5 airlines' presence at airports. The tendencies of the previous table are fairly stable: Ryanair is consistently most present at airports, with easyJet mostly being number two. COVID-19 had also in these metrics the same downward impact: airlines frequented much fewer airports.

Figure E.3: Average number of departure airports for the top 5 airlines



Note: Summary statistics are across airline-year-quarter

Source: Project Team based on Cirium

Table E.8 shows the top 20 airlines in terms of number of passengers carried that frequent the airports at ORs. Ryanair and easyJet are still present. The composition of the top 20 in OR airports is different than for airports overall, with several regional airlines, such as Binter Canarias, and charter companies, such as TUI Airways being present in the top 20.

Table E.8: Summary statistics on airlines' presence at airports for ORs

Rank	Airline	Number of airports			
		Mean	Std. Dev.	Min	Max
1	Ryanair Ltd. LCC	7	1	6	10
2	Vueling Airlines S.A. LCC	6	1	3	7
3	EASYJET UK LIMITED LCC	6	1	5	7
4	Jet2.com Limited LCC	5	0	4	5
5	Binter Canarias	8	2	5	11
6	Air France	4	1	4	6
7	Compania Operadora de Corto y Medio Radio Iberi...	6	0	5	6
8	TUI Airways Limited	7	1	4	9
9	Air Caraibes	4	0	4	5
10	Air Europa Lineas Aereas, S.A.	5	1	2	9
11	Condor Flugdienst GmbH LCC	7	1	6	10
12	TUIfly GmbH LCC	5	1	1	7
13	SATA (Air Acores)	11	0	10	11
14	Air Austral	3	0	2	3
15	TAP Portugal	5	1	4	7
16	Naysa	8	0	8	9
17	Canarias Airlines, Compania de Aviacion S.L.U.	7	1	6	9
18	Corsair t/a Corsair International	4	0	3	5
19	SATA Internacional Azores Airlines SA	6	1	4	7
20	Canary Fly S.A	6	1	4	6

Note: Period: 2014–2023 (inclusive). Summary statistics are across airline-year-quarter. Unit of observation: airline × year-quarter. For each airline and quarter, we count the number of airports served in that quarter, reported separately for hub and regional airports. The Mean is the average quarterly count of airports served; Std. Dev. captures dispersion across airline-quarter observations; Min and Max are the lowest and highest quarterly counts observed for that airline within the period.

Source: Project Team based on Cirium

Table E.9: Airline Entry

Year	ICAO Code	IATA Code	Airline
2015	EVJ	-	Everjets - Aviacao Executiva S.A.
2015	-	-	Small Planet Airlines GmbH (Germany)
2015	OLY	-	Olympus Airways
2015	EST	EE	Regional Jet Ou
2015	CSW	CS	Chair Airlines
2015	NRS	DI	Norwegian Air UK Ltd.
2015	NDA	-	Nordic Aviation Group AS
2015	GSW	CS	Chair Airlines AG
2015	-	-	Jonair Affarsflyg AB
2015	LWI	L9	Lumiwings
2016	FCB	-	Cobaltair Ltd
2016	SDR	SR	SundAir GmbH

Year	ICAO Code	IATA Code	Airline
2016	VAW	F6	Fly2Sky Ltd.
2016	FIA	5F	Fly One S.R.L.
2016	OTF	-	Orange2Fly Airlines S.A.
2016	CYF	U8	TUS Airways Ltd.
2016	KTB	-	Transaviabaltika
2016	GJT	GW	GetJet Airlines, UAB
2016	EWE	-	Eurowings Europe GmbH
2016	CDX	-	Cedar Executive
2016	RIV	GP	APG Airlines
2017	NYX	OJ	NyxAir OU
2017	MAR	MV	Air Mediterranean S.A
2017	GCK	-	Glock Aviation GmbH
2017	BFY	-	Bestfly Aircraft Management Aruba
2017	EAF	3E	Electra Airways
2017	EJU	EC	EasyJet Europe Airline GmbH
2017	TJB	-	Tayaran Jet
2017	ERN	EG	Ernest S.p.A. dba Ernest Airlines
2017	SZS	SL	SAS Connect
2017	FBU	BF	French Bee dba French Bee
2017	JON	-	Joon
2017	GWR	U5	Aura Airlines S.L.
2017	WUK	W9	Wizz Air UK
2018	FOO	-	Anisec Luftfahrt GmbH
2018	STB	LE	St Barth Executive / Air Inter Îles
2018	CBX	-	Cobrex Trans
2018	LPA	-	Air Leap Aviation AB
2018	NSZ	AB	Norwegian Air Sweden
2018	IBK	D8	Norwegian Air Sweden AB
2018	-	-	Great Dane Airlines A/S
2018	APP	AL	AlpAvia D.O.O.
2018	RYS	RR	Ryanair Sun /Buzz
2018	VXS	-	Voluxis
2018	MMO	MT	Malta Air Travel Ltd
2018	JNK	-	Aircompany JONIKA Ltd Liability
2018	ABB	KF	Air Belgium SA
2018	LDM	-	Laudamotion GmbH
2019	MLH	4X	Avion Express Malta Ltd
2019	MAY	MW	Malta Air Ltd
2019	ATW	-	Air Antwerp BV
2019	FHM	MI	Freebird Airlines Europe Limited
2019	ITI	-	iNTAIRLINE
2019	ATW	WP	Air Antwerp
2019	LYX	2N	SmartLynx Airlines Malta
2019	RUK	RK	Ryanair UK Ltd

Year	ICAO Code	IATA Code	Airline
2020	AWG	A2	Anima Wings Aviation S.A.
2020	LDA	LW	Lauda Europe Ltd
2020	GJM	RE	Airhub Airlines Limited
2020	WPT	3P	World 2 Fly Portugal S.A.
2020	CTB	-	Thomas Cook Airlines Balearics S.L.
2021	GBG	G2	Gullivair Ltd.
2021	JTD	JP	Jetttime A/S
2021	OCN	4Y	Discover Airlines
2021	HLJ	H3	Hello Jets S.R.L.
2021	EGW	-	Ego Airways S.p.A.
2021	SWU	BQ	SkyAlps SRL
2022	SVS	-	SAS Link AB
2022	NGN	KK	LEAV Aviation GmbH
2022	EFW	A0	BA Euroflyer Limited
2022	KON	KS	Air Connect Aviation Group S.A.
2022	EAI	EA	Emerald Airlines Ireland Limited
2022	EWL	E6	Eurowings Europe Ltd.
2022	AEZ	XZ	Aeroitalia SRL
2022	WMT	W4	Wizz Air Malta Ltd
2022	LHX	VL	City Airlines GmbH
2022	BIX	TT	Braathens International Airways AB
2022	SQP	PQ	SkyUP LLC
2023	MBU	DI	Marabu Airlines OU
2023	DNA	DN	Dan Air S.R.L
2023	ALX	EO	Alpi Jets GmbH
2023	SEU	U5	SkyUp MT Ltd

Source: Project Team based on Cirium and Desk Research

Table E.10: Airline Bankruptcy

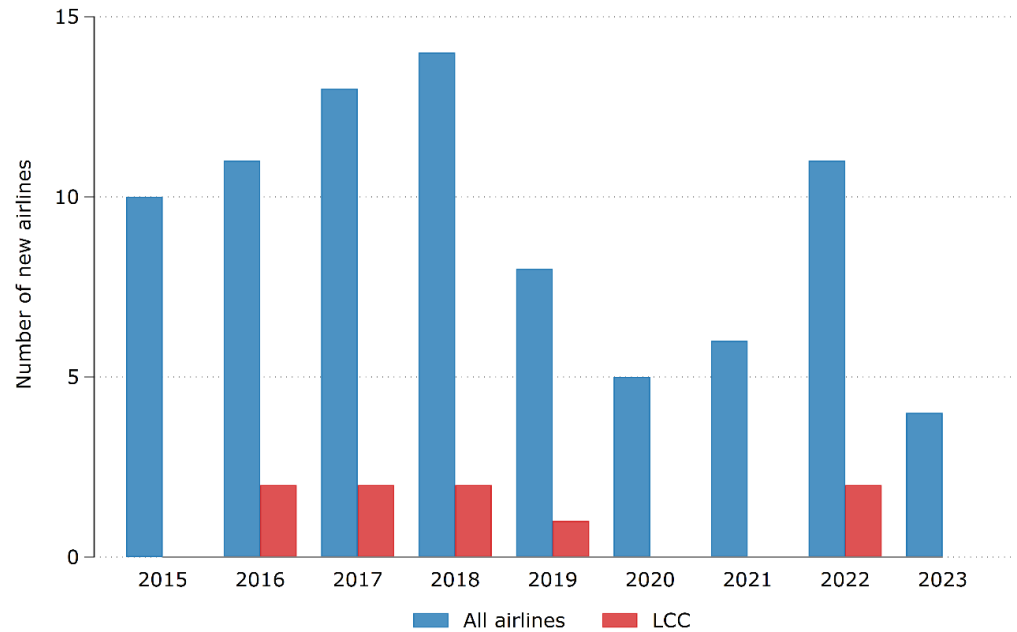
Year	ICAO Code	IATA Code	Airline
2014	-	-	New Livingston S.p.A.
2014	HTH	-	Helitt Lineas Aereas
2014	-	-	HHA Hamburg Airways
2015	-	-	AS Avies
2015	-	-	Skygreece Airlines SA
2015	-	-	Estonian Air
2015	ELO	-	EuroLot S.A.
2015	-	-	InterSky Luftfahrt GmbH
2015	-	-	JSC Air Lituanica
2015	-	CY	Cyprus Airways
2016	BIE	DR	Air mediterranee (France)
2016	VLM	VG	SHS Antwerp Aviation NV dba VLM Airlines
2017	-	-	NIKI Luftfahrt GmbH

Year	ICAO Code	IATA Code	Airline
2017	-	-	Darwin Airline SA
2017	WLC	2W	Welcome Air Luftfahrt Gmbh and Co. Kg
2017	MON	ZB	Monarch Airlines
2017	-	-	Air Berlin GmbH and Co. Luftverkehrs KG
2018	FCB	-	Cobaltair Ltd
2018	CLJ	-	Cello Aviation Ltd.
2018	PRW	-	Primera Air Nordic
2018	LLC	-	Small Planet Airlines UAB
2018	-	-	NextJet AB
2018	-	-	Primera Air Scandinavia A/S
2018	WLM	-	VLM Airlines D.D.
2018	-	-	Belair Airlines Ltd.
2018	-	-	Privatair SA
2018	-	-	Skywork Airlines AG
2019	ADR	JP	Adria Airways d.o.o.
2019	AZI	-	Astra Airlines
2019	AAF	ZI	Aigle Azur
2019	XLF	-	XL Airways France
2019	-	-	Germania Fluggesellschaft mbH
2019	JAI	9W	Jet Airways (India) Limited
2019	BMR	BM	flybmi
2019	TCX	MT	Thomas Cook Airlines Limited of Manchester
2019	BMR	-	British Midland Regional Limited t/a bmi Regional
2019	-	-	WOW Air ehf
2020	MGX	YM	Montenegro Airlines (Montenegro)
2020	FOO	-	Anisec Luftfahrt GmbH
2020	KKK	-	Atlasjet Havacilik A.S. AtlasGlobal
2020	-	-	Jet Time A/S
2020	ERN	EG	Ernest S.p.A. dba Ernest Airlines
2020	-	-	Air Italy S.p.A.
2021	CTB	-	Thomas Cook Airlines Balearics S.L.
2021	ATW	-	Air Antwerp BV
2021	IBK	D8	Norwegian Air Sweden AB
2021	-	-	Norwegian Air UK Ltd.
2021	-	-	Great Dane Airlines A/S
2021	-	-	Norwegian Long Haul AS
2021	BPA	BV	Blue Panorama Airlines S.p.A
2022	OHY	8Q	Onur Air Tasimacilik A.S.
2022	ENZ	-	Jota Aviation Ltd.
2022	LPA	-	Air Leap Aviation AB
2023	BLA	-	Blue Air Aviation S.A.

Source: Project Team based on Cirium and Desk Research

Figure E.4 and Figure E.5 show the number of airlines appearing in the EU for the first time, as well as those that defaulted over the past decade.^{202,203} Between 2015 and 2023, a total of 82 airlines entered the EU market, with several market entries in 2018 (14) before decreasing the following years to reach 4 in 2023. Over the same period, 54 airlines went bankrupt (2014–2023), with sharp peaks in 2018 and 2019, when 10 carriers exited the market each year. LCCs represented only a small but steady share of these failures, averaging about one per year between 2017 and 2022.

Figure E.4: Airlines operating for the first time in the EU-27, UK and Türkiye



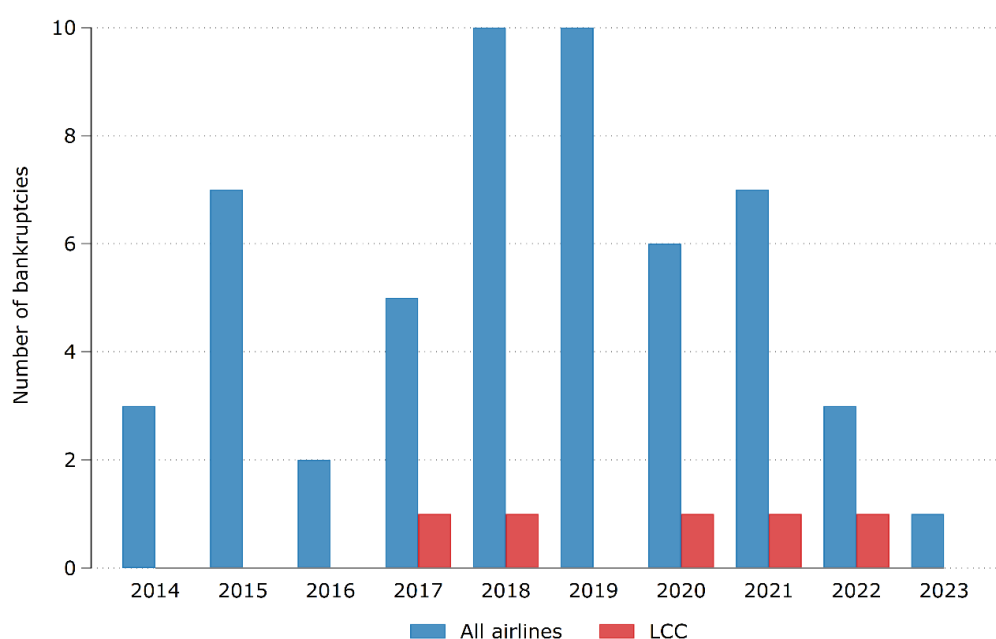
Note: This figure reflects the number of airlines observed operating in the EU for the first time within the period in our sample.

Source: Project Team based on Cirium and Desk Research

²⁰² We define entry as the first year an airline appears in the records (e.g. 2018 if absent 2014–2017). This assumption identified potential entrants, and for these cases we carried out desk research to validate the information.

²⁰³ We define exit as the last year an airline appears in the records (e.g. 2016 if absent thereafter). This assumption identified potential exits, which we refined through desk research to confirm actual bankruptcies.

Figure E.5: Bankruptcy of airlines



Source: Project Team based on Cirium and desk research

The statistics reveal a dynamic but concentrated airline sector in the EU. While the total number of airlines fluctuated over the past decade, the presence of LCCs has remained a defining feature. FSCs continue to dominate hub operations, but consolidation and bankruptcies have reduced their number. Overall, the evidence suggests that competition is shaped less by the sheer number of airlines than by the strength and stability of a few large players, especially in the low-cost segment.

Table E.11: Number of airlines operating in EU (plus UK and Türkiye)

Year	Number of airlines operating within EU	of which LCCs	(%)	Number of airlines operating to/from EU	of which LCCs	(%)
2014	201	24	(12)	340	34	(10)
2015	198	23	(12)	339	35	(10)
2016	205	28	(14)	348	36	(10)
2017	209	30	(14)	362	38	(10)
2018	241	31	(13)	386	46	(12)
2019	240	33	(14)	396	54	(14)
2020	209	32	(15)	362	54	(15)
2021	200	28	(14)	347	53	(15)
2022	221	33	(15)	376	53	(14)
2023	227	32	(14)	393	53	(13)

Notes: Within EU = flights where both departure and arrival are inside EU27, Türkiye, or the UK.

To/from EU = flights where either the departure or the arrival is in EU27, Türkiye, or the UK.

Airlines within EU" is a subset of "Airlines to/from EU".

Source: Project Team based on Cirium

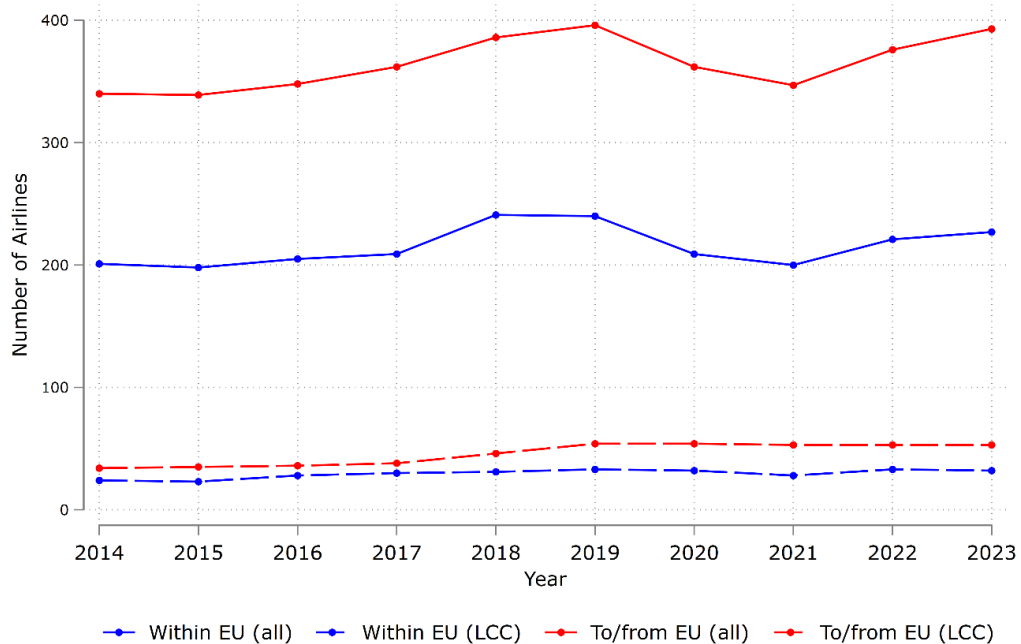
Table E.12: Annual Herfindahl–Hirschman Index (HHI) of airlines operating in EU (plus UK and Türkiye), based on number of flights (2014–2023)

Year	Airlines operating within EU (plus UK and Türkiye)			Airlines operating to/from EU (plus UK and Türkiye)		
	HHI – LCC segment	HHI – FSC segment	HHI – Total market concentration (LCC + FSC)	HHI – LCC segment	HHI – FSC segment	HHI – Total market concentration (LCC + FSC)
2014	97.01	179.25	276.27	126.81	191.43	318.24
2015	105.89	159.15	265.04	136.46	166.53	302.98
2016	187.87	126.50	314.37	246.58	129.42	376.01
2017	209.46	126.20	335.67	278.05	130.87	408.92
2018	203.56	109.24	312.80	269.38	112.14	381.52
2019	208.63	102.14	310.77	277.84	104.76	382.60
2020	164.88	112.94	277.82	206.78	114.78	321.56
2021	165.44	120.37	285.81	206.52	122.80	329.32
2022	201.27	120.38	321.65	252.67	124.81	377.48
2023	154.01	139.67	293.67	197.14	151.74	348.89

Notes: The Herfindahl–Hirschman Index (HHI) quantifies market concentration among airlines using their share of total flights operated per year. Results are reported separately for LCCs, FSCs, and the combined total market (LCC + FSCs). Within EU= flights where both departure and arrival are inside EU27, Türkiye, or the UK. To/from EU= flights where either the departure or the arrival is in EU27, Türkiye, or the UK. Airlines within EU" is a subset of "Airlines to/from EU".

Source: Project Team based on Cirium

Figure E.6: Evolution over time of number of airlines operating to/from and within EU



Source: Project Team based on Cirium

E.2 Publicly Available Information

E.2.1 Eurostat Data

The Team is using Eurostat as a primary source of regional demographic and economic data for the period 2014 to 2023.²⁰⁴

Variables collected from Eurostat include (at NUTS3 and NUTS2 level):

- Regional economic indicators: GDP, employment statistics.
- Demographics: population size.
- The dataset covers EU27 countries, UK and Türkiye. Our dataset contains currently 1,426 NUTS3 regions.²⁰⁵

Table E.13: Summary statistics of the Eurostat data

	Obs.	Mean	Std. Dev.	Min	Max
GDP per capita (euro)	13,223	28,836.48	24,340.08	2,500	703,436.63
Employment level (# people)	13,049	221,771.73	323,708.03	3,200	6,448,800
Population (# people)	13,689	415,620.92	635,941.01	10,484	15,907,951
Population density	13,348	493.41	1,281.39	1.9	21,490

Note: Summary statistics across region-year.

Source: Project Team based on Eurostat

Table E.13 shows the summary statistics for our Eurostat variables. The coverage for population - the average number of people residing in a region of the EU, UK, and Türkiye within a given year - is better than the coverage for the other three variables. The mean GDP per capita in regions of the EU, UK, and Türkiye is € 28,836.5. Employment level refers to the average number of people aged 20 to 64 who are employed per year in these regions.

Table E.14 shows the GDP per capita by country, where of course larger countries have on average more NUTS3 regions and therefore more observations.

²⁰⁴ We are using the most up-to-date Eurostat NUTS 3 data currently available.

²⁰⁵ Employment data for Türkiye are not available at the NUTS3 level; we used NUTS2 level data to fill in NUTS3 regions.

Table E.14: Summary statistics of the Eurostat data by country - GDP per capita

Country	Obs.	Mean	Std. Dev.	Min	Max
Austria (AT)	315	38,502	9,198	20,000	65,400
Belgium (BE)	440	33,453	11,774	16,600	82,100
Bulgaria (BG)	280	6,783	3,742	3,100	31,600
Cyprus (CY)	10	25,880	4,472	20,500	33,800
Czechia (CZ)	140	19,096	8,755	10,100	62,200
Germany (DE)	3,600	37,963	16,660	14,700	199,100
Denmark (DK)	110	50,443	17,073	31,800	115,200
Estonia (EE)	50	16,964	6,973	9,200	36,800
Greece (EL)	468	14,446	4,687	8,800	38,600
Spain (ES)	531	23,006	5,040	14,900	39,200
Finland (FI)	190	38,046	6,427	26,200	61,100
France (FR)	1,010	30,040	12,859	8,200	138,600
Croatia (HR)	210	11,375	4,460	5,700	32,600
Hungary (HU)	200	11,898	5,434	4,700	44,900
Ireland (IE)	73	55,795	43,264	18,100	191,300
Italy (IT)	963	26,748	7,670	14,400	66,500
Lithuania (LT)	100	13,913	5,898	6,900	39,100
Luxembourg (LU)	10	103,290	9,718	92,800	118,800
Latvia (LV)	45	11,420	5,641	5,700	27,600
Malta (MT)	20	22,650	7,968	11,800	38,300
Netherlands (NL)	400	41,824	11,930	23,700	114,000
Poland (PL)	657	12,120	5,277	5,800	46,500
Portugal (PT)	155	17,872	4,627	10,300	39,900
Romania (RO)	420	9,285	4,901	3,500	50,100
Sweden (SE)	210	42,158	7,221	32,200	70,600
Slovenia (SI)	120	19,464	5,775	10,200	44,600
Slovakia (SK)	80	17,443	8,973	8,400	45,200
Türkiye (TR)	810	6,998	2,658	2,500	20,000
United Kingdom (UK)	1,606	38,862	51,093	17,189	703,437

Note: Summary statistics across region-year.

Source: Project Team based on Eurostat

We further provide data regarding employment and population by country.

Table E.15: Summary statistics of the Eurostat data by country – employment level

Country	Obs.	Mean	Std. Dev.	Min	Max
Austria (AT)	315	127,260	172,844	9,700	1,104,000
Belgium (BE)	440	109,745	131,382	13,180	727,730
Bulgaria (BG)	252	123,482	171,387	26,300	1,120,780
Cyprus (CY)	10	429,567	45,833	363,410	489,420
Czechia (CZ)	140	376,741	207,637	118,590	984,850
Germany (DE)	3,602	111,919	156,060	19,640	2,190,680
Denmark (DK)	110	269,778	140,752	17,140	569,330
Estonia (EE)	50	128,637	110,453	46,610	368,250
Greece (EL)	468	88,833	110,665	7,690	688,720
Spain (ES)	531	331,371	546,958	3,200	3,705,600
Finland (FI)	190	137,401	193,712	17,020	1,007,990
France (FR)	1,010	283,462	288,683	30,800	2,109,200
Croatia (HR)	210	76,936	83,865	15,320	471,480
Hungary (HU)	200	227,662	316,628	47,230	1,652,880
Ireland (IE)	80	286,863	209,178	97,470	937,740
Italy (IT)	963	233,911	299,571	28,700	2,203,100
Lithuania (LT)	100	138,677	128,099	38,400	505,530
Luxembourg (LU)	10	453,186	40,458	395,120	512,580
Latvia (LV)	45	179,785	154,179	82,940	498,180
Malta (MT)	20	124,774	116,761	10,630	290,620
Netherlands (NL)	360	232,503	214,801	18,100	1,115,200
Poland (PL)	657	226,758	151,727	66,000	1,440,300
Portugal (PT)	134	199,451	245,384	32,780	1,338,340
Romania (RO)	420	203,781	155,191	71,100	1,107,730
Sweden (SE)	210	244,720	312,669	30,400	1,425,100
Slovenia (SI)	120	84,722	88,191	16,580	384,520
Slovakia (SK)	80	296,178	65,984	226,220	472,080
Türkiye (TR)	810	877,059	660,191	265,800	6,448,800
United Kingdom (UK)	1,512	177,677	96,269	9,300	595,100

Note: Summary statistics across region-year.

Source: Project Team based on Eurostat

Table E.16: Summary statistics of the Eurostat data by country – population

Country	Obs.	Mean	Std. Dev.	Min	Max
Austria (AT)	350	251,899	304,887	20,118	1,982,097
Belgium (BE)	496	255,288	239,087	46,701	1,253,178
Bulgaria (BG)	280	240,674	228,324	72,754	1,280,334
Cyprus (CY)	10	878,607	31,903	847,008	949,084
Czechia (CZ)	140	756,973	338,961	283,210	1,439,391
Germany (DE)	4,016	205,612	240,376	33,264	3,677,472
Denmark (DK)	110	525,447	228,448	39,583	928,096
Estonia (EE)	64	236,363	169,889	121,335	638,076
Greece (EL)	520	205,911	213,817	17,317	1,123,676
Spain (ES)	590	796,090	1,123,208	10,484	6,871,903
Finland (FI)	199	287,401	340,961	28,666	1,733,033
France (FR)	1,010	665,307	508,784	76,309	2,616,909
Croatia (HR)	210	192,493	162,485	42,469	809,235
Hungary (HU)	200	485,752	361,875	182,038	1,741,601
Ireland (IE)	80	614,277	323,697	289,600	1,499,179
Italy (IT)	1,126	540,899	594,495	55,535	4,263,542
Lithuania (LT)	100	285,516	220,640	90,617	848,724
Luxembourg (LU)	10	606,250	36,528	549,680	660,809
Latvia (LV)	60	322,011	150,024	180,431	643,368
Malta (MT)	20	241,849	212,980	31,838	501,860
Netherlands (NL)	400	431,347	335,719	45,389	1,488,475
Poland (PL)	730	515,874	209,378	174,147	1,869,188
Portugal (PT)	254	421,903	596,794	81,101	2,921,564
Romania (RO)	420	463,805	262,539	189,707	1,865,143
Sweden (SE)	210	482,236	560,880	57,161	2,440,027
Slovenia (SI)	120	173,590	138,656	52,334	561,407
Slovakia (SK)	80	679,670	86,450	557,608	827,028
Türkiye (TR)	810	1,003,041	1,812,556	75,620	15,907,951
United Kingdom (UK)	1,074	366,246	201,001	21,568	1,194,634

Note: Summary statistics across region-year.

Source: Project Team based on Eurostat

E.2.2 European Environment Agency (EEA) Data

Data on pollution exposure from the data hub of the European Environment Agency (EEA) are available for NUTS3 regions.²⁰⁶

The dataset contains information on pollution for EU27 countries and Türkiye at the NUTS3 level, for the period 2014-2022 (yearly). It includes observations on air

²⁰⁶ Air Quality Health Risk Assessments for exposure to three main pollutants (PM_{2.5}, PM₁₀, NO₂ and O₃) at NUTS3 and Country and City levels are available from EEA at the following [link](#).

pollutants, namely NO₂, O₃ and PM_{2.5}.²⁰⁷ Table E.17 shows summary statistics on these pollution dimensions (averages and population weighted averages); where one can observe that ozone has a much lower coverage than the other variables.

Table E.17: Summary statistics by pollutant

	Obs.	Mean	Std. Dev.	Min	Max
Nitrogen Dioxide - Annual Mean (µg/m ³)					
Air Pollution Average	10,935	9.95	4.99	0.10	43.70
Air Pollution Population Weighted Average	10,935	14.89	5.57	0.30	48.00
Ozone Peak (µg/m ³)					
Air Pollution Average	1,233	95.04	8.05	74.60	125.70
Air Pollution Population Weighted Average	1,233	92.04	8.33	63.50	121.70
Ozone – Sum Over 35 ppb (µg/m ³)					
Air Pollution Average	10,935	5,076.10	1,955.80	707.60	14,662
Air Pollution Population Weighted Average	10,935	4,460.90	1,671.60	196.70	12,751
Particulate Matter 2.5 - Annual Mean (µg/m ³)					
Air Pollution Average (µg/m ³)	10,368	10.70	3.67	1.80	43
Air Pollution Population Weighted Average	10,368	12.12	4.34	2.50	44

Note: Summary statistics across region-year.

Source: Project Team based on the European Environment Agency data

These datasets are used for analysing the impact of regional airports on regional economic development, as well as pollution.

E.3 State aid Data

A State aid dataset has been constructed using the following sources:

- the EC's Competition Case Search Database;
- the EC'S Transparency Database;
- the EC's State aid records (information shared by the EC).

From the two public European Commission databases, cases were retrieved by using the filter Economic Sector of activity: *Air Transport*.²⁰⁸

The dataset includes the following variables:

- Identifier data: State aid case number;
- Airport or airports to which the aid measure refers;
- Start and end dates of the aid measure, as reported in the databases²⁰⁹,
- Aid type: operating aid, investment aid, start-up aid, environmental protection aid, social aid, COVID-19 aid, SGEI aid, Rescue & Restructuring aid;
- Aid amount, when available;

²⁰⁷ PM_{2.5} data are not available for Türkiye.

²⁰⁸ NrCE sector: H51 - Passenger Air Transport.

²⁰⁹ When no explicit start date was available, the publication date of the State aid decision was used; when the end date was missing, the aid was assumed to be ongoing. Measures ending before 2014 were excluded.

- Whether the decision approves an individual aid or an aid scheme;
- Prolongation indicator: whether the aid is a prolongation of an existing measure (when explicitly stated in the case title).

The dataset contains 160 State aid decisions, broken down as follows: 42 COVID-19 related measures, 39 investment aids, 35 operating aids, 26 start-up aids, 9 SGEI aids, 3 Rescue & Restructuring aids, 2 social aids, 2 environmental protection aids and 2 decisions simultaneously approving both operating and investment aid. Out of the total, 118119 are individual measures, while 42 correspond to aid schemes.

The dataset covers the period 2014–2025 (yearly), with some measures starting earlier or extending beyond this range. It includes cases from all EU27 Member States as well as the UK.

Overall, the dataset covers 231 airports.

Table E.18: Start-up aid measures

Aid Number	Country	Title	Airport	Start	End
SA.31898	LT	Start-up Aid for Regional Airports in Lithuania – [Lithuanian Route Development Scheme (RDS)]	Regional Airports in Lithuania ²¹⁰	2011	2020
SA.34050	RO	Start-up scheme for airlines departing from Cluj-Napoca international airport	Cluj Avram Iancu International Airport	2012	2016
SA.34352	IT	Start-up aid to airlines departing from Firenze and Pisa airports	Firenze and Pisa Airports	2012	2016
SA.35053	RO	Start-up aid scheme to airlines departing from Craiova Airport	Craiova International Airport	2012	2018
SA.35979	RO	Start-up aid to airlines departing from Oradea Airport	Oradea International Airport	2013	2017
SA.37121	ES	Programa de Desarrollo de Vuelos en el Ámbito Territorial de la Región Ultraperiférica de Canarias	Canarian Airports ²¹¹	2013	2021
SA.35908	RO	State aid scheme for new airlines departing from Sibiu	Sibiu International Airport	2013	2017
SA.38938	FR	Régime d'aide au démarrage des compagnies aériennes au départ des petits et moyens aéroports français	Small and medium-sized French airports ²¹²	2015	2024

²¹⁰ Kaunas International Airport, Palanga International Airport, Vilnius International Airport, Šiauliai International Airport.

²¹¹ César Manrique-Lanzarote Airport, El Hierro Airport, Fuerteventura Airport, Gran Canaria Airport, La Gomera Airport, La Palma Airport, Tenerife Norte-Ciudad de La Laguna Airport, Tenerife Sur Airport.

²¹² List identified by the Project Team based on the criteria outlined in the decision, as it is not explicitly stated in the text: Agen-La Garenne Airport, Ajaccio-Napoléon Bonaparte Airport, Albert-Picardie Airport, Aurillac Airport, Avignon-Caumont Airport, Bastia-Poretta Airport, Bergerac Dordogne Périgord Airport, Biarritz-Anglet-Bayonne Airport, Brest Bretagne Airport, Brive-Souillac, Béziers-Vias Airport, Caen-Carpiquet Airport, Calvi-Sainte-Catherine Airport, Carcassonne Airport, Castres-Mazamet Airport, Cayenne – Félix Eboué Airport, Chambéry Savoie Mont Blanc Airport, Châlons-Vatry Airport, Châteauroux-Déols "Marcel Dassault" Airport, Clermont-Ferrand Auvergne Airport, Deauville-Normandie Airport, Dijon-Bourgogne Airport, Dinard-Pleurtuit-Saint-Malo Airport, Dole-Jura Airport, Dzaoudzi Pamandzi International Airport, EuroAirport Basel-Mulhouse-Freiburg, Figari Sud-Corse Airport, Grand Case-Espérance Airport, Grenoble-Isère Airport, La Rochelle-Île de Ré Airport, Lannion-Côte de Granit Airport, Le Havre-Octeville Airport, Lille Airport, Limoges Airport, Lorient South Brittany (Bretagne Sud) Airport, Maripasoula Airport, Metz-Nancy-Lorraine Airport, Montpellier-Méditerranée Airport, Nîmes-Arles-Camargue Airport, Paris-Le Bourget Airport, Pau Pyrénées Airport, Perpignan-Rivesaltes (Llabanère) Airport, Pierrefonds Airport, Pointe-à-Pitre Le Raizet International Airport, Poitiers-Biard Airport, Quimper-Cornouaille Airport, Rennes-Saint-Jacques Airport, Rodez-Aveyron Airport, Roland Garros Airport, Rouen Vallée de Seine Airport, Saint-Nazaire-Montoir Airport, Saint-Étienne-Bouthéon Airport, Strasbourg Airport, Tarbes-Lourdes-Pyrénées Airport, Toulon-Hyères Airport, Tours Val de Loire Airport.

Aid Number	Country	Title	Airport	Start	End
SA.39466	UK	Start-up aid to airlines operating in the United Kingdom	UK Airports ²¹³	2015	2019
SA.40744	IT	Trapani airport start-up aid	Vincenzo Florio Airport Trapani-Birgi	2015	2018
SA.41815	IT	Start-up aid for new routes from/to the airport of Comiso (city)	Comiso Airport	2016	2020
SA.40605	LT	Start-up aid for flights from regional airports	Regional Airports in Lithuania ²¹⁴	2016	2025
SA.48345	RO	Start-up aid scheme for routes from Tulcea Airport	Tulcea Danube Delta Airport	2017	2019
SA.47746	NL	Start-up aid to Maastricht-Aachen airport (Provincie Limburg)	Maastricht Aachen Airport	2017	2019
SA.46709	IT	Start-up aid for new routes from/to airports in the Region of Calabria	Airports in the Region of Calabria ²¹⁵	2017	2022
SA.48872	ES	Prolongation of start-up aid scheme to airlines operating from the Canary Islands	Canarian Airports ²¹⁶	2019	2021
SA.57002	IT	Start-up aid to new routes from Ancona airport	Ancona Airport	2021	2022
SA.102618	RO	Start-up aid - State aid scheme for opening new routes at Sibiu International Airport	Sibiu International Airport	2022	2025
SA.105331	SI	Start-up aid - State aid scheme to ensure enhanced air connectivity in Slovenia.	Slovenia's international airports ²¹⁷	2022	2026
SA.101586	IT	Prolongation and refinancing of start up aid scheme in Ancona airport	Ancona Airport	2022	2025
SA.102756	FR	Start-up aid - Aide au démarrage à une compagnie aérienne pour une liaison au départ de l'aéroport Pierrefonds	Pierrefonds Airport	2022	2023
SA.100802	ES	Start-up aid (compatible aid) - Reintroduction of a start-up aid scheme to airlines operating from the Canary Islands	Canarian Airports ²¹⁸	2022	2026
SA.112783	FR	Réintroduction du régime d'aide au démarrage des compagnies aériennes au départ des petits et moyens aéroports français	Small and medium-sized French airports ²¹⁹	2024	2027
SA.108978	IT	Start-up aid for the establishment of new air routes from/to airports in Calabria	Airports in the Region of Calabria ²²⁰	2024	2027
SA.111720	IT	Start-up aid for the establishment of new air routes to/from airports in Sardinia	Airports in Sardinia ²²¹	2024	2027
SA.113202	SK	State aid scheme to enhance air connectivity	Slovak Airports ²²²	2024	2027

Source: Project Team based on EC's data

²¹³ Barra Airport, Benbecula Airport, Blackpool International Airport, Bournemouth Airport, Brighton City Airport, Cambridge City Airport, Cardiff International Airport, City of Derry Airport, Cornwall Airport Newquay, Dundee Airport, Elstree, Exeter International Airport, George Best Belfast City Airport, Glasgow Prestwick Airport, Gloucestershire Airport, Humberside Airport, Inverness Airport, Islay Airport, Kent International Airport (Manston), Kirkwall Airport, Land's End Airport, Lerwick / Tingwall Airport, London Biggin Hill Airport, London Southend Airport, Lydd London Ashford Airport, Norwich Airport, Robin Hood Doncaster Sheffield Airport, Scatsta Airport, Southampton Airport, St. Mary's Airport, Stornoway Airport, Sumburgh Airport, Teesside International Airport, Tiree Airport, Wick Airport.

²¹⁴ See footnote 210.

²¹⁵ Crotone Airport, Lamezia Terme Airport, Reggio Calabria Airport.

²¹⁶ See footnote 211.

²¹⁷ Ljubljana Jože Pučnik Airport, Maribor Edvard Rusjan Airport, Portoroz Airport.

²¹⁸ See footnote 211.

²¹⁹ See footnote 212.

²²⁰ See footnote 215.

²²¹ Alghero-Fertilia Airport, Cagliari Elmas Airport, Olbia Costa Smeralda Airport.

²²² Košice International Airport, M. R. Štefánik Airport, Piešťany Airport, Poprad-Tatry Airport, Zilina Airport.

E.4 Airport survey data

The airport survey dataset (referred to below as the *final version*) used for the analysis records EBITDA net of aid for the years 2014–2024 and passenger numbers for the years 2023–2024, with each record identified by the ICAO airport code and the flight year (unit of observation: airport–year). The dataset also contains a “Notes” field capturing airports’ original comments on the construction of EBITDA net of aid and, where relevant, the Team’s documentation of currency conversion for non-EUR submissions. In addition, a dummy variable flags whether an airport appears in the EC dataset of airports receiving operating aid.

E.4.1 Summary of initial survey questionnaire responses

The first version of the survey (the *initial survey*), sent to airports, covered an extensive scope across:

- Ownership (2014–2024): legal form, ownership type and shareholder composition/changes, operator transitions/concessions, and links to multi-airport groups.
- Catchment area: self-identified competitors, a tailored competitor list, views on the 100 km/60-min criterion, rail stations (HS vs non-HS) as rivals/feeders, and implications for regional vs hub competition and sustainability.
- Public funding & compensations (2014–2024): start-up aid (as defined under the Aviation Guidelines), operating aid (excluding SGEI/PSO and non-economic activities), investment aid (purposes and amounts), SGEI compensations, non-economic public-remit reimbursements, and notification status/reasons.
- Financial overview (2014–2024): aviation and non-aviation revenues (with guidance on discount/pass-through treatment), operating costs, and earnings (EBITDA/EBIT/EBT).
- Expected operating and financial performance and cost coverage (2025–2027): passenger and freight forecasts, revenues/costs/earnings on an ex-aid basis, expected aid by type, and the likelihood/timing of achieving cost coverage (incl. April 2027 benchmark); and (vi) supplementary modules: views on the Aviation Guidelines (e.g. operating aid beyond April 2027, investment-aid priorities, ORs/SGEI) and a COVID-19 block on financial impacts and lessons learned.

However, due to the initial low number of respondents, the questionnaire had to be significantly reduced, focusing essentially on information on EBITDA net of any aid received to cover operating costs and of any compensation received to cover SGEI obligations (“EBITDA net of aid”), from 2014 to 2025. Table E.19 summarises the number of respondents and the mean values reported for each quantitative question in the initial survey questionnaire.

Table E.19: Summary of initial survey questionnaire responses

Quantitative survey questions	Number of respondents	Mean
Q24.1 - Amount of public funding for operating costs (euros, 2014–2024)	4	6,870,969.00 €
Q25.1 - Amount of public investment aid received (euros, 2014–2024)	6	6,401,892.50 €
Q28 - Total public funding for investments (actual or estimated, euros)	0	
Q28 - Total public funding to cover operating costs (actual or estimated, euros)	0	
Q32 - Operating costs (euros, 2014–2024, excl. capital/financial/tax)	14	26,452,426.00 €
Q31 - Revenue from passengers (euros, 2014–2024, excl. public funding)	14	21,990,114.00 €
Q31 - Revenue from cargo operations (euros, 2014–2024, excl. public funding)	4	873,954.06 €
Q31 - Non-aviation revenues (euros, 2014–2024, excl. public funding)	14	11,322,371.00 €
Q31 - Estimated public funding included in reported revenues	2	3,051,787.00 €
Q31 - Other revenue (euros, e.g. general aviation, 2014–2024)	7	7,959,849.50 €
Q31 - Total revenues including general aviation (euros, 2014–2024)	13	40,920,276.00 €
Q33 - Earnings Before Taxes (euros, 2014–2024)	12	7,221,210.00 €
Q33 - Earnings Before Interest and Taxes (euros, 2014–2024)	12	7,831,784.50 €
Q33 - Earnings Before Interest, Taxes, Depreciation, Amortization (euros, 2014–2024)	15	11,507,348.00 €
Q37 - Earnings Before Taxes (euros, 2025–2027)	10	19,571,194.00 €
Q37 - Earnings Before Interest and Taxes (euros, 2025–2027)	10	19,907,660.00 €
Q37 - Earnings Before Interest, Taxes, Depreciation, Amortization (euros, 2025–2027)	12	24,584,588.00 €
Q37 - Operating costs (euros, 2025–2027, excl. capital/financial/tax)	13	39,460,984.00 €
Q37 - Revenue from passengers (euros, 2025–2027, excl. public funding)	13	36,169,944.00 €
Q37 - Revenue from cargo operations (euros, 2025–2027, excl. public funding)	5	10,646,410.00 €
Q37 - Non-aviation revenues (euros, 2025–2027, excl. public funding)	13	21,122,420.00 €
Q38 - Amount of public investment aid expected (euros, 2025–2027)	6	3,493,120.50 €
Q38 - Amount of public funding for operating costs expected (euros, 2025–2027)	1	4,750,000.00 €
Total distinct airports	20	-

Source: Project Team based on the initial survey questionnaire responses

Table E.20: Airport responses to Q36 – expectations on achieving operating or full cost coverage by April 2027

Q36. Do you expect your airport to likely achieve operating or full cost coverage by April 2027?	Number of respondents
Yes, after 2027 given current expectations, the airport would be in equilibrium at least the level of EBITDA (covering at least operating costs)	5
Yes, after 2027 given current expectations, the airport would be in equilibrium also at the level of EBIT (covering also depreciations and amortizations of tangible and intangible assets)	6
None of the above*	16
Total distinct airports*	27

*Note: In this context, "cost coverage" refers to the ability of the airport to achieve profitability by April 2027. Profitability can be defined using standard financial metrics such as EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortisation), EBIT (Earnings Before Interest and Taxes), EBT (Earnings Before Taxes), or net profits/losses. *Among respondents, regional airports are 22 out of 27 in total (while 2 are hubs and 3 are mid-size); and 14 out of 16 that responded, "None of the above" (while 1 is a mid-size and 1 is a hub).*

Source: Project Team based on Survey data

E.4.2 Description of the final survey dataset

The final version of the survey comprises 828 observations covering 76 airports in Europe distributed as follows:

Table E.21: Distribution of survey responses (airports) by country and airport class size (full sample)

Country	Total	Class				
		<200k	[200k-700k]	(700k-1M]	(1M-3M]	>3M
Austria	3	0 (0%)	0 (0%)	1 (33.3%)	1 (33.3%)	1 (33.3%)
Belgium	2	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)
Czechia	1	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)
Germany	23	5 (21.7%)	3 (13%)	1 (4.3%)	5 (21.7%)	9 (39.1%)
Denmark	2	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)
Finland	8	0 (0%)	7 (87.5%)	0 (0%)	1 (12.5%)	0 (0%)
France	8	2 (25%)	3 (37.5%)	1 (12.5%)	2 (25%)	0 (0%)
Croatia	2	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Ireland	1	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)
Italy	5	1 (20%)	0 (0%)	0 (0%)	1 (20%)	3 (60%)
Lithuania	4	1 (25%)	1 (25%)	0 (0%)	1 (25%)	1 (25%)
Poland	2	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)
Romania	8	3 (37.5%)	2 (25%)	0 (0%)	3 (37.5%)	0 (0%)
Sweden	5	2 (40%)	3 (60%)	0 (0%)	0 (0%)	0 (0%)
Slovenia	2	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)
Total	76	15 (19.7%)	24 (31.6%)	3 (3.9%)	17 (22.4%)	17 (22.4%)

Note: The class size of the airports was defined using Cirium.

Source: Project Team based on Survey data and Cirium

Table E.22: Distribution of survey responses (airports) by country and airport class size (Excluding the four largest airports)

Country	Total	Class				
		<200k	[200k-700k]	(700k-1M]	<200k	>3M
Austria	2	0 (0%)	0 (0%)	1 (50%)	1 (50%)	0 (0%)
Belgium	2	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)
Czechia	1	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)
Germany	20	5 (25%)	3 (15%)	1 (5%)	5 (25%)	6 (30%)
Denmark	2	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)
Finland	8	0 (0%)	7 (87.5%)	0 (0%)	1 (12.5%)	0 (0%)
France	8	2 (25%)	3 (37.5%)	1 (12.5%)	2 (25%)	0 (0%)
Croatia	2	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Ireland	1	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)
Italy	5	1 (20%)	0 (0%)	0 (0%)	1 (20%)	3 (60%)
Lithuania	4	1 (25%)	1 (25%)	0 (0%)	1 (25%)	1 (25%)
Poland	2	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)
Romania	8	3 (37.5%)	2 (25%)	0 (0%)	3 (37.5%)	0 (0%)
Sweden	5	2 (40%)	3 (60%)	0 (0%)	0 (0%)	0 (0%)
Slovenia	2	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)
Total	72	15 (20.8%)	24 (33.3%)	3 (4.2%)	17 (23.6%)	13 (18.1%)

Note: The class size of the airports was defined using Cirium. Four largest airports defined based on the number of passengers handled.

Source: Project Team based on Survey data, Eurostat and Cirium

Table E.23: Distribution of airports in Cirium by country and class size

Country	Total	Class				
		<200k	[200k-700k]	(700k-1M]	(1M-3M]	>3M
Austria	6	0 (0%)	2 (33.3%)	1 (16.7%)	2 (33.3%)	1 (16.7%)
Belgium	6	1 (16.7%)	3 (50%)	0 (0%)	0 (0%)	2 (33.3%)
Bulgaria	4	0 (0%)	1 (25%)	0 (0%)	2 (50%)	1 (25%)
Cyprus	4	1 (25%)	0 (0%)	0 (0%)	0 (0%)	3 (75%)
Czechia	6	3 (50%)	1 (16.7%)	1 (16.7%)	0 (0%)	1 (16.7%)
Germany	39	16 (41%)	5 (12.8%)	1 (2.6%)	8 (20.5%)	9 (23.1%)
Denmark	11	5 (45.5%)	3 (27.3%)	0 (0%)	1 (9.1%)	2 (18.2%)
Estonia	5	4 (80%)	0 (0%)	0 (0%)	1 (20%)	0 (0%)
Greece	40	19 (47.5%)	9 (22.5%)	2 (5%)	4 (10%)	6 (15%)
Spain	50	15 (30%)	6 (12%)	2 (4%)	11 (22%)	16 (32%)
Finland	21	12 (57.1%)	7 (33.3%)	0 (0%)	1 (4.8%)	1 (4.8%)
France	80	38 (47.5%)	19 (23.8%)	2 (2.5%)	10 (12.5%)	11 (13.8%)
Croatia	9	3 (33.3%)	1 (11.1%)	1 (11.1%)	2 (22.2%)	2 (22.2%)
Hungary	3	1 (33.3%)	1 (33.3%)	0 (0%)	0 (0%)	1 (33.3%)
Ireland	7	2 (28.6%)	1 (14.3%)	0 (0%)	2 (28.6%)	2 (28.6%)
Italy	44	12 (27.3%)	7 (15.9%)	1 (2.3%)	5 (11.4%)	19 (43.2%)
Lithuania	4	1 (25%)	1 (25%)	0 (0%)	1 (25%)	1 (25%)
Luxembourg	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Latvia	2	1 (50%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)
Malta	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Netherlands	7	2 (28.6%)	2 (28.6%)	0 (0%)	1 (14.3%)	2 (28.6%)
Poland	15	3 (20%)	4 (26.7%)	1 (6.7%)	1 (6.7%)	6 (40%)
Portugal	21	12 (57.1%)	3 (14.3%)	0 (0%)	2 (9.5%)	4 (19%)
Romania	17	7 (41.2%)	4 (23.5%)	2 (11.8%)	3 (17.6%)	1 (5.9%)
Sweden	40	23 (57.5%)	10 (25%)	0 (0%)	5 (12.5%)	2 (5%)
Slovenia	2	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)
Slovakia	5	3 (60%)	1 (20%)	0 (0%)	1 (20%)	0 (0%)
Türkiye	54	16 (29.6%)	15 (27.8%)	3 (5.6%)	11 (20.4%)	9 (16.7%)
United Kingdom	65	35 (53.8%)	5 (7.7%)	3 (4.6%)	7 (10.8%)	15 (23.1%)
Total	569	236 (41.5%)	111 (19.5%)	20 (3.5%)	82 (14.4%)	120 (21.1%)

Note: The class size of the airports was defined using Cirium.

Source: Project Team based on Cirium

E.4.3

Summary statistics based on Survey data

Table E.24: Number of competing airports within the catchment area of surveyed airports by profitability status (including and excluding COVID-19 years)

Number of competitors ²²³	Including COVID-19 years		Excluding COVID-19 years	
	Airports with a negative average EBITDA net of aid	Airports with a positive average EBITDA net of aid	Airports with a negative average EBITDA net of aid	Airports with a positive average EBITDA net of aid
Median number of competitors within 100 km (all)	0	1	0	1
Median number of competitors within 100 km (hubs)	0	0	0	0
Median number of competitors within 100–200 km (all)	4	3	4	3
Median number of competitors within 100–200 km (hubs)	0	0	0	0
Median number of competitors within 200–300 km (all)	5	5	5	6
Median number of competitors within 200–300 km (hubs)	0	0	0	0
Median number of competitors within 60 min (all)	0	0	0	0
Median number of competitors within 60 min (hubs)	0	0	0	0
Median number of competitors within 60–120 min (all)	2	2	2	2
Median number of competitors within 60–120 min (hubs)	0	0	0	0
Median number of competitors within 120–180 min (all)	5	5	4	5
Median number of competitors within 120–180 min (hubs)	0	0	0	0

Note: The average EBITDA net of aid is calculated as the unweighted mean of annual values across all available years for each airport. Airports are classified as having either positive or negative average EBITDA net of aid based on this value. The mean or median number of competitors within each catchment area is obtained by first calculating, for each airport, the total number of other airports located within its catchment area. These airport-level values are then aggregated as unweighted averages or medians across airports within EBITDA net of aid groups (positive vs. negative).

Source: Project Team based on Survey data & Cirium

²²³ The selection of potential competitor airports is described in Annex F.1.

Annex F Competition for passengers

F.1 Relevant markets definition

The catchment area dataset is built from the cleaned Cirium dataset described in Annex E.1.1. It is defined at the airport-pair level: each pair links a focal airport to a potential rival. Focal airports are located in the EU, the UK, or Türkiye (569 airports), while potential rivals face no geographic restrictions. We keep a focal–rival pair only if both airports meet all three conditions:

- they are commercial airports (i.e. have an IATA code);
- they are listed in *OurAirports* database, with *OurAirports* used to retrieve exact latitude/longitude coordinates; and
- the linear (great-circle) distance between the focal airport and the potential competitor is no more than 500 km.

For each eligible focal–rival pair, we compute road-based proximity measures using the Google Maps API. We calculate car travel distance (“travel distance”) and car travel time (“travel time”) assuming a 5:30 PM Friday departure to approximate peak flight demand conditions relevant for airport choice. We exclude pairs if travel distance exceeds 300 km or travel time exceeds 180 minutes. The resulting estimation sample comprises 527 focal airports and 588 distinct potential rivals.

Finally, we construct catchment-area indicators based on alternative thresholds and segmented (“donut”) definitions for both travel distance and travel time.

- Travel Distance categories:
 - ≤ 100 km
 - ≤ 200 km
 - ≤ 300 km
 - 100–200 km
 - 200–300 km
- Travel Time categories:
 - ≤ 60 min
 - ≤ 120 min
 - ≤ 180 min
 - 60–120 min
 - 120–180 min

F.2 Summary statistics of rival airports and focal airports in the catchment areas

Table F.1 shows summary statistics of the number of rival airports within these different catchment areas, split up between hubs, mid-size airports and regional airports. The reported means indicate, for each focal airport, the average number of other airports located within the given distance or travel-time catchment.

The first panel shows that, on average for each airport in the sample, there are few hubs within 100 km (a mean 0.1), whereas the mean for regional airports is 0.7.

These numbers are also shown for larger catchment areas, i.e. 200 km and 300 km, respectively. The means for of hub airports increase when catchment areas become larger. However, the median number of hubs is still zero, reflecting the fact that, for the sample considered, most catchment areas do not include a hub. The median number of

regional airports increases (from 0) to 3 and 7, for 200 km and 300 km catchment areas, respectively.

Table F.1: Summary statistics – number of rival airports within catchment areas of each airport in the sample

Category & Variables	Mean	Median	Std. Dev.	Min	Max
100 km Catchment Area					
Number of airports (total)	0.9	1.0	1.3	0	7
Number of hub airports	0.1	0.0	0.3	0	2
Number of mid-size airports	0.2	0.0	0.4	0	3
Number of regional airports	0.7	0.0	1.1	0	7
200 km Catchment Area					
Number of airports (total)	4.4	4.0	2.9	0	17
Number of hub airports	0.3	0.0	0.6	0	3
Number of mid-size airports	0.7	0.0	1.1	0	7
Number of regional airports	3.4	3.0	2.2	0	11
300 km Catchment Area					
Number of airports (total)	9.6	9.0	5.2	1	28
Number of hub airports	0.6	0.0	0.9	0	5
Number of mid-size airports	1.7	1.0	1.8	0	10
Number of regional airports	7.3	7.0	3.9	0	18
60 min Catchment Area					
Number of airports (total)	0.4	0.0	0.7	0	4
Number of hub airports	0.0	0.0	0.2	0	2
Number of mid-size airports	0.1	0.0	0.3	0	2
Number of regional airports	0.3	0.0	0.5	0	3
120 min Catchment Area					
Number of airports (total)	2.8	2.0	2.6	0	14
Number of hub airports	0.2	0.0	0.5	0	3
Number of mid-size airports	0.5	0.0	0.9	0	6
Number of regional airports	2.1	2.0	1.9	0	9
180 min Catchment Area					
Number of airports (total)	6.8	5.0	5.2	0	26
Number of hub airports	0.5	0.0	0.8	0	4
Number of mid-size airports	1.3	1.0	1.7	0	10
Number of regional airports	5.0	4.0	3.7	0	16

Note: Each row reports summary statistics across 17,319 observations (each observation = focal airport × year–quarter). For each focal airport–quarter we count the number of rival airports located within the indicated catchment band (100/200/300 km or 60/120/180 min). Mean is the arithmetic average of the counts across observations; Median is the 50th percentile; Std. Dev. is the sample standard deviation (measuring dispersion); Min/Max are the observed minimum and maximum counts across the sample. The row "Number of airports (total)" is the sum of the three component counts (hubs, mid-size, regional) for each observation. Classification of airports as hub / mid-size / regional follows Annex E.1.1.

Source: Project Team based on Cirium & OurAirports.

Table F.2: Distribution of airports with at least one competitor within 300km/180 min, by presence of other airports within defined catchment areas

Category	Count (%)
Airports with a competitor within 100 km catchment area	288 (54.65%)
Airports with a competitor within 200 km catchment area	516 (97.91%)
Airports with a competitor within 300 km catchment area	527 (100%)
Airports with a competitor within 60 min travel time	156 (29.6%)
Airports with a competitor within 120 min travel time	431 (81.78%)
Airports with a competitor within 180 min travel time	503 (95.45%)
Total number of airports	527 (100%)

Note: Airport counts and percentages are reported on a cumulative basis; each successive threshold (e.g. 200 km or 120 min) also includes airports within the smaller distance or shorter travel-time threshold (e.g. 100 km or 60 min).

Source: Project Team based on Cirium & OurAirports.

F.3 Average Delay for Congestion

Table F.3 shows the delay at regional airports versus hubs. Flights leaving from hubs have a mean delay of around 13 min versus 10 min from regional airports.

Table F.3: Delay in minutes by Regional and Hub Airports

	Obs.	Mean	Median	Std. Dev.	Min	Max
Regional airports	172,805	9.94	4	19.13	-103	131
Hub airports	361,140	13.15	9	16.88	-103	131

Note: Period: 2014–2023 (inclusive). Unit of observation: quarterly records at airport-pair (origin–destination) × flight-category level. Summary statistics across airline-route-year-quarter. Mean/Median report the average and 50th percentile of these quarterly per-pair counts; Standard deviation captures dispersion across airport-pair–quarter observations; Min/Max are the lowest/highest quarterly per-pair values observed.

Source: Project Team based on Cirium

F.4

Competition for passengers: regression results

F.4.1

Competition of rival airports on focal airports

Table F.4: Regression results by rival airport types (distance)

Dependent variable: log(total number of passengers)	(1)
LCC Share	3.265*** (0.138)
Focal hub airport	2.384 (0.258)
Rival hub airports:	
100km (number of pax)	-9.24e-07*** (5.28e-08)
100-200km (number of pax)	-6.63e-07*** (9.37e-08)
200-300km (number of pax)	-1.78e-07*** (4.49e-08)
Rival mid-size airports:	
100km (number of pax)	-2.42e-06*** (1.59e-07)
100-200km (number of pax)	-9.90e-07*** (7.90e-08)
200-300km (number of pax)	-5.93e-07*** (8.17e-08)
Rival regional airports:	
100km (number of pax)	-5.19e-06*** (4.74e-07)
100-200km (number of pax)	-2.07e-06*** (5.05e-07)
200-300km (number of pax)	3.59e-06*** (5.31e-07)
Constant	11.13*** (0.159)
NUTS3 FE * year-quarter FE	Yes
Number of focal airports	526
Number of observations	17,125
R-squared	0.941
Adj.R2	0.610
F-Stat	187.2
Prob > F	0

*Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium

Table F.5: Regression results by rival airport types (time)

Dependent variable: log(total number of passengers)	(1)
LCC Share	3.176*** (0.138)
Focal hub airport	3.138*** (0.268)
Rival hub airports:	
60min (number of pax)	-1.02e-06*** (5.53e-08)
60-120min (number of pax)	-6.28e-07*** (6.89e-08)
120-180min (number of pax)	-5.07e-08 (4.20e-08)
Rival mid-size airports:	
60min (number of pax)	-3.38e-06*** (1.78e-07)
60-120min (number of pax)	-1.06e-06*** (1.46e-07)
120-180min (number of pax)	-1.02e-06*** (8.72e-08)
Rival regional airports:	
60min (number of pax)	-1.39e-05*** (1.00e-06)
60-120min (number of pax)	-3.61e-06*** (4.66e-07)
120-180min (number of pax)	-2.65e-06*** (5.94e-07)
Constant	11.65*** (0.155)
NUTS3 FE * year-quarter FE	Yes
Number of focal airports	526
Number of observations	17,135
R-squared	0.946
Adj.R2	0.645
F-Stat	126.7
Prob > F	0

*Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium

F.4.2 Competition Between Airports: focus on regional airports

The extent to which regional airports exercise competitive pressure on hubs

Table F.6: Regression results for focal hub airports and rival regional airports (distance)

Dependent variable: log(total number of pax)	(1)
LCC Share	3.319*** (0.0766)
Focal hub airport	4.317*** (0.170)
Focal hub airports	
<i>Rival regional airports</i>	
100 km (number of pax)	-1.09e-05*** (1.32e-06)
100-200 km (number of pax)	7.15e-06*** (1.26e-06)
200-300 km (number of pax)	2.28e-06** (9.76e-07)
Focal mid-size and regional airports	
<i>Rival regional airports</i>	
100km (number of pax)	-3.98e-06*** (4.08e-07)
100-200km (number of pax)	-2.12e-06*** (2.69e-07)
200-300km (number of pax)	6.10e-08 (2.23e-07)
Constant	9.243*** (0.0604)
NUTS2 FE * year-quarter FE	Yes
Number of focal airports	526
Number of observations	17,125
R-squared	0.753
Adj.R2	0.466
F-Stat	407.1
Prob > F	0

*Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium

Table F.7: Regression results for focal hub airports and rival regional airports (time)

Dependent variable: log(total number of pax)	(1)
LCC Share	3.333*** (0.0767)
Focal hub airport	4.406*** (0.198)
Focal hub airports	
<i>Rival regional airports</i>	
60min (number of pax)	-4.52e-06*** (1.62e-06)
60-120min (number of pax)	-4.72e-06*** (9.41e-07)
120-180min (number of pax)	7.32e-06*** (1.41e-06)
Focal mid-size and regional airports	
<i>Rival regional airports</i>	
60min (number of pax)	-4.66e-06*** (8.16e-07)
60-120min (number of pax)	-1.94e-06*** (2.91e-07)
120-180min (number of pax)	4.13e-07 (2.51e-07)
Constant	9.115*** (0.0554)
NUTS2 FE * year-quarter FE	Yes
Number of focal airports	526
Number of observations	17,125
R-squared	0.750
Adj.R2	0.461
F-Stat	394.3
Prob > F	0

Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Project Team based on Cirium

Competition among regional airports

Table F.8: Regression results for focal regional airports (distance)

Dependent variable: log(total number of pax)	(1)
LCC Share	2.829*** (0.133)
Focal hub airport	2.125*** (0.292)
Focal regional airports:	
<i>Rival regional airports:</i>	
100km (number of pax)	-6.78e-06***

Dependent variable: log(total number of pax)	(1)
	(4.85e-07)
100-200km (number of pax)	-4.19e-06*** (4.96e-07)
200-300km (number of pax)	3.17e-06*** (5.12e-07)
<i>Rival hub airports:</i>	
100km (number of pax)	-7.20e-07*** (9.08e-08)
100-200km (number of pax)	-6.22e-07*** (1.01e-07)
200-300km (number of pax)	-1.91e-07*** (4.28e-08)
<i>Rival mid-size airports:</i>	
100km (number of pax)	-1.51e-06*** (1.98e-07)
100-200km (number of pax)	-6.42e-07*** (7.76e-08)
200-300km (number of pax)	-3.81e-07*** (8.45e-08)
Focal hub and mid-size airports:	
<i>Rival hub airports:</i>	
100km (number of pax)	-9.41e-07*** (5.17e-08)
100-200km (number of pax)	2.86e-06*** (3.83e-07)
200-300km (number of pax)	5.02e-07*** (9.11e-08)
<i>Rival mid-size airports:</i>	
100km (number of pax)	-1.56e-06*** (4.24e-07)
100-200km (number of pax)	-1.53e-06*** (4.21e-07)
200-300km (number of pax)	-2.17e-07 (1.62e-07)
<i>Rival regional airports:</i>	
100km (number of pax)	-5.71e-06*** (1.29e-06)
100-200km (number of pax)	-2.22e-07 (9.82e-07)
200-300km (number of pax)	9.51e-06*** (8.51e-07)
Constant	10.04*** (0.197)
NUTS3 FE * year-quarter FE	Yes

Dependent variable: log(total number of pax)	(1)
Number of focal airports	526
Number of observations	17,125
R-squared	0.949
Adj.R2	0.664
F-Stat	141
Prob > F	0

Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Project Team based on Cirium

Table F.9: Regression results for focal regional airports (time)

Dependent variable: log(total number of pax)	(1)
LCC Share	2.908*** (0.142)
Focal hub airport	2.619*** (0.321)
Focal regional airports:	
<i>Rival regional airports:</i>	
60min (number of pax)	-1.60e-05*** (1.27e-06)
60-120min (number of pax)	-4.98e-06*** (4.68e-07)
120-180min (number of pax)	-4.32e-06*** (6.51e-07)
<i>Rival hub airports:</i>	
60min (number of pax)	-7.81e-07*** (1.05e-07)
60-120min (number of pax)	-5.25e-07*** (1.04e-07)
120-180min (number of pax)	-1.83e-07*** (4.42e-08)
<i>Rival mid-size airports:</i>	
60min (number of pax)	-2.16e-06*** (3.22e-07)
60-120min (number of pax)	-4.96e-07*** (1.50e-07)
120-180min (number of pax)	-6.20e-07*** (9.89e-08)
Focal hub and mid-size airports:	
<i>Rival hub airports:</i>	
60min (number of pax)	-1.02e-06*** (5.60e-08)
60-120min (number of pax)	-6.13e-07***

Dependent variable: log(total number of pax)	(1)
	(8.71e-08)
120-180min (number of pax)	2.50e-07*** (8.50e-08)
<i>Rival mid-size airports:</i>	
60min (number of pax)	-2.32e-06*** (5.25e-07)
60-120min (number of pax)	-2.06e-06* (1.17e-06)
120-180min (number of pax)	-5.42e-08 (1.69e-07)
<i>Rival regional airports:</i>	
60min (number of pax)	-1.90e-05*** (1.81e-06)
60-120min (number of pax)	3.64e-06*** (1.12e-06)
120-180min (number of pax)	1.56e-06 (9.80e-07)
Constant	11.20*** (0.232)
NUTS3 FE * year-quarter FE	Yes
Number of focal airports	526
Number of observations	17,125
R-squared	0.946
Adj.R2	0.645
F-Stat	126.7
Prob > F	0

Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Project Team based on Cirium

F.5 Relevant Market: General Approach (No Heterogeneous Effect)

The Team examines how passengers at a focal airport are influenced by the presence of other airports within various distances (100 km, 200 km, and 300 km) and travel distances (60mins, 120, and 180 mins).²²⁴ To do so, the Team introduces a "donut" approach to examine the relationship between the number of passengers, in logs ($\log(\text{Pass}_{iat})$) at a focal airport i at time t (where t is a quarter within 2014-2023) in catchment area a and other airports in the same catchment area. In particular, the impact of the presence, and their respective passengers, of other regional airports (Regional_{at}), hubs (Hub_{at}) and mid-size airports (MidSize_{at}) is assessed within specific distance and time bands.

²²⁴ This approach is similar to methods used in retail to test the impact of nearby competitors in relevant product markets.

The log-linear equation estimated is²²⁵:

$$\log(\text{Pass}_{iat}) = \beta_1 + \sum_2^4 d_j \beta_j \text{Pax_other}_{at} + \beta_{11} \text{LCC Share}_{iat} + \beta_{12} \text{Focal_Hub}_{iat} + \omega_r * \omega_t + \epsilon_{iat}.$$

where:

- d_j, d_k, d_l indicate the number of passengers of airports at distance bands, 0–100 km, 100–200 km, and 200–300 km, or travel times, 0–60 min, 60–120 min, and 120–130 min.

Controls are:

- LCC Share_{iat} is the share of low-cost carriers at the focal airport i ,
- Focal_Hub_{iat} is a dummy equal one if the focal airport is a hub,
- $\omega_r * \omega_t$ are NUTS 3 region-by-year fixed effects,
- ϵ_{iat} is the error term.

Instead of including demographic variables directly, we use NUTS3 region $\times$ year fixed effects, which absorb all time-varying regional characteristics such as population density and GDP per capita. We include NUTS3 region $\times$ year fixed effects because they do a better job capturing regional factors that might influence air traffic. Regional characteristics do not change much over time, hence including them directly does not add much explanatory power.²²⁶

Table F.10 shows the regressions for various distances in kilometres for all airports pooled (i.e. without distinguishing between regional, hub, and mid-size rival airports). The model is well specified in terms R-squared and F-stats: it has a high explanatory power in terms of variance with such a high R-squared and the F-stat implies that all variables together do a good job in explaining the dependent variable. In terms of controls, the focal airport being a hub attracts more passengers, having relatively more LCCs as well. For the main effects, we find that passengers of other airports negatively impact passengers at the focal airport, and this at a lower rate the further away.

²²⁵ The log-level model was chosen because it simplifies interpretation—coefficients represent approximate percentage changes in passenger numbers.

²²⁶ Note further that we do not include airport fixed effects, where the LCC share takes that role.

Table F.10: Regression results for all airport types (distance)

Dependent variable: log(total number of pax)	(1)
LCC-share	3.736*** (0.138)
Focal hub airport	1.330*** (0.253)
All rival airports	
100km (number of pax)	-1.12e-06*** (5.04e-08)
100-200km (number of pax)	-8.88e-07*** (6.13e-08)
200-300km (number of pax)	- 1.77e-07*** (4.01e-08)
Constant	11.01*** (0.140)
NUTS3 FE * year-quarter FE	Yes
Number of focal airports	526
Number of Observations	17,125
R-squared	0.935
Adj.R2	0.572
F-Stat	328.4
Prob > F	0

*Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium & OurAirports.

Table F.11 shows the regressions for various travel times in minutes for all airports pooled (i.e. without distinguishing between regional, hub, and mid-size rival airports). The model specification and control variables are the same as before. For the main effects, we find that passengers of other airports negatively impact passengers at the focal airport, and this at a lower rate the further away (in travel time).

Table F.11: Regression results for all airport types (time)

Dependent variable: log(total number of pax)	(1)
LCC Share	3.674*** (0.140)
Focal hub airport	1.295*** (0.263)
All rival airports	
60min (number of pax) – rival airports	-1.19e-06*** (5.60e-08)
60-120min (number of pax) – rival airports	-8.08e-07*** (6.31e-08)
120-180min (number of pax) – rival airports	-2.65e-07*** (4.06e-08)
Constant	10.69*** (0.127)
NUTS3 FE * year-quarter FE	Yes
Number of focal airports	526
Number of observations	17,125
R-squared	0.933
Adj.R2	0.556
F-Stat	297.5
Prob > F	0

Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Project Team based on Cirium & OurAirports.

Table F.12 shows the quantitative impact of an increase in passenger numbers at rival airports within various distance ranges ("distance bands" in kilometres) on passenger numbers at the focal airport. Given that we have estimated a log-level specification, one can look at what the impact is of the increase of the absolute number of passengers in rival airports on percentage changes in the number of passengers in focal airports. If the number of passengers at rival airports within a 100 km catchment area increases by 100,000, the number of passengers at the focal airport decrease by approximately 10.60%. Similarly, if the number of passengers at rival airports within a 100–200 km catchment area increases by 100,000, the number of passengers at the focal airport decrease by about 8.50%. Similarly, if the number of passengers at rival airports within a 200–300 km catchment area increases by 100,000, the number of passengers at the focal airport decrease by about 1.75%. We further give percentage changes for an increase of 10,000 passengers in rival airports, as this is more in line with regional airport sizes (see further below).

Table F.12: Catchment area interpretation results for all airport types (distance)

Catchment area	Coefficient	% change in + 10,000 pax	% change in + 100,000 pax
100km (number of pax)	-1,12E-06	-1,11	-10,60
100-200km (number of pax)	-8,88E-07	-0,88	-8,50
200-300km (number of pax)	-1,77E-07	-0,18	-1,75

Source: Project Team based on Cirium & OurAirports.

Table F.13 shows the impact of increases in passenger numbers at rival airports within various distance ranges ("distance bands" in minutes) on passenger numbers at the focal airport. If the number of passengers at rival airports within a 60mins catchment area increases by 100,000, the number of passengers at the focal airport decrease by approximately 11.22%. Similarly, if the number of passengers at rival airports within a 60-120min catchment area increases by 100,000, the number of passengers at the focal airport decrease by about 7.76%. Similarly, if the number of passengers at rival airports within a 120-180min catchment area increases by 100,000, the number of passengers at the focal airport decrease by about 2.62%. We further give percentage changes for an increase of 10,000 passengers in rival airports, as this is more in line with regional airport sizes (see further below).

Table F.13: Catchment area interpretation results for all airport types (time)

Catchment area	Coefficient	% change in + 10,000 pax	% change in + 100,000 pax
60min (number of pax)	-1,190E-06	-1,18	-11,22
60-120min (number of pax)	-8,08E-07	-0,80	-7,76
120-180min (number of pax)	-2,65E-07	-0,26	-2,62

Source: Project Team based on Cirium & OurAirports.

Comparing the results for catchment areas in terms of distance and time in Table F.12 and Table F.13, the results are consistent, both in terms of monotonicity of effects (further away both in distance and time leads to a smaller impact), and in terms of magnitude per donut.

Annex G Start-up aid

G.1 Definition and statistics on routes

Table G.1 provides summary statistics on all routes and regular routes separately and show their evolution over time; where seasonal routes are the difference between all routes and regular routes, and their numbers are not shown here.

Table G.1: Summary statistics of routes and regular routes

Variables	Obs.	Mean	Median	Std. Dev.	Min	Max
Routes	720,943	111	97	80	1	360
Regular routes	720,943	63	49	57	0	262
LCC routes						
Routes	338,393	65	59	42	1	207
Regular routes	338,393	35	32	27	0	121

Note: Period: 2014–2023 (inclusive). Unit of observation: airport × year–quarter. An observation represents the total number of distinct routes served from each airport in a given quarter. Summary statistics are calculated across airport–year–quarter observations. "Obs." reports the number of quarterly airport observations. The Mean and Median show the average and 50th percentile number of routes per airport–quarter; the Standard Deviation captures variation across airports and quarters; Min and Max indicate the lowest and highest quarterly counts observed.

Source: Project Team based on Cirium.

Table G.2: Average number of airlines per routes and regular routes

Variables	Obs.	Mean	Std. Dev.	Min	Max
Routes	720,943	2.43	1.61	1	13
Regular routes	720,943	2.67	1.71	1	13

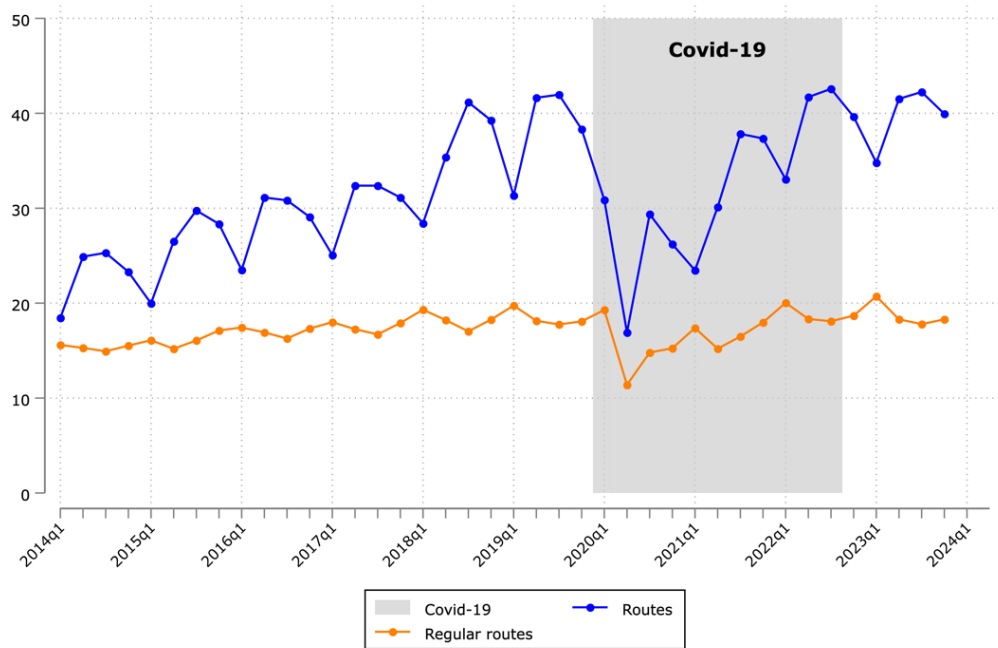
Note: Period: 2014–2023 (inclusive). Unit of observation: airport × year–quarter. An observation represents the total number of distinct routes served from each airport in a given quarter. Summary statistics are calculated across airport–year–quarter observations. "Obs." reports the number of quarterly airport observations. The Mean and Median show the average and 50th percentile number of airlines per routes per airport–quarter; the Standard Deviation captures variation across airports and quarters; Min and Max indicate the lowest and highest quarterly counts observed.

Source: Project Team based on Cirium.

There are on average 111 routes per airport-year-quarter, of which 63 are regular routes on average (with medians of 97 and 49, respectively). Focusing on routes with an LCC present, averages are 65 and 35, for routes and regular routes (and medians 59 and 32, respectively).

Figure G.1 shows the evolution over time of the average number of routes and regular routes. Here it can clearly be seen that the overall number of routes show seasonality, where our regular routes show virtually none, which is the exact aim by filtering out seasonal routes. Furthermore, it can be observed a drop of about 50% at the beginning of COVID-19, with a slow recovery of routes, reaching again at the end of the COVID-19 period the same heights as pre-COVID-19.

Figure G.1: Average number of routes and regular routes



Note: Summary statistics are across airport-year-quarter

Source: Project Team based on Cirium

Table G.3 splits statistics up along airport classes. While it is intuitive that there are in general more routes at larger airports, the average number of routes in class 1 is fairly large (and larger than class 2 and 3), but not their median. This is because a few class 1 airports, like Paris-Le Bourget Airport, are used for many non-ticketed flights, such as private business aviation.

Table G.3: Summary statistics of routes and regular routes per airport class

Variables	Obs.	Mean	Median	Std. Dev.	Min	Max
Airport class 1						
Routes	46,962	38	9	65	1	280
Regular routes	46,962	15	3	25	0	98
LCC routes						
Routes	4,347	4	3	4	1	20
Regular routes	4,347	2	1	2	0	10
Airport class 2						
Routes	47,107	16	13	11	1	74
Regular routes	47,107	5	4	4	0	28
LCC routes						
Routes	15,641	7	6	5	1	24
Regular routes	15,641	3	2	3	0	15
Airport class 3						
Routes	15,758	26	24	13	1	60
Regular routes	15,758	7	6	5	0	30
LCC routes						
Routes	6,762	13	12	7	1	31
Regular routes	6,762	4	3	4	0	18
Airport class 4						
Routes	96,735	42	39	22	1	120
Regular routes	96,735	14	13	9	0	50
LCC routes						
Routes	45,167	24	22	13	1	61
Regular routes	45,167	9	8	8	0	43
Airport class 5						
Routes	514,381	142	129	72	1	360
Regular routes	514,381	84	73	55	1	262
LCC routes						
Routes	266,476	78	72	38	1	207
Regular routes	266,476	42	39	26	0	121

Note: Period: 2014–2023 (inclusive). Unit of observation: airport × year–quarter. An observation represents the total number of distinct routes served from each airport in a given quarter. Summary statistics are calculated across airport–year–quarter observations. "Obs." reports the number of quarterly airport observations. The Mean and Median show the average and 50th percentile number of routes per airport–quarter; the Standard Deviation captures variation across airports and quarters; Min and Max indicate the lowest and highest quarterly counts observed.

Source: Project Team based on Cirium.

Table G.4 splits the routes between airports in ORs and inner regions. All numbers are higher for inner regions, as expected.

Table G.4: Summary statistics of routes and regular routes, ORs vs inner regions

Variables	Obs.	Mean	Median	Std. Dev.	Min	Max
Outermost regions						
Routes	25,364	73	78	48	1	168
Regular routes	25,364	51	51	33	0	102
LCC routes						
Routes	12,188	55	61	23	1	102
Regular routes	12,188	41	43	17	0	74
Inner regions						
Routes	695,579	112	99	81	1	360
Regular routes	695,579	64	49	58	0	262
LCC routes						
Routes	326,205	65	59	43	1	207
Regular routes	326,205	35	31	28	0	121

Note: Period: 2014–2023 (inclusive). Unit of observation: airport × year–quarter. An observation represents the total number of distinct routes served from each airport in a given quarter. Summary statistics are calculated across airport–year–quarter observations. "Obs." reports the number of quarterly airport observations. The Mean and Median show the average and 50th percentile number of routes per airport–quarter; the Standard Deviation captures variation across airports and quarters; Min and Max indicate the lowest and highest quarterly counts observed.

Source: Project Team based on Cirium.

Given that we are also interested in analysing the impact of startup aid on the entry (and eventual exit) of routes, we characterise the entry and exit of routes for the routes we have in our sample.

- Entry: a route appears for the first time in time period t (quarter), but was not there in the previous time period $t-1$.
- Exit: a route is not present in time period t (quarter), but was present in the previous time period $t-1$.

One can show, based on the above characterization, averages of entry and exit per airport-quarter-year. We show these in Table G.5 below. The average number of routes that enter is 19 for all routes and 4 for regular routes (with medians 13 and 2, respectively). The average number of routes that exit is 17 for all routes and 4 for regular routes (with medians 12 and 2, respectively). The corresponding numbers for LCC routes are roughly half of all routes.

Table G.5: Summary statistics of entry and exit

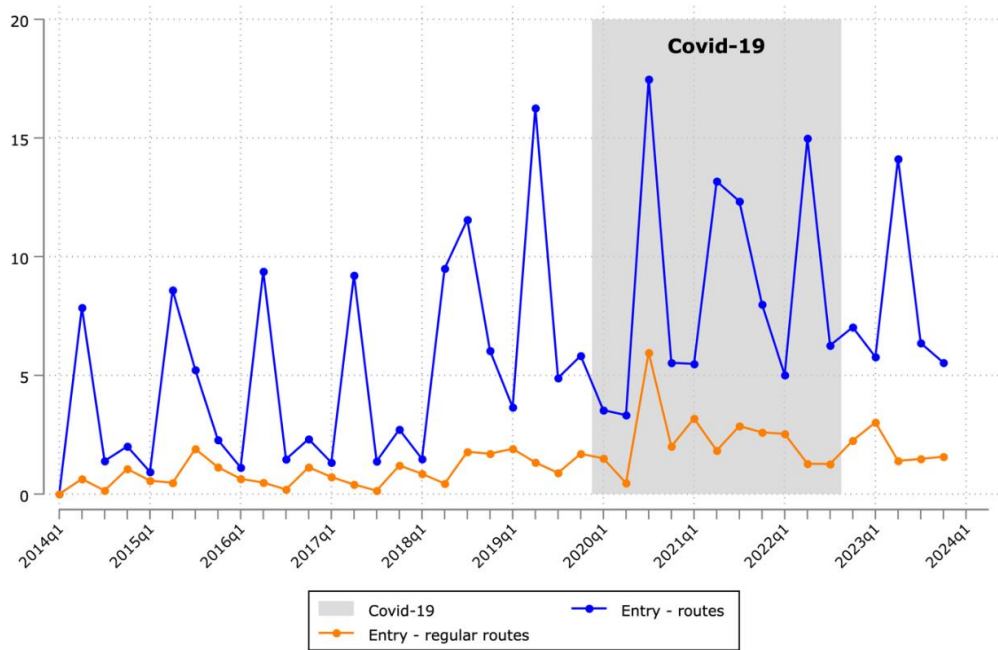
Variables	Obs.	Mean	Median	Std. Dev.	Min	Max
Entry						
Routes	720,943	19	13	20	0	254
Regular routes	720,943	4	2	7	0	185
Exit						
Routes	720,943	17	12	18	0	256
Regular routes	720,943	4	2	8	0	168
LCC routes						
Entry						
Routes	338,393	10	6	13	0	121
Regular routes	338,393	2	1	5	0	75
Exit						
Routes	338,393	9	5	12	0	115
Regular routes	338,393	2	1	5	0	78

Note: Period: 2014–2023 (inclusive). Unit of observation: airport × year–quarter. Exit and entry represent the total number of exits and entries in each airport in a given quarter. Summary statistics are calculated across airport–year–quarter observations. "Obs." reports the number of quarterly airport observations. The Mean and Median show the average and 50th percentile number of routes per airport–quarter; the Standard Deviation captures variation across airports and quarters; Min and Max indicate the lowest and highest quarterly counts observed.

Source: Project Team based on Cirium.

When looking at the evolution over time, Figure G.2 below shows entry per quarter for all and regular routes. It can be observed the strong seasonality in entry patterns of all routes. Regular routes show on average less entry and less seasonality, with the strongest entry in the 3rd quarter of the pandemic.

Figure G.2: Average number of route entries (all routes and regular routes)

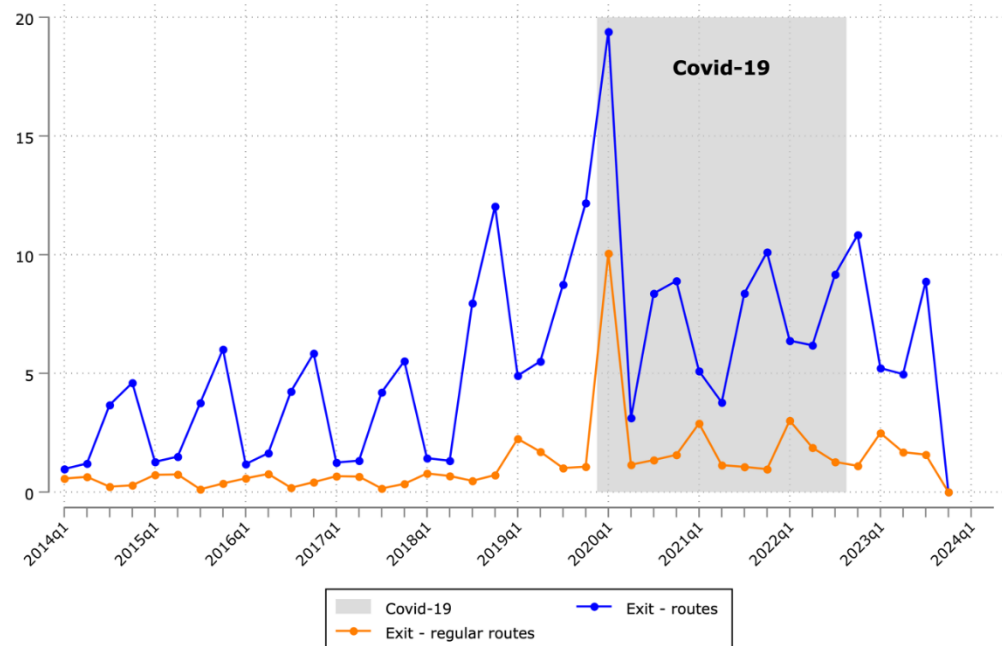


Note: Summary statistics are across airport-year-quarter

Source: Project Team based on Cirium

Figure G.3 shows exit per quarter for all and regular routes. It can be observed the strong seasonality in exit patterns here again for all routes. The strongest exit, by far, arrived in the 1st quarter of the pandemic, as expected.

Figure G.3: Average number of route exits (all routes and regular routes)



Note: Summary statistics are across airport-year-quarter

Source: Project Team based on Cirium

Table G.6 below show entry and exit patterns per airport class. Those show quite similar comparisons as the numbers of routes per class.

Table G.6: Summary statistics of entry and exit per airport class

Variables	Obs.	Mean	Median	Std. Dev.	Min	Max
Airport class 1						
Entry						
Routes	46,962	14	3	22	0	96
Regular routes	46,962	4	1	7	0	45
Exit						
Routes	46,962	11	3	18	0	81
Regular routes	46,962	3	1	6	0	37
LCC routes						
Entry						
Routes	4,347	1	1	2	0	17
Regular routes	4,347	0	0	1	0	7
Exit						
Routes	4,347	1	1	2	0	11
Regular routes	4,347	0	0	1	0	7
Airport class 2						
Entry						
Routes	47,107	6	4	7	0	48
Regular routes	47,107	1	0	2	0	20

Variables	Obs.	Mean	Median	Std. Dev.	Min	Max
Exit						
Routes	47,107	5	3	7	0	51
Regular routes	47,107	1	0	2	0	24
LCC routes						
Entry						
Routes	15,641	2	1	3	0	22
Regular routes	15,641	1	0	1	0	15
Exit						
Routes	15,641	2	1	3	0	16
Regular routes	15,641	0	0	1	0	15
Airport class 3						
Entry						
Routes	15,758	9	6	9	0	50
Regular routes	15,758	1	1	2	0	11
Exit						
Routes	15,758	8	5	8	0	34
Regular routes	15,758	1	0	2	0	11
LCC routes						
Entry						
Routes	6,762	4	1	5	0	26
Regular routes	6,762	1	0	1	0	14
Exit						
Routes	6,762	3	2	4	0	19
Regular routes	6,762	1	0	1	0	12
Airport class 4						
Entry						
Routes	96,735	12	8	14	0	92
Regular routes	96,735	2	1	3	0	18
Exit						
Routes	96,735	11	7	12	0	80
Regular routes	96,735	2	1	3	0	32
LCC routes						
Entry						
Routes	45,167	5	2	8	0	47
Regular routes	45,167	1	0	2	0	19
Exit						
Routes	45,167	5	2	6	0	38
Regular routes	45,167	1	0	2	0	20
Airport class 5						
Entry						
Routes	514,381	22	17	21	0	254
Regular routes	514,381	5	3	8	0	185
Exit						
Routes	514,381	19	15	19	0	256

Variables	Obs.	Mean	Median	Std. Dev.	Min	Max
Regular routes	514,381	5	2	9	0	168
LCC routes						
Entry						
Routes	266,476	12	7	14	0	121
Regular routes	266,476	3	2	5	0	75
Exit						
Routes	266,476	11	7	13	0	115
Regular routes	266,476	2	1	6	0	78

Note: Period: 2014–2023 (inclusive). Unit of observation: airport × year-quarter. Exit and entry represent the total number of exits and entries in each airport in a given quarter. Summary statistics are calculated across airport–year–quarter observations. "Obs." reports the number of quarterly airport observations. The Mean and Median show the average and 50th percentile number of routes per airport–quarter; the Standard Deviation captures variation across airports and quarters; Min and Max indicate the lowest and highest quarterly counts observed.

Source: Project Team based on Cirium.

Finally, for entry and exit, the below table shows the entry and exit split up between ORs and inner regions. Again, the same patterns are visible.

Table G.7: Summary statistics of entry and exit, ORs vs inner regions

Variables	Obs.	Mean	Median	Std. Dev.	Min	Max
Outermost regions						
Entry						
Routes	25,364	10	4	13	0	65
Regular routes	25,364	4	1	6	0	36
Exit						
Routes	25,364	9	7	14	0	111
Regular routes	25,364	4	1	8	0	70
LCC routes						
Entry						
Routes	12,188	6	5	7	0	48
Regular routes	12,188	3	2	5	0	38
Exit						
Routes	12,188	6	6	9	0	71
Regular routes	12,188	3	1	6	0	52
Inner regions						
Entry						
Routes	695,579	19	13	20	0	254
Regular routes	695,579	4	2	7	0	185
Exit						
Routes	695,579	17	12	18	0	256
Regular routes	695,579	4	2	8	0	168
LCC routes						
Entry						
Routes	326,205	11	6	13	0	121
Regular routes	326,205	2	1	4	0	75
Exit						
Routes	326,205	9	5	12	0	115
Regular routes	326,205	2	1	5	0	78

Note: Period: 2014–2023 (inclusive). Unit of observation: airport × year–quarter. Exit and entry represent the total number of exits and entries in each airport in a given quarter. Summary statistics are calculated across airport–year–quarter observations. "Obs." reports the number of quarterly airport observations. The Mean and Median show the average and 50th percentile number of routes per airport–quarter; the Standard Deviation captures variation across airports and quarters; Min and Max indicate the lowest and highest quarterly counts observed.

Source: Project Team based on Cirium.

G.2 Impact of start-up aid on cancelled routes

Table G.8 reports the impact of individual aid on cancelled routes. The coefficient on the start-up aid dummy and its lags is insignificant, suggesting that start-up aid had no discernible effect on route cancellations.

Table G.8: Impact of Individual Start-up Aid on the Total Number of Cancelled Routes

Dependent variable: total number of cancelled routes	(1)
<i>Start up Aid_{it}</i>	-0.0462 (0.133)
<i>Start up Aid_{it-1}</i>	0.152 (0.216)
<i>Start up Aid_{it-2}</i>	-0.337 (0.276)
LCC Share	0.0851 (0.132)
Total number of passengers	-1.03e-06*** (1.47e-07)
Constant	0.547*** (0.0711)
Airport FE	Yes
Year-quarter FE	Yes
Number of focal airports	396
Number of observations	10,029
R-squared	0.296
Adj.R2	0.266
F-Stat	13.36
Prob > F	0

*Note: Clustered standard errors in parentheses at the airport level, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium and state-aid data.

Table G.9: Impact of Start-up Aid by Scheme on the Total Number of Cancelled Routes

Dependent variable: total number of cancelled routes	(1)
<i>Start up Aid_{it}</i> (Scheme)	0.0967 (0.221)
<i>Start up Aid_{it-1}</i> (Scheme)	-0.203 (0.230)
<i>Start up Aid_{it-2}</i> (Scheme)	0.0378 (0.0655)
LCC Share	0.0884 (0.132)
Total number of passengers	-1.04e-06*** (1.48e-07)
Constant	0.606*** (0.0788)
Airport FE	Yes
Year-quarter FE	Yes
Number of focal airports	401
Number of observations	10,089
R-squared	0.299
Adj.R2	0.269
F-Stat	13.44
Prob > F	0

*Note: Clustered standard errors in parentheses at the airport level, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Source: Project Team based on Cirium and State aid data.

Annex H Airport Closure and Its Impact on Regional Development

H.1 Summary statistics

Table H.1: Closed airports since 2014

Airport	IATA	ICAO	Country	NUTS1	Class	Class Size: Breakdown
Permanently closed airports since 2014						
Scatsta Airport	SCS	EGPM	UK	UKM	Class 1: < 200,000 pax	50,000–99,999 pax
Airports no longer operating scheduled passenger flights since 2014						
Augsburg Airport	AGB	EDMA	DE	DE2	Class 1: < 200,000 pax	< 50,000 pax
Sea-Airport Cuxhaven/Nordholz	FCN	ETMN	DE	DE9	Class 1: < 200,000 pax	< 50,000 pax
Straubing Airport	RBM	EDMS	DE	DE2	Class 1: < 200,000 pax	< 50,000 pax
Zweibrücken Airport	ZQW	EDRZ	DE	DEB	Class 1: < 200,000 pax	150,000–199,999 pax
Seinäjoki Airport	SJY	EFSI	FI	FI1	Class 1: < 200,000 pax	< 50,000 pax
Varkaus Airport	VRK	EFVR	FI	FI1	Class 1: < 200,000 pax	< 50,000 pax
Agen-La Garenne Airport	AGF	LFBA	FR	FRI	Class 1: < 200,000 pax	50,000–99,999 pax
Angers-Loire Airport	ANE	LFJR	FR	FRG	Class 1: < 200,000 pax	< 50,000 pax
Angoulême-Brie-Champniers Airport	ANG	LFBU	FR	FRI	Class 1: < 200,000 pax	< 50,000 pax
Avignon-Caumont Airport	AVN	LFMV	FR	FRL	Class 1: < 200,000 pax	< 50,000 pax
Dijon-Bourgogne Airport	DIJ	LFSD	FR	FRC	Class 1: < 200,000 pax	< 50,000 pax
Dinard-Pleurtuit-Saint-Malo Airport	DNR	LFRD	FR	FRH	Class 1: < 200,000 pax	100,000–149,999 pax
Lannion-Côte de Granit Airport	LAI	LFRO	FR	FRH	Class 1: < 200,000 pax	< 50,000 pax
Le Havre-Octeville Airport	LEH	LFOH	FR	FRD	Class 1: < 200,000 pax	< 50,000 pax
Le Touquet-Côte d'Opale Airport	LTQ	LFAT	FR	FRE	Class 1: < 200,000 pax	< 50,000 pax
Morlaix-Ploujean Airport	MXN	LFRU	FR	FRH	Class 1: < 200,000 pax	< 50,000 pax
Rouen Vallée de Seine Airport	URO	LFOP	FR	FRD	Class 1: < 200,000 pax	< 50,000 pax
Lošinj Airport	LSZ	LDLO	HR	HR0	Class 1: < 200,000 pax	< 50,000 pax
Waterford Airport	WAT	EIWF	IE	IE0	Class 1: < 200,000 pax	< 50,000 pax
Grosseto Air Base	GRS	LIRS	IT	ITI	Class 1: < 200,000 pax	< 50,000 pax
Liepāja International Airport	LPX	EVLA	LV	LV0	Class 1: < 200,000 pax	< 50,000 pax
Arad International Airport	ARW	LRAR	RO	RO4	Class 1: < 200,000 pax	< 50,000 pax
Dala Airport	BLE	ESSD	SE	SE3	Class 1: < 200,000 pax	< 50,000 pax
Oskarshamn Airport	OSK	ESMO	SE	SE2	Class 1: < 200,000 pax	< 50,000 pax
Säve Airport	GSE	ESGP	SE	SE2	Class 2: 200,000–700,000 pax	200,000–700,000 pax
Cengiz Topel Airport	KCO	LTBQ	TR	TR4	Class 1: < 200,000 pax	50,000–99,999 pax
Uşak Airport	USQ	LTBO	TR	TR3	Class 1: < 200,000 pax	< 50,000 pax
Anglesey Airport	VLY	EGOV	UK	UKL	Class 1: < 200,000 pax	< 50,000 pax
Blackpool International Airport	BLK	EGNH	UK	UKD	Class 1: < 200,000 pax	150,000–199,999 pax
Carlisle Lake District Airport	CAX	EGNC	UK	UKD	Class 1: < 200,000 pax	< 50,000 pax
Gloucestershire Airport	GLO	EGBJ	UK	UKK	Class 1: < 200,000 pax	< 50,000 pax

Airport	IATA	ICAO	Country	NUTS1	Class	Class Size: Breakdown
Hawarden Airport	CEG	EGNR	UK	UKL	Class 1: < 200,000 pax	< 50,000 pax
Out Skerries Airfield	OUK	missi ng	UK	UKM	Class 1: < 200,000 pax	< 50,000 pax
RAF Linton-On-Ouse	HRT	EGXU	UK	UKC	Class 1: < 200,000 pax	< 50,000 pax
Scatsta Airport	SCS	EGPM	UK	UKM	Class 1: < 200,000 pax	50,000–99,999 pax

Source: Project Team based on Cirium and Desk Research

Table H.2: Closed airports by class - Breakdown

Class size: Breakdown	Number of Airports
Permanently closed airports since 2014	
50,000–99,999 pax	1
Total	1
Airports no longer operating scheduled passenger flights since 2014	
< 50,000 pax	28
50,000–99,999 pax	2
100,000–149,999 pax	1
150,000–199,999 pax	2
200,000–700,000 pax	1
Total	34

Source: Project Team based on Cirium and Desk Research

Table H.3: Permanently closed airport located on Island Regions ²²⁷

List of closed Airports located on Island Regions
Permanently closed airports since 2014
Scatsta Airport
Airports no longer operating scheduled passenger flights since 2014
Out Skerries Airfield
Waterford Airport

Source: Project Team based on Cirium and Desk Research

H.2 Simulation details

In particular, we proceed as follow:

1. Identify airport closures
 - 1.1. Assign each closed airport (2014–2024) to its NUTS3 region.
 - 1.2. Compute its yearly average passenger share of total regional air traffic when active.
2. Adjust passenger traffic to simulate closure

²²⁷ Airports located in NUTS3 regions classified as island regions by the European Commission.

$$Total_pax_regional_{rt}^{closure} = Total_pax_regional_{rt} - (share_{ar} \times Total_pax_regional_{rt})$$

3. Compute fitted values

3.1. Baseline prediction:

$$\exp(\hat{Y}_{rt}) = \beta_1 + \beta_2 RegionType_r + \beta_3 Total_pax_regional_{rt} + \omega_t + \omega_r + \epsilon_{rt}$$

3.2. Counterfactual prediction (closure):

$$\exp(\hat{Y}_{rt}^{closure}) = \beta_1 + \beta_2 RegionType_r + \beta_3 Total_pax_regional_{rt}^{closure} + \omega_t + \omega_r + \epsilon_{rt}$$

4. Compute percentage effects

$$\% \Delta Y_{rt} = (\exp(\hat{Y}_{rt}^{closure}) - \exp(\hat{Y}_{rt})) / \exp(\hat{Y}_{rt})$$

5. Aggregate effects

5.1. Take the mean $\% \Delta Y_{rt}$ across years when the airport was active.

Report results separately for employment level and GDP per capita.

Annex I Glossary

ACA - Airport Carbon Accreditation

Institutionally endorsed, global carbon management certification programme for airports, launched by ACI in 2009, that independently evaluates and recognises airports' efforts to manage and reduce their GHG emissions through 7 levels of certification.

ACI Europe - Airports Council International Europe

European legal entity of ACI, the global trade association for airport operators.

AG - Aviation Guidelines

EC's 2014 Aviation Guidelines on State Aid to airports and airlines which sets out general principles and compatibility conditions for State aid to airports and airlines in the EU.

Aid intensity

Total aid amount expressed as a percentage of eligible costs, both figures expressed in net present value terms at the moment the aid is granted and before any deduction of tax or other charges.

Air connectivity

Level to which an airport (or a region) is connected to the rest of the world, through the global air transport network, either by direct flights (in terms of destinations and frequency of flights) or accounting for the availability of indirect connections via other airports.

Airport charges

Airport charges are prices or levies that airlines pay for the use of airport's facilities and services which are exclusively provided by the airport and which are related to landing, take-off, lighting and parking of aircraft, processing of passengers and freight.

AZEA - Alliance for Zero-Emission Aviation

EU voluntary initiative with the objective to prepare the entry into commercial service of hydrogen-powered and electric aircraft.

Break-even threshold

Minimum annual passenger traffic necessary for an airport's operating revenues to fully offset its operating costs, absent external subsidy.

Capital costs

"Depreciation of the eligible investment costs into airport infrastructure and equipment, including the underlying costs of financing" (AG, §25(10)).

Catchment area

Geographic area surrounding an airport where the latter can reasonably expect to draw passengers. Based on the AG "it is normally set at around 100 kilometres or around 60 minutes travelling time by car, bus, train or high-speed train to/from the airport (...)", although it can vary depending on specific characteristics of an airport "including its business model, location and the destinations it serves." (AG, §25(12)).

CEEAG - Climate, Energy and Environmental State aid Guidelines

Guidelines on Climate, Energy and Environmental State aid, issued by the EC to provide guidance on how the Commission assesses the compatibility of environmental protection, including climate protection, and energy aid measures which are subject to the notification requirement under Article 107(3), point (c), of the Treaty on the Functioning of the European Union (OJ C 80, 18.2.2022, pp. 1–89).

Congestion of an airport

When access to airport facilities (capacity utilisation) equals or exceeds the supply capacity of the airport, causing delays and inefficiencies. There are two main areas where airport congestion can arise: (1) in the passenger terminals and (2) on the runway(s). The allocation of capacity at congested airports is regulated in the EU by Regulation (EEC) No 95/93 on common rules for the allocation of slots at European Union airports (slot regulation).

CORSIA - Carbon Offsetting and Reduction Scheme for International Aviation

International offsetting scheme for regulating CO₂ emissions from international aviation, established by ICAO Resolution A39-3 and adopted by the 39th General Assembly in October 2016, under which airlines are required to purchase carbon credits to offset any growth in CO₂ emissions above 85% of 2019 level that cannot be mitigated through technological advancements, operational improvements, or sustainable aviation fuels.

Cross-subsidisation

A financial arrangement within a group of airports where profitable airports subsidise loss-making ones, commonly within a multi-airport operating company group.

CSRD - Corporate Sustainability Reporting Directive

EU law requiring large companies, including airport operators, to publish regular reports on the social and environmental risks they face, and on how their activities impact people and the environment.

DEA - Data Envelopment Analysis

Non-parametric method to measure efficiency of a production process which involves several outputs and several inputs, such as that of airports.

Decarbonisation of aviation

The process of reducing CO₂ and other greenhouse gas (GHG) emissions across the aviation sector, through e.g. the implementation of market-based measures, the adoption of technologies, the use of alternative fuels, the adoption of operational measures, and infrastructure upgrades, with the goal of aligning the sector with climate targets.

Demand substitution

Shift in passenger or airline behaviour from one airport or route or transport mode to another, often due to price, convenience, or availability.

DG COMP - Directorate-General for Competition

Commission department is responsible for EU policy on competition and for enforcing EU competition rules, in cooperation with national competition authorities.

EASA - European Union Aviation Safety Agency

Agency of the European Union with responsibility for civil aviation safety.

EBIT - Earnings Before Interest and Taxes

Company's operating profit without interest expenses and income taxes.

EBITDA - Earnings Before Interest, Taxes, Depreciation and Amortisation

Company's operating profit without interest expenses, income taxes and amortization.

EC - European Commission

Executive body of the EU.

EEA - European Environment Agency

Agency of the EU that delivers knowledge and data to support Europe's environment and climate goals.

EEArea - European Economic Area

Consists of the Member States of the EU and three countries of the European Free Trade Association (Iceland, Liechtenstein and Norway; excluding Switzerland).

EU - European Union

Economic and political union of European countries.

EUA - EU Allowance

Allowance to emit one ton of carbon dioxide equivalent, which is valid for the purposes of meeting the requirements of the EU ETS Directive.

EU ETS - EU Emissions Trading System

A "cap and trade" system to reduce emissions via a carbon market established by Directive 2003/87/EC (the 'EU ETS Directive'). It limits the total amount of greenhouse gas (GHG) emissions from activities covered by the EU ETS Directive. Companies receive or buy emission allowances — each representing the right to emit one tonne of CO₂ equivalent — and can trade these allowances with one another. The total cap decreases over time, ensuring overall emissions fall in line with the EU's climate targets, while trading creates a market price for carbon that incentivises emission reductions where they are cheapest.

Feeder traffic

Traffic flows from regional airports that connect to longer-haul flights via hub airports. Feeder traffic supports the hub-and-spoke airline model.

Fixed costs

Operational and capital costs that, given airport capacity, do not change with traffic volume (e.g. capital costs, infrastructure maintenance, administrative and personnel expenses).

FSC - Full-Service Carrier

Type of airline (also referred as "legacy" or "network" or "flag" airline or carrier) that offers a comprehensive range of services to its passengers, distinguishing itself from LCCs through its operational model and customer experience. FSCs typically operate hub-and-spoke networks, offer short-, medium-, and long-haul routes, and multiple travel classes, and may provide amenities such as in-flight meals, entertainment, seat selection and free checked baggage included in the ticket price.

GBER - General Block Exemption Regulation

Commission Regulation which sets out the conditions that allow European Union (EU) Member States to give significant amounts of public aid to a wide range of projects and activities without having to formally notify a measure to and receive an express approval from the EC.

GDP - Gross Domestic Product

Standard measure of the value added created through the production of goods and services in a country during a certain period.

GHG - Greenhouse Gas

Group of gases contributing to global warming and climate change (e.g. CO₂, NO_x).

GRI - Global Reporting Initiative

Independent and nonprofit international organization providing standards for sustainability reporting for companies.

Green conditionality

A policy mechanism linking State aid to airports and airlines under the Aviation Guidelines to measurable decarbonisation outcomes that the aid recipient should comply with.

Ground handling services

Services required by airlines to operate flights, including areas such as maintenance, fuel, and freight handling, de-icing, but also passenger check-in, catering, baggage handling and transport within the airport.

GSE - Ground Support Equipment

Equipment used at airports to service aircraft between flights. Services include refuelling, towing airplanes or luggage/freight carts.

H₂ - Hydrogen

Energy carrier considered for future aircraft propulsion and airport refuelling infrastructure.

HHI - Herfindahl-Hirschman Index

A measure of market concentration used to assess competition.

HSR - High-Speed Rail

Passenger rail service operating at significantly higher speeds than conventional trains. In the context of this Study, HSR is considered as it may serve as an alternative mode of transport for short to medium-distance flights. When integrated with airports, HSR can provide added advantages through improved connectivity.

Hub airport

In the context of the data analysis, hub airports are defined based on the following criteria: (i) more than 10% transfer passengers on average between 2014–2024, and/or (ii) more than 1% of total European transfer passenger volume on average between 2014–2024, and/or (iii) designation as a hub by the main flag carrier and handling over 5 million passengers per year.

Hub-and-spoke

A network model in which an airline typically designates one central hub airport (and potentially also secondary regional hubs) to serve as transfer point for passengers travelling to their final destinations, with several smaller airports (spokes) feeding traffic into the hub(s).

IATA - International Air Transport Association

Airline trade association founded in 1945.

ICAO - International Civil Aviation Organization

United Nations agency responsible for establishing standards and regulations to ensure the safety, efficiency, and regularity of global air transport.

Investment aid

"Public funding to finance fixed capital assets, specifically, to cover the capital costs funding gap." (AG, §25(18))

KPI - Key Performance Indicator

Metrics used to assess operational or environmental performance of airports and airlines.

kg - Kilogram

Unit of mass used in fuel and emission measurements.

LCC - Low-Cost Carrier

Type of airline (also known as a no-frills, discount or budget airline) operating with a business model that focuses on reducing operational expenses while providing lower basic fares than FSCs. LCCs usually operate direct high-demand routes between secondary or regional airports, avoiding complex hub-and-spoke systems to reduce turnaround times and increase aircraft utilization, and rely on fewer aircraft models than FSCs. To make up for revenue lost in low-cost ticket prices, the airline usually charges extra fees for food, baggage, priority boarding, seat selection.

Long/medium/short-haul flights

Transport of passengers or goods over long/medium/short distances (typically more than six hours, between 3 and 6 hours, less than 3 hours, respectively).

MEOP - Market Economy Operator Principle

Test used to assess the existence of State aid in cases of public investments in the form of capital injections. To determine whether a public investment constitutes State aid, the public operator must examine whether, in similar circumstances, a private investor of a comparable size operating in normal market economy conditions would have made the same investment.

Mid-size airports

In the context of data analysis, mid-size airports are those that are neither classified as hub nor regional airports.

min / km - Minutes / Kilometres

Units used in defining airport catchment areas.

MTOW - Maximum Take-Off Weight

The maximum weight at which an aircraft is certified for take-off.

NGO - Non-Governmental Organisation

Non-profit entity distinct from government bodies.

Non-aeronautical revenues

Revenues coming from commercial services to airlines or other users of the airport, such as ancillary services to passengers, freight forwarders or other service providers, renting out of offices and shops, car parking and hotels. (AG, §25(20))

NOx - Nitrogen oxides

GHG pollutants.

NUTS - Nomenclature of Territorial Units for Statistics

Geographical nomenclature subdividing the economic territory of the European Union (EU) into regions at three different levels (NUTS 1, 2 and 3 respectively, moving from larger to smaller territorial units).

OAG - Official Airline Guide

Global travel data provider of flight information data.

OECD - Organisation for Economic Co-operation and Development

An intergovernmental economic organisation of market-based economies collaborating to develop policy standards to promote sustainable economic growth.

Operating aid

"Public funding to cover the operating losses, either in the form of an upfront payment or in the form of periodic instalments to cover expected operating costs (periodic lump sum payments)." (AG, §25(21))

Operating costs

"Underlying costs of an airport in respect of the provision of airport services, including cost categories such as cost of personnel, contracted services, communications, waste, energy, maintenance, rent and administration, but excluding the capital costs, marketing support or any other incentives granted to airlines by the airport, and costs falling within a public policy remit." (AG, §25(22))

OR - Outermost Regions

Close list of nine EU territories (Guadeloupe, French Guiana, Martinique, Mayotte, Réunion and Saint Martin (France), the Canary Islands (Spain) and the Azores and Madeira (Portugal)), defined in Article 349 TFEU and distinguished by their remoteness from mainland Europe, insularity, small size, difficult topography and climate and economic dependence on a few products.

Pax - Passenger

Common shorthand for passenger.

PBN - Performance-Based Navigation

Aircraft's capability to navigate using performance standards.

Peripheral airports

Airports located in peripheral regions.

Peripheral regions

Areas located far from economic or transport hubs, often with limited alternative transport options.

PM - Particle Matter

Pollutants consisting of a mixture of solids and liquid droplets generated by aircraft and ground operations.

Point-to-point airline operations

A network model, also called a direct network or line network, in which flights are operated directly between destinations, instead of routing through a central hub (typical of LCCs).

ppa - Passengers Per Annum

Common shorthand for passengers per year.

PSO - Public Service Obligation

Tendered air services ensuring minimum connectivity on routes which are vital for the economic development of the region they serve, for which public compensation can be granted.

Public remit

Activities that the State normally performs in the exercise of its public powers. The public funding of such activities does not fall under the State aid rules as long as it does not exceed what is necessary to compensate the extra costs related to the public remit activities, for which separated cost accounting is required. In the air transport sector, such activities may include operating special flights for the purpose of repatriation of nationals, transporting people for medical reasons, by military aircraft or similar, requirements to stay open to accommodate certain flights, air traffic control, housing of police, customs, firefighting equipment and fire station building, meteorological services, heliport for rescue services, activities necessary to safeguard civil aviation against acts of unlawful interference and the investments relating to the infrastructure and equipment necessary to perform those activities.

Regional carrier

There is no technical or legal definition of regional airline under EU aviation law. However, the concept is acknowledged by EU institutions and associations. Regional airlines, also called feeder or commuter airlines, are understood as typically operating short-haul routes with smaller aircraft (e.g. Turboprops or regional jets), often serving lower demand ("thin") markets that are not viable for larger carriers, thereby enhancing connectivity between regional/peripheral airports and major hubs, often under Public Service Obligations (PSOs) or as feeders for larger network carriers. They can operate independently or under franchise/codeshare agreements with larger carriers.

Regional airport

"Airport with annual passenger traffic volume of up to 3 million." (AG, §25(26))

Remote airports

Airports located in remote regions.

Remote regions

List of regions including "outermost regions, Malta, Cyprus, Ceuta, Melilla, islands which are part of the territory of a Member State, and sparsely populated area" (AG, §25(27))

RDI guidelines

Guidelines on State Aid for Research, Development and Innovation issued by the EC to provide guidance on how the Commission will assess the compatibility of State aid for Research, Development and Innovation ("R&D&I") activities (OJ C 414, 28.10.2022, pp. 1–38).

Route churn

The frequent opening and closing of air routes, particularly by LCCs, that focus on high demand point-to-point routes, in response to market demand and route profitability.

RQ - Research Question

Refers to specific questions the Project Study aims to address.

SAF - Sustainable Aviation Fuel

Sustainable, non-conventional, alternative to fossil-based jet fuel.

Scheduled/Non-Scheduled flights

Flight with a scheduled timetable or additional flight resulting from extra traffic on services with a scheduled timetable/Flight that does not operate according to a fixed timetable.

SDGs - Sustainable Development Goals

Set of goals established in 2015 by the international community as part of the United Nations 2030 Agenda for Sustainable Development through which countries of the world collectively pledged to eradicate poverty, find sustainable and inclusive development solutions, ensure everyone's human rights, and generally make sure that no one is left behind by 2030.

SES / SES2+ - Single European Sky (and 2024 SES2+ update)

SES is a holistic framework to harmonise and improve the performance of ATM in terms of safety, capacity, cost-efficiency and the environment. SES2+ is the second phase of the SES initiative, a set of regulations that came into force in late 2024 to reform Europe's ATM.

SGEI - Services of General Economic Interest

Certain economic activities carried out by undertakings that are defined as services of general economic interest and may be subject to public service compensation.

Seasonality

Annual fluctuation in flight demand and ticket prices, driven by factors like holidays, weather, and peak travel periods.

Size classes

The AG rely on a categorisation of airports in five classes, based on their number of annual passengers, to flag the varying degree of airports' ability to cover operating costs and, accordingly, determine access to and intensity of operating aid. Regional airports are those that belong to the first four classes. The five classes are: Class 1: up to 200,000 ppa; Class 2: 200,001-700,000 ppa; Class 3: 700,001-1 million ppa; Class 4: 1,000,001-3,000,000 ppa; and Class 5: above 3 million ppa.

Sparsely populated areas

"NUTS 2 regions with less than 8 inhabitants per km² or NUTS 3 regions with less than 12.5 inhabitants per km² (AG, §25(28)).

Start-up aid

"State aid granted to airlines for launching a new route with the aim of increasing the connectivity of a region." (AG, §138)

Surveyed airports

In the context of the data analysis, the expression refers to airports that responded to the airport survey conducted for the Study.

TFEU - Treaty on the Functioning of the European Union

Primary law organising the functioning of the Union and determines the areas of, delimitation of, and arrangements for exercising its competences.

ToR – Terms of Reference

Document defining the requirements of the Study.

VFR - Visiting Friends and Relatives

Person travelling for the purpose of visiting friends and/or relatives.

WLU - Workload Unit

A combined metric of 1 passenger or 100 kg of freight, used in airport planning.



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