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# Pricing for sustainability: Analysing the demand-side steering effect of a flight ticket levy in Switzerland.

A choice-based conjoint analysis.

**Nico Egli**
Etzbergstrasse 31k
8405 Winterthur
Switzerland
+41 76 409 41 40
egli.nico@gmail.com

**Dr. Andreas Wittmer**
Center for Aviation Competence (CFAC-HSG)
University of St. Gallen
Dufourstrasse 40a
9000 St. Gallen
Switzerland
+41 - 71 224 25 25
andreas.wittmer@unsig.ch

In June 2020, a majority of the Swiss parliament voted in favour of the introduction of a flight ticket levy as a part of a revision of the federal law on greenhouse gas emissions ($CO_2$ law). The aim of this incentive tax was to reduce the demand for flights in Switzerland and thereby the $CO_2$ emissions generated by the commercial aviation sector. However, there is controversy as to the effectiveness of this measure, as critics have often argued that travellers would circumvent it by using foreign departure airports and thus generate more $CO_2$ emissions than before. Given that no research has considered the interaction between a flight ticket levy and such evasive behaviour in Switzerland, this paper addresses this research gap. Through a choice-based conjoint analysis, this paper examines the effect of the flight ticket levy on Swiss citizens' airport choice behaviour for short-haul economy class flights. The results indicate that introducing a flight ticket levy would only impact the choice of departure airport if it were to significantly exceed the planned level of CHF 30 in the short-haul context. Additionally, the paper demonstrates that only a small number of Swiss passengers are likely to avoid the levy by using foreign airports. A flight ticket levy of CHF 120 in the context of this study would lead to a decrease in travelling passengers rather than to environmentally harmful evasive behaviour.

**KEYWORDS**: Sustainability, Aviation, Flight Ticket Levy, Airport Choice, Switzerland

**CLASSIFICATION**: XYZ

# 1 Introduction

"CO2 law: The flight ticket levy misses the mark." (Schöchli, 2021)

The above headline of an article published in the *Neue Zürcher Zeitung* on 17 May 2021 clearly suggests that the planned flight ticket levy in Switzerland is doomed to fail. This is just one of many voices making themselves heard in the mobilisation against the federal law on greenhouse gas emissions ($CO_2$ law) in Switzerland. Among them is Switzerland's national airline, Swiss. The airline states that Switzerland acting alone concerning the regulation of airline tickets makes neither ecological nor economic sense (Würgler, 2020). Their voices were heard, and the law was clearly rejected by the electorate in summer 2021. Nevertheless, many politicians and scholars still view an incentive tax on airline tickets as a practical and necessary means of counteracting the increase in $CO_2$ emissions caused by aviation.

The current scientific literature reveals that despite a global pandemic, no natural decline in air travel is to be expected in the medium or long term (Araghi et al., 2014, p. 42; Fahey & Lee, 2016, p. 104). Global demand for air travel is growing so rapidly that technological advances can only compensate for a fraction of the additional greenhouse gas (GHG) emissions generated by aviation (Markham et al., 2018, p. 206). In Switzerland, aviation even accounts for 13.5% of annual nationwide $CO_2$ emissions and 11% of the total GHG emissions, making it the second largest source of GHG emissions in Switzerland after land transport (Brülhart et al., 2020, p. 2; Neu, 2021, p. 4). These figures are more than five times the international average (Teter, 2020). If Switzerland is to achieve its climate goal of zero net emissions by 2050 (Schweizerischer Bundesrat, 2019), action must be taken. This can be done via different policy approaches on an international or national level. At the international level, trading schemes such as the European Union's Emission Trading Scheme (EU ETS) and the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) are particularly popular. While Switzerland participates in these initiatives, these efforts do not seem to be sufficient to counteract the increase in emissions on a large scale. Moreover, the political inertia of international negotiations on such concepts leads to many compromises and untapped potential (Larsson et al., 2019, p. 788). Accordingly, it is up to individual states to become involved and make an independent contribution to the decarbonisation of air transport. Flight ticket levies and taxes are particularly popular as a unilateral policy instrument because they are both practically and politically easy to implement. Many EU states have already taken action to regulate the aviation industry in order to reduce emissions (European Commission, 2019, pp. 20–22). With the revision of the $CO_2$ law, Switzerland wanted to follow suit. Since the Swiss electorate rejected the $CO_2$ law, this initiative remains unsuccessful for the time being. However, with the steadily growing $CO_2$ emissions of Switzerland's commercial aviation industry (Bundesamt für Statistik, 2021a, p. 20), regulation of the industry will continue to be an important issue in the context of Swiss climate policy. Additionally, implementing appropriate measures at the state level is a complex undertaking. Aviation is known to be the most challenging industry when it comes to the translation of sustainability into regulation (Kantenbacher et al., 2018, p. 46). The reasons for this often lie in contradictory governmental environmental and economic goals and the limited number of sustainable alternatives to flying that offer similar benefits (Baumeister, 2019, p. 262; Kantenbacher et al., 2018, p. 46). Thus, a detailed data foundation on the effectiveness of different regulatory approaches will be of great importance for the legislator in order to be able to work out majority-supported solutions.

While the perception of the flight ticket levy was initially very positive, critics soon noted that travellers would circumvent it by using other, further away departure airports and thus generate more $CO_2$ emissions than before. While international studies have been conducted on the effectiveness of flight ticket taxes and levies, most of them are difficult to transfer to the Swiss context, as the air travel market is strongly influenced by regional characteristics (InterVISTAS Consulting Inc., 2007, p. III). Accordingly, this paper aims to contribute to the collection of initial data for the assessment of such a policy measure in Switzerland by addressing the interaction between a flight ticket levy and evasive consumer behavior in Switzerland.

To analyse the effectiveness of the Swiss flight ticket levy in the context of harmful avoidance behaviour, two aspects must be considered:

- Is the flight ticket levy, depending on its specific design, a key determinant in airport choice for Swiss passengers?
- If this is the case: How strong is the influence of a flight ticket levy on the airport choice decision?

To answer these research questions, a systematic literature review on the flight ticket levy as a policy instrument and on air travellers' choice of airports was conducted. In addition, a choice experiment was performed to gather empirical data with which to test the hypotheses. The resulting findings were analysed using statistical models.

# 2 Literature Review

## 2.1 Flight Ticket Levy

A flight ticket levy is a so-called *incentive tax*. The aim of such an incentive tax is to reduce the demand for flights and thereby the associated emissions. This intended steering effect and the associated environmental impact of a flight ticket levy depend mainly on the extent to which the flight ticket price can be manipulated, as this price change should subsequently induce a change in demand (Wild et al., 2021, p. 3). The design of the levy plays a central role in determining how strongly the measure influences the price. The price effect that the end consumer then actually perceives leads to a change in their behaviour and thus to a potential decline in demand. The strength of this effect depends on the price elasticity of demand[1] (Brülhart et al., 2020, p. 3). Finally, based on the effects described the impact on the environment occurs, which manifests itself in the reduction of $CO_2$ emissions.

In Switzerland, the incentive tax is levied on airline tickets for passengers who take a flight powered by fossil fuels. Transit passengers, children under the age of two years who do not need their own seat, and passengers who are responsible for air traffic safety are exempt from the levy. In addition, no levy is imposed on purely military and medical flights (Schweizerischer Bundesrat, 2021, p. 83). The airlines issuing the tickets are liable for the levy (Schweizerischer Bundesrat, 2021, p. 84). This can prevent the companies from passing on part of the tax to the customer, which often occurs, especially in competitive markets such as commercial air travel (Denstadli & Veisten, 2020, p. 1). As with the $CO_2$ levy for heating oil and gas, part of the revenue from the flight ticket levy is redistributed. At least 50% should be reimbursed via the national health insurance. In the process, each person in Switzerland would receive the same amount, which would have been approximately CHF 60 per person (Vonplon, 2021). The rest of the revenue flows into the climate fund, which promotes, among other goals, the development of synthetic, climate-friendly fuels. In addition, up to CHF 30 million is invested annually in the promotion of night trains, which offer direct competition to certain short-haul flights (Bundesamt für Umwelt, 2021). This distribution is intended to ensure that the levy is fair and socially structured. According to the basic study on the corresponding levy, approximately 60% of the Swiss population would have a positive refund balance insofar as only Swiss citizens would have to pay the levy (Bosshardt et al., 2020, p. 17). In principle, every person who does not fly within Europe more than once should receive money back (Schweizerischer Bundesrat, 2021, p. 58). However, it would have been reasonable to assume that foreigners would also have been subject to the levy for return flights from Switzerland. They would not receive any repayments via the health insurance fund. This would mean that the Swiss population would be reimbursed even more. In this scenario, according to Bosshardt et al. (2020, p. 5), approximately 90% of the population would have a net positive balance. In concrete terms, this means that Swiss citizens would not pay a surcharge even for two European flights per year (Vonplon, 2021). The amount of the levy is defined as between a

[1] For more information on the price elasticity of demand in the aviation sector see InterVISTAS Consulting Inc., 2007 and Seetaram et al., 2018.

minimum of CHF 30 and a maximum of CHF 120 depending on the class of transport and the travel distance (Keystone-SDA-ATS AG, 2020). However, the draft version of the law did not specify exactly how the levy should be designed; the draft only mentions that it must be applied in such a way that it leads to the desired effect on demand (Schweizerischer Bundesrat, 2021, p. 84).

## 2.2 Evasive Behaviour

Many critics have noted that the tax would not be able to generate the targeted effects in the first place because there are ways for consumers to circumvent it: Passengers could travel to nearby airports abroad or, for short-haul routes, use other modes of travel, such as a car or train, to make their journey. While the second option might be desirable in some cases, the second option could lead to greater $CO_2$ emissions for the same journey than would have been the case prior to the introduction of the levy (Enz, 2019; Keystone-SDA-ATS AG, 2020; Schöchli, 2021; von Ledebur, 2021). The reason for this emission surplus is additional emissions which are generated by traveling to a more distant departure airport, while especially in the short-haul context, emissions for a minimally shorter flight remain nearly identical. This is due to the higher emission density per kilometre flown of short-haul flights which caused by the energy-intensive take-off and landing phases, which account for a larger part of the total flight emission on short-haul routes, as well as the generally lower load factor (Baumeister, 2019, p. 262). Additionally, Dällenbach (2020, p. 14) indicates that most air travellers do not consider a train as a valid alternative to an aircraft. Accordingly, it can be assumed that it is not included in their decision-making process. The choice of alternative airports is thus particularly relevant as a substitute for avoidance behaviour and is therefore the focus of this paper, looking specifically at short-haul flights where the relative negative effects of avoidance behaviour are greatest.

## 2.3 Determinants of Airport Choice

To understand whether travellers would choose a different departure airport to avoid the levy, the factors that influence airport choice behaviour must be understood. Due to the complexity and multitude of factors influencing decision-making processes (Wittmer & Daum, 2016, p. 43), the focus of this section is on the criteria most frequently discussed in the literature.

### 2.3.1 Access Time

Access time refers to the travel time required to reach the departure airport and is one of the most frequently used determinants in studies on airport choice. Almost without exception, studies suggest that travellers clearly prioritise those airports that are geographically closest to them in their decision-making processes (Blackstone et al., 2006; Hess et al., 2007; Hess & Polak, 2005, 2006; Loo, 2008; Paliska et al., 2016). In other words, access time shows a significant negative effect on the probability that an airport will be selected in the decision-making process in different models (Zijlstra, 2020, p. 2). This observation supports the paper of various scholars that airports have a regional monopoly (Paliska et al., 2016, p. 143; Zijlstra, 2020, p. 7). A potential reason for the great relevance of travel time for many passengers is that the means of transport available in the countryside are usually considerably slower than flying (Zijlstra, 2020, p. 2), and travel time is a central value driver for air travellers (Dällenbach, 2020, p. 7). Additionally, a monopoly position can also be reinforced by national borders. Zijlstra (2020, pp. 7–8) found that most travellers clearly prefer airports in the country they live in to foreign airports. Paliska et al. (2016, p. 143) also supports the existence of this effect, which is also called the border effect.

### 2.3.2 Flight Frequency

Flight frequency is also discussed in many airport choice studies; it refers to the frequency of flight connections for a specific origin–destination pair during a specific time period. In contrast to access time, flight frequency is usually associated with a positive effect on the probability of an airport being selected (Zijlstra, 2020, p. 3, 2020, p. 7). This means that as the frequency of departures from an airport increases, that airport becomes more

attractive to a traveller. This result is supported by Loo (2008, p. 123), who found weekly flight frequency to be the second most important factor influencing the choice of departure airport after access time. Marcucci and Gatta (2011, p. 77) and Hess and Polak (2005, p. 63) also obtained comparable findings using their models. In contrast, Palsika et al. (2016, p. 148) found a lower relevance of flight frequency, while favourable departure times emerged as an important factor. The reason for this deviation from the other studies could be that the attributes of flight frequency and favourable departure times partly overlap in that a high flight frequency is often associated with more preferable potential departure times in studies that do not separate these two aspects. In the case of flight frequency, it is also generally important to consider how the attribute is defined in the specific context of a study. In the research conducted by Hess and Polak (2005, p. 63), for example, flight frequency was not presented as a separate attribute but was instead reflected in the relative frequency with which flight offers at an airport were represented in the data and in the reliability of alternative flight options in the event of flight cancellations. These two aspects also explain why flight frequency is associated with positive benefits for travellers in most studies. A higher flight frequency from one destination to another leads to greater flexibility for travellers. This means that it is possible to optimise one's flight schedule or to switch to other flights in the event of cancellations (Zijlstra, 2020, p. 3).

### 2.3.3 Airfare

Especially in the context of stated choice studies, air ticket price is often included among the important factors influencing airport choice. However, study results in this regard are slightly more mixed than is the case with access time and flight frequency. For example, Hess et al. (2007, p. 227), Loo (2008, p. 121) and Hess and Polak (2005, p. 64) found that higher airfare has a significant negative effect on a departure airport option. In contrast, Blackstone et al. (2006, p. 323) found that many travellers indicated that airfare plays an important role in their choice behaviour. However, when examining traveller's actual decisions regarding airport choice, low airfares had little influence. Paliska et al. (2016) present similar insights: In their survey, leisure travellers indicated ticket price second most often as the most important attribute affecting their travel decisions. However, an evaluation of the actual decisions made by travellers only showed a significant effect of airfare for the low-income group and visiting leisure travellers (Paliska et al., 2016, pp. 149–152). Hess and Polak (2006, p. 556) came to a similar conclusion. The reason for these mixed results could be that many studies that analyse historical data include prices in aggregated form, whereas, in reality, these vary greatly (Cserep et al., 2018, p. 30). In addition, it is possible that people find different price options due to different search behaviour, such as on the internet, and therefore do not have a complete overview of all price options. This would lead to the fact that in the modelling of the data, not all options considered in a study are actually included in the participants' decision sets (Zijlstra, 2020, p. 3). Overall, the literature suggests that there is a discrepancy between attitude and behaviour concerning the relevance of airfare in travel decisions: Travellers state that they prefer the cheapest flight when asked but do not act accordingly when making their actual decisions (Zijlstra, 2020, p. 3).

### 2.3.4 Flight Ticket Levy

This paper investigates the influence of the flight ticket levy on airport choice. There are currently no studies investigating this specific relationship. Nevertheless, there are indications in the literature as to what this relationship might look like.

As described in the previous section, the flight ticket levy should create a steering effect based on the price effect triggered by the increase in the ticket price. Accordingly, the levy could be considered as part of the airfare. Thus, the effect of the levy on decision-making behaviour would be congruent with that of the airfare. This thesis is supported by the results of the study by Denstadli and Veisten (2020, p. 10), which showed that the willingness to pay a mandatory tax or levy in addition to the ticket price reflects the total willingness to pay for the product. This finding indicates that a person is only willing to pay a certain price for an airline ticket regardless of whether the price includes a flight ticket levy. Araghi et al. (2014, p. 45) found comparable results showing that a higher collective emissions offset increases price sensitivity regarding an increased airfare.

In contrast, a study by Sonnenschein and Smedby (2019, p. 655) indicates greater willingness to pay for a flight ticket levy. The study results suggest that passengers are willing to pay a premium on existing fares for the levy, especially if the levy is directly associated with emission offsets. Additionally, this willingness to pay is found to be higher for mandatory levies than for voluntary measures (Seetaram et al., 2018, p. 91; Sonnenschein & Smedby, 2019, p. 652). Regarding airport choice, these results indicate that the flight ticket levy differs from the pure ticket price in the strength of its impact on decision-making behaviour. Nevertheless, it can be assumed that the direction of the effect remains the same as with the airfare – that is, with an increasing flight ticket levy, the utility for a decision option decreases.

As mentioned at the beginning of this section, the exact influence of a levy on the departure airport decision has not yet been concretely investigated. Accordingly, only assumptions can be made as to whether the described differences would also appear in a real decision-making situation. In addition, whether a consumer has an overview of the share of the price charged for the flight ticket levy would be a decisive factor when making a purchase decision. Furthermore, the design could also play a role in relation to a consumer's willingness to pay the levy. For example, the willingness could be higher if the levy revenues support more specific projects as opposed to generating unspecific revenue for the state (Seetaram et al., 2018, p. 91).

### 2.3.5 Individual Factors

The impact of the attributes in the previous section depends in turn on various individual traveller factors.

*Reason for Travelling*

In most studies, a distinction is made between business and leisure travel. For example, differences between business and leisure travellers have been found in the strength of the effect of access time. Although access time has a significant influence on both groups, business travellers place more weight on this factor when making a decision (Hess et al., 2007, p. 227; Paliska et al., 2016, p. 148; Pels et al., 2003, p. 78). Willingness to pay to reduce travel time to an airport is significantly higher for business travellers (Hess et al., 2007, p. 231). Seventy percent of business travellers only consider the nearest airports for their trips because this group also largely consists of people who fly quite often and are usually more strongly connected to their "home airport" (Paliska et al., 2016, p. 147). In addition, they are often members of frequent flyer programmes. Hess et al. (2007, p. 228) were able to establish a connection between a frequent flyer programme membership and the evaluation of flight options. Frequent flyers were found to have a stronger negative attitude towards flight-related regulations (Kantenbacher et al., 2018, p. 46). Their willingness to pay a flight ticket levy is accordingly lower (Sonnenschein & Smedby, 2019, p. 658), indicating that they react more strongly to changes in the amount of the flight ticket levy than people who fly less frequently do.

*Income*

Current research also recognises income as a relevant factor. People with higher incomes rate longer access times more negatively (Marcucci & Gatta, 2011, p. 82) and are less sensitive to travel costs in general (Hess & Polak, 2006, p. 553). Accordingly, they also demonstrate a higher willingness to pay a flight ticket levy (Denstadli & Veisten, 2020, p. 7; Kantenbacher et al., 2018, p. 49; Sonnenschein & Smedby, 2019, p. 657). This leads to the conclusion that monetary costs weigh less in wealthy air travellers' decision-making process.

*Sense of Responsibility*

Specifically in relation to the flight ticket levy, one study demonstrated that willingness to pay is particularly high among people who have a strong sense of responsibility towards the environment (Sonnenschein & Smedby, 2019, p. 658). Such individuals might react less strongly to changes in the level of the flight ticket levy.

## 2.4 Hypotheses

The following hypotheses address the research questions based on the theoretical foundation developed in the previous section.

The aim of the flight ticket levy is to reduce the volume of flights. This is achieved by means of the price effect, which generates a demand-reducing effect. Accordingly, it can be assumed that airline passengers prefer those travel options for which they do not have to pay a levy or for which they must pay a lower levy.

- H1a: The utility of a choice alternative regarding a short-haul trip decreases significantly with an increased flight ticket levy.

The analysis of relevant literature indicates that three main factors directly influence airport choice. Access time represents timewise costs for the passenger. Therefore, it can be assumed that travellers want to avoid long access times.

- H1b: The utility of a choice alternative regarding a short-haul trip decreases significantly with increased airport access time.

Flight costs are the direct monetary costs associated with air travel. Since flights normally exhibit a negative price elasticity of demand, it can be assumed that as costs increase, the demand for a choice alternative decreases.

- H1c: The utility of a choice alternative regarding a short-haul trip decreases significantly with increased airfare.

Flight frequency represents the availability of more options for passengers. With more options the desirability of an airport increases because a greater range of alternatives for optimising one's flight schedule or in the event of delays are available. Therefore, this attribute is expected to have a positive effect on utility.

- H1d: The utility of a choice alternative regarding a short-haul trip increases significantly with increased flight frequency.

With regard to the relationship among the various main effects, hypotheses can also be derived based on the existing literature. It can be assumed that airfare is more important than flight ticket levy for the consumer decision since it has a higher monetary value and there is an additional willingness to pay the levy.

- H2a: On average, the flight ticket levy is less important than the airfare for the choice of airport in the short-haul context.

Second, the literature suggests that travel time is the most important attribute in the departure airport decision.

- H2b: On average, the flight ticket levy is less important than the access time for the choice of airport in the short-haul context.

Considering the individual factors influencing the impact of the decision attributes, flight behaviour plays an important role. For example, frequent flyers have a stronger aversion to flight regulation and accordingly demonstrate a lower willingness to pay for flight ticket levies. Therefore, frequent flyers can be expected to react more strongly to changes in the level of the flight ticket levy.

- H3a: More flights per year leads to a stronger negative reaction on the utility of a choice alternative when increasing the flight ticket levy.

People with higher incomes are less price sensitive. Accordingly, it can be assumed that they react less strongly to changes in monetary costs.

- H3b: Higher annual household income leads to a weaker negative reaction on the utility of a choice alternative when increasing the flight ticket levy.

Finally, people who are more environmentally conscious tend to have a higher willingness to pay airline ticket levies. Therefore, they are likely to be less responsive to changes in the amount of the levy imposed on a flight.

- H3c: Higher environmental consciousness leads to a weaker negative reaction on the utility of a choice alternative when increasing the flight ticket levy.

# 3 Methodology

To make an empirical contribution to a better understanding of the airport choice behaviour of Swiss people in the context of a flight ticket levy a quantitative method of multivariate preference measurement is used, namely conjoint analysis (CA). This chapter describes the methodology behind this research process.

## 3.1 Conjoint Analysis

CA has gained considerable relevance in the airline industry in recent years, especially in analysing travellers' choice behaviour (Hergesell, 2017, p. 600; Zhou et al., 2020, p. 188). The reason for this increased use is the ability of the method to replicate realistic choice situations (Haaijer et al., 2001, p. 93). According to Backhaus (2018, p. 539), the choice-based conjoint analysis (CBCA) is the most commonly used variant of CA in practice (Sawtooth Software, 2017, p. 2). The use of a dichotomous narrow decision situations in CBCA has the advantage that it requires relatively low cognitive effort in the assessment due to an increased use of judgement heuristics (Backhaus et al., 2018, p. 576). Since consumers usually have to choose one option in purchase situations, the CBCA reflects market situations better than, for example, the traditional CA (Sawtooth Software, 2017, p. 2). Especially with a comparatively low number of considered attributes, CBCA produces particularly good results compared to other types of procedures (Sawtooth Software, 2017, p. 3). Since a flight ticket levy has not yet been introduced, there is no existing market data to conduct data analysis. Accordingly, the CA offers the possibility of collecting very realistic data on this hypothetical scenario. The specific choice of CBCA further enhances the realism and thus the practical validity of the data collected. However, the disadvantage of this method is that the dichotomous choice situations in the CBCA result in a higher loss of information than is the case for other types of CAs because the assessor cannot evaluate all alternatives individually (Backhaus et al., 2018, p. 577; Sawtooth Software, 2017, p. 3). This must be compensated for with a larger sample during data collection.

## 3.2 Attributes and Levels

The selection and definition of attributes and attribute levels are among the most critical steps in CBCA. If these are not chosen and defined well, the quality of the database can be limited, and even the most effective analysis procedure cannot compensate for these shortcomings (Rao, 2014, p. 43; Weiber & Mühlhaus, 2009, p. 44). Accordingly, it is important to consider several requirements when selecting relevant attributes and levels: Completeness (Backhaus et al., 2018, p. 502; Park & Ha, 2006, p. 98; Weiber & Mühlhaus, 2009, p. 47), independence (Rao, 2014, p. 44; Weiber & Mühlhaus, 2009, p. 45), realism (Rao, 2014, p. 44), compensatory effect (Weiber & Mühlhaus, 2009, p. 48), and limitedness (Backhaus et al., 2018, p. 502; Weiber & Mühlhaus, 2009, pp. 47–48).

The results of the literature review form the basis for defining the attributes. Three key factors influencing choice of airport were identified: access time, flight frequency, and airfare. Various studies have demonstrated the relevance of these attributes in the context of airport choice situations, which leads to the conclusion that they might also be relevant in Swiss travellers' decision-making. Additionally, the flight ticket levy is considered as an attribute to investigate its specific impact on the airport decision. The expected steering effect of the regulatory instrument suggests that it is also a preference-relevant attribute.

In order to define realistic and relevant attribute levels, a scenario must first be created. The context of the study is a short-haul economy class plane trip. Specifically, the starting point for the trip in Switzerland was defined as Zurich, which is the largest city in Switzerland and therefore well known by most people (Bundesamt für Statistik, 2021b). Berlin was defined as the destination because it is the second most flown route from Zurich Airport (ZRH; Flughafen Zürich AG, 2020, p. 5), meaning that it covers a route that many Swiss citizens have flown. Additionally, the distance from Zurich to Berlin corresponds to the distance used in the Swiss study by Brülhart et al. (2020, p. 5) as a reference value for short-haul flights. Based on these prerequisites, four specific airports were selected that could most closely correspond to a realistic airport choice situation for Swiss travellers and thus be the basis for defining the attribute levels. The aim was that they are roughly comparable in terms of service quality and size. In addition, domestic and foreign options should be balanced in the experiment, and the airport access time should not vary excessively. The following airports were chosen: ZRH and Basel Airport (BSL) in Switzerland, Munich Airport (MUC) and Stuttgart Airport (STU) in Germany. In particular, ZRH and MUC, as major hubs, and BSL and STU, as secondary airports, are comparable (ADV, 2021; EuroAirport, 2021; Flughafen München, 2021; Flughafen Zürich AG, 2021).

Based on the outlined scenario, four levels for each of the selected attributes were defined using actual market data for the four airports. Table 1 presents a summary of all attributes with their respective levels.

*Table 1: Choice-based conjoint analysis attributes and levels (own illustration).*

| **Attribute Description** | **Levels** | |
|---|---|---|
| Access Time | | |
| Rail and car travel times to the four airports were taken into account to define the access time levels since these are the most frequently used access modes in Switzerland (Bundesamt für Statistik, 2017, p. 67). Since travel times vary significantly by airport and access mode, the fastest travel time was chosen for each airport and rounded up or down to the nearest half hour, resulting in evenly spaced levels. To ensure realism with regard to the decision-making situation, the airport names are also linked to the different access times. | 30 min<br>1 h 30 min<br>2 h 30 min<br>3 h 30 min | ZRH<br>BSL<br>STR<br>MUC |
| Flight Frequency | | |
| The levels of the flight frequency attribute are based on the number of available departures from the corresponding airport to Berlin on the cut-off date of 17 July 2020. This date was selected to be approximately one month in the future based on the day of the level definition. One month is the usual booking interval for short-haul flights by private individuals (A4A, 2018). Specifically, BSL offered one, ZRH two, STR four, and MUC six flights on the chosen date. | 1<br>2<br>4<br>6 | BSL<br>ZRH<br>STR<br>MUC |
| Airfare | | |
| The airfares were also calculated based on the cut-off date and the four departure airports. In each case, average values of the ticket prices to Berlin on the corresponding date were calculated and rounded to the nearest CHF 50 so that the levels were evenly distributed. Only economy class flights with hand baggage but without seat reservation were considered. | CHF 150<br>CHF 200<br>CHF 250<br>CHF 300 | BSL<br>MUC<br>STR<br>ZRH |

| Flight Ticket Levy | |
|---|---|
| The attribute levels for flight ticket levy were defined based on the scenarios for short-haul flights in the economy class used in the Swiss baseline study by Brülhart et al. (2020). The use of these scenarios allows for linkages to existing research and thus for comparisons, which increase the diversity of possible uses of the results. Since scenarios one and two had the same levy value, they were not treated separately. However, a "no levy" option was added to investigate how the absence of a levy affects decision-making behaviour. | CHF 0 (no levy)<br>CHF 10<br>CHF 30<br>CHF 120 |

## 3.3 Study Design

The survey is structured in three parts. *First*, the participants had to answer screening questions as well as questions about their flight behaviour and environmental awareness. These questions served to segment the participants during the subsequent data analysis.

In the *second part*, the choice experiment was performed. For this study, the full-profile method was chosen because the study should represent the airport choice as realistically as possible. This means that several attributes have to be weighed simultaneously. In addition, the 256 possible variations of attributes and levels already mean the study is relatively complex, which is why a reduced design was chosen. Since interaction effects should also be evaluated, the randomised reduction method was used. In combination with the balanced overlap method, solid effect estimates should be possible for both the main and interaction effects. Each participant had to answer 11 choice tasks. Of these, nine were randomly generated, and two were predefined as holdout tasks which are configured according to the actual attribute levels per airport. In each choice task, a decision must be made between two alternatives described with attributes and the "no choice" option. The design was tested using the dedicated function within Lighthouse Studio. Standard errors were estimated for the parameters of less than 0.05, and almost identical frequencies were found for the attributes. This data indicates a solid CBCA design. Additionally, a pretest with 15 participants was performed to check the understanding of the questions. The participants' feedback was collected in a summary and implemented in the survey.

The *third part* contained a control question to ensure that the survey had been completed with sufficient attention as well as voluntarily questions about the participants demographic details. The entire survey was conducted online via Sawtooth Software servers.

## 3.4 Data Collection and Analysis

To perform a CBCA a discrete choice analysis is applied to a conjoint design (Balderjahn et al., 2021, p. 186). This statistical method is subject to certain preconditions: It assumes that the consumer's utility function with regard to individual product attributes can be inferred from a discrete decision and that consumers always choose the alternative that offers the highest relative utility value of the alternatives considered (Rao, 2014, p. 154). The utility value is described in each case by the addition of a deterministic and a stochastic random component (Balderjahn et al., 2021, p. 130; Rao, 2014, p. 154). The deterministic component can be explained with a utility model. In CBCA, an additive part-worth model is generally used to do so (Backhaus et al., 2018, p. 189; Balderjahn et al., 2021, p. 187; Klein, 2002, p. 18). The stochastic component is specified by means of a choice model which calculates the probability that a consumer will choose a specific alternative (Balderjahn et al., 2021, p. 188). In CBCA, a multinomial logit model (MNL) is typically used for this purpose (Backhaus et al., 2015, p. 191; Rao, 2014, p. 154). Since the stochastic component is unknown, the MNL assumes a random, independent, and uniform distribution of the values (Rao, 2014, p. 155). Additionally, a hierarchical Bayes (HB) analysis can be used to calculate estimates on an individual level (Backhaus et al., 2018, pp. 378–379; Rao, 2014, p. 154;

Sawtooth Software, 2017, p. 3). This allows heterogeneous selection preferences to be taken into account in the analysis (Backhaus et al., 2015, p. 216).

# 4 Empirical Results

## 4.1 Descriptive Results

Overall, 290 people finished the survey. After cleaning the dataset, a total of 202 valid participants remained. Based on the Sawtooth Software guideline for minimum sample size calculation as well as the Sawtooth Software Sample Size Calculator which is based on the underlying total population[2] considered (Bock, 2019; Sawtooth Software, n.d.) the sample size for this study should be at least between 149 and 385 participants. Thus, a sample of 202 participants allowed for a good representation of the Swiss travellers. The study was launched on 3 June 2021 and disseminated for a fortnight via e-mail, social media, or word-of-mouth in the author's environment, at the University of St. Gallen, and in various online forums.

Of the 202 respondents, 50.5% were male and 49% were female. As expected, due to the convenience sampling method, the participants are rather young and well educated: 79% of the participants are between 18 and 30 years old, with a total range from 18 to 70 years; 78.3% have a bachelor's or master's degree. In terms of income, 52% earn between CHF 0 and 5,000 per month, 31.3% between CHF 5,000 and 10,000, and 16.7% over CHF 10,000. For the majority of the respondents, air travel is the first choice as a means of transport for leisure trips of several days within Europe, whereas trains and cars are only of secondary importance. Other modes of travel, such as buses, play no relevant role at all. Holidays are by far the most important travel reason, as indicated by 86.1% of the respondents. In terms of the order of relevance, these data correspond to the state survey on transport behaviour in Switzerland (Bundesamt für Statistik, 2017, p. 66). The travel behaviour of the sample is thus comparable with the Swiss average in terms of mode choice and reasons for travel. However, differences were found in the frequency of flights. The majority of respondents (39.1%) stated that they usually take two to three flights (outbound and return) per year. This result is significantly higher than the Swiss average of 0.83 annual flights per person (Bundesamt für Statistik, 2017, p. 66). This difference could be due to the respondents' high level of education and the associated (expected) higher income.

## 4.2 Statistical Results

Before analysing the specific part-worth values, the model quality was evaluated. A chi-square test was used to examine the model quality. The present model has a chi-square value of 1560.14428 and 13 degrees of freedom. Thus, the chi-square is already significant at a 0.01 level with a value of 27.688. Therefore, the critical value is exceeded, and the model shown to be highly significant. This result indicates that the model used is appropriate for estimating the utility parameters. Furthermore, the RLH value for the HB estimate is 0.807. The minimum value is 0.33 with two choice alternatives and one "none" option. The present RLH value thus exceeds the minimum value by more than double. Therefore, the model reflects the data relatively well. In addition, holdout samples were used to check how well the model reflects the participants' actual decisions. For this purpose, the expected share of preference (SOP) for the concepts of the holdout tasks was calculated using the market simulation tool in Lighthouse Studio based on the HB estimates. The HB estimates were compared with the actual concepts selected. A mean absolute error of 5.31% in the first task and 2.89% in the second task were found. These results indicate that the forecast can simulate actual decisions relatively well. Possible interaction effects

[2] According to the Federal Statistical Office (2020), Switzerland has 8.667 million inhabitants. Each Swiss person makes an average of 0.83 air journeys per year (Bundesamt für Statistik, 2017, p. 67). This results in 7,284,080 people making air journeys each year. According to the statistics of ZRH (2020, p. 4), 74% of the flights are made within Europe and are therefore short-haul flights. This results in a total of 5,390,220 Swiss passengers who undertake a short-haul journey by air each year.

between the attributes were also analysed to improve the model. However, no effects that had a significant influence of more than 1% on the model were found. Accordingly, no interaction effects were used in the model for the final parameter estimates.

### 4.2.1 Main Direct Effects

When interpreting the utility values, it should be noted that the absolute values are not relevant. Of interest are the differences of the levels within an attribute or the total utility of a choice alternative. Additionally, part-worth utility values are measured as interval data adding up to 0 within each attribute; therefore, they cannot be compared across attributes (Backhaus et al., 2015, p. 212).

*Table 2: Aggregated Logit Model Estimates*

| MNL-Model Estimates | | n = 202 | |
|---|---|---|---|
| **Label** | **Utility** | **Std Error** | **t Ratio** |
| **Access time to departure airport** | | | |
| 30min | 2.19154** | 0.08713 | 25.1512 |
| 1h 30min | 0.90998** | 0.07192 | 12.65181 |
| 2h 30min | -1.10070** | 0.08963 | -12.28014 |
| 3h 30min | -2.00082** | 0.11391 | -17.56539 |
| **Flight frequency** | | | |
| 1 | -0.00037 | 0.07843 | -0.00477 |
| 2 | -0.02672 | 0.07762 | -0.34418 |
| 4 | 0.00906 | 0.07909 | 0.11459 |
| 6 | 0.01803 | 0.07959 | 0.22649 |
| **Airfare** | | | |
| 150 CHF | 0.85417** | 0.0801 | 10.66378 |
| 200 CHF | 0.41329** | 0.07791 | 5.30463 |
| 250 CHF | -0.24476** | 0.07935 | -3.08438 |
| 300 CHF | -1.02270** | 0.08641 | -11.83556 |
| **Flight ticket levy** | | | |
| 0 (no levy) | 0.36701** | 0.07849 | 4.67566 |
| 10 CHF | 0.21225** | 0.07839 | 2.70749 |
| 30 CHF | 0.16382* | 0.07742 | 2.11587 |
| 120 CHF | -0.74308** | 0.08393 | -8.85404 |
| No choice | 0.062 | 0.0656 | 0.94512 |
| * Significant on a 95% confidence level | | | |
| ** Significant on a 99% confidence level | | | |

H1 is focused on the main direct effects of the attributes. The estimated parameters largely coincide with the expected effect direction for the attributes access time, airfare, and flight ticket levy based on previous literature:

- A longer access time to the departure airport leads to lower part-worth values of the levels for the participants.
- The lower the price of an airline ticket, the higher the relative utility values of the levels.

- The lower the flight ticket levy, the higher the utility values. The highest relative utility value occurs in the absence of a levy.

All these effects are significantly different from 0 at least at the 0.05 level, indicating a significant impact on the participants' decision-making behaviour (see Table 2). Furthermore, the differences between the levels within each attribute were tested for their significance by performing univariate analyses of variances (ANOVAs) combined with a Bonferroni post hoc test for all attribute level combinations. The results show that the levels within the attributes access time and airfare differ significantly. This finding indicates that the observed effect directions can be assumed to be accurate with at least 95% certainty. The same is the case for the attribute flight ticket levy except that for the CHF 0 and CHF 10 levels, the differences in the part-worth utilities are not significant. However, since all the other levels vary significantly, the overall effect that a higher levy leads to lower utility values can still be assumed to be valid. Based on this data, H1a, H1b and H1c can be accepted.

In contrast, the results concerning flight frequency contradict the expected effect direction and do not differ significantly from 0. It can therefore be concluded that flight frequency had no significant influence on the participants' decisions. Thus, H1d must be rejected.

#### 4.2.2 Main Relative Effects

With regard to the relative relevance of the different attributes that are the focus in H2, the average importance of the attributes can be considered. To estimate them, the relative importance of each attribute in selecting the preferred concepts in the choice tasks is calculated at the individual level and averaged across all respondents. Access time was by far the most critical selection criterion for the choice of airport in this study with an aggregated importance of 56%. The lowest value is shown for the attribute flight frequency, which, at 5%, was hardly relevant for the participants' average decision behaviour. Again, the differences between the average importance values were tested for significance and found to be significant.

H2a makes a statement concerning the relative importance of the flight ticket levy compared to the airfare. Airfare has a 24% and the flight ticket levy only a 15% aggregated estimated importance. This difference indicates that on average, airfare was more relevant to individual participants when deciding between alternatives within a choice task. However, since both attributes are measured in monetary value, they are difficult to compare. This is particularly the case because both the absolute magnitude and the relative differences between the two attribute level values are different. Therefore, they need to be compared with identical monetary changes between levels to account for this problem. Linearly coded attributes can be used for this purpose. Instead of estimating individual part-worth utilities for each level, only one coefficient is estimated; this coefficient reflects the slope of the attribute levels. The values for the estimation matrix must be defined metrically according to what was shown to the participants. In concrete terms, the linear model finally outputs how much the relative utility value of an attribute changes if a level changes by a value of 1. In this concrete case, 1 corresponds to CHF 100. The average change in utility value for CHF 100 is estimated to be at -60.81 for airfare and -42.99 in the case of the flight ticket levy. This means that for an additional airfare of CHF 100, the utility of an option changes -60.81 on average. In the case of the flight ticket levy, this value is -42.99. The difference between these two aggregated utility values was also tested with a t-test for independent samples and found to be highly significant with a confidence level of 95%. It can be concluded that a change in the flight ticket levy is on average less important than a change in airfare for the choice of airport. H2a is thus verified.

#### 4.2.3 Indirect Effects

Based on the parameter estimates of the HB analysis (see Appendix), part-worth utilities for different segments of the participants can be estimated and tested for significance. The results contribute to understanding differences in customer preferences based on the behavioural and sociodemographic attributes collected in the survey. However, the data collected for the variables of annual flights per person, household income and environmental attitude did not show any significant values with sufficient explanatory power. Thus, the available data does not

allow assumptions about the indirect effects measured by the three variables mentioned. Accordingly, H3a, H3b and H3c must be rejected indicating that there are no significant differences in preferences between subsegments of travellers. However, it should be noted that an uneven distribution of the number of participants per segment could have led to the absence of differences between the groups.

### 4.2.4 Share of Preference Analysis

In addition to the investigation of part-worth utility values, an SOP analysis was conducted. This analysis predicts what percentage of the participants would choose a particular alternative in a defined scenario based on the estimated part-worth utilities of the underlying model (Orme & Chrzan, 2017, p. 186). The SOP estimates were generated by the Lighthouse Studio software based on the HB analysis. Different scenarios were considered as part of the analysis. The aim of the defined scenarios was to consider the influence of the flight ticket levy on the participants' airport choice behaviour. Therefore, the alternatives compared in the scenario were chosen to be as realistic as possible to allow travellers to compare all of the different airports at once in an actual choice situation. They were not restricted to two alternatives, as was the case in the CBCA. Hence, the SOP prediction included all four airports and a "none" option. The levels for each airport were chosen based on the real characteristics of each airport. Only the attribute levels of the flight ticket levy were varied. The defined scenarios are outlined in Table 3.

*Table 3: Scenarios for the share of preference analysis (own illustration).*

| Scenario | Description |
|---|---|
| Scenario 1 "Base levy 0" | No flights are subject to a flight ticket levy. This scenario was used as a base case for the analysis. |
| Scenario 2 "Swiss airports levy 10" | Flights from the Swiss airports (ZRH and BSL) are subject to a CHF 10 levy. |
| Scenario 3 "Swiss airports levy 30" | Flights from the Swiss airports (ZRH and BSL) are subject to a CHF 30 levy. |
| Scenario 4 "Swiss airports levy 120" | Flights from the Swiss airports (ZRH and BSL) are subject to a CHF 120 levy. |
| Scenario 5 "All airports levy 10" | Independent of the departure airport, all flights are subject to a CHF 10 levy. |
| Scenario 6 "All airports levy 30" | Independent of the departure airport, all flights are subject to a CHF 30 levy. |
| Scenario 7 "All airports levy 120" | Independent of the departure airport, all flights are subject to a CHF 120 levy. |

Table 4 shows that the domestic airports ZRH and BSL are strongly preferred in all scenarios compared to the foreign airports MUC and STR. In the base case scenario without a flight ticket levy, only 1.05% of the participants are estimated to choose MUC as a departure airport for their trip to Berlin, and only 0.04% would choose STR. Even the "none" option shows a higher preference value of 7.25% in the corresponding scenario. These results suggest that 1.5 hours could be a critical maximum access time that travellers would accept to reach the starting point of their journey, supporting the theory that airports in Switzerland have a regional monopoly.

Of the domestic airports, BSL has the highest SOP in all scenarios, ranging from 46.14% in the "Swiss airports levy 120" scenario to 56.47% in the "Swiss airports levy 0" scenario. These results are in contrast to the facts that access time is the most important decision criterion for the participants and ZRH has a shorter access time than BSL does. Since the flight ticket levy was held constant for the two airports and the flight frequency was

found to have a low impact on the choice, the difference in the price level seems to be the determining factor. To better understand this effect, an SOP analysis was performed using different price levels for BSL and ZRH while holding the other airports constant on their designated price. With the same price of CHF 300 for ZRH and BSL, the results change drastically. In this case, the SOP of ZRH is estimated to be 68.3%, whereas BSL only reaches an SOP of 2.6%. Reperforming the model several times shows that the lower the price levels become, the stronger this effect becomes if the price levels for ZRH and BSL are held the same.

*Table 4: Share of preferences of the realistic scenarios (own illustration).*

| Scenarios / Airports | Base levy 0 | Swiss airports levy 10 | Swiss airports levy 30 | Swiss airports levy 120 | All airports levy 10 | All airports levy 30 | All airports levy 120 |
|---|---|---|---|---|---|---|---|
| **Share of preference** | | | | | | | |
| ZRH | 35.19% | 35.29% | 35.07% | 31.74% | 35.56% | 35.26% | 31.74% |
| MUC | 1.05% | 1.80% | 1.46% | 1.01% | 1.04% | 1.05% | 1.01% |
| BSL | 56.47% | 56.22% | 56.70% | 46.14% | 56.76% | 57.03% | 46.14% |
| STR | 0.04% | 0.12% | 0.16% | 0.03% | 0.04% | 0.04% | 0.03% |
| None | 7.25% | 6.58% | 6.61% | 21.08% | 6.60% | 6.61% | 21.08% |
| **Differences of share of preference values based on "Swiss airports levy 0"** | | | | | | | |
| ZRH | 0.00% | 0.09% | -0.12% | -3.45% | 0.36% | 0.07% | -3.45% |
| MUC | 0.00% | 0.75% | 0.41% | -0.04% | -0.01% | 0.00% | -0.04% |
| BSL | 0.00% | -0.25% | 0.23% | -10.33% | 0.30% | 0.57% | -10.33% |
| STR | 0.00% | 0.08% | 0.12% | -0.01% | 0.00% | 0.00% | -0.01% |
| None | 0.00% | -0.67% | -0.64% | 13.83% | -0.65% | -0.64% | 13.83% |

In comparison to the baseline model, imposing a flight ticket tax of CHF 10 or 30 only leads to marginal changes in SOP below 1% regardless of whether the levy is only introduced in Switzerland or also abroad. However, the scenarios with the highest levy of CHF 120 show more significant changes: In the "Swiss airports levy 120" and "All airports levy 120" scenarios, an additional 13.83% of the participants would be expected to choose the "none" option compared to the baseline scenario without a levy. This change would lead to an overall SOP of 21.08% for the "none" option in these scenarios. Additionally, BSL would lose 10.33% of its SOP and ZRH 3.45%. Furthermore, these scenarios are the only ones that lead to a reduction of the SOP at all airports in favour of the "none" option. Overall, this indicates that under the defined circumstances, a flight ticket levy of CHF 10 or 30 has nearly no impact on participants' airport choice process, whereas a levy of CHF 120 leads to many people deciding not to travel and no evasive decision behaviour. Interestingly, imposing the ticket levy on all available airports does not lead to significant differences in the SOP values of the scenarios. Overall, these results show that the flight ticket levy does not significantly impact airport choice in those scenarios.

# 5 Discussion

The aviation industry is one of the largest sources of GHG emissions in Switzerland. Despite many efforts, a natural decrease in emissions does not seem viable in the short and medium term. Thus, regulatory approaches to tackle this issue are a key variable in the equation to reach climate goals in Switzerland. This research aimed to achieve a better understanding of the steering effect of a flight ticket levy in Switzerland and create an initial data basis for the implementation of such a regulatory instrument. The study demonstrates that a flight ticket

levy as it has been planned by the Swiss government would only marginally influence the demand behaviour of Swiss citizens. A steering effect with regard to airport choice only becomes apparent if the levy is significantly higher than the previously planned 30 CHF for short-haul economy class flights. In addition, in the Swiss context, only a limited number of passengers could be expected to avoid the levy by using foreign airports. A flight ticket levy of a sufficient amount would lead to a decrease in passengers rather than to environmentally harmful evasive behaviour. These findings offer practical implications for legal authorities as well as airport and flight operators:

- *Legal Authorities*: Since levies achieve their demand-side steering effect via a price effect, the level of the levy plays a central role, as it determines how high the price increase caused will be. How strong the demand reaction will be in concrete terms can be quantified through the price elasticity of demand. This is strongly dependent on regional and market-specific factors. To assess the effectiveness of a levy in terms of its steering effect before introducing it, corresponding data has to be collected. Specifically, the available results show that the planned levy of CHF 30 would likely have to be quadrupled to achieve a significant steering effect. Additionally, an incentive tax as planned by Switzerland for the flight ticket levy faces the difficulty that it is only aimed at producing a behavioural change and deliberately does not focus on revenue or investments. As previously mentioned, much higher levies would be necessary to significantly influence behaviour and the redistribution of parts of the levy might even additionally dampen the steering effect. However, higher levies might be politically difficult to implement. There is thus an opportunity to use air travellers' willingness to pay in a constructive way to achieve environmental goals. For example, the funds obtained via such a levy could be used directly to offset the $CO_2$ emissions caused or to support specific projects that aim to maintain existing travel behaviour without increasing the environmental impact.
- *Airport and Flight Operators*: The results of this thesis also have some practical implications for airport and flight operators. First, they show that airport and flight operators do not have to fear a loss of customers due to levies of up to CHF 30 for short-haul flights. Given that the Swiss electorate has rejected the levy for the time being, there could be a potential opportunity for operators to improve their positioning regarding sustainability. For example, travellers' willingness to pay for mitigation measures could be used to reduce the $CO_2$ emissions balance across the entire value chain. Willingness to pay could be monetised through small price changes in airline tickets or offering sustainable services and products. A study by Hinnen et al. (2017), for example, identified a willingness to pay of travellers for sustainable products in the area of supplementary services. Such positioning may result in opportunities to achieve environmental goals and generate additional revenue. If the measures described positively affect the $CO_2$ emissions balance, future regulations could possibly be prevented. This would allow operators to move in the direction where their sustainability investments have the best impact on their profits and growth rather than being passively regulated by legal authorities.

Beyond practical implications, the results of this paper also present interesting insights for researchers in the field. Even though a broad base of literature exists concerning airport choice and travellers' behaviour, hardly any research has been conducted in this regard for the Swiss context. Moreover, few studies can be found regarding flight ticket levies. Thus far, studies show that existing flight ticket levies in most countries at present do not take full advantage of the willingness to pay of the travellers for such levies. However, how these findings manifest themselves in travellers' concrete behaviour has only been peripherally investigated so far. Hence, this paper extends previous research by synthesising previous findings regarding airport choice in combination with new empirical research on flight ticket levies, taking into account the Swiss context.

Nevertheless, the results of this study can only reflect a specific snapshot in a very dynamic industry. At the time the study was conducted, the COVID-19 pandemic was ongoing, which massively restricted the freedom to travel by air. This might have had an influence on the participants' attitude regarding travel in general and thus on the answers in the survey. Additionally, the sample mainly reflects younger, well-educated Swiss

citizens. It is thus difficult to assess to which extend the sample is representative to all Swiss citizens. the conducted experiment was limited by the specific scenario it was based on. Specifically, the context of a leisure trip with the starting point in Zurich was defined, and only economy class flights to a specific destination (Berlin) were considered. Accordingly, the results obtained can only be applied to other situations with reservations.

In summary, this paper shows that the success of a flight ticket levy depends on a variety of factors. Particularly critical is the fact that air travel is a very international market, which leaves little room for regional regulation. Finding an effective and efficient solution for Switzerland within this scope is difficult, as has been shown. Nevertheless, such a levy could be a good basis for the further development of regulations concerning climate protection in the airline industry. Ultimately, however, with the Swiss electorate rejecting the $CO_2$ law, this will not be the case in the foreseeable future. Thus, it is again up to the Swiss state or aviation companies to develop alternative, better, and ultimately more majority-supported solutions to reduce the carbon footprint of the aviation industry.

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# Appendix

Zero-centred aggregated hierarchical Bayes parameter estimates (own illustration)

| Labels | Average Utilities | Standard Deviation |
|---|---|---|
| **Access time to departure airport** | | |
| 30 min | 116.61959 | 36.59119 |
| 1 h 30 min | 49.60632 | 18.29717 |
| 2 h 30 min | -60.08792 | 27.69297 |
| 3 h 30 min | -106.13799 | 30.10033 |
| **Flight frequency** | | |
| 1 | 0.54226 | 11.74670 |
| 2 | 0.48298 | 7.67358 |
| 4 | 1.11838 | 9.27837 |
| 6 | -2.14362 | 10.15589 |
| **Airfare** | | |
| CHF 150 | 38.93442 | 21.77998 |
| CHF 200 | 24.44251 | 6.94804 |
| CHF 250 | -10.87545 | 8.91882 |
| CHF 300 | -52.50148 | 18.10165 |
| **Flight ticket levy** | | |
| 0 (no levy) | 14.70001 | 17.42117 |
| CHF 10 | 13.85071 | 7.54567 |
| CHF 30 | 6.63667 | 8.71570 |
| CHF 120 | -35.18740 | 21.02460 |
| No choice | 3.12894 | 72.34854 |