Technical Report - TRAVEL Chair

June 2026

From Intent to Itinerary: Understanding Demand for Air–Rail Multimodality in Europe

Full Report

TRAVEL Chair Survey Results

Authors of this report

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From Intent to Itinerary:
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Acknowledgments:

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Presentation of the Chair

Initiated in June 2024 by Estelle Malavolti, the TRAVEL Chair is sponsored by Air Caraïbes, French bee, and AéroGestion. Its primary objective is to understand how medium- and long-distance mobility demand evolves, with a focus on multimodality–defined as using multiple transport modes such as train, plane, ferry, or bus during a single trip. To do this, the research identifies who chooses multimodality (passenger profiles) and what service attributes drive that decision.

While this integrated approach is well established in Asia, particularly in China, its adoption by European travelers remains marginal. This is true despite existing European partnerships, such as those between Air France and SNCF or Lufthansa and Deutsche Bahn. Therefore, it is necessary to investigate the root causes of this market friction. By analyzing these barriers, we can understand why consumers bypass multimodal offerings in favor of traditional unimodal travel, or choose to forgo their trips entirely.

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Chapter 1

Research Axes and Framework

In this chapter, we will focus on the different research topics addressed in the TRAVEL Chair. The primary objective of this Chair is to understand how medium- and long-distance mobility demand evolves, with a specific focus on understanding consumer and traveler behavior in the face of industry transformations.

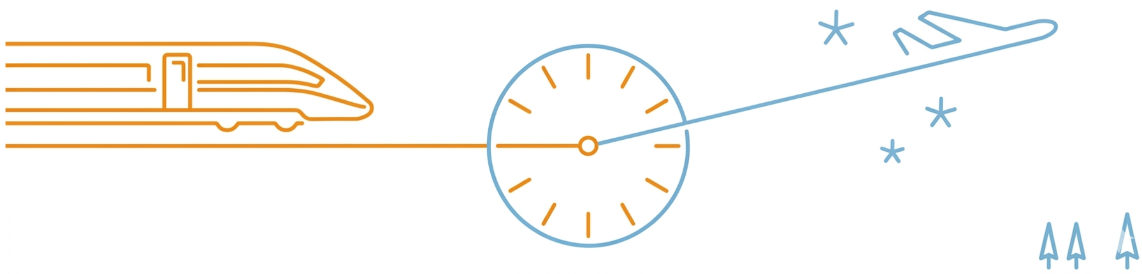
This understanding is achieved through a multi-stream evidence-building strategy. On one hand, we analyze revealed preferences and the impact of public policies using existing historical datasets. On the other hand, we anticipate how users might behave when faced with new travel offers through dedicated European discrete-choice surveys and controlled laboratory experiments.

While the primary purpose of this report is to detail the results of the European questionnaire, aimed at building a better understanding of multimodal transport demand, we use this introductory chapter to highlight the broader data collection and research framework that the Chair actively deploys.

In the existing literature, the terms multimodality and intermodality are frequently used interchangeably, although they represent different concepts. In freight transport, a multimodal journey refers to the use of multiple transport modes under the management of a single firm, whereas an intermodal journey involves multiple operators coordinating the use of different transport modes . When these concepts are translated into passenger transport, the distinction becomes less straightforward.

Multimodal trips may require the purchase of several tickets, whereas intermodal trips imply a single ticket for all transport modes. In this analysis, we define intermodality as coordinated transport across various networks with a single ticket, while multimodality refers to uncoordinated transport requiring multiple tickets.

Image inspired by Lufthansa Express Rail website.



1.1 Retrospective Studies: Insights from Historical Data

We present two studies based on existing datasets. The first defines air travel demand using the French Civil Aviation Authority's *National Airport Passenger Survey* (ENPA) survey carried out in 10 major French airports [2] . The second measures the impact of increased "Solidarity Tax" (TSBA) on supply and demand, using data from diverse sources such as AéroGestion market data, Eurostat, the OECD, and the World Bank.

1.1.1 Air-Rail Multimodality Trends in France

This project is driven by our consideration of *Air-Rail* multimodality as a greener substitute for short-haul feeder flights (Vespermann and Wald, 2011; Chiambaretto and Decker, 2012; Zanin et al., 2012). This substitution relies on a favorable trade-off: the additional travel time is often non-prohibitive when balanced against the significant mitigation of CO_2 emissions (Avogadro et al., 2021). Apart from the ecological argument, *Air-Rail* integration is also perceived as a decongestion tool of air traffic in some countries like China (Li and Sheng, 2016).

This study investigates the determinants of Air–Rail multimodal travel among French air passengers, with a focus on how this behavior has evolved. Specifically, we examine the extent to which socio-demographic characteristics, travel habits, and environmental awareness shape passengers' likelihood of choosing a multimodal itinerary over a unimodal one. The analysis sheds new light on the share of passengers already opting for greener travel alternatives, the segments most inclined to do so, and the key factors driving the adoption of Air–Rail connections.

To this end, we draw on the ENPA survey, conducted annually in France since 2009 by the DGAC. This repeated cross-sectional survey is particularly well-suited for the study of multimodal travel drivers for two reasons. First, it captures *revealed preferences*: passengers report the mobility choices they actually made under real-world conditions, providing door-to-door information on their full journey. Second, the surveys are exceptionally rich in content, enabling us to model modal choice as a function of individual characteristics as well as those of accompanying travelers.

Dataset Presentation and Selection Criteria

Each wave of the ENPA surveys approximately forty thousand passengers across France's largest commercial airports. The information collected falls into three broad categories:

- **Socio-demographic characteristics** of the passengers and the persons accompanying them (residence, age, gender, employment, etc);
- **Travel characteristics**: full details of the journey being undertaken (origin and destination, travel date, airport, booking information, and ticket structure);
- **Future travel intentions**: passengers' self-assessed expectations regarding their future travel behavior in light of environmental challenges.

To study multimodality, we restrict the sample to passengers who face a genuine choice between rail, road, and air on the first leg of their journey. Specifically, we select passengers departing on an international flight from Paris Charles de Gaulle (CDG) airport whose origin lies in a French or European region sufficiently distant from Île-de-France, to abstract from the

[2] Enquête Nationale des Passagers Aériens (ENPA), Direction Générale de l'Aviation Civile (DGAC).

question of mere airport access. Figure 1.1 maps this selection, displaying the departure regions in France and Europe of passengers taking an international flight from Paris CDG airport.

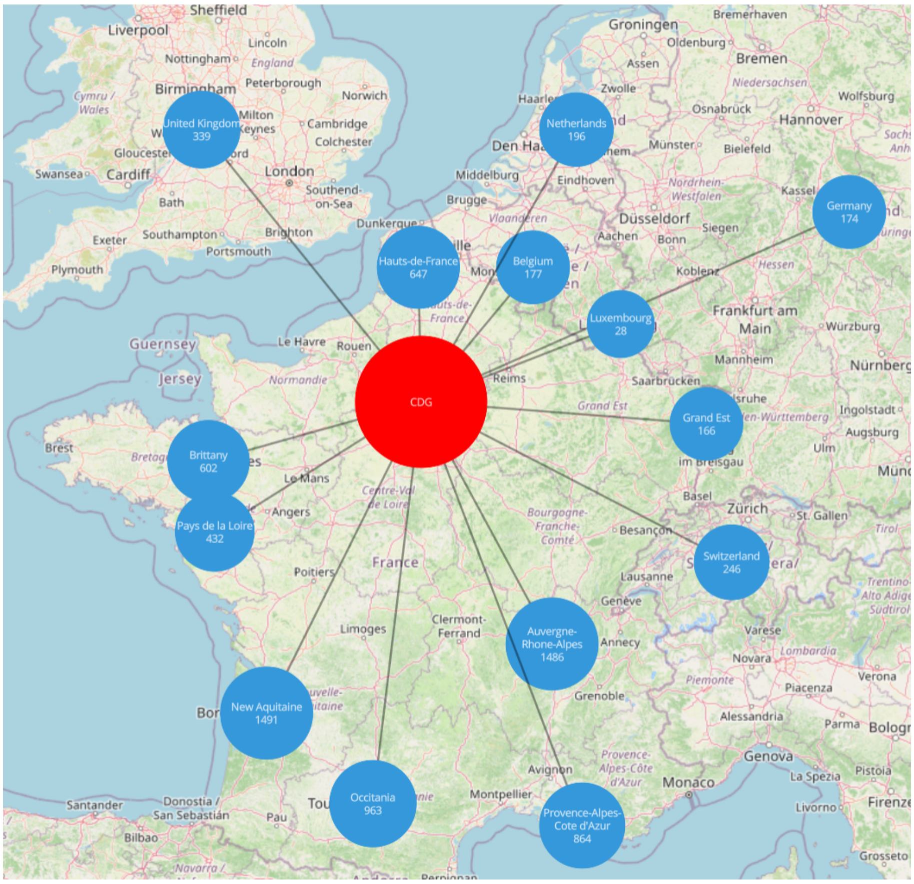


Figure 1.1: Departure regions of respondents reaching Paris CDG airport.

CDG is particularly appropriate for our analysis for two reasons. First, the hub is served by an extensive road and rail network, making it accessible to passengers across France by multiple modes. Second, CDG handles a large volume of passengers traveling to numerous international destinations — 72 million passengers in 2025[3] — which ensures sufficient statistical power across all modal categories.

Table 1.1 presents the final sample size (and percentage) per year resulting from the data selection process described above. The data analysis and empirical work will be based on these 8293 individuals.[4]

Descriptive Patterns of Passenger Multimodality

Defining the Modal Combinations

We distinguish between three possible modal combinations: *Air-Air, Air-Rail and Air-Road*. Air-Rail and Air-Road, respectively, correspond to passengers who have taken rail or road transportation (bus, car, etc) on the first part of their journey to reach CDG airport. Namely, it is the

[3]Source: Group *Aéroports de Paris*.

[4]For the moment, we focus on individuals departing CDG, but extending this analysis to passengers departing other large and highly connected airports such as Lyon-Saint Exupéry remains a promising venue for future research.

Survey year	Number of passengers
2012	819 (2,44%)
2013	441
2014	750
2015	700
2016	710
2023	2,502 (5.45%)
2024	2,503 (5.95%)
Total	**8,293**

Table 1.1: Number of surveyed passengers by year (% of passengers selected from the full sample)

first transport mode employed before taking their flight at CDG airport. Air-Air applies to passengers who have taken a flight to reach CDG airport. They were thus connecting passengers at the airport during the time of the survey.

Temporal Trends and Seasonality

Figure 1.2 displays the distribution of mode choices across survey years. No monotonic trend is apparent in the dependent variable: Air-Rail appears to have been the predominant choice before 2016, before giving way to Air-Air in subsequent years. This absence of a clear unconditional trend highlights the need to control for individual and trip characteristics to understand the determinants of passengers' modal choices.

Figure 1.2: Modal choice across years.

Figure 1.3 presents the same distribution broken down by travel month. While no clear seasonal pattern emerges overall, the share of Air-Rail itineraries rises noticeably in July, suggesting a potential seasonality effect for this mode that warrants further investigation.

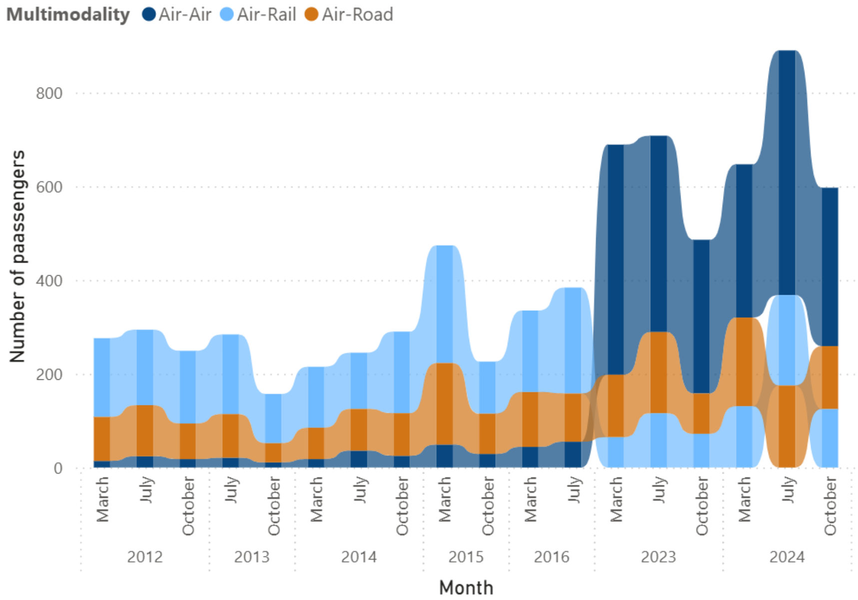


Figure 1.3: Number of passengers per multimodality choice by month and year of the trip.

The Influence of Travel Purpose

Understanding travel behavior requires accounting for travel purposes, as different passenger segments are likely to exhibit distinct transport demand functions. Figure 1.4 illustrates the distribution of travel purposes across the survey waves in our sample.

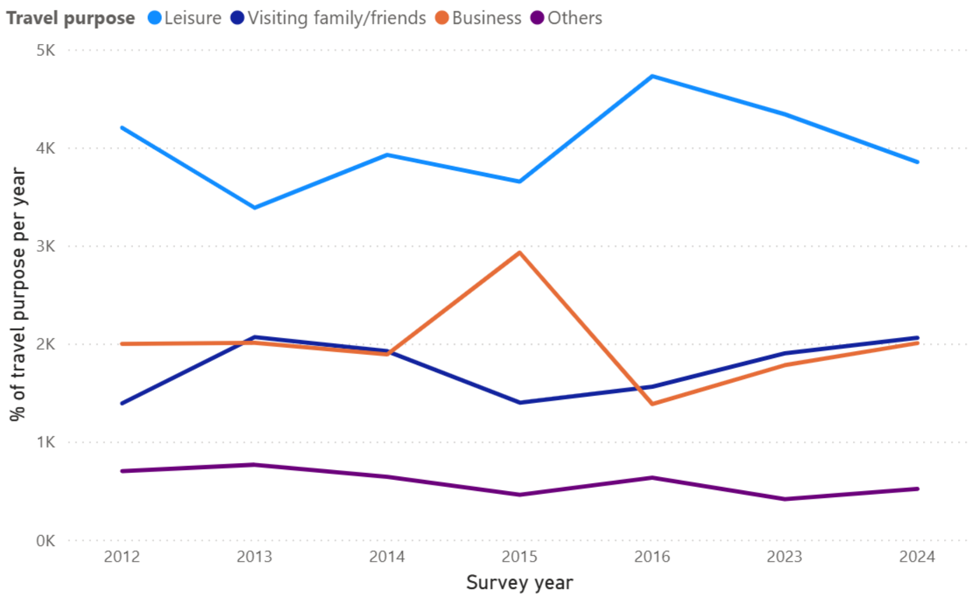


Figure 1.4: Travel purposes across survey years.

Leisure consistently emerges as the dominant motive, accounting for the largest share of trips throughout the observed timeframe, followed by business travel and visits to friends or relatives, which remain comparable in magnitude. [5] Interestingly, between 2015 and 2016, the share of leisure travel rose markedly, mirroring a corresponding decline in business travel. This compositional shift represents a reversal of the trend observed between 2014 and 2015, which saw a sharp, temporary expansion in business travel. The gap in data collection between 2016 and 2023 precludes a more granular assessment of how travel purposes evolved over this period. Nonetheless, the 2023 and 2024 waves suggest that the overall ranking of travel motives has remained broadly stable.

Figure 1.5 presents the distribution of modal choices across travel purposes. Leisure travelers account for the largest share of Air-Rail journeys, although the proportion of Air-Rail adoption remains broadly comparable across motives. A notable pattern emerges among passengers traveling to visit family or friends, who display a markedly higher propensity to select Air-Air connections relative to other groups. Conversely, the share of Air-Rail itineraries is slightly higher for leisure travelers and somewhat lower for business travelers. Two interpretations may account for this divergence. First, business and leisure travelers may differ in their valuation of travel time, with business passengers placing a greater premium on speed and schedule reliability. Also, travelers visiting friends or relatives may favor schedules that allow them to spend more time with their close ones. Second, the different traveler groups may have varying tolerance levels associated to the logistical burden of coordinating distinct transport modes, a constraint that may weigh more heavily on time-sensitive business trips.

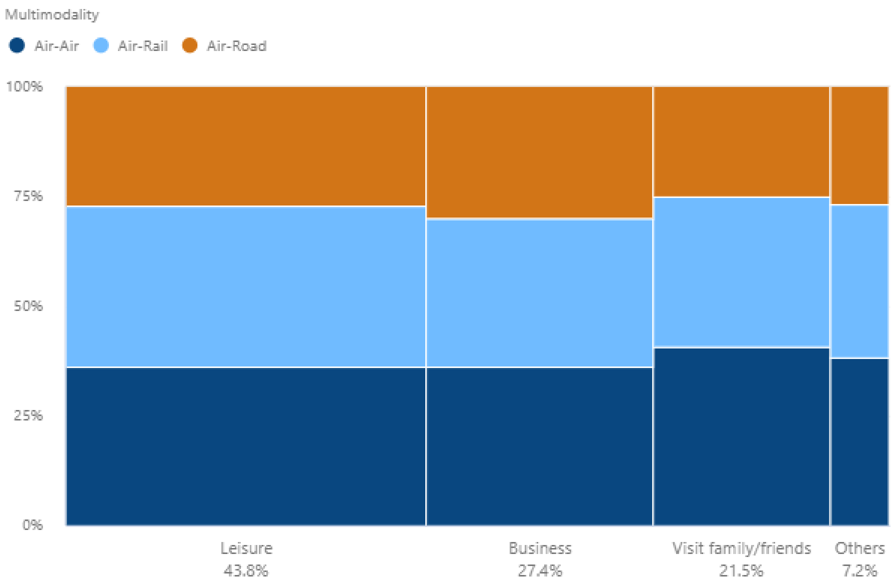


Figure 1.5: Multimodality across travel purposes.

Day of the Week Dynamics

The survey data reveal different modal preferences between weekdays and weekends. As shown in Figure 1.6, Air-Rail combinations become the predominant choice during weekends, displacing a bit of Air-Air itineraries. Weekend trips are generally for leisure and visiting purposes, thus weekend passengers may have more time to combine rail transport with their flight. Conversely, business travelers traveling during the week may be constrained by professional obligations, limiting the time available to connect between modes.

Booking Horizon (Advance Purchase)

[5] *Others* encompasses travel for health treatment, cultural or sporting events, studies, and other purposes not specifically categorised.

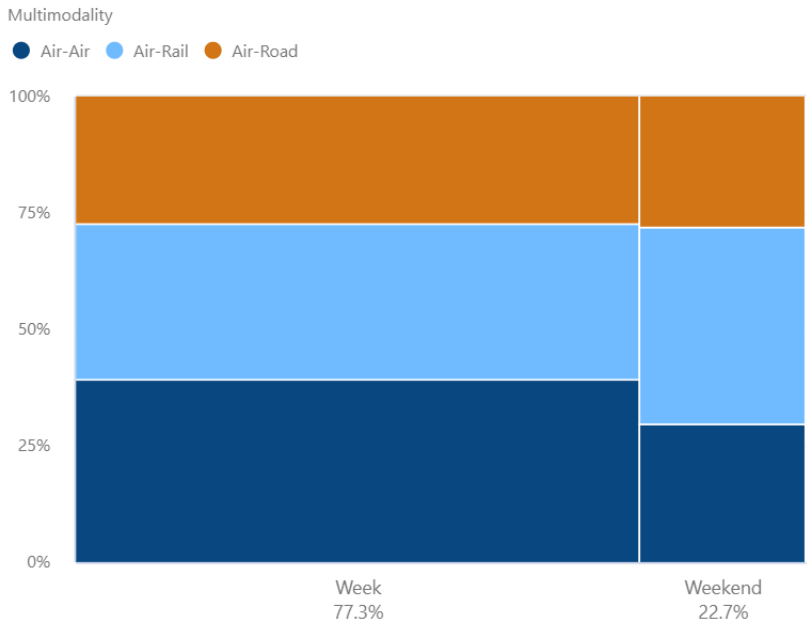


Figure 1.6: Multimodality across travel days.

Another variable of interest is the advance purchase period, measured as the number of days elapsed between ticket purchase and the date of travel. Figure 1.7 plots the average advance purchase by modal choice over the survey years. Between 2013 and 2026, we observe that Air-Air passengers tend to book their tickets further in advance than the other passengers. However, we observe a different pattern in the last two years of our sample (2023 and 2024) with Air-Rail passengers booking earlier than Air-Air passengers. On the other hand, Air-Road passengers consistently display the shortest booking horizon (2012 being the only exception).

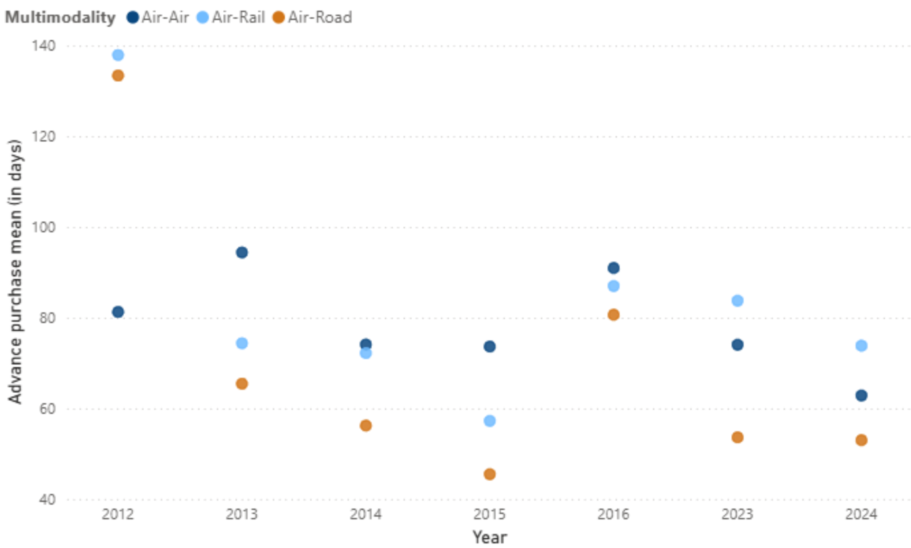


Figure 1.7: Advance purchase mean in days: number of days between booking and travel.

When splitting the sample by travel purpose, the pattern is slightly different (Figure 1.8). Indeed, Air-Rail passengers systematically book their tickets sooner than any other passengers. This could be explained by the fact that this was largely the case in the last two years of our sample (2023 and 2024), which represent a larger share of our total sample (see Table 1.1). Another interesting but not surprising fact is that business travelers generally take less advance, while leisure travelers take more advance, with a difference of about 30 days.

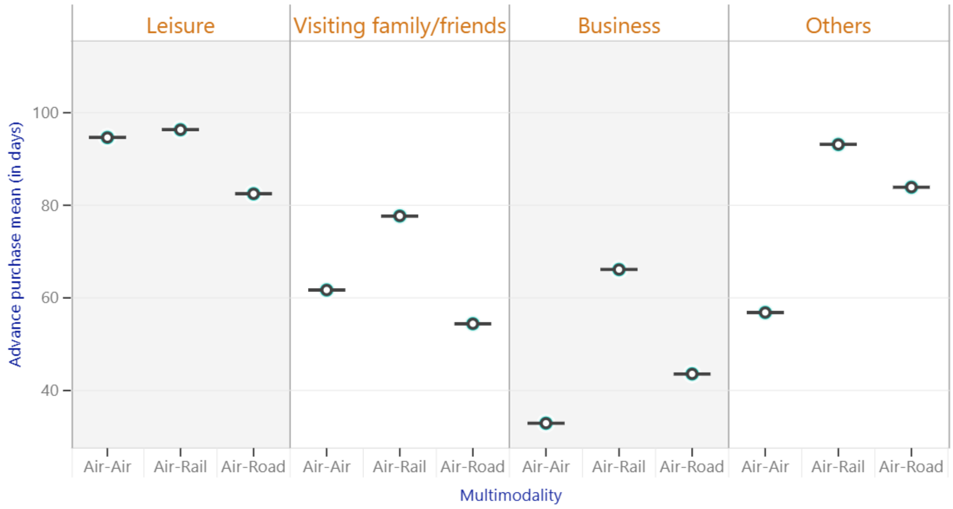


Figure 1.8: Advance purchase mean per travel purpose.

Figure 1.9 further examines whether this pattern varies by season. Regardless of the travel season considered — spring, summer, or autumn — Air-Rail passengers consistently book their tickets earlier than passengers opting for other modes, with the highest anticipation recorded in October.[6] Turning to Air-Air passengers, the longest booking horizon is observed in July, a month predominantly associated with leisure and family/friends visits, which is consistent with the earlier finding that leisure travelers tend to plan their trips further in advance.

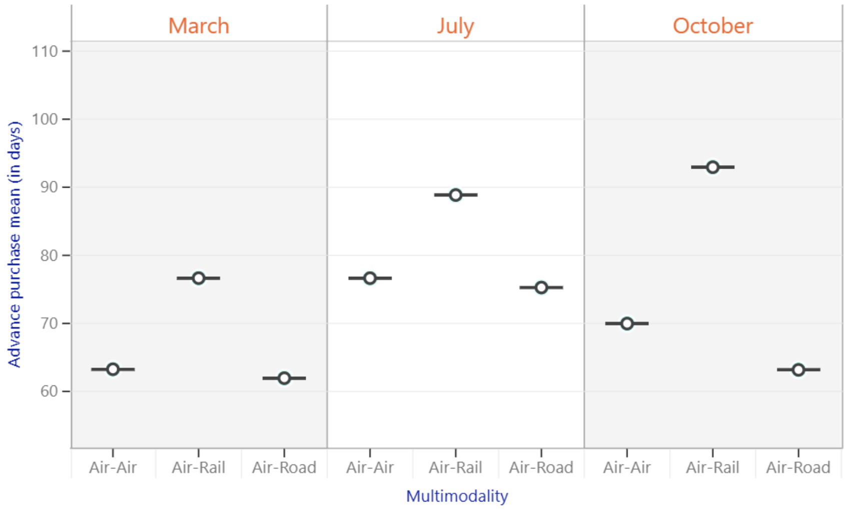


Figure 1.9: Advance purchase mean per month of travel.

Journey Distance

We further examine whether modal choices vary with journey distance. As illustrated in fig-

[6] The ENPA survey is typically administered in three distinct waves per year: March, July, and October. However, data collection was less systematic in some years with fewer waves completed. Hence, our sample does not include winter passengers.

ure 1.10, long-haul passengers display a stronger preference for Air-Air itineraries relative to short- and medium-haul passengers. This pattern is consistent with the idea that long-haul travellers prioritise seamless connections and minimise transfer complexity, making a single aviation-based itinerary more attractive. Conversely, short- and medium-haul passengers exhibit a notably higher share of Air-Road choices, suggesting that ground transport remains a competitive — or preferred — access mode for shorter journeys, where travel time differentials between road and rail are less pronounced.

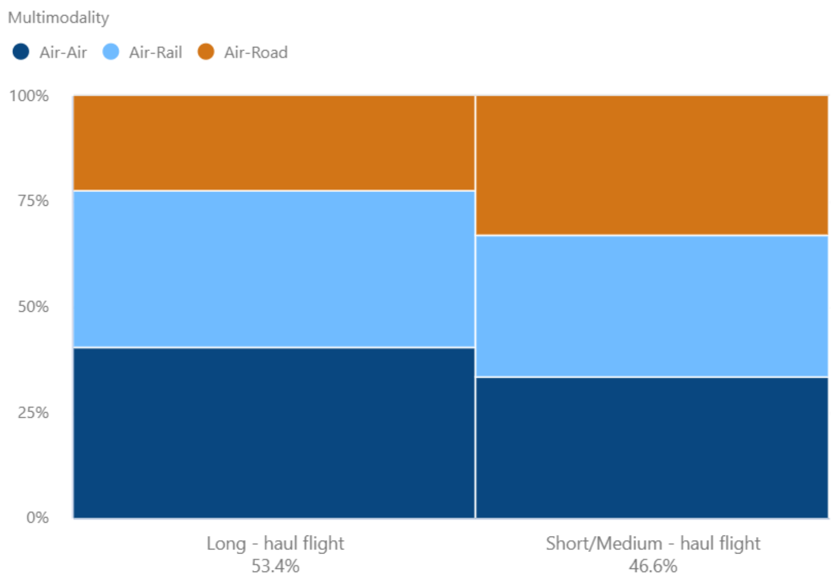


Figure 1.10: Multimodality choice by distance category of the trip.

Socio-demographic characteristics

Further descriptive analysis was conducted on the remaining control variables. Regarding age, the data reveals a clear generational gradient in intermodal preferences: younger passengers exhibit the highest propensity for Air-Rail travel, while older passengers display a stronger tendency toward Air-Air itineraries. This pattern may reflect generational differences in familiarity with rail travel, digital booking platforms, environmental awareness, or simply a preference for the simplicity offered by a unique transport mode.

We next consider the composition of the travel groups. Passengers traveling alone account for the largest share of Air-Rail choices, whereas those traveling in groups of four or more display a higher propensity for Air-Air itineraries. This result is intuitive: larger groups may find it logistically simpler — and potentially more cost-effective — to rely on a single aviation-based itinerary rather than coordinating a multimodal journey across several travelers. We also noted that Air-Road trips are comparatively more prevalent among smaller groups of three passengers or fewer, but their share declines markedly from four passengers onward. This threshold effect may reflect the growing inconvenience and cost of road travel as group size increases, making air-based connections relatively more attractive.

A natural extension of this analysis would be to examine whether the presence of young children shapes modal preferences. However, this specific demographic proved particularly challenging to capture within the ENPA survey. Due to the likely under representation of passengers traveling with children under 12 in the recruited sample, their size is too limited to draw statistically significant conclusions, and this dimension is therefore left aside.

Econometric Strategy: Multinomial Logit Model

To estimate the probability of choosing a given journey combination (Air-air, Air-Rail, or Air-Route), a **multinomial logit model** is used. As controls in the estimations, we have socio-demographic variables (age category of the respondents, socio-professional category, gender, etc.) and trip-specific variables (purpose of travel, number of persons traveling with the interviewee, length of stay, etc.). We also add an Origin-Destination fixed effect to account for routes better suited for multimodal combinations than others.

Multinomial logit model

The multinomial logit (MNL) model is used to estimate the probability that a traveler chooses intermodal combination $j \in \{\text{Air-Air, Air-Rail, Air-Road}\}$ given a set of observed characteristics $\mathbf{x}$. Each alternative j is associated with a latent utility:

$$U_{ij} = \mathbf{x}_i' \boldsymbol{\beta}_j + \varepsilon_{ij}$$

where $\mathbf{x}_i$ denotes individual and trip characteristics, $\boldsymbol{\beta}_j$ is the vector of alternative-specific coefficients, and ε_{ij} is an i.i.d. Gumbel error term. Under this assumption, the choice probability takes the closed-form expression:

$$P(y_i = j \mid \mathbf{x}_i) = \frac{\exp(\mathbf{x}_i' \boldsymbol{\beta}_j)}{\sum_{k=1}^{J} \exp(\mathbf{x}_i' \boldsymbol{\beta}_k)}$$

Coefficients are estimated by maximum likelihood and interpreted as log-odds relative to the reference mode (Air-Air).

Preliminary Findings on Modal Choice

Figure 1.11 reports the log-odds of choosing Air-Rail or Air-Road. The base outcome is *Air-Air*, meaning that the estimation coefficients are computed based on this transport mode category. Several significant coefficients of our first estimations draw our attention.

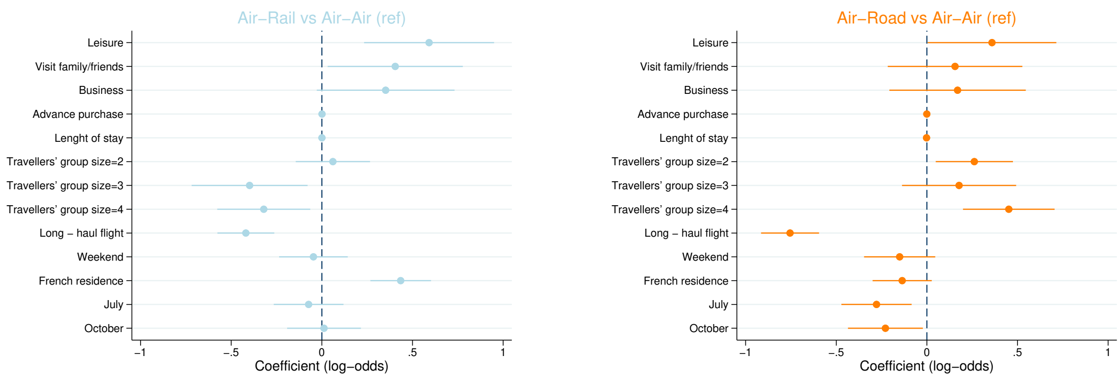


Figure 1.11: Multinomial logit model, base: Air-Air.

- **Travel purpose:** Compared to the reference category (*Others*), vacation and visit motives are associated with a significantly higher probability of choosing Air-Rail over Air-Air, while the professional motive is also significant at the 10% level.

- **Advance ticket purchase:** The number of days between booking and departure is positively and significantly associated with the probability of choosing Air-Rail over Air-Air, suggesting that Air-Rail passengers tend to plan their journey further in advance. It is worth noting a potential reverse causality issue regarding the advance purchase variable. On one hand, the time remaining before departure may constrain the set of feasible transport options, effectively forcing passengers toward a particular modal choice. On the other hand, a prior preference for a given transport mode may lead passengers to adapt their booking date accordingly. Addressing this endogeneity concern would require a dedicated empirical strategy, which we acknowledge as an important avenue for future work.

- **Age:** Older passengers are significantly less likely to choose intermodal alternatives relative to Air-Air. The negative effect reaches significance at the 10% level from the 25-34 age group onward for Air-Road, and from the 55-64 group onward for Air-Rail, confirming a generational gradient in intermodal adoption.

- **Group size:** Traveling in a group of 3 significantly reduces the probability of choosing Air-Rail relative to Air-Air, while groups of 2 and 4 or more are significantly more likely to choose Air-Road.

- **Haul length:** Long-haul flights are associated with a significantly lower probability of choosing both Air-Rail and Air-Road relative to Air-Air, consistent with the descriptive analysis showing that long-haul passengers strongly prefer seamless Air-Air connections.

The robustness of the estimations is tested with several heterogeneity analysis. First, we distinguish the passengers depending on whether the passengers are residents in France or not (See Figure 1.12). The intuition being that French passengers may be more likely than foreigners to integrate rail transport in their journey thanks to a better understanding of the options of the rail transport company.

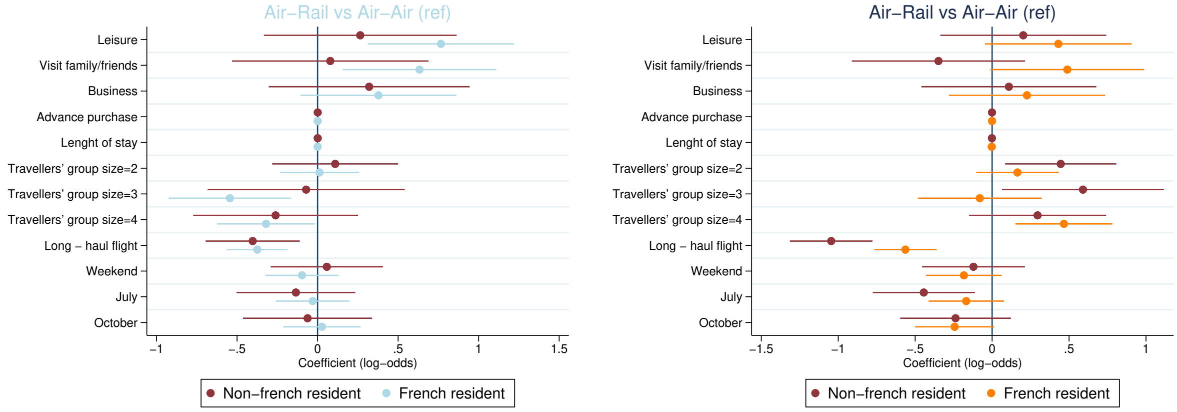


Figure 1.12: Multinomial logit model, heterogeneity analysis based on French residence.

We also run the estimations across the different travel purposes and find results similar in signs with the main specifications. A few distinctions rise: among passengers traveling to visit their close ones, compared to passengers aged 18-25 years old, older pax are less likely to choose Air-Road. We also noted that among passengers traveling for business reasons, groups of 3 are associated with higher odds of choosing Air-Rail.

Future extensions

The ENPA framework provides a valuable longitudinal perspective, enabling the tracking of air passenger behavior over time to accurately diagnose shifting dynamics within the aviation sector. This underscores the critical importance of maintaining continuous survey waves and pursuing the analytical approach established in this study. From an empirical standpoint, it is highly probable that several determinants exhibit interaction effects. Consequently, the next step will consist in refining the model specification by systematically cross-referencing the key variables that influence modal split.

1.1.2 Policy Impact Evaluation: The 2025 French Aviation Tax Reform

This research leverages impact evaluation methods to identify the causal effect of public policy interventions on market equilibrium variables such as prices and quantities. The empirical focus is on the French Solidarity Tax on Airplane Tickets (TSBA, or taxe Chirac), first introduced in 2006. The tax concerns all passengers departing the French territory.[7]

Initially, this tax aimed to collect revenues for international development and global health initiatives, but since 2025, the funds are used to finance the national ecological transition. Furthermore, the 2025 revision introduced a significant increase in the tax level; for instance, the levy increased from €2.63 to €7.40 per passenger for domestic and intra-European economy class flights (See Table 1.2). This reform aligns with the broader objectives of the European Union's 2021 "Fit for 55" legislative package. While the proposed revision of the Energy Taxation Directive (ETD) has faced persistent legislative delays, the TSBA provides a national policy lever to internalize environmental externalities while circumventing the legal constraints of Article 24 of the 1944 Chicago Convention, which prohibits kerosene taxation in international aviation.

Table 1.2: Structure of the TSBA before and after the 2025 revision per market segment

Destination	Before 03/2025		After 03/2025	
	Economy	Business	Economy	Business
France & Europe	2.63€/PAX	20.27€/PAX	7.4€/PAX	30€/PAX
Medium-haul	7.51€/PAX	63.07€/PAX	15€/PAX	80€/PAX
Long-haul			40€/PAX	120€/PAX

The study conducted by the Chair aims to evaluate the short-run impact of this reform on key market variables, specifically traffic and capacity (number of seats). The academic literature suggests that aviation tax effects are most pronounced immediately after implementation - 1 year, with the impact often attenuating over time (Falk and Hagsten, 2019; Helmers and van der Werf, 2025; Bernardo et al., 2024). This provides a coherent time window to assess the impact of the TSBA using the Synthetic Control Method.

Synthetic Control Method (SCM)

The SCM, developed by Abadie et al. (2010), combines elements of matching and difference-in-differences (DiD) to identify causal impacts when only a single unit is treated. This approach is particularly relevant for the TSBA revision, where a straightforward control group is unavailable because the policy affects all flights departing France. We construct a counterfactual trajectory for the treated unit ($i = 1$, France) using a

[7] Excluding transit passengers whose stopover occurs in France. Also, some exemptions exist for overseas territory residents.

weighted average of a "donor pool" ($j \in \{2, \dots, J+1\}$) consisting of untreated units, such as other European countries. Let $D_{it} \in \{0,1\}$ be the treatment indicator, where $D_{1t} = 1$ for $t > T_0$ (post-March 2025) and $D_{it} = 0$ otherwise.

The Optimization Framework

The model determines the composition of the synthetic unit by matching on a vector of M pre-treatment predictors (X_{im}, e.g., GDP, population, cargo, employment, pre reform traffic levels.) that determine the trajectory of the outcome (Y_{it}, E.g., traffic, seat number, frequency of flights).

- **Donor Weights (w_j):** The model identifies the optimal w_j^* that minimizes the pre-intervention distance (or discrepancy) between France and the donor pool:

$$\min_{w_j} \sum_{m=1}^{M} v_m \left(X_{1m} - \sum_{j=2}^{J+1} w_j X_{jm} \right)^2 \quad \text{s.t. } w_j \geq 0, \sum w_j = 1$$

- **Predictor Weights (v_m):** These importance weights are selected to minimize the Mean Squared Prediction Error (MSPE) between the observed outcome for France and its synthetic counterpart while $D_{1t} = 0$:

$$V^* = \arg\min_{V} \sum_{t=1}^{T_0} \left(Y_{1t}(D=0) - \sum_{j=2}^{J+1} w_j^*(V) Y_{jt}(D=0) \right)^2$$

Causal Identification

The outcome for France is then $Y_{1t} = Y_{1t}(0) + D_{1t}\tau_{1t}$. Since $Y_{1t}(0)$ is unobserved for $t > T_0$, we estimate it using the weighted donor pool. The Average Treatment Effect on the Treated (ATT) is estimated as:

$$\widehat{ATT}_{1t} = \mathbb{E}[Y_{1t}(1) - Y_{1t}(0) | D_{1t} = 1] = Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt} \qquad (1.1)$$

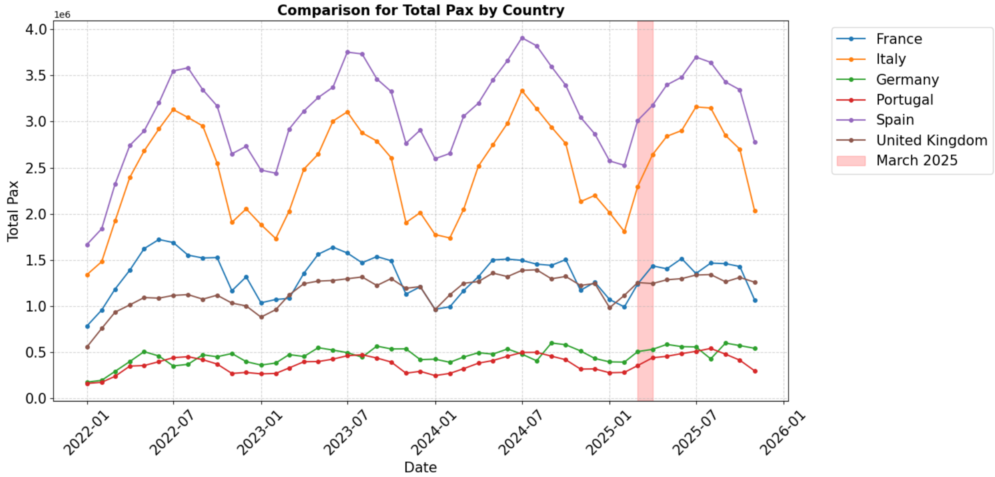
Where the second term represents the estimated counterfactual $\hat{Y}_{1t}(D=0)$. Under the assumption that the synthetic unit tracks France accurately before the revision ($t \leq T_0$), $\hat{\tau}_{1t}$ identifies the causal impact of the TSBA policy.

Data and Identification Strategy

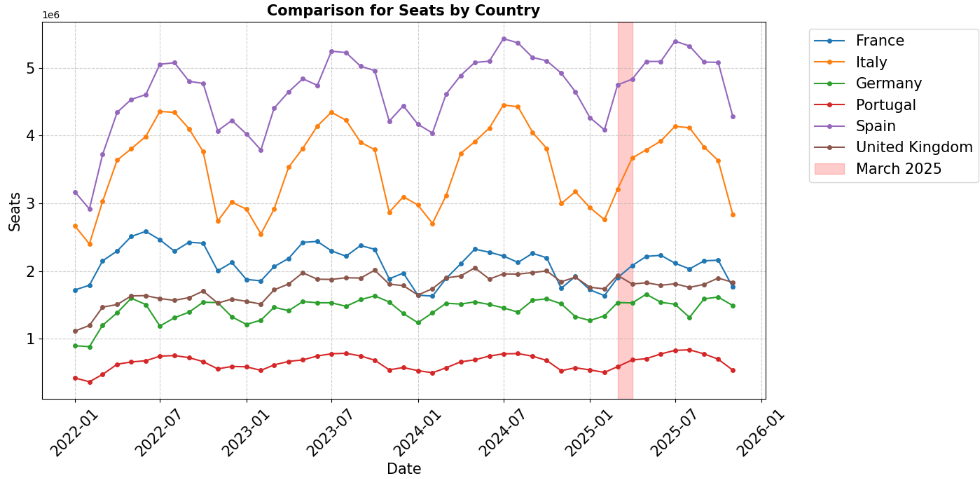
Our analysis relies on detailed market data between 2022 and 2025 provided by AeroGestion, including passenger traffic, capacity (total seats), and average fares per quarter. The primary value added of this study relative to the existing literature lies in the granularity of our data. While previous research has often been limited to aggregate departing airport traffic or frequency-only data (Borbely, 2019; Falk and Hagsten, 2019; Helmers and van der Werf, 2025; Gordijn and Kolkman, 2011; Bernardo et al., 2024), our dataset allows for a traffic analysis at the specific route level. This level of detail is especially relevant for the domestic segment—our primary focus—which faces the highest relative tax exposure as a percentage of the final ticket price.

We perform several key refinements to our domestic sample to ensure robust identification. First, unlike studies using aggregate airport figures, we can distinguish true departing passengers from connecting ones. This is critical for identification, as transit passengers are typically exempt from the TSBA; their inclusion in aggregate counts would otherwise dilute and bias the estimated treatment effect. Second, following the established literature, we exclude border airports to isolate the domestic policy shock from potential cross-border substitution effects.

Figure 1.13 illustrates the domestic market trends across our donor pool (UK, Italy, Spain, and Portugal) and the treated unit (France).[8] The traffic and seat capacity trends are part of the inputs used for our synthetic control matching.



(a) Total number of passengers



(b) Total number of seats

Figure 1.13: Domestic Market Trends in selected European countries (2022-2025 in millions)

These granular data points pre-intervention are used as predictors (X_{im}) within our Synthetic Control framework. Hence, we ensure that the constructed counterfactual is matched not only on broad macroeconomic trends, but on structural trends of the aviation market. We complement this market data with macroeconomic variables from the World Bank -specifically

[8] While data for Germany was collected, its inclusion in the donor pool is precluded by a similar aviation tax revision implemented in 2024, which would contaminate the counterfactual estimation. It would violate the SUTVA - Stable Unit Treatment Value Assumption.

GDP, employment, population, and freight volume- to capture the underlying drivers of air travel demand.

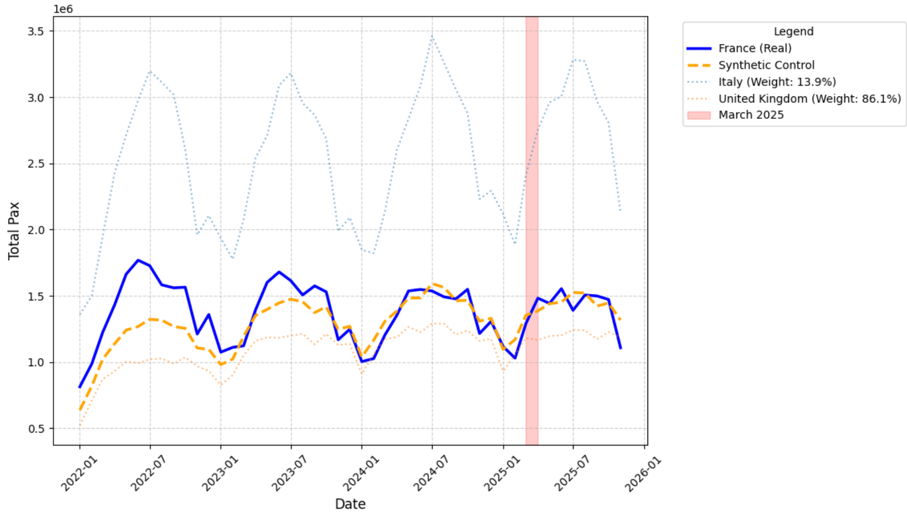


Figure 1.14: Passenger trends: France vs synthetic-France

The SCM allows for a sparse weight distribution where the most similar units dominate the counterfactual. In our domestic market estimation, the UK is the closer proxy to France in terms of market dynamics, capturing idiosyncratic shocks and seasonality that other European peers may not share (see Figure 1.14).

Heterogeneity Across Airport Types

We also perform our analysis using different subsamples, distinguishing between hub and non-hub departing flights. This distinction is key as the existing literature generally identifies a larger impact of aviation taxes at non-hub airports (Borbely, 2019; Helmers and van der Werf, 2025). However, these findings are often based on aggregate departing passengers by airport counts that fail to account for the internal composition of traffic:

- **Non-hub Airports (LCC/Point-to-Point)**: High sensitivity to tax shocks. Because base fares are lower, a fixed tax represents a larger percentage increase. Combined with high price elasticity and the availability of high-speed rail substitutes, this often leads to significant traffic drops or route withdrawals.
- **Hub Airports (Network Carriers)**: Greater resilience. The hub-and-spoke model allows network carriers to adapt to policy shocks by reallocating capacity or adjusting flight frequencies rather than simply cutting routes outright.

Preliminary Impact Estimates

Preliminary estimations suggest that the 2025 TSBA revision has led to an estimated 9.4% decrease in the total number of passengers departing from hub airports and a 7.3% reduction in total seat capacity. This last coefficient is relatively in line with the literature pre-COVID. Interestingly, unlike previous literature, we find the effect to be non-statistically significant for non-hub airports (which exhibit a larger share of LCCs). While these results highlight a significant demand response, the magnitude of the interaction coefficients varies based on route structure and connectivity.

Future Extensions

Future robustness checks will further investigate the sensitivity of these results to the donor pool composition. Indeed, the strong similarity between the French and British aviation sectors, as reflected in the weighting of the donor pool, motivates us to perform future 'leave-one-out' sensitivity tests. This will ensure that the identified -9.4% impact remains robust across different synthetic compositions. Extending the analysis to other market segments (medium and long haul) is also part of the research agenda.

1.2 Prospective Studies: Anticipating Future Mobility Behavior

To anticipate future travel patterns in the context of the environmental transition, the Travel Chair addresses a critical data gap: traditional datasets focus on completed, isolated trips, failing to capture the decision-making processes behind multimodal alternatives like air–rail. To overcome this, the Chair employs a multi-method data collection strategy—integrating questionnaires, laboratory experiments, and focus groups. Combining these social science approaches ensures the robust data foundation necessary for subsequent advanced econometric modeling.

1.2.1 Stated-Preference Survey and Choice Modeling

This work builds on our prior analyses conducted using existing datasets, which provided an understanding of observed travel patterns and some of the factors shaping them. However, these data are primarily limited to socio-economic characteristics (such as age, income, or location) and observable behaviors. They typically capture the characteristics of the chosen mode of transport but offer limited insight into the broader decision-making process.

The choice of a transport mode does not depend solely on the intrinsic characteristics of a single option. Rather, travelers make decisions within a market context, where they are exposed to a set of available alternatives (e.g., different itineraries combining air and rail). It is fair to assume that during the descion making process they compare and arbitrate these options based on their attributes such as cost, travel time, reliability, and environmental impact.

This decision process also includes the possibility of not traveling at all. When searching for travel options on booking platforms, individuals may review the available offers and ultimately decide not to proceed with any of them. This segment of potential travelers, those who consider traveling but opt out, is not observable in traditional datasets, which only record completed trips.

Travel decisions are fundamentally shaped by individual and collective perceptions, as well as by the psychological characteristics of travelers. Beyond observable attributes, latent factors—such as latent attitudes toward environmental impact, subjective perceptions of control, and cognitive trip complexity—exert a significant influence on how individuals evaluate available options. Furthermore, travelers often rely on behavioral heuristics and simplified decision rules rather than purely rational trade-offs when navigating complex transport systems.

Incorporating this attitudinal, psychological, and heuristic layer into the analysis is therefore essential to achieve a more complete and realistic understanding of travel behavior. Because traditional, passively collected market data cannot capture these unobservable dynamics, existing data sources provide only a partial view of transport demand. Specifically, standard empirical datasets fail to systematically isolate key structural components of the decision-making process, including:

- The full set of alternatives considered by individuals
- The trade-offs made between competing options

- The decision to abandon the market
- The influence of psychological characteristics.

To address these limitations, and in the context of analyzing future mobility patterns, a dedicated survey was designed and implemented. The objective is to better understand the mechanisms underlying choices between air-air and air-rail alternatives, as well as the factors driving the decision not to travel. This approach allows for a more comprehensive and forward-looking understanding of both mode choice and potential market drop-off.

Conceptual Framework and Analytical Approach

The proposed framework aims to explain how travel decisions are formed in a multimodal context. Rather than focusing on the final choice, the framework seeks to identify the factors that affect the decision-making process.

The framework presented in Figure 2.1 is centered around the level of satisfaction (utility) that each travel alternative provides to the respondent. In the survey, each alternative is described though a set of attributes: travel time, cost, CO_2 emissions reduction, stopover possibility, baggage handling and ticket flexibility. These attributes make it possible to analyze how trade-offs are made between economic, practical, and environmental considerations.

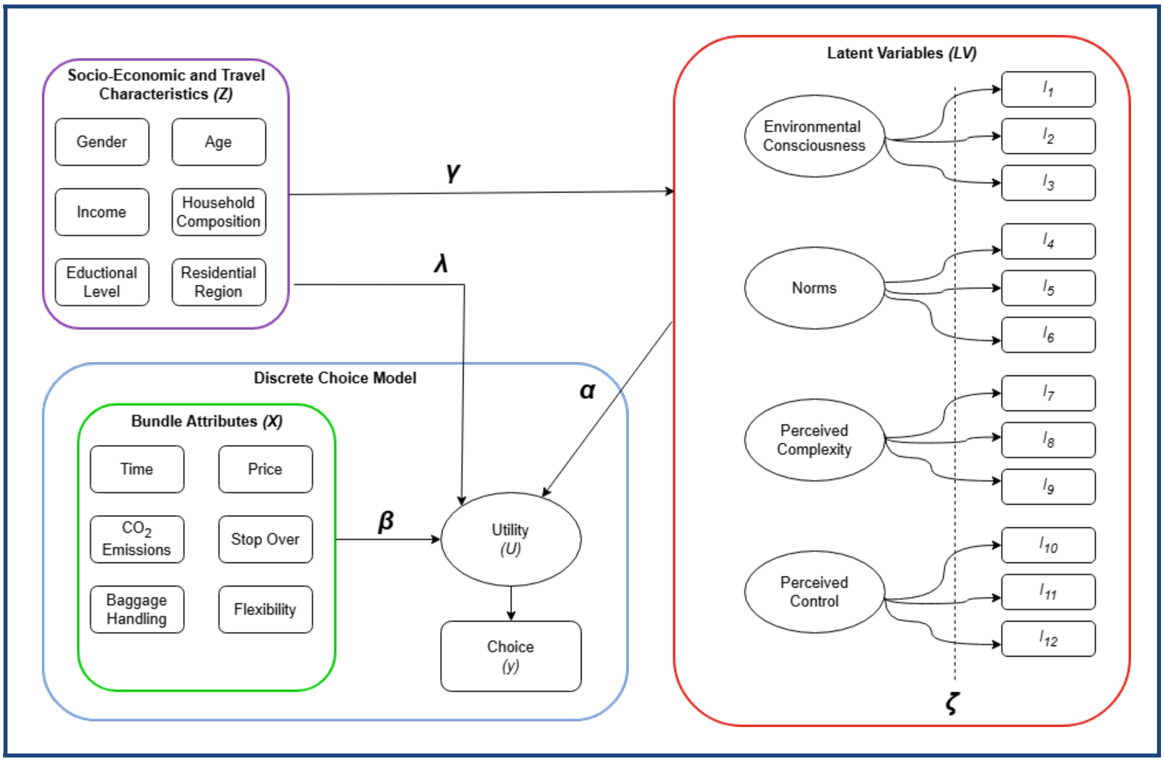


Figure 1.15: Conceptual framework of transport mode choice analysis

The framework incorporates socioeconomic and travel characteristics. Variables such as age, gender, income, household composition and residential region are included in the analysis to capture heterogeneity of preferences and constraints across respondents. These characteristics help explain variations in sensitivity to transport attributes and differences in travel behavior.

In addition to observable factors, the approach integrates several psychological dimensions that may influence the preferences and therefore the evaluation of travel alternatives. Four latent constructs are considered in the model: environmental consciousness, social norms, perceived complexity and practical control. Although these dimensions cannot be directly observed, they can be measured indirectly through attitudinal questions included in the questionnaire.

By combining travel attributes, socioeconomic characteristics and psychological dimensions within the same framework, the model provides a broader understanding of travel behavior. This integrated approach makes it possible to analyze not only the choices themselves, but also the mechanism and perceptions that shape them.

Survey Architecture and Data Collection

Our survey was designed to capture the determinants of travel decisions from several perspectives.

Discrete Choice Experiment

At the core of the survey, respondents evaluated a series of hypothetical travel scenarios involving three types of alternatives:

- Air-Air
- Air-Rail
- Not to travel

Discrete Choice Experiment (DCE)

What is a DCE? A survey-based method designed to elicit individual preferences by observing choices among alternatives characterized by multiple attributes in hypothetical scenarios. It rests on the assumption that any good, service, or policy can be decomposed into a bundle of attributes, each taking different levels, and that individuals choose the alternative that maximizes their utility.

How does it work? Respondents face a series of scenarios constructed via an experimental design that systematically varies attribute levels, forcing trade-offs between competing alternatives - approximating real-world decision-making more closely than direct rating or ranking methods.

How are results analyzed? The observed choices are modeled using discrete choice models (Multinomial Logit, Mixed Logit) to estimate attribute importance, marginal rates of substitution, and willingness to pay.

Where is it applied? Behavioral economics (transport, health, etc.), marketing, public policy evaluation.

Each alternative was described using a consistent set of attributes, including:

- Travel cost,
- Travel time,
- Carbon emissions reduction level,
- Possibility of a stopover,
- Level of ticket flexibility.

These attributes were systematically altered across scenarios, following a structured experimental design, ensuring that their effect can be observed independently. This approach enables a direct and controlled observation of how individuals arbitrate between competing factors and options.

Revealed preferences

In addition to the DCE, the survey collects information on revealed preferences, that is, actual travel behavior. Respondents were asked to report recent trips, itineraries, and used transport modes. These data reflect real-world behavior. They provide a useful reference point. The objective is to anchor the analysis in observed behavior and to compare it with stated choices. This helps assess the consistency of responses, allows to observe choice shifts and strengthens the robustness of the results.

The questionnaire also explores habits through questions on routine mobility patterns. Respondents indicate how often they use specific modes. Some individuals tend to repeat the same choices regardless of changes in attributes levels or available alternatives. The objective is to capture this behavioral inertia. Doing so allows distinguishing between deliberate choices and those driven by habits.

Psychological characteristics

A dedicated section focuses on psychological characteristics, captured through a set of attitudinal questions included in the questionnaire. These are measured using Likert-scale statements. Several key dimensions are considered. Environmental consciousness reflects the importance individuals attach to the environmental impact of their travel choices. Social norms capture the influence of others' opinions or behaviors on individual decisions. Perceived control refers to the extent to which individuals feel capable of organizing and managing their journey. Finally, perceived complexity relates to how difficult or demanding a travel option is considered to be. These factors play an important role in shaping decision-making. They influence how alternatives are evaluated and how trade-offs are made. The objective is to capture latent determinants that are not observable through standard variables. Integrating these dimensions allows for a better understanding of preference heterogeneity and contributes to a more realistic representation of travel behavior.

Socioeconomic variables

Finally, the survey gathers standard socioeconomic variables, such as age, income, education, employment status, and household structure. These variables define the context in which decisions are made. The objective is to identify how constraints and preferences vary across individuals. This enables population segmentation and supports a more detailed interpretation of the results.

1.2.2 Experimental Economics: Laboratory Approaches

The questionnaire described in the previous section is designed to capture stated preferences, psychological characteristics, revealed travel habits, and socio-economic heterogeneity. This provides a broad picture of how individuals evaluate air–air, air–rail, and outside options when facing hypothetical travel scenarios. However, stated-choice data remain limited by the fact that respondents do not bear the consequences of their decisions. For this reason, the Chair also plans to complement the survey with a controlled laboratory experiment grounded in behavioral and experimental economics.

Our approach of laboratory experiment in modal choice

The objective of the laboratory experiment is not to reproduce a real trip in all its operational complexity. Rather, the aim is to isolate specific behavioral mechanisms that are difficult to identify cleanly in observational or survey data. In real-world air–rail markets, several dimensions are bundled together: price, travel time, connection risk, ticket integration, compensation rules, comfort, baggage handling, and perceived complexity. When passengers reject an intermodal itinerary, it is therefore difficult to determine whether they are reacting to the rail segment itself, to the risk of missing a connection, to the lack of contractual protection, to the loss of comfort, or to the cognitive burden of organizing a multi-operator trip. A laboratory experiment allows these dimensions to be varied independently while keeping the rest of the environment constant.

The experimental approach relies on the principle of induced value. Participants are assigned monetary incentives so that the main dimensions of the travel decision have direct payoff consequences. For example, ticket prices reduce the participant's experimental budget; successful completion of a trip can generate a monetary bonus; missed connections can reduce earnings; compensation or protected-connection mechanisms can change the payoff consequences of disruptions; and comfort can be operationalized through the possibility of using travel time productively in a paid task. In this way, the experiment does not simply ask participants what they would prefer. It observes choices in a controlled environment where decisions affect earnings.

This approach is especially useful for studying air–rail intermodality because several relevant mechanisms are behavioral rather than purely technological. The experiment can be used to test, for instance, how sensitive individuals are to connection risk, whether protection mechanisms or compensation schemes increase the attractiveness of air–rail itineraries, and whether productive or comfortable travel time can partly offset longer total travel duration. These dimensions are particularly relevant for intermodal travel, where the passenger must evaluate not only the characteristics of each mode, but also the quality of their integration within a single journey.

The laboratory experiment is therefore intended as a complement to the questionnaire, not as a substitute. The questionnaire provides scale, heterogeneity, and external contextual richness. It allows the analysis of stated trade-offs across countries, socio-economic groups, travel habits, and psychological profiles. The experiment, by contrast, prioritizes internal validity. It allows the researcher to manipulate one mechanism at a time and to observe whether behavior changes when choices have real consequences. Combining both approaches makes it possible to link broad survey-based evidence with causal evidence on selected mechanisms.

Frrom a methodological perspective

The design will follow the main requirements of experimental economics. First, incentives must satisfy monotonicity: participants should prefer higher experimental earnings to lower earnings. Second, incentives must be salient: choices must directly affect the payoff received by the participant. Third, incentives must be dominant: the monetary and time-related consequences created by the experiment should be sufficiently meaningful to limit the influence of uncontrolled motivations. These principles are central to ensuring that the experiment provides interpretable behavioral evidence rather than merely hypothetical responses.

At this stage, the precise experimental design remains open. Several variants are possible. A first option would focus on risk and integration, by comparing standard air–rail itineraries with alternatives that include protected connections, delay compensation, or integrated ticketing. A second option would focus on comfort and productive time, by testing whether rail segments become more attractive when travel time can be used to perform a paid activity. A third option would combine both dimensions and evaluate whether integration mechanisms and productive travel time act as complements. In all cases, the common purpose is to understand whether specific service-design mechanisms can increase the willingness to choose air–rail intermodality under controlled and incentive-compatible conditions.

The expected contribution of this experimental component is therefore twofold. First, it will help identify which frictions are most behaviorally relevant in air–rail choice: risk exposure, lack of protection, travel-time disutility, comfort, or perceived complexity. Second, it will allow the comparison of possible incentive mechanisms, such as price discounts, guarantees, compensation, or improvements in the usability of travel time. The results will not be interpreted as direct forecasts of market shares. Instead, they will provide causal evidence on the behavioral mechanisms that may condition the adoption of future air–rail services.

Chapter 2

The European Survey: Design and Scope

2.1 Research Objectives

Our prospective European survey on transport demand is motivated by four key trends:

- European passengers' transport activity is back at its historical peak: 1.1 billion air passengers were recorded in the European Union (EU) in 2024, above the pre-pandemic benchmark, with growth rates that diverge sharply across Member States (Eurostat, 2025).
- European transport policy considers intermodality as the cornerstone of the Trans-European Transport Network (European Commision, 2024). Namely, it advocates for connecting major airports to long-distance rail, positioning high-speed rail as a competitive alternative to feeder flights. Airlines currently face persistent supply-side constraints—such as aircraft delivery backlogs and labor shortages— and have reached record levels of fleet utilization and yield optimization (IATA, 2025). Since operational efficiency alone cannot meet modern demand, intermodality is essential for optimizing total network capacity while reducing the sector's carbon footprint.
- The historical fragmentation of ticketing and real-time information remains a primary friction for multimodal travellers. Digitalization can resolve this through integrated ticketing platforms and cross-modal data sharing, enabling a frictionless user experience across diverse transport modes (CERRE, 2026).
- In the verge of increasing environmental and capacity constraints, the traditional silos of mode-specific regulation are becoming obsolete. Effectively serving mobility needs requires a holistic approach that targets aggregate travel demand rather than individual mode demand. Hence, policy interventions must consider all travel demand, from urban transit and high-speed rail to long-distance aviation, to ensure a sustainable transition of transport networks.

Against this backdrop of persistent travel demand and escalating sustainability challenges, the consumer response to policy-driven systemic changes remains a critical open question. Although regulatory mandates increasingly dictate a multimodal future, the behavioral barriers to adoption and the real-world public acceptability of intermodal transport are not yet fully understood.

Today the main challenge in transportation research is data fragmentation. Indeed, most existing datasets focus exclusively on a single mode, failing to capture the joint behavior of rail and air passengers. Furthermore, secondary data sources typically suffer from selection bias, as they primarily capture active travelers through satisfaction surveys or booking databases.

To address these limitations, our study engages directly with households to characterize the demand of both current travellers and non-travellers. This approach allows us to identify the levers required to encourage market entry for those who currently opt not to travel. More broadly, our survey is designed to capture three critical dimensions of the consumer experience:

- **Past Actions:** Establishing a behavioral baseline through retrospective data.
- **Future Intentions:** Measuring prospective responses to evolving transport options.
- **Psychological Drivers:** Identifying the underlying cognitive factors that dictate decision-making.

2.2 Architecture of the Questionnaire

To capture the heterogeneity of consumer preferences, the questionnaire was structured around three main analytical pillars. In addition to these components, the survey also includes standard socioeconomic variables such as income, age, gender, education level, and household size.

2.2.1 Discrete Choice Experiment

The core of the questionnaire relies on a discrete choice experiment in which respondents are presented with a series of hypothetical travel scenarios. Based on an experimental design generating 36 scenarios, each respondent faces 9 choice situations. For every situation, respondents must choose between combined flights, an intermodal Air–Rail alternative, or the option not to travel at all (opt-out alternative). This process makes it possible to elicit stated preferences by observing the option individuals declare they would choose in a hypothetical context.

The alternatives are defined through a set of specific attributes: ticket price, travel time, CO_2 emissions reduction, presence of stopovers, baggage handling, and ticket flexibility. This approach enables a direct observation of how respondents arbitrate between competing attributes and transport configurations while also making it possible to estimate sensitivities to different service characteristics. Specifically, this method allows the estimation of elasticities related to key variables such as price or travel time, as well as the value of travel time, by analyzing the trade-offs respondents make between monetary and temporal costs. In addition, the framework provides insights into the willingness to adopt intermodal Air–Rail solutions under different travel conditions and service configurations.

Attributes	Air-Air ✈ + ✈	Air-Rail ✈ + 🚆	Not to travel
Price	125€	205€	
Travel time	4h25	5h10	
CO_2 emissions	-5%	-15%	
Stop Over	No	Yes	
Baggage Handling	Not included	Included	
Flexibility	Fully flexible (changeable + refundable)	Changeable	
	Air-Air	Air-Rail	**Not to travel**

Table 2.1: Example of a scenario presented during the discrete-choice experiment.

As illustrated in Table 2.1, the different characteristics are defined as follows:

- **Price**: Total out-of-pocket cost in euros.[1]
- **Travel time**: Total travel duration.
- **CO_2 emissions**: Percent change relative to a standard fossil kerosene flight.
- **Stop Over**: Optional stopover of a few hours or overnight, allowing the passenger to visit the connecting city if he wishes. Accommodation and expenses are not included in the ticket price.
- **Baggage Handling**: Automatic luggage transfer between connections.
- **Flexibility**: "Fully flexible" (free changes/cancellation), "Flexible" (free changes) or "Not flexible".

2.2.2 Assessment of psychological determinants

Research on interurban mobility, and particularly air transport, has historically relied heavily on objective or “hard” attributes such as ticket prices, traffic volumes, flight frequencies, and physical travel distances.[2] While these variables are readily accessible in conventional transport datasets, the latter fail to account for the latent factors and behavioral heuristics that actively shape the decision-making process.

Integrating these psychological dimensions is essential for two primary reasons. First, such behavioral factors are already widely utilized in urban mobility research, which consistently demonstrates that individuals with identical demographic profiles and trip characteristics—but distinct latent attitudes or heuristics—exhibit highly heterogeneous choice behavior. Second, preliminary focus groups conducted with transport experts, aviation industry stakeholders, and passengers highlighted the recurrent salience of several qualitative themes. Among these, risk aversion regarding missed connections or baggage loss, environmental awareness, and the perceived cognitive complexity of multimodal travel emerged as central determinants of individual travel decisions.

For this reason, our questionnaire integrates measures related to four key psychological constructs: **Environmental consciousness, Social norms, Perceived complexity, Practical control.** Each of these dimensions is measured through a series of five attitudinal statements evaluated using five-point Likert scales (see an example in figure 2.1). The objective is to quantify latent psychological traits that may influence the evaluation of transport alternatives and the trade-offs made between them.

- *Environmental consciousness* refers to the extent to which individuals consider environmental issues when making travel decisions. This dimension captures concerns related to climate change, the environmental impact of personal mobility, and the willingness to align travel choices with environmental values. In the context of multimodality, environmental attitudes are expected to play an important role in the attractiveness of lower-emission transport alternatives. It is measured through statements such as:
  - *"I am concerned about climate change."*
  - *"I am concerned about the environmental impact of my personal travel."*

[1] Note that this implies a single ticket for the whole trip. Hence, our experiment relates to intermodality rather than multimodality (see the definition of these concepts in Chapter 1).

[2] A few exceptions exist; for instance, de Jong et al. (2022) incorporate risk aversion as a latent factor driving airline choice.

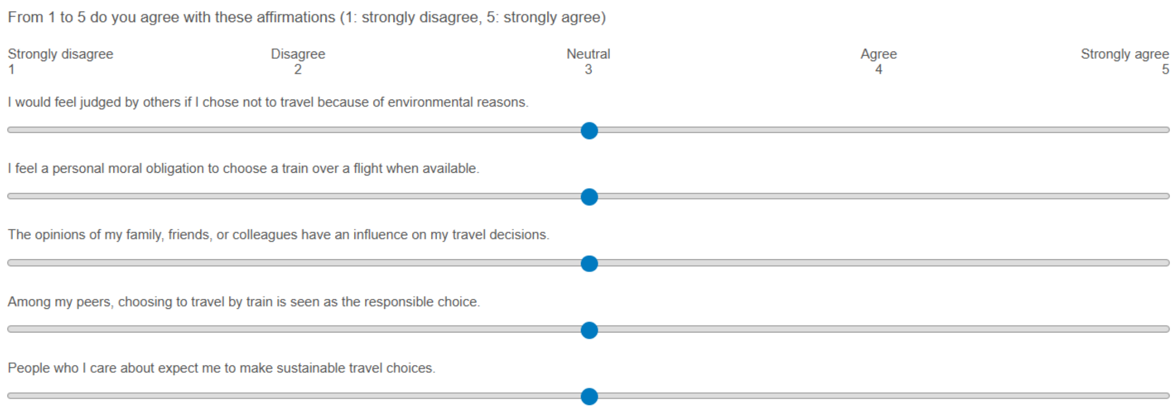


Figure 2.1: Examples of psychological questions included in the questionnaire (here, the environmental component).

- *Social norms* capture the influence of interpersonal expectations and perceived social pressure on travel behavior. This construct reflects the extent to which individuals perceive sustainable mobility choices as socially valued, morally desirable, or encouraged by peers, family members, or professional circles. The inclusion of this dimension is particularly relevant given the increasing social visibility of environmentally responsible travel practices. They encompass statements including:
  - *"The opinions of my family, friends, or colleagues have an influence on my travel decisions."*
  - *"People who I care about expect me to make sustainable travel choices."*
- *Practical control* captures travellers' individual cognitive capacity and self-efficacy associated with planning and managing multimodal journeys. Rather than evaluating the transport system itself, this internal dimension reflects a passenger's personal confidence in their ability to process complex travel information, evaluate alternative configurations, and psychologically cope with the organizational demands and inherent stresses of connected travel. It is empirically grounded in survey items measuring personal trust in information channels and individual stress thresholds, such as:
  - *"I trust the information given by websites/apps when booking my trip."*
  - *"I believe that traveling with connections (whether air-air or air-rail) can be stressful or uncertain."*
- *Perceived Complexity* relates to the structural, operational, and frictional barriers inherent to the transport network, particularly regarding air-rail connections. This external dimension encompasses the traveler's assessment of systemic reliability, the physical friction of intermodal transfers, and the operational uncertainty of blending distinct transport modes. It isolates how difficult the network architecture appears to the user. It is measured in the survey through five statements, including:
  - *"I find it easy to understand complex information."*
  - *"I would avoid booking an air-rail connection if it requires changing terminals."*
  - *"I think that connecting flights (Air-Air) are more reliable than Air-Rail connections."*

Practical control and perceived complexity are tied to Perceived Behavioral Control (PBC), a concept present in the literature on the psychological determinants of route choice. Applied to travelers' intentions, PBC can be disentangled into two distinct dimensions—self-efficacy and perceived controllability—to evaluate the intention to choose itineraries involving transfers (Chowdhury and Ceder, 2013). From another perspective, both psychological factors are also a matter of reliability (Alousi-Jones et al., 2025) and desired quality of the information (Grotenhuis et al., 2007). Specified as latent variables in our empirical investigation, these notions serve as unconventional variables (as labeled by Yoo et al. (2025)) that actively shape the perceived accessibility of intermodal transport alternatives.

Together, these psychological dimensions provide a broader understanding of travel behavior beyond purely economic or operational variables. They allow the analysis to account for subjective perceptions, attitudes, and cognitive constraints that may shape preferences toward intermodal transport solutions.

2.2.3 Travel habits as revealed preferences

The third part of the survey focuses on travel habits, elicited as revealed preferences. Unlike the discrete choice experiment, which captures stated intentions in hypothetical settings, revealed preferences reflect actual travel behaviour and previously experienced mobility patterns.

Integrating this dimension is essential for a comprehensive behavioural analysis. The behavioural literature consistently shows that transport decisions are shaped by status quo bias and strong inertia: individuals tend to reproduce familiar choices even when alternative options become available or improve (Gao et al., 2022; Ortega and Link, 2025).

The questionnaire therefore includes questions on travel frequency, preferred transport modes, and past experience with connections and multimodal journeys. These variables serve a dual purpose: they refine the characterisation of respondents, and they allow observed behaviour in the discrete choice experiment to be interpreted in light of prior travel experience.

Combining revealed and stated preferences also helps assess the extent to which past experience acts as a cognitive filter in the decision-making process. Prior travel behaviour may either attenuate or reinforce the influence of specific attributes — such as perceived complexity, sensitivity to travel time, or the attractiveness of intermodal alternatives — on stated choices.

2.3 European Deployment

Our study followed a multi-stage validation process. We first conducted two pilot studies using a representative panel of the United Kingdom population, with 200 and 50 respondents, respectively. These phases were instrumental for assessing the clarity of our questions and the overall alignment of the survey instrument with our research objectives. The preliminary feedback allowed us to refine the experimental design and confirm the validity of the psychological constructs before full-scale deployment.

Once the survey structure was consolidated, it was deployed at scale across a European panel. To capture a representative perspective and account for country-specific disparities within the European transport landscape, our final dataset covers six strategic markets: **France, Italy, Spain, Germany, Austria, and the United Kingdom.**[3]

[3] Data for Austria was still in the collection phase during this report's elaboration. Hence, the following analysis omits Austrian travelers.

Chapter 3

Survey results

3.1 Psychological Profile of Respondents

3.1.1 General Distribution of Psychological Pillars

This study examines transport mode choices within the framework of intermodal mobility. We assume a priori that some specific psychological factors can either facilitate or constrain the decision-making process. For instance, it is essential to consider the respondents' environmental sensitivity to understand how this influences their travel choices—or their decision to forgo travel altogether. Consequently, here we evaluate the distribution of the four core psychological pillars introduced in the previous section.

Figure 3.1 shows the distribution of respondents' average scores for each of the pillars. It can be seen that the majority of scores cluster around 3, indicating sensitivity to the various pillars. This distribution also serves to validate the measurement scale by confirming the existence of observable variability in the responses. The scores related to control and complexity are more clustered (indicating less diversity in profiles) than those for the environment and social norms dimensions. Finally, a slight pro-environmental bias emerges, with a significant concentration of scores around 5 for the environmental pillar compared to the others.

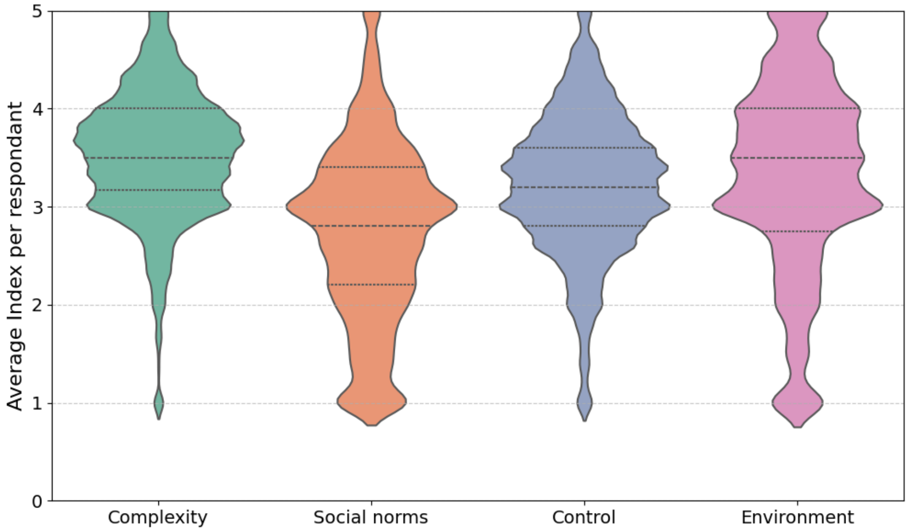


Figure 3.1: Distribution of average psychological indices per respondent (Complexity, Social Norms, Control, Environment).

Psychological factors

Respondents are sensitive to environmental concerns, as well as to their own sense of control over their decisions and the itinerary's perceived complexity. Designing trips that minimize structural complexity, provide intuitive information, and explicitly address environmental concerns is an effective way of meeting their expectations.

3.1.2 Socio-Demographic Disparities in Psychological Sensitivity

Figure 3.2 displays the distribution of psychological scores (1 to 5) across four factors — Complexity, Control, Environment, and Social Norms — cross-tabulated with four socio-demographic variables (age, education, employment status, and income).

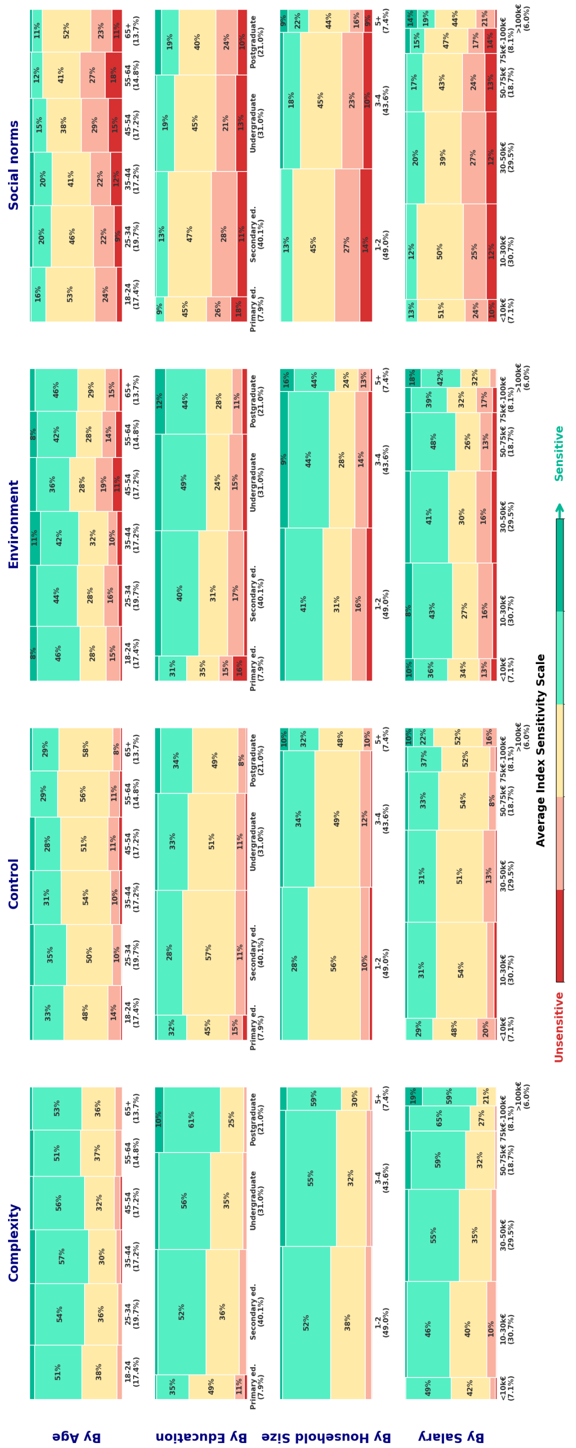


Figure 3.2: Average psychological indices broken down by socio-demographic criteria (age, education, employment status, income).

A strongly contrasted sensitivity gradient is immediately apparent across factors: Complexity and Control scores are uniformly high (dominance of green shades, scores 3–4–5), whereas Environment and, even more so, Social Norms exhibit a substantial share of low scores (red/salmon shades, scores 1–2).

Salient findings by factor

- **Sensitivity to Complexity** (the perceived complexity of the decision-making environment) is overall very high: the majority of respondents fall at score 4, regardless of subgroup. The "Postgraduate" category stands out with the largest proportion of score 5, which corresponds to maximal sensitivity.

- **Sensitivity to Control** (the perceived control over one's own decisions) is likewise elevated, although slightly less skewed toward the upper end than Complexity (a mix of scores 3 and 4). A pronounced education and income effect emerges: as educational attainment and income rise, the share of scores 4–5 increases (highly educated and high-income respondents report a stronger sense of mastery over their decisions). Low-income respondents show a higher concentration at score 3, suggesting a weaker sense of control.

- **The distribution of scores for sensitivity to environmental concerns** is markedly more heterogeneous, with a noticeable emergence of scores 1–2 (low sensitivity). A clear age effect is observed: the 45–54, 55–64, and 65+ brackets display a substantially higher share of low scores (1–2) than younger cohorts. "Postgraduates" and high-income respondents (>75 k€) stand out with the largest proportions of scores 4–5.

- **The Social Norms factor** (sensitivity to social judgment and expectations) is the most polarised: scores 1–2 are heavily represented across nearly all subgroups. Low-income respondents and the 55–64 age bracket exhibit the highest concentration at score 1, indicating a low receptiveness to social norms. By contrast, younger respondents (18–34), students, and higher-education graduates appear more sensitive, with scores 4–5 occurring more frequently.

Psychological factors x Socio-demographic characteristics

Respondents report being highly sensitive overall to the complexity of their decision-making environment and to their sense of control, but markedly less so to environmental concerns and, above all, to social norms. The latter two factors also reveal pronounced socio-demographic cleavages: advanced age and low income diminish sensitivity, whereas educational attainment and income enhance it. The key message is therefore that psychological sensitivity is not uniform: it depends strongly on the factor considered and is structured along a generational and socio-educational axis, which is particularly conspicuous for social norms and environmental concerns.

3.2 Past Travel Experiences and Habits

3.2.1 Traveller Archetypes and Market Exclusion

Past travel experiences provide a characterization of travel habits. The results displayed in Figure 3.3 correspond to travel habits over the past two years. The five segments sum to 100% of the sample, allowing both cross-profile comparisons and the derivation of meaningful subtotals, such as travelers versus non-travelers, or passengers traveling with or without a connection.

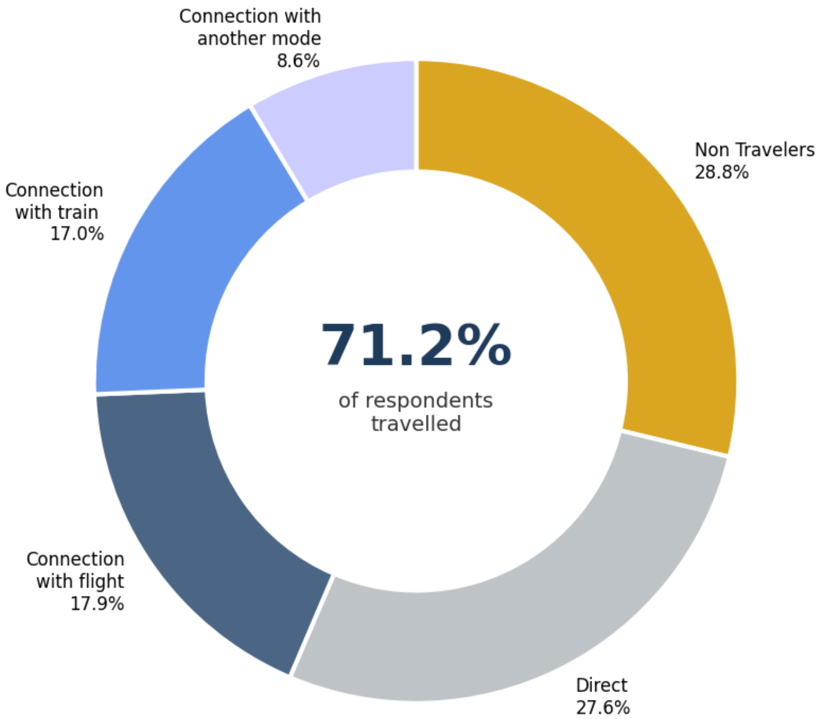


Figure 3.3: Five mutually exclusive profile archetypes.

A detailed analysis of the five profiles reveals the following:

- **Non-travelers** — 28.8%: Almost one out of three respondents reports not having traveled in the past two years.
- **No connection (Direct)** — 27.6%: This is the most represented profile among travellers, with more than one in four respondents traveling without any connection. The predominance of this segment suggests that a significant share of trips are direct, involving a single mode on a point-to-point basis.
- **Connection with flight** — 17.9%: Air connections rank first among connection types. The proximity of this figure to that of non-travelers (28.8%) indicates that approximately one in five respondents regularly combines their journey with a flight, a non-negligible volume likely driven by long-distance travel.
- **Connection with train** — 17.0%: Train-based connections emerge as the second-ranked form of connection and the dominant form of multimodal connection. Almost on a par with the no-connection profile, this result underscores the central role of rail as a multimodal link in passengers' travel practices.

- **Connection with another mode** — 8.6%: Connections involving other modes (bus, car, bicycle, etc.) constitute the smallest segment, confirming the predominance of rail and air as the structuring modes of multimodal travel chains.

It is worth noting that a significant share of the population falls outside the scope of mobility.[1] Close to 28.8% of respondents report not traveling at all, and therefore cannot directly contribute to our behavioural analysis of modal choices, connections, or travel trade-offs.

The presence of a non-negligible group of non-travelers raises the question of the underlying causes of this non-mobility: economic constraints, age, occupational status (inactive individuals, retirees), geographical location, health conditions, or personal and environmental choices. Cross-referencing this profile with socio-demographic variables (see Figure 3.4) helps shed light on who these non-travelers are, and whether their immobility is chosen or imposed.

Understanding the profile of non-travelers carries implications for the interpretation of public mobility policies. If the objective is to guide transport policy or foster modal transition, non-travelers represent a blind spot: incentive measures targeting connections or multimodality do not directly concern them. They may instead constitute a reservoir of latent demand, or conversely, a population for whom different levers — such as proximity of services, remote working, or improved accessibility — would be more relevant.

Connection in past travel experiences

The majority of respondents are travelers (71.2%), of whom nearly one-third use connections — some with trains (17%) and others with other modes (8.6%). Multimodality, and in particular connections centered on trains, thus appears to be a key factor shaping the observed mobility patterns. Furthermore, with 28.8% of non-travelers, the sample includes a substantial number of individuals excluded from the mobility dynamics studied: this group must be taken into account in behavioral analyses in its own right and characterized specifically, as it represents both a potential bias for the overall indicators and a distinct challenge for understanding the barriers to mobility.

3.2.2 Socio-Demographic Drivers of Mobility Options

The cross-analysis of traveler profiles and respondents' socio-economic characteristics confirms several expected patterns while also offering useful insights for the experiment to which respondents will be subjected.

Age category

The share of non-travelers increases sharply with age, rising from 22% among 25-34 year-olds to 38% among those aged 65 and over. The withdrawal from mobility is gradual but becomes particularly pronounced after the age of 55 (24%, then 38%). The 25-34 age group is by far the most intensive users of rail connections (21%, the highest rate across all categories), with a correspondingly very low share of other modes (8%). This is the most rail-oriented age group. The 18-24 age group displays the most diversified profile, with a high share of air connections (23%) and alternative modes (30%), suggesting a fragmented and experimental mobility pattern, consistent with low-cost travel, multimodality, and shared or soft mobility practices.

[1] Non-travelers account for 28.8% of the sample, or approximately one in three respondents. This is not a marginal segment: it exceeds the share of connecting travelers.

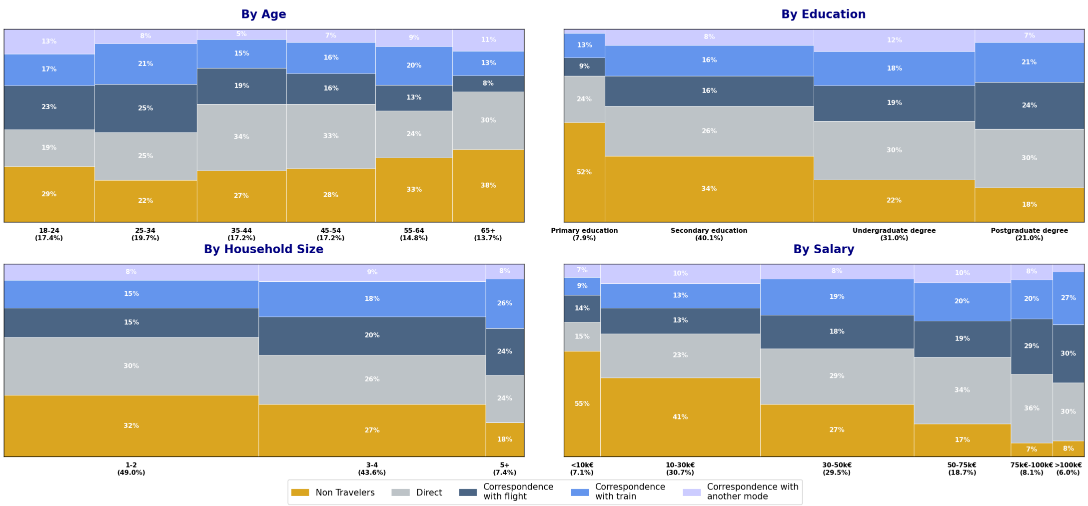


Figure 3.4: Traveler type distributed by socio-demographic profiles.

Education

The relationship between education and mobility is unambiguous: the share of non-travellers falls from 52% among primary-educated respondents to 18% among postgraduates, confirming that higher educational attainment is associated with greater travel frequency. Postgraduates display the most travel-intensive and multimodal profile, with similar shares of air and rail connections (respectively, 24% and 21%) and only 30% travelling without any connection.

Household Size

The relationship between household size and mobility is positive: the share of non-travelers decreases as household size increases (from 32% to 18%). A similar trend is observed regarding itinerary structures, where the reliance on connecting flights and multimodal itineraries increases relative to direct flights.

Income

Turning to income, the relationship with non-traveling is clear and monotonic: 55% of non-travellers among respondents earning less than 10k€, falling to 7-8% above 75k€. Financial capacity thus largely determines access to mobility. Air connections are a marker of high income: 12% of air connections among 10-30k€ earners, rising to 30% above 100k€ (against 27% for train). Above 100k€, air becomes the primary connection mode, ahead of rail. Rail is more prevalent among intermediate income groups (29% at 10-30k€ and 30-50k€), while the 75-100k€ segment stands out for the highest share of direct trips (36%), possibly reflecting targeted and direct professional journeys.

Cross-cutting patterns

When combining the effects of the various socio-economic factors considered, the following cross-cutting patterns emerge. Advanced age, primary education, and low income converge toward the same non-traveler profile, and these variables likely reinforce one another. Education and income, by contrast, act as enablers of air travel, while rail appears as a more accessible and generational mode, favored by young active respondents and intermediate income groups. Finally, students form a distinct profile: limited financial resources but a high propensity to fly, likely driven by international mobility such as Erasmus programs, low-cost travel, and family visits abroad.

Connecting modes x Socio-demographic characteristics

Access to mobility and the choice of connection mode are strongly shaped by socio-economic variables. Advanced age, primary eduction and low income are associated with a marked withdrawal from travel - while higher education and income levels favour multimodality and, in particular, air connections, which account for up to 30% among respondents earning above 100k€. Rail, by contrast, emerges as the most cross-cutting mode, predominating among young active respondents (25-34 year-olds) and intermediate income groups.

3.2.3 Travel Motives and Modal Trade-offs

Travel motives and transport modes

The mosaic plot in Figure 3.5 crosses two dimensions: transport mode (column width - rail 56.4% vs. air 43.6% of total trips) and travel purpose (row height - business, visits, and leisure). The height of each row represents the share of each motive within a given mode, enabling a comparison of the motivational structure of air and rail travel.

Leisure is the predominant motive regardless of mode. It accounts for 52.8% of air trips - more than one in two - and 44.7% of rail trips, a slightly lower but still majority share. Air travel thus appears more leisure-oriented than rail, with a gap of 8.1 percentage points, likely reflecting the role of air in long-distance and tourist travel (holidays, short breaks, international destinations).

The business motive is surprisingly balanced across modes: 21.2% for rail versus 19.2% for air - a marginal difference of 2.0 points. Contrary to the common assumption that business travel is predominantly air-based, the internal share of professional trips is comparable across both modes, and even slightly higher for rail. This suggests that rail has established itself as a fully fledged professional transport mode in the sample studied, likely reflecting the influence of high-speed rail services.

Rail carries the majority of passengers across all three travel motives. Recalculating shares over the total sample confirms this:

- **Leisure**: 52.3% by rail, 47.7% by air;
- **Visiting family/friends**: 61.2% by rail, 38.8% by air;
- **Business**: 58.8% by rail, 41.2% by air.

Air travel does not exceed rail in volume for any travel motive. While air carries a higher internal share of leisure trips, rail dominates in absolute terms across all segments, a result directly driven by its larger overall modal share (56.4%).

Transport mode x Travel purpose

Rail emerges as the dominant mode across all travel motives (56.4% of trips), capturing the majority of leisure, visit, and business journeys alike. Air travel nonetheless retains a stronger leisure identity, with 52.8% of its trips motivated by leisure, while rail stands out for a more versatile usage - notably for visits and, remarkably, for business travel, which it serves in a proportion comparable to that of air.

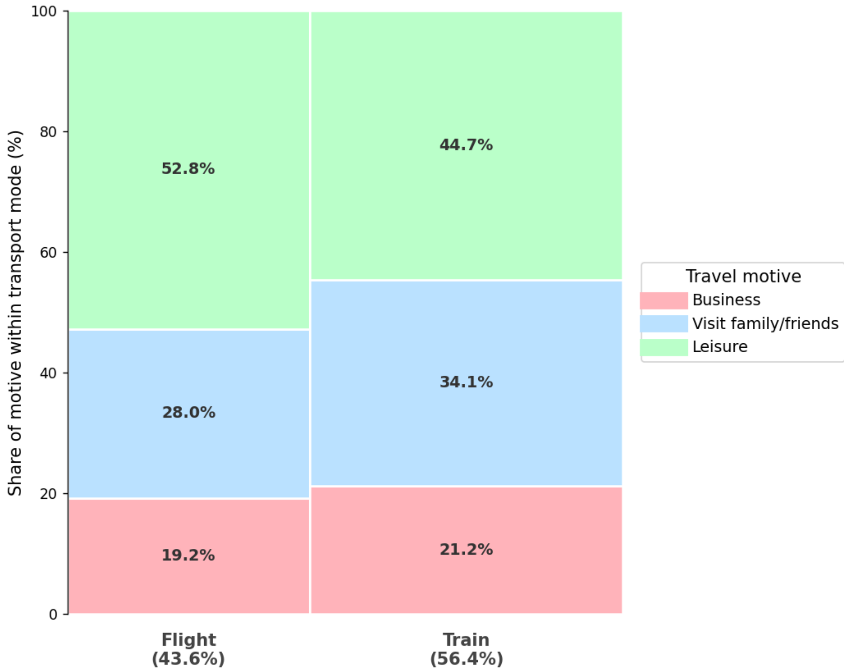


Figure 3.5: Distribution of travel purposes (Business, Visits, Leisure) by mode (Air vs Rail).

3.2.4 Trip Context: Companions, Airlines, and Preferences

Travel companions

Mobility is primarily organized around two dominant and nearly equivalent configurations, traveling alone (28.9%) or as a couple (34.1%), which together account for 63% of travelers (see Figure 3.6). Family travel remains a minority practice (14.5%), and travel among friends represents (17.3%), revealing a mobility pattern that is strongly individualized or couple-based.

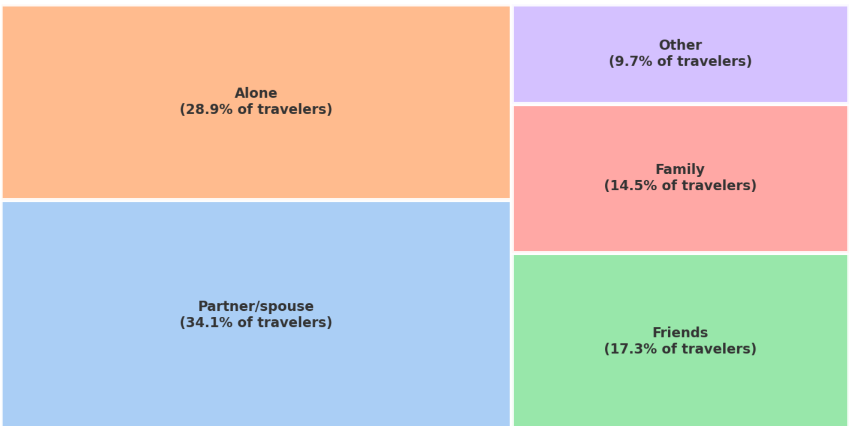


Figure 3.6: Distribution of travelers by travel companions (alone, as a couple, with family, etc.)

Choice of airline type

We can see on Figure 3.7 Airline choice is strongly structured by distance: low-cost carriers dominate short-haul travel (59.0%), which itself accounts for 68.1% of air volume, while full-service carriers prevail almost exclusively on long-haul routes (78.1%). Medium-haul represents the competitive tipping point between the two models, and passenger uncertainty is found to increase with distance, with 9.4% of long-haul respondents undecided about their carrier choice.

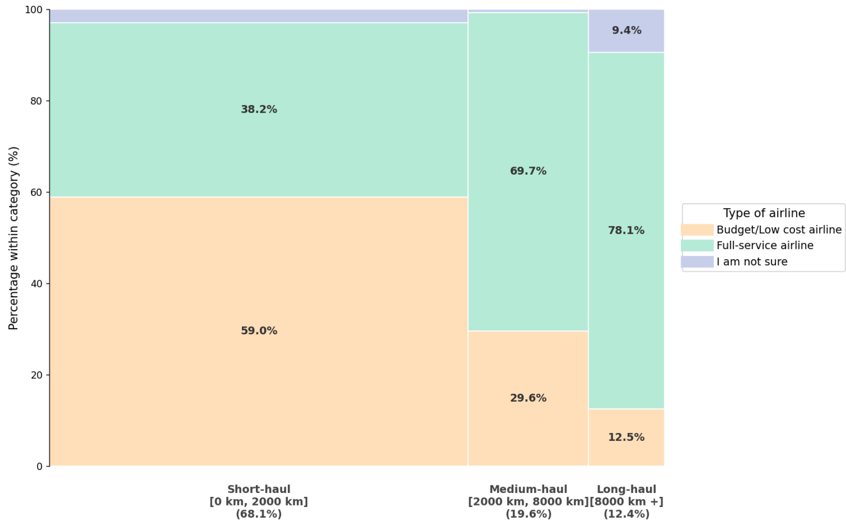


Figure 3.7: Choice of airline type (Low-cost vs. Full-service) depending on the flight distance.

3.3 Stated Preferences: Choices Made in the Discrete Choice Experiment (DCE)

3.3.1 Global Distribution of Transport Mode Preferences

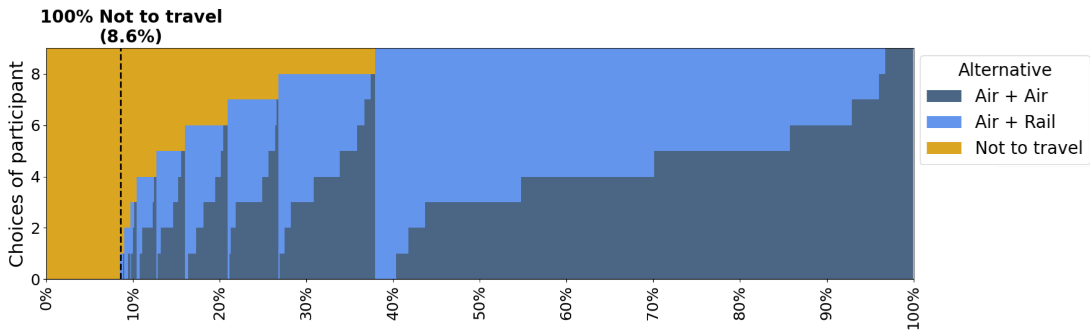


Figure 3.8: Global distribution of transport mode chosen (Air+Air, Air+Rail, Not to travel) in the DCE.

The individuals recruited for the survey faced nine choice scenarios during the Discrete Choice Experiment (DCE). Figure 3.8 presents the distribution of the transport mode selected. Each vertical column represents a respondent, ordered horizontally according to the composition of their choices, while the height (0 to 9) reflects the number of times each of the three alternatives was selected: Air+Air (dark blue), Air+Rail (light blue), and the opt-out option (yellow).

Several insights emerge from this representation. First, a marginal but non-negligible share of respondents appears systematically captive to the opt-out option: 8.6% of participants refused to travel in all nine scenarios presented. This subgroup can be assimilated to structural non-travelers, whose preferences are not revealed by the attributes of the alternatives offered, and who will warrant specific treatment in the modeling stage, for instance, through a latent class model or conditional exclusion from the behavioral analysis.

Second, the opt-out option is mobilized heterogeneously across approximately 30-35% of the panel, reflecting a significant sensitivity among a fraction of respondents to attribute levels (price, duration, connection type, etc.). Beyond this threshold, the opt-out option virtually disappears, suggesting that a substantial majority of participants treat travel as a given and position themselves exclusively between the two proposed modes.

Third, among respondents genuinely willing to travel, a clear duality emerges between a marked preference for Air+Rail in the central portion of the panel (approximately 35-70%) and a progressive dominance of Air+Air toward the right tail. Respondents at the far right of the chart appear as air captives, selecting Air+Air in virtually all scenarios, revealing a strong preference for air travel regardless of attribute trade-offs. Conversely, the absence of a zone where Air+Rail dominates across all nine choices suggests that the rail-air combination is primarily adopted contextually, in response to specific attribute configurations, rather than out of strict modal loyalty. This point will be examined in greater detail further in the report.

Overall, this chart highlights substantial behavioral heterogeneity within the sample, justifying the use of choice models that account for this variability, such as mixed logit or latent class models, rather than a conditional logit model with fixed coefficients.

3.3.2 The Influence of Socio-Demographic Characteristics on Modal Choice

Transport mode discrete choice and socio-demographic characteristics

Figure 3.9 crosses the choices made during the discrete choice experiment (*Air+Air*, *Air+Rail*, or the opt-out option *Not to travel*) with four socio-demographic variables: age, education level, household size, and income. The main finding of this analysis lies in the dichotomy between the decision to enter the mobility market and the choice of transport mode. It appears clearly that socio-economic profiles do not uniformly influence the different stages of the traveler's decision-making process.

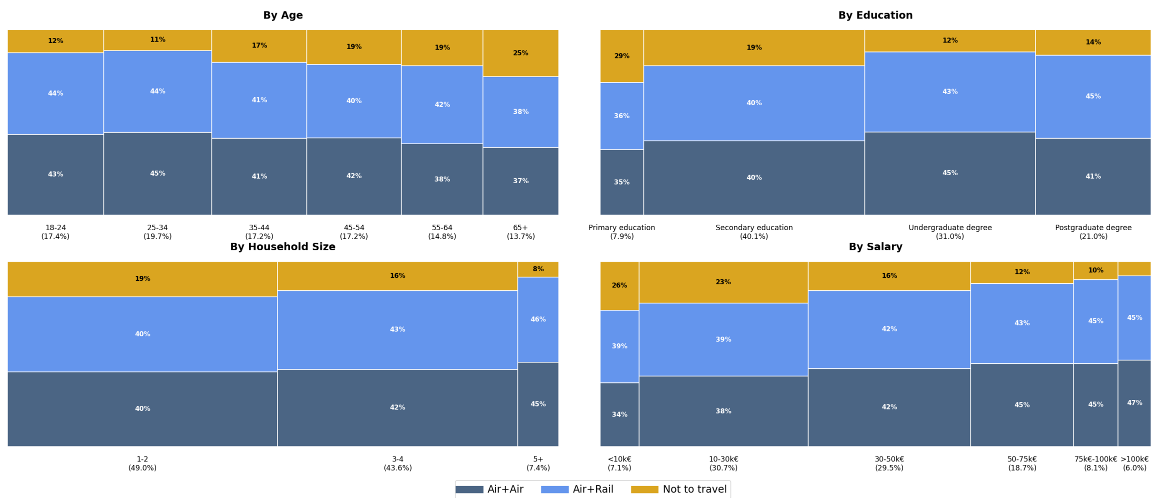


Figure 3.9: Transport mode choice in the DCE according to socio-demographic profiles.

The impact of socio-economic parameters is concentrated on the opt-out option (*Not to travel*), which acts as a genuine barrier to entry. The decision to forgo travel is associated with economic constraints and generational inertia: older respondents, lower income brackets, and less educated individuals reject the proposed travel scenarios far more frequently. This exclusion, driven by price or logistical complexity, is also observed among smaller households. Conversely, as economic capital (income > 75k€) or social capital (higher education) increases, the propensity to select the opt-out option logically collapses.

However, once this barrier to entry is crossed, modal choice appears insensitive to socio-demographic variation. Among respondents who decide to travel, competition between the unimodal alternative (*Air+Air*) and the intermodal alternative (*Air+Rail*) remains balanced, almost regardless of age, income, or education level. While one might have expected a substantial shift toward the rail option among more educated or affluent respondents, the data show that the distribution of choices is remarkably stable across groups. The acceptability of intermodality thus appears to escape socio-economic determinism, suggesting that the choice between air and rail connections rests on other factors, such as service attributes, travel habits, and psychological determinants.

3.4 Cross-Dimensional Analysis: Linking Habits, Stated Choices, and Psychology

3.4.1 Evaluating Modal Inertia: From Past Experience to Stated Choice

Figure 3.10 presents a diagram linking respondents' prior mobility profile (left column, "Traveler type") to their choice behavior observed in the discrete choice experiment (right column, "Choice behavior"). This representation allows for a visual assessment of the consistency, or divergence, between revealed travel practices and stated trade-offs in a hypothetical setting.

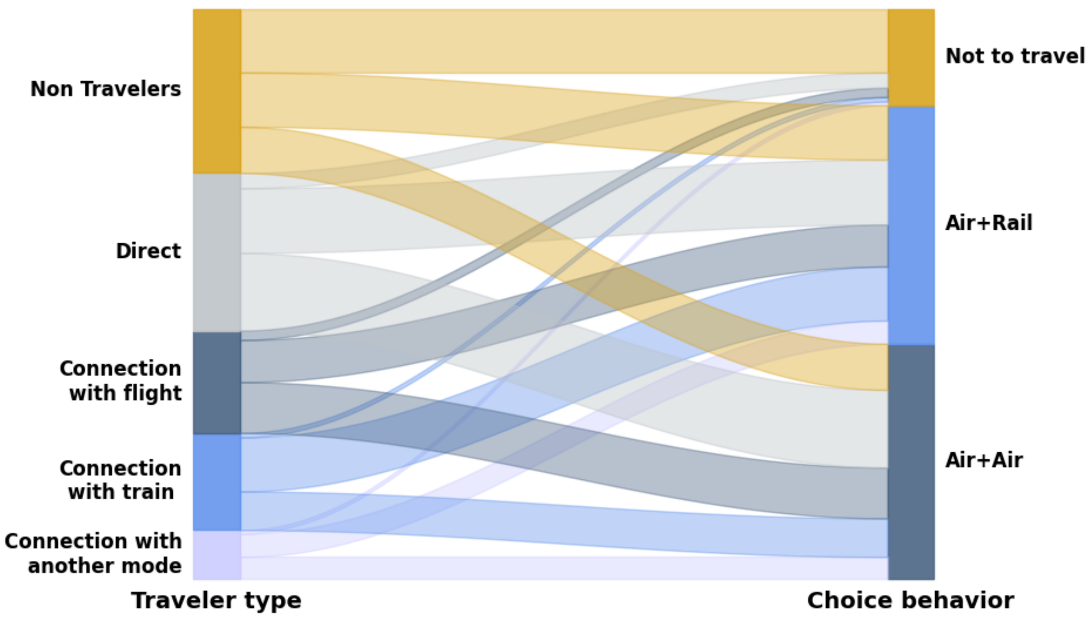


Figure 3.10: Diagram illustrating transition flows between past traveler types and final choices in the DCE.

Four main dynamics emerge from the analysis of flows:

- Non-travelers feed predominantly into the opt-out option (Not to travel), confirming the stability of their non-traveler status: even in an experimental setting, they tend to reproduce their abstention from mobility. However, non-travellers cannot be reduced to the 8.6% of absolute captives: a significant share of this group selects a travel alternative in certain scenarios, shifting toward Air+Rail and, more marginally, Air+Air. This suggests that part of this category is not structurally averse to travel but rather latent, but rather a potential demand reservoir under specific attribute configurations.

- Respondents experienced with direct travel ("No connection") and those accustomed to air connections ("Correspondence with flight") converge predominantly toward the Air+Air alternative. This result reflects a form of modal inertia: users familiar with all-air itineraries, whether direct flights or air connections, reproduce this pattern in their experimental choices. A non-negligible fraction of both groups nonetheless opts for Air+Rail, indicating a degree of permeability to rail when the proposed conditions are attractive.

- Respondents who have previously experienced a rail connection ("Correspondence with train") constitute the primary reservoir for the Air+Rail alternative, confirming the hypothesis of an experience or habit effect favorable to air-rail intermodality. Nevertheless, a substantial share of this group also shifts toward Air+Air, suggesting that prior familiarity with rail does not imply an exclusive preference: some of these respondents trade off between alternatives based on attributes, demonstrating behavioral elasticity.

- Respondents who have experienced a connection via another mode ("Correspondence with another mode") distribute themselves relatively evenly across the three alternatives, with no marked dominance. This diffuse distribution likely reflects the internal diversity of this residual category, whose behavior is not structured by a single modal habit.

A robust effect of modal experience.

The mode used during the reference trip seems to be related to the choice made in the DCE, supporting the introduction of experience or habit variables (modal inertia) in the specification of choice models.
This strong path dependency suggests that travelers frequently rely on habitual heuristics—using past behavior as a cognitive shortcut to simplify complex multi-attribute decisions. However, cross-flows, notably between "Correspondence with train" and Air+Air, or between "No correspondence" and Air+Rail, show that respondents are not locked into their previous mode and remain sensitive to the attributes of the proposed alternatives.
This flexibility legitimizes the conduct of the experiment itself for estimating willingness-to-pay values or intermodal elasticities.
Finally, the strong persistence of the "Non Travelers" to "Outside" flow calls for cautious treatment of this sub-population in the modeling stage, distinguishing between structural non-travelers and latent travelers.

The overall DCE split is as follows **Not-to-travel 14.7 %, Air+Air 42.4 %, Air+Rail 42.9 %**—a striking statistical tie between the two intermodal alternatives (see table 3.1).

Past-mode loyalty is weaker than one might assume

The matrix exposes a relatively low level of behavioural lock-in. Only one row exhibits a clear

Profile / Segment	Mainly Not to travel	Mainly Air+Air	Mainly Air+Rail	Total
Non Travelers	11.5 %	7.5 %	9.8 %	**28.8 %**
Correspondence with flight	1.0 %	9.7 %	7.2 %	**17.9 %**
Correspondence with train	0.3 %	6.3 %	10.4 %	**17.0 %**
Correspondence with another mode	0.4 %	3.5 %	4.7 %	**8.6 %**
Direct	1.5 %	15.4 %	10.8 %	**27.7 %**
Total	**14.7 %**	**42.4 %**	**42.9 %**	**100.0 %**

Table 3.1: Sample share by past-experience archetype and dominant DCE choice (%).

retention pattern: past **Correspondence with train** flows predominantly to *Mainly Air+Rail* (10.4 %) rather than to *Mainly Air+Air* (6.3 %)—a 62/38 split in favour of rail consistency. All other archetypes show much narrower preference gaps:

- Past **Correspondence with flight** splits roughly 57/43 between Air+Air (9.7 %) and Air+Rail (7.2 %)—air-experienced travellers are far from captive.
- Past **Direct** travellers form the largest single cell of the entire matrix at *Direct* × *Air+Air* (15.4 %), but a comparable 10.8 % migrate to Air+Rail—a 59/41 split that, given the volume involved, represents the single largest *absolute* pool of intermodal conversion candidates.
- Past **Non-Travellers**, who account for 17.9 % of the sample, distribute across the three options almost in proportion to their column totals (11.5 % / 7.5 % / 9.8 %), with a mild over-representation in *Air+Rail*—indicating that non-travel is not a stable identity and that latent demand exists for both intermodal products.

The Air+Rail receptive population is much broader than the rail-experienced segment Aggregating across rows, the Air+Rail column captures 42.9 % of the sample, of which only 10.4 pp come from rail-loyal respondents. The remaining 32.5 pp originate from *Direct* (10.8 pp), *Non-Travellers* (9.8 pp), *Correspondence with flight* (7.2 pp) and *Correspondence with another mode* (4.7 pp). The intermodal product is therefore **not a niche addressed to past rail users**: it is, at the survey horizon, a mainstream alternative recruiting conversions and activations from every other behavioural background.

3.4.2 The Psychological Signatures of Modal Shifts

Psychological signatures inside the cells

We now aggregate in Figure 3.11 the three layers of information that the report has so far considered separately: past travel experience (rows; five mutually exclusive archetypes), dominant DCE choice (columns; *Mainly Not to travel*, *Mainly Air+Air*, *Mainly Air+Rail*), and the within-cell psychological signature on the four behavioural factors (Complexity, Control, Environment, Social Norms, encoded on a red–to–green five-step scale). Each cell percentage represents the share of the *total* sample falling in that (past × stated) combination. Hence, the cells aggregate to 100 % and the column totals reveal the overall DCE split mentioned before.

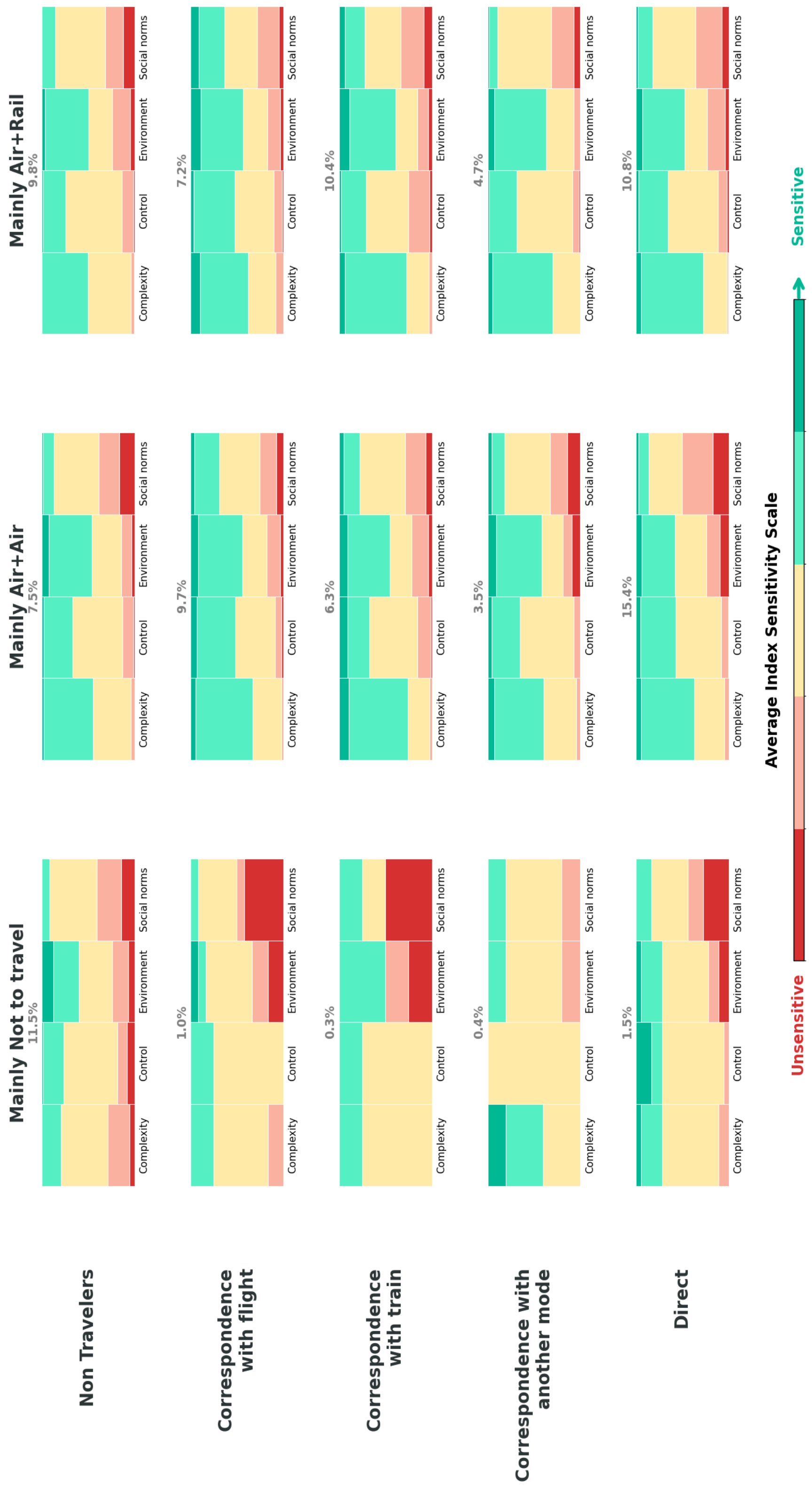


Figure 3.11: Cross-matrix of past experience, dominant DCE choice and psychological signature.

The within-cell mini-bars provide the interpretive layer. Three patterns recur with sufficient regularity to be commented on:

- *Complexity and Control are uniformly skewed toward sensitivity (green) in every cell, including the Not-to-travel column.* These factors discriminate *between travellers and non-travellers*, but they do not discriminate between Air+Air and Air+Rail. They are constants, not levers.
- *Environmental sensitivity is the strongest within-row differentiator.* Comparing the Air+Air and Air+Rail cells inside each row, the Air+Rail column shows a systematically greener Environment bar. The contrast is the most pronounced between *Direct* × *Air+Rail* vs. *Direct* × *Air+Air* (the largest pair of cells), and for *Correspondence with flight* × *Air+Rail* vs. *Air+Air*—air-experienced respondents who select Air+Rail are visibly more environmentally sensitive than their Air+Air counterparts.
- *Social Norms separate the Not-to-travel column from the rest.* The *Correspondence with flight* × *Not-to-travel* (1.0 %) and *Correspondence with train* × *Not-to-travel* (0.3 %) cells display dominant red on Social Norms, suggesting an active norm-driven rejection of travel by a small but ideologically distinct minority of past travellers—a different mechanism from the resignation pattern that characterises the *Non-Travellers* × *Not-to-travel* cell, which is dominated by economic and demographic constraints.

Main take-away

The three-way cross-matrix delivers the single most actionable analysis of the survey: **Air+Rail is not an option intended for loyal rail travelers, but a market-wide conversion product whose psychological signature is its pro-environmental dimension.** Three findings support this claim:

- Past-mode loyalty is structurally weak: among effective travelers, the Air+Air vs. Air+Rail margins are 59/41 (Direct), 57/43 (Flight), and 38/62 (Train)—i.e., only the rail-experienced sub-segment behaves like a captive base. The other 64 % of past travelers are persuadable.
- The Air+Rail column draws 32.5 percentage points of its 42.9% of total respondents from non-rail backgrounds (Direct, Flight, Other, Non-Travellers). Conversion volume exceeds retention volume by a factor of three. The largest absolute pool of conversion candidates is past Direct travellers (10.8 % of the sample).
- Within each row, the Environment factor is the only psychological dimension that systematically discriminates Air+Air from Air+Rail. Complexity and Control are uniformly high among all travellers and do not differentiate between the two intermodal products. Social Norms differentiate Not-to-travel from the rest, but not Air+Air from Air+Rail.

Industry implication. The decisive lever for Air+Rail market expansion is not infrastructure familiarity, demographic targeting, or simplification of the rail experience per se-it is the credibility and salience of the *environmental proposition* attached to the intermodal product. Promoting Air+Rail to past Direct and past Flight travellers on environmental grounds reaches a larger and more elastic pool than reinforcing it among rail loyalists.

3.4.3 The Environmental Paradox: Stated Sensitivity vs. Concrete Action

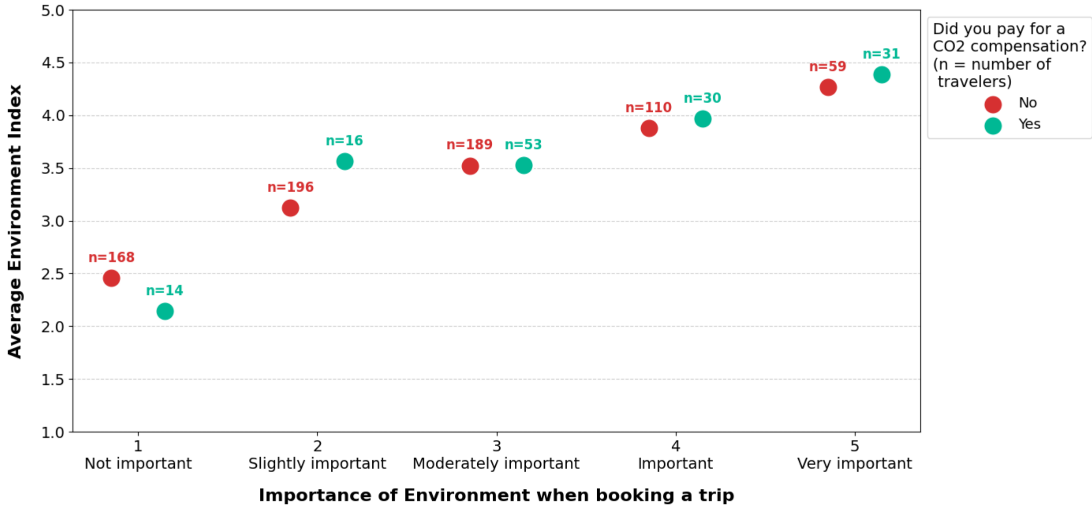


Figure 3.12: Correlation between the average environmental index, the importance of the environment as reported at the time of booking, and the actual payment of a CO_2 offset.

The analysis of Figure 3.12 reveals a degree of consistency between respondents' psychological profile and their concrete actions. First, a positive correlation is observed between the importance attributed to environmental concerns at the time of booking and respondents' average psychological environmental index.

Second, the share of travelers willing to pay a carbon offset increases proportionally with the stated importance of environmental considerations during booking: it rises from a negligible minority among those who consider the issue unimportant (14 payers versus 168 non-payers) to a substantially larger proportion among those who rate it as "very important" (31 payers versus 59 non-payers).

Although the maximum adoption rate peaks at around one third (approximately 34%), which may be considered low in absolute terms, this progression confirms a logical alignment between environmental sensitivity, in-trip behavior, and the use of carbon offsetting - even if the latter remains broadly underutilized across the panel as a whole.

3.5 Cross-Country Comparison of Mobility Behaviors

Overall, the five countries considered (Germany, Spain, France, Italy, and the United Kingdom) exhibit broadly similar psychological profiles and travel intentions. The data nevertheless reveal some pronounced national specificities, in particular with respect to market access and environmental trade-offs.

3.5.1 Discrete Choice Experiment (DCE) and Market Access

The *"Not-to-travel"* option chosen systematically across all DCE scenarios measures a lack of willingness to engage with the market we have defined. Cross-referencing this stated inertia with revealed abstention (the percentage of respondents who have not traveled in the past two years) provides a nuanced metric of national mobility dynamism (Table 3.2).

Three distinct country profiles emerge from this cross-analysis:

Table 3.2: Stated inertia (DCE) versus actual market abstention, by country.

Country	Systematic Not to travel	Revealed abstention rate
Germany	9.4 %	28.2 %
Spain	**3.0 %**	24.6 %
France	**12.7 %**	**38.5 %**
Italy	8.7 %	29.1 %
United Kingdom	6.0 %	**17.9 %**

- **France** exhibits the highest inertia across both metrics, recording the highest voluntary exclusion in the DCE (12.7 %) alongside the highest revealed abstention rate (38.5 %). Despite the structural gap between stated intentions and actual behaviors, a clear internal consistency remains: some French respondents express a strong reluctance to travel in the DCE and, in practice, seem to travel significantly less than their European counterparts.
- **The United Kingdom** displays high market engagement; while 6.0 % of British participants systematically opt out in the DCE, the country registers the lowest revealed abstention rate (17.9 %). This nearly 20-percentage-points gap with France points to a highly dynamic, potentially more accessible or structurally segmented long-distance travel market in the UK.
- As for **Spain**, it highlights a substantial intention-behavior gap: while hosting the lowest proportion of systematic non-travelers in the choice experiment (3.0 %), nearly a quarter of its population (24.6 %) remained entirely outside the actual travel market over the last two years.

3.5.2 Travel Activity and Multimodal Habits

The analysis of multimodality reveals major structural disparities. Beyond the overall volume, it is the balance between rail and other modes (coach, car-sharing, etc.) that defines national specificities.

Table 3.3: Multimodal mobility rate over the past two years

Country	Total multimodal (%)	Train (%)	Other (%)
Germany	22.4%	20.1%	**2.3%**
Spain	22.6%	13.1%	9.5%
France	**21.7%**	**12.4%**	9.3%
Italy	28.0%	16.3%	11.7%
United Kingdom	**37.3%**	**24.4%**	**12.9%**

Three typical profiles can be distinguished from these data:

- The **United Kingdom** tops the ranking with 37.3% multimodal practices. It exhibits not only the highest reliance on rail but also a strong complementarity with other transport modes.
- Although **Germany** posts a respectable overall score (22.4%), its structure is the most unbalanced. It rests almost exclusively on rail (20.1%), with virtually no reliance on other forms of multimodality (2.3%), the lowest in the panel.

- **France** closes the ranking in terms of overall practice (21.7%). Although its mix between rail and "other modes" is balanced (similar to Spain), the total volume of combined trips remains the lowest of the countries studied, echoing the more restricted market access rate observed above.

Italy stands out as a solid runner-up, driven by substantial diversification (11.7% for non-rail modes), which suggests a particularly efficient or heavily used intermodal network (coach/rail).

3.5.3 CO_2 Offsetting and the Environmental Paradox

While stated environmental sensitivity is homogeneous across Europe (whether captured through the psychological-profile items or through the importance attached to environmental criteria in trip choice), the translation into actual financial behaviour (*willingness to pay* for carbon offsetting) varies between Northern and Southern European countries (Table 3.4).

Table 3.4: CO_2 offsetting practices, by country.

Country	Take-up rate (%)	Average cost (% of ticket price)
Germany	17.3 %	10.2 %
Spain	13.3 %	10.8 %
France	**20.7 %**	7.8 %
Italy	**12.9 %**	**13.8 %**
United Kingdom	17.0 %	**8.1 %**

France leads the ranking, with nearly one traveller in five willing to offset their CO_2 emissions. Italy and Spain exhibit a more pronounced "green gap" (the discrepancy between stated intention and effective action): although the populations declare themselves concerned about the environment, the actual take-up rate is the lowest, despite an average cost per ticket that is paradoxically higher.

Chapter 4

Conclusion: What Industry Should Take Away

The evidence assembled in this report converges on a single diagnosis: European intermodal demand is real, structurally significant and currently constrained less by traveller preferences than by the architecture of the travel product itself. The revealed-preference baseline drawn from ENPA and the European discrete-choice survey deliver mutually consistent signals. Five operational take-aways follow, in direct correspondence with the five findings highlighted in the Executive Summary.

1. Multimodality is the dominant pattern among active European travellers. Three in five Europeans who travelled over the past two years report at least one correspondence; ground-based connections (rail and other non-air modes, 25.6 %) outweigh flight correspondences (17.9 %) as the structural connecting infrastructure of European mobility, while rail and flight are now statistically tied as single connecting modes (17.0 % versus 17.9 %). The discrete-choice experiment confirms the strategic relevance of the intermodal product: Air–Rail (42.9 %) and Air–Air (42.4 %) are deadlocked, with the not-to-travel option retaining only 14.7 %. Industry capacity planning should treat the rail leg as part of the relevant production frontier rather than as an external constraint, and intermodal products should be designed for the mass market rather than for a rail-oriented niche.

2. Is Demographic the right lever? Socio-economic profile predicts *whether* respondents enter the travel market, not systematically *which* mode they pick once they do. The non-travelers share moves from 22 % (25–34) to 38 % (65+), from 18 % (postgraduate) to 52 % (primary education), and from 7–8 % (> 75 k) to 55 % (< 10 k)—an income spread of 48 points. By contrast, the Air–Air/Air–Rail modal split remains remarkably stable across every socio-demographic dimension (Air–Air 35–47 %, Air–Rail 36–46 %, with gaps rarely exceeding three percentage points within any group). Communicating intermodal products predominantly to the affluent or the educated will therefore not move the needle. The levers that empirically shift the modal split are service-design choices that reduce perceived complexity, protect the traveller against connection risk and preserve optionality at every step of the journey.

3. Air–Rail is a market-wide conversion product, not a niche for rail-experienced travellers. Of the 42.9 % of the sample gravitating towards Air–Rail in the discrete-choice experiment, only 10.4 percentage points originate from past rail-correspondence users; the remaining 32.5 pp come from past direct travellers (10.8 pp), non-travellers (9.8 pp), past flight-correspondence users (7.2 pp) and other modes (4.7 pp). Conversion volume therefore exceeds retention volume by a factor of three, past-mode loyalty is structurally weak (**76 %** of past travellers are persuadable across modal categories), and the single largest absolute pool of conversion candidates is the past-direct-traveller segment. The most decisive discriminant between Air–Air and Air–Rail choices within each past-experience archetype is the environmental signature of the respondent—not the familiarity with rail infrastructure per se—which directly motivates the next take-away.

4. Climate framing alone does not scale: the bottleneck is the architecture of the choice. Environmental consciousness is concentrated in younger, more educated and higher-income segments, and even among the most engaged respondents the take-up of voluntary CO_2 compensation plateaus at about one third (34 % among those rating environmental concern as "very important"), against 7–8 % at the bottom of the scale. The value–action gap is therefore a structural feature of environmental decision-making, not a measurement artefact. The behavioural friction lies in the architecture of the choice, not in preferences: embedding the climate value into default product configurations is more likely to scale than relying on opt-in surcharges. The non-traveller segment confirms the same logic at the extensive margin: 28.8 % of European respondents report no trip over the past two years, yet only **8.6 %** systematically refuse to travel in every hypothetical scenario of the discrete-choice experiment—meaning that roughly two thirds of self-declared non-travellers reveal a latent demand under favourable attribute configurations, and that latent demand is structurally biased towards Air–Rail (57/43) rather than Air–Air. Product bundles that simplify the booking experience, contractually protect connections and embed the environmental value at the point of sale can therefore convert a meaningful share of this latent reservoir into intermodal demand.

5. A single European strategy will under-perform. The cross-country analysis refutes the assumption of a homogeneous "European traveller". The United Kingdom combines high market access (82.1 %) with the highest multimodality rate in the panel (37.3 %) and a balanced rail / non-rail correspondence mix, defining a mature intermodal market. France combines the highest voluntary exclusion (12.7 %) with the lowest effective access rate (61.5 %), pointing to a structurally segmented long-distance market. Spain exhibits the largest latent growth potential, with only 3.0 % systematic refusal on top of a 75.4 % access rate. Germany shows a respectable headline multimodality figure (22.4 %) that masks a near-monomodal rail dependence (20.1 % rail vs. 2.3 % other modes). Italy emerges as a solid runner-up driven byexceptional diversification beyond rail (28.0 % multimodality, 11.7 % non-rail correspondences). Industry strategy must be calibrated to each profile—mature intermodal markets, under-served markets with high latent demand, and structurally constrained markets whose limitations differ in nature—rather than to a single European archetype.

Next steps. The TRAVEL Chair is currently extending the empirical base along two axes. The European panel will be enlarged in the next survey wave to sharpen the geographic and socio-economic breakdowns, and to deepen the country-level analyses sketched above. In parallel, a controlled laboratory experiment grounded in behavioural and experimental economics will isolate the causal effect of specific service-design features—protected connections, compensation schemes, productive use of travel time, default-embedded environmental value—on the willingness to adopt Air–Rail itineraries. The findings will be released in successive technical reports as analyses mature.

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