Innovation Potential in Pricing and Product Line Design of SBB Based on the Increasing Heterogeneity of Customers: An Empirical Analysis of Train Section and Rush Hour Access

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4 Management Summary

The needs of Swiss travelers are becoming increasingly diverse and nuanced, providing opportunities for the Swiss Federal Railways (SBB) to increase revenues by offering more targeted and differentiated offers. In this project, we generated opportunities for innovative travel card offerings and empirically investigated two showing high promise. We empirically measured travelers' preferences for variations of travel card offerings and derived policy recommendations for SBB based on these values. We used a so-called hybrid choice approach for this purpose, which not only allows measuring consumers' preferences, but also linking them to their psychographic and demographic characteristics.

In the first project, we examined travelers' preferences for being able to access specific dedicated sections on the train that focus on one specific travel need. Examples of such dedicated sections include SBB's current silent or family wagons. These sections offer the possibility to travel with other traveler groups who share a similar travel need and to stay away from traveler groups with different travel needs. Social identity theory has already highlighted that individuals have a general tendency to separate from different others (i.e., from the out-group). The empirical analysis, however, revealed that the average traveler does not necessarily put a higher value on having access to such dedicated sections. Only certain specific groups of travelers value having this type of access, such as individuals who feel highly disturbed by dissimilar others on the train. Although quite specific, these groups of individuals are quite sizeable. For instance, at least 16 percent of travelers would be willing to pay on average CHF 664.- more for having additional access to one of the four dedicated sections. These results imply that separately pricing these dedicated sections may allow the generation of additional revenues and profits for SBB. Nevertheless, a final decision about who these traveler segments exactly are, which to target, and what price points to use requires further research.

In the second project, we addressed the highly relevant topic of peak-load pricing. Specifically, we investigated whether travelers would be willing to travel at times other than rush hour for a reduced price. We find that travelers, in general, do not like to do so as they have a very strong preference for unlimited access, including during the rush hour. In fact, they are willing to pay CHF 2'556.- more for a travel card with unlimited access during the rush hour than for the least preferred travel card with limited access. The formal time constraints travelers face, e.g., at their workplace, could explain this result. They simply cannot deviate from the rush hour in a meaningful way and this tendency is exacerbated for commuters. Although not representing a large traveler segment, we find that some individuals would be fine with limited rush hour access. These include different types of leisure travelers, such as pensioners and other non-commuters. Among the different variations of limited cards that could be offered, we found that travelers do value the number of times they can access the rush hour and how long the duration of the rush hour is defined. Our recommendation to SBB is thus to be very cautious with rush hour pricing as travelling during these times is typically a necessity, since most travelers simply do not have the required flexibility to do otherwise.

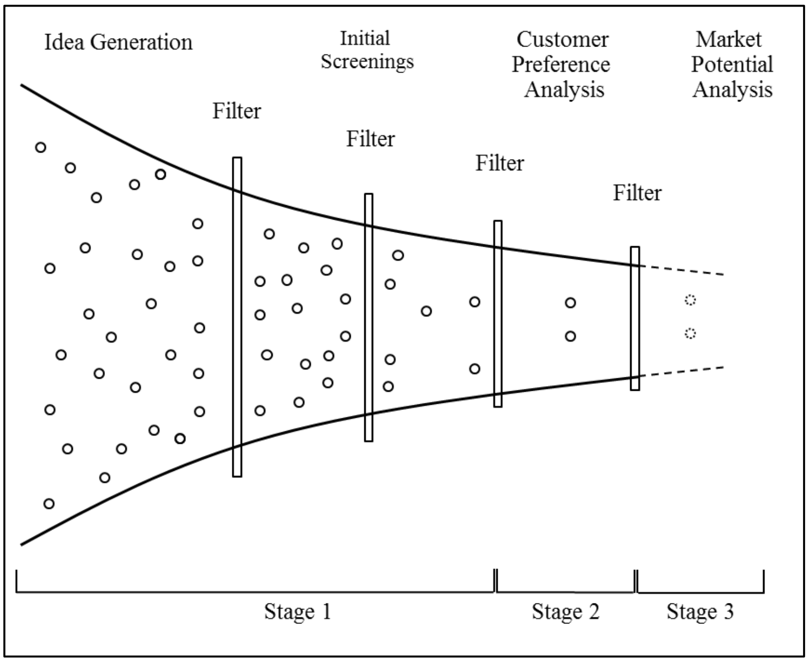
5 Introduction

The needs of Swiss travelers are becoming increasingly diverse and nuanced (Nguyen & Mariani, 2014). This provides an opportunity for the Swiss Federal Railways (SBB), who could potentially increase revenues by offering more targeted and differentiated offers. The current product line of SBB is mainly organized around key service offerings, such as the Half-Fare or General Abonnement travel cards. These offerings are provided via one single travel card, the SwissPass (SBB, 2017). Innovations in the product line should thus ideally fit into the existing logic of the SwissPass, but could vary the type of services offered and the breadth and depth of the product line, aiming at meeting the diverse needs of travelers.

In this project, we generated opportunities for innovative travel card offerings and empirically investigated two showing high promise. We followed the typical stage-gate process of product innovation management in which large numbers of opportunities are first identified and then sequentially screened out until the most promising ones remain, which are subsequently introduced to the market (Terwiesch & Ulrich, 2009). Our project featured two main stages and gates (see Figure 1). During the first stage, we identified potential innovations in the product line through desk research, discussions with stakeholders of SBB, and by interviewing customers using an open innovation approach. Two main ideas passed the gate and remained after this first stage. In the second stage, we empirically investigated customers' preferences for these two ideas using a hypothetical choice approach. Based on the results of this analysis, we also point to the third stage of the product innovation management process in which the actual revenue potential of the selected ideas would be estimated; however, this third stage was not part of the scope of this project.

Figure 1

Stage-Gate Product Innovation Management Process



Methodologically, we applied both qualitative and quantitative approaches. In the first stage, we employed a variety of descriptive and qualitative approaches, such as desk research, discussion rounds and brainstorming with different internal and external stakeholders, and an ideation session. In the second stage, we applied both a discrete choice approach and a so-called hybrid choice approach to investigate customers' preferences for the two ideas. This approach allowed for the investigation of the role of psychographics and demographics as drivers of utility. Traditional economists have typically used discrete choice models to analyze decision makers' preferences assuming a completely rational behavior. In contrast, behavioral scientists have focused on understanding how individuals form decisions and in analyzing the nature of the decision-making process based on psychological theory that does not always satisfy such an assumption of rationality. Since the results of these two camps were often quite different, researchers have developed more integrative approaches that account for both perspectives (Ben-Akiva et al., 2002). This hybrid approach allows us to not only estimate attribute utilities, but also the influence of the proposed socio-psychological factors on the utilities. Further, it allows using the collected data for future market potential and revenue analyses, such as segmentation, targeting, or market simulations.

The first idea that passed the gate to the second stage (Train Section Access Project) addressed the increasingly crowded trains faced by SBB (Ungricht, 2010) and the accompanied increasing heterogeneity of traveler types and behaviors on the trains (Saameli, 2014). Currently, SBB provides special silence, business, and family sections dedicated to particular individual needs. Although these sections provide additional value to the specific individuals, they are not priced separately. This project thus investigates whether it could be sensible for SBB to extend their service by explicitly offering access to such or other sections on the train, potentially against payment. Greater separation of different traveler segments may offer value to customers who currently feel disturbed by the behaviors of other travelers. Even though SBB is not planning to price these sections separately in the near future, gaining quantitative insight into the degree to which travelers value these sections is of high interest to SBB (e.g. for “service hardware” decisions in the fleet management).

Conceptually, the need to access these dedicated sections can be driven by a traveler’s need to travel with other travelers of similar kind and to stay away from travelers with different needs. Take a business traveler, for instance, who would rather travel with other business travelers so as not to be disturbed by the noise potentially created by other travelers (e.g., crying babies). We capture this general tendency using the latent construct of out-group derogation, i.e., individuals’ tendency to ascribe more negative characteristics to individuals that are not part of the own social group (Dasgupta, 2004) and test if it moderates travelers’ preferences for dedicated sections. We hypothesize that a higher (vs. lower) tendency towards out-group derogation leads to a higher utility for a travel card with access to a dedicated section in addition to the common section (i.e., where diverse types of travelers travel together) and a lower utility for a travel card with access only to the common section.

Two studies test our conceptual hypothesis and provide insight into travelers’ preferences for such a service. For the average traveler, we find that having a travel card with access to dedicated sections does not necessarily provide additional value. Only travelers who have a high tendency towards out-group derogation would be willing to pay CHF 664.- more for the dedicated sections (average over the all dedicated sections, compared with having access to the common section only). Individuals high in out-group derogation have a more negative view of traveling and a more workaholic, frustrated, and status-seeking lifestyle. Additionally, we find that the choice of each individual dedicated section over any other section is driven by a set of individual consumer characteristics. Therefore, separately pricing and offering dedicated sections could make sense for SBB, but would require a highly targeted approach.

The second idea that passed the gate to the second stage led to the creation of the Rush Hour Access Project. It tackles the problem of highly crowded trains during the rush hour, which has been raised in several newspaper articles over the last years (Bloch, 2011; Riedener, 2012; Valda, 2015; Vontobel & Guanziroli, 2008). Currently, the peak hours are between 7:00 and 8:00 in the morning and between 17:00 and 18:00 in the evening (as determined by SBB). However, also the respective hours before and after the main rush hour still have a higher capacity utilization than the absolute off-peak hours (Bloch, 2011). SBB has already made a successful effort to shift the passenger load away from the rush hour by requiring its own employees to avoid it, e.g., work from at home (Weichbrodt et al., 2013; Zemp, 2014).

In this project, we examine the potential of a price incentive to motivate travelers to choose travel card offerings that limit traveling during the rush hour. We measured traveler preferences for travel cards with either unlimited access (i.e., valid all day, every day), no access (i.e., not valid during the defined rush hour interval), or some form of limited access (i.e., not valid during the defined rush hour interval, except for a limited number of trips) during the rush hour.

We find that travelers derive a substantially higher utility from unlimited access during the rush hour than from limited access or no access. They are willing to pay CHF 2’556.- more to have unlimited access (compared with having limited access for 20 trips per year only during 6.00 to 9:00

and 16:00 to 19:00). This difference increases even more (to CHF 3’335.-) for commuters. Among the travel cards that limit access to the rush hour, we find that increasing the number for trips during the rush hour that are permitted with that travel card by 10 increases the utility (CHF 495.-), but this increase appears marginal relative to a difference of CHF 2’556.- between unlimited and limited access. A narrower definition of the rush hour (7:00 to 8:00 and 17:00 to 18:00 instead of 6:00 to 9:00 and 16:00 to 19:00) increases utility by CHF 447.- for travel cards with limited access, but also these increases are small relative to the overall difference between limited and unlimited access. These results show, in sum, that unlimited access provides the most utility to travelers, independent of how the limited access is designed. It seems that travelers perceive limited access travel cards as highly inconvenient, even in comparison with travel cards that provide no access to the rush hour. We further observe that those commuters who face formal time constraints have limited flexibility in their traveling times (i.e., the variance in their travel time is significantly lower). The results are thus likely driven by external factors and do not only represent intrinsic traveler preferences. A price differentiation strategy based on such extrinsic factors is not necessarily advisable given that consumers may perceive it negatively and unfair, potentially harming customer loyalty (e.g., similar to the negatively perceived monopolist who perfectly discriminates customers[1] (Kahneman et al., 1986)). Limiting the rush hour access by charging a higher price is not a reasonable alternative to SBB, unless the formal constraints of their travelers could be substantially reduced. However, we also explore which traveler characteristics drive the choice of one of limited access and no access over unlimited access and find that there are certain traveler characteristics that lead to the choice of these options. Therefore, there seems to be potential for an introduction of these travel card options with a highly targeted approach.

The rest of the document is structured as follows: We first state and motivate the changes from the original proposal for this project. Second, we outline our idea generation process (stage-gate stage 1) by describing the SBB starting environment for the project and the analyses performed to determine the two ideas we investigate in the second stage. Third, we explain the hybrid choice methodology. Fourth, we present both the Train Section Access Project and the Rush Hour Access Project. Finally, we summarize the results of both projects and discuss the implications for SBB.

6 Changes from Original Research Proposal

During the project, the interests of SBB in terms of project goals and research questions have significantly changed. Mainly, they shifted away from the original idea of focusing on product-line pricing with an emphasis on the train section access towards investigating preferences for different rush hour options. These changes have significantly increased the workload associated with the project at the expense of some of the original goals. Together with SBB, we decided to abandon the product-line optimization and pricing part of the project. Instead, we focused on analyzing travelers preferences for train section and rush hour access. Importantly, we collected the data in such a way that the product-line pricing analysis could still be performed. We simply did not conduct it as it had lost relevance for SBB.

The specific changes relative to the original proposal are as follows. We focused on the following core questions as outlined in the original application: 1.1, Developing an initial understanding of decision behavior of Swiss travelers; 1.3, Illustrate optimization potential for the current product line (but without market simulation); and 1.4, Linking the product line explorative to customer segments (without segmentation analysis).

We did not specifically pursue the following goals: 1.2, Defining price and cross-price elasticities of product line; 1.5, General discussion of access vs. product-price strategies. Please again note that 1.2 could still be performed based on the data we collected. Although we did not calculate elasticities, we calculated willingness-to-pay (WTP) values for certain product bundles and attribute levels of interest.

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[1] Kahneman, Knetsch, and Thaler (1986) have argued that a monopolist’s strategy to maximize their profits by applying a perfect price discrimination may backfire, since individuals regard individual-level price discrimination as highly unfair.

Concerning the detailed questions, we focused on question 2.2 with an emphasis on train section and rush hour access. We did not specifically investigate 2.1 and 2.3. We further focused on research question 3.1, i.e., the contribution of psychometric variables, which we further extended. We decided not to further investigate incentive-aligned approaches, as outlined in 3.2, because the innovative attributes we investigated were purely hypothetical.

7 Idea Generation and Selection Process

Following the typical stage-gate process of product innovation management, we first generated a number of product innovation ideas and then screened them out based on several criteria until the most promising ones remained (Terwiesch & Ulrich, 2009). In order to generate ideas, we first analyzed the starting situation of SBB in terms of their subscription (Chapter 7.1) and pricing structure (Chapter 7.2) at the beginning of the project in 2014. Then, we reviewed innovative product offers of other railway companies in Europe and compared them with the SBB offer to identify possible gaps (Chapter 7.3). In addition, we also involved consumers in the first stage of the product innovation process via an ideation session that will be outlined in Chapter 7.4. Based on these analyses, we selected two innovative product offers for which the consumer preferences were empirically analyzed in the second stage.

7.1 SBB Subscription Structure

SBB offers a range of products for both domestic and international trips. Concerning domestic travel, a main distinction is made between individual tickets and subscriptions. SBB addresses individual tickets mainly to travelers who use public transportation with a low frequency. Among these products, there are ordinary tickets (one-way tickets, round trip, multiple journey cards, and city-ticket), daily tickets that allow unlimited mobility throughout all of Switzerland for a whole day, or tickets for groups and discounted tickets. In contrast, subscriptions (i.e., travel cards) are addressed to travelers who frequently use public transportation. For instance, the Half-Fare travel card allows travelers to use most of the public transport in Switzerland at half-fare. All other travel cards vary by geographical access, time-wise access, and validity as defined by the age of the traveler. The General Abonnement (GA) travel card allows unlimited access to the entire country (train, bus, ferries, etc.) and thus provides the most complete access. The Track 7 travel card allows young people (< 25 years' old) with a Half-Fare travel card to have an unlimited number of trips in second class from 19:00 to 5:00. The Point-to-Point travel card provides access to a specific route. The regional travel cards were developed by SBB in cooperation with the local transport fare networks for those who travel frequently in their own fare network. Thus, they provide the same access as the GA, but on a smaller geographical scope. Finally, the Inter-Regional travel cards are similar to the Point-to-Point travel card, allowing travels from one point to another, as well as the use of local transportation in their home and/or destination area.

7.2 SBB Pricing Structure

The pricing structure of SBB is based on travel characteristics (travel class, period of validity, number of trips, and scope of geographical access), the type of payment (monthly, annual, etc.), and the characteristics of the traveler (age, presence of disability, and family status).

To determine the price range of subscriptions offered by SBB, we conducted a price analysis using data from the SBB website and internal documents (SBB, 2014). This analysis allowed the definition of plausible values that served as a starting point for the development of the choice experiments and the derivation of travelers' willingness-to-pay (WTP) based on their utilities (in the second stage of the project).

During the price analysis, we first collected data on all available subscriptions and their respective prices to obtain a general overview of the price range. The analysis showed that prices for subscriptions ranged from ca. CHF 500.- for regional subscriptions, such as Arcobaleno, TVBeo, Onde Verte, Zug, Vagabond with 1-2 zones and second class to CHF 6'000 for the first class GA which provides unlimited access to public transport in Switzerland.

7.3 Overview of Innovative Product Offers by Other Railway Companies in Europe

At the beginning of the project in 2014, we reviewed the offers of other railway companies in Europe via desk research. The goal of this desk research was to identify offers that were new to SBB and at the same time, interesting from a scientific point of view. After screening the European railway market, we were able to divide the innovative offers into five categories: (1) segmentation on the train, (2) CRM and customer loyalty, (3) mobility partnerships, (4) ticket options and pricing, and (5) service innovations. In the following, we summarize the most innovative offers with respect to the SBB offering at the starting point of the project.

7.3.1 Segmentation on the Train

Several railway companies have moved away from the classical system that divides trains merely into first and second class and now offer a more fine-grained segmentation into which travelers can self-select. For example, the premium trains of Trenitalia have four classes: (1) standard, allowing to travel at low cost; (2) premium, allowing to travel at high comfort; (3) business, targeted to business travelers; and (5) executive, which is meant for exclusive trips with the highest comfort (Trenitalia, 2014). The Norwegian railway company NSB also removed the two-class system and offers different coaches, including “NSB Komfort”, which offers the facilities and services for working on the train, “NSB Sove”, which offers beds for night trips, “NSB Familie”, which offers services and facilities for families traveling with little kids, and “NSB Stille”, that requires traveling in complete silence (NSB, 2014). The French railway company SNCF lets its customers choose between first and second class and between the two different traveling styles: “iDZAP” for travelers who want to socialize and “iDZEN” for travelers that want to spend their trip in silence (SNCF, 2014). Nuovo Trasporto Viaggiatori (NTV) is the second train operator in Italy and a competitor of Trenitalia. NTV does not distinguish between classes, but between the three ambiences: “Club”, “Prima”, and “Smart” with different characteristics and services provided. The Club ambience offers meals served at the seats, free Wi-Fi, at-seat TV, and private lounges. The Prima ambience offers meals served at the seats, free Wi-Fi, and a welcome service. The Smart ambience offers changing tables (for newborns), self-service vending machines, free Wi-Fi, and one Cinema Coach. In addition, travelers can book a larger seat for an additional fee in the “Smart XL Coach” (NTV, 2014). Finally, between August 1999 and December 2004, the German railway company Deutsche Bahn (DB) operated the “Metropolitan” train exclusively on their Cologne-Hamburg route (Wikipedia, 2009). This train was introduced to compete with air transport by providing high quality products and extreme punctuality. The wagons of the Metropolitan were comparatively luxuriously designed and unlike any other product created by Deutsche Bahn AG. In the first years of activity, the Metropolitan did not have a division between first and second class, but only one class with three categories. This choice emphasized the high quality services provided. With the decline in sales, the repartition between first and second class was introduced to attract more customers. The categories used in the first years were the “Silence” wagons, the “Office” wagons, and the “Club” wagons. The Silence wagons were meant for people that wanted to rest. If they wanted, they could receive a pillow, blanket, and earplugs for free. There was also a free audio program and people could receive headphones if they wished. Moreover, to prevent travelers in the Silence wagons from being disturbed by regular travelers, these wagons were placed at the end of the train. The Office wagons were meant for people that wanted to work on the train. There were no extra services except for electricity outlets at each seat, mobile phone amplifiers, and a cocktail and espresso bar. A select number of four-person seat groups with a table were available for work calls. Finally, the Club wagons were meant for people who wanted to neither work nor sleep. They could borrow portable DVD players and DVDs. The club area as well had a cocktail and espresso bar and one of the Club wagons was built without barriers.

7.3.2 Loyalty Programs

Several railway companies in Europe offer loyalty programs. SJ (Sweden) offers “SJ Prio”, where customers can collect points, for instance by purchasing tickets, and then use these points to buy new tickets and a list of other items (SJ, 2014). Trenitalia (Italy) and Renfe (Spain) offer loyalty cards that provide various discounts for offered services (Renfe, 2014; Trenitalia, 2014). In addition, the

German railway company Deutsche Bahn offers a loyalty card called "bahn.bonus card" which allows customers to collect points and then use these points to buy new tickets and gifts (Deutsche Bahn, 2014). The French SNCF offers the "SNCF Voyageur Programme", which allows customers to collect points and then use these points for discounts. In addition, the loyalty card contains all information regarding the electronic tickets purchased, eliminating the need to print the ticket (SNCF, 2014).

7.3.3 Mobility Partnerships

Like SBB, many other railway companies in Europe have entered into partnerships with car rentals, car-sharing providers, or bike rentals to offer a complete mobility service (Deutsche Bahn, 2014; SJ, 2014; Trenitalia, 2014). Deutsche Bahn and the Austrian ÖBB in addition have partnerships with airlines and Deutsche Bahn with travel agencies for booking (Deutsche Bahn, 2014; ÖBB, 2014).

7.3.4 Ticket Options and Pricing

The Swedish railway company SJ and the French SNCF have a so-called "Best Buy Calendar" (a monthly calendar of day-to-day offers) that compares ticket prices (SJ, 2014; SNCF, 2014). The Italian railway company Trenitalia offers tickets at lower prices when they are booked far in advance (Trenitalia, 2014). The Belgian railway company SNCB offers a part-time travel card for people that travel on the same route two or three times a week (SNCB, 2014).

7.3.5 Service Innovations

The German railway company Deutsche Bahn provides several services in the train stations and on trains, such as Wi-Fi high-speed access and an entertainment service (Deutsche Bahn, 2014). The French railway company SNCF provides activities for kids (SNCF, 2014). On its premium trains, Trenitalia offers internet access through Wi-Fi onboard and multimedia library with entertainment services (Trenitalia, 2014).

7.4 Ideation Session

In addition to the overview of innovative product offers by other railway companies, we also made an effort to collect innovative ideas directly from potential travel customers. Therefore, we conducted an ideation session between July 2 and July 4, 2014, which involved 19 participants (10 female, 53 percent; $M_{age} = 26.5$) recruited from the population of the Università della Svizzera italiana (USI) students via e-mail. During the session, participants were asked to list ideas regarding possible innovations for SBB relative to their offer in an online form. We performed a parallel search approach to control for group dynamics that could reduce the number of ideas produced. The best five ideas were each rewarded a one-day second class ticket valid for all trains in Switzerland.

Participants suggested 85 ideas comprised of 22 ideas regarding offers in the train, 33 ideas regarding ticket options, 8 regarding offers at the track, 4 regarding web/mobile options, 2 regarding staff, 4 regarding pre/post trip offers, 6 regarding the timetable, 2 regarding the distribution channels, and 6 unclassifiable ideas. Subsequently, three coders from SBB and USI independently evaluated each idea using the criteria innovativeness, expected utility for target segment, and impact on brand image. The ranking of the ideas by these three criteria as well as average over these criteria can be found in the Appendix Tables 8, 9, 10, and 11. Finally, two project members from SBB[2] have evaluated the generated ideas on four additional criteria: (1) newness to the market, (2) newness to SBB, (3) sales/market potential, and (4) investment costs. Sorting ideas first by newness to SBB, then by sales/market potential, investment costs, and finally by newness to the market, results of the top ten ideas are listed in Table 1.

[2] Christopher Nigg and Roberta Marcionni (both SBB Personenverkehr, Preis und Sortiment).

Table 1
Top Ideas Suggested in Ideation Session

No.	Idea	Description
1	Seats with multimedia access to watch movies and read newspapers online	Introduce new service that allows people to watch movies and read newspapers using an online platform
2	Printers in business wagon	Introduce printers in business wagon to allow customers to print their documents during the trip
3	A digital onboard library	Introduce multimedia library for customers' entertainment during the trip
4	Party trips with dance/drink/dating-wagon	Special trips with events where customers can dance/drink/date with others
5	iPad/PC onboard	Introduce tablet and pc onboard for people that want to use the "Online" services
6	Sommelier service in business wagon	Introduce a sommelier service (personal wine consultant at seat) in business wagon
7	Book-rental (station-to-station)	Introduce a book-rental service; customers can pick up books in a specific station and return them in the arrival station
8	Massage seats	Introduce new type of seats with "massage" function
9	Hostess/steward to accompany kids on their travels	Introduce specific support services for unaccompanied kids traveling
10	Music available via SBB multimedia database	Introduce new function that allows customers to listen music at seat using dedicated headphones (like a private radio)

7.5 Selection of Product Line Innovations for Empirical Investigation in Stage 2

Based on all the information we collected in the previous analyses, we selected product line innovations that warranted further analysis. The final selection decisions were made during USI-internal meetings and meetings with SBB. We proceeded as follows. Based on the overview of innovative product offers by other railway companies in Europe, we identified five possible directions for innovation: (1) segmentation on the train, (2) loyalty programs, (3) mobility partnerships, (4) ticket options and pricing, and (5) service innovations. Regarding the segmentation on the train (1), SBB already offers silence and business sections in its first class wagons and family sections in its second class wagons, as well as a family coach on certain routes. Offering these and other sections independent of first and second class could be a product line innovation for SBB that would allow catering to a more heterogeneous traveler base. This innovation was previously identified at the initial stage of the idea generation process as being worthy of investigation also from a research point of view.[3]

Both introducing a loyalty program (2) and extending mobility partnerships (3) to airlines and travel agencies was relatively new to SBB's product line at the beginning of the project, but would not directly address the increasing heterogeneity of consumers. Therefore, these options were not considered further. In 2014, SBB did not offer special ticket and pricing options, such as discounts, which made this a possible product innovation. Since ticket options and pricing (4) were not the focus of the project as defined by the original research proposal, this option was also discarded. Nevertheless, offering part-time travel cards was identified as having potential to address traveler heterogeneity in terms of frequency of travel. Finally, the service innovations (5) were also new to SBB at the beginning of the project and thus considered further in the idea generation and selection process.

Further, the ideas generated from the ideation session were mostly related to service innovations. The suggested service innovations create utility for travelers with different characteristics (for example, some are related to business, others to lifestyle). An agreement between the USI and SBB project team members led to the decision to focus on offers in the train that cater to the needs of

[3] This research interest was identified in an USI-internal meeting with Prof. Dr. Reto Hofstetter, Prof. Dr. Rico Maggi, Dr. Stefano Scagnolari, Salvatore Maione, and Lisa Maria Schiestel on 16.09.2014.

different consumer groups (Train Section Access Project).[4] More specifically, it led to an investigation regarding utilities of these special sections on the train and the potential of pricing them separately. This is also in line with the outcome of the overview of innovative product offers of other railway companies in Europe. In addition to the existing business, silence, and family sections, the suggested ideas prompted the creation of the lifestyle section. SBB told us that they have already investigated certain service add-ons in the context of the GA. For this reason, we abstracted from particular services and focused on the train section access idea. The train sections can include certain services. We are agnostic to the particular service and look at the section access only.

Further to the customer-driven idea generation process outlined above, the SBB management had a strong interest in investigating one particular pricing-related product innovation. In several discussion rounds with members of the SBB pricing team and the USI project team,[5] investigating the pricing potential of different access options to the rush hour was identified as a second research direction, since it would inform actions related to new pricing strategies. Based on these discussion rounds, the Rush Hour Access Project was created, which is the second project that will be outlined in this document.

In summary, after the product innovation process, the USI-SBB project team decided to investigate separately two innovative product offers. The Train Section Access Project investigates a customer need-related product innovation by estimating the utilities of the different train section access options. On the other hand, the Rush Hour Access Project investigates a management need-related product innovation by estimating the utilities of different access options to the rush hour. Together with SBB, we also made important decisions concerning the scope of the project. Most importantly, we decided together with SBB to focus our analyses on yearly subscriptions.[6] We also decided to consider the scope of geographical access as well as the time-wise validity of the travel cards in our research.[7] Based on the analysis of the pricing structure, initially the price range was agreed to be set to CHF 1’000 to 5’500 in order to show meaningful prices (see Train Section Access Project (Study 1) in Chapter 9.2.3). Throughout the course of the project, however, it was agreed with SBB to set the maximum price in our studies at CHF 6’000.- in order to be able to analyze possible price increases[8] (see Train Section Access Project (Study 2, Chapter 9.4) and Rush Hour Access Project (Chapter 10)).

In stage two of the project, we then empirically investigated these two ideas. Below, we present the hybrid choice methodology used and then we outline the consumer preference analysis regarding the two innovative product offers that we chose to examine.

8 Methodology of Choice Models

In the following, we first provide a general overview of the hybrid choice modeling approach we used. We then discuss how we applied the approach to each of the projects separately.

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[4] This decision was made during an USI internal meeting with Prof. Dr. Reto Hofstetter, Prof. Dr. Rico Maggi, and Salvatore Maione on 28.11.2014 USI-SBB and confirmed during a meeting with Stephan Osterwald (SBB Kommunikation; Verkehrsökonomie, Statistik, Forschungszusammenarbeit), Sean Schwegler (SBB Personenverkehr, Preis und Sortiment), Roberta Marcionni (SBB Personenverkehr, Preis und Sortiment), Prof. Dr. Reto Hofstetter (USI), Salvatore Maione, and Lisa Maria Schiestel on 17.12.2014 in Bern.

[5] This decision was made during a meeting with Prof. Dr. Reto Hofstetter, Dr. David Blatter (SBB Personenverkehr, Preis und Sortiment), and Dr. Silvio Sticher (SBB Personenverkehr, Preis und Sortiment) on 22.04.2016 in Bern.

[6] This decision was made during the project kick-off meeting with Stephan Osterwald (SBB Kommunikation; Verkehrsökonomie, Statistik, Forschungszusammenarbeit), Sean Schwegler (SBB Personenverkehr, Preis und Sortiment), Roberta Marcionni (SBB Personenverkehr, Preis und Sortiment), Prof. Dr. Reto Hofstetter, and Lisa Maria Schiestel on 10.06.2014 in Bern.

[7] This decision was suggested during an internal USI meeting with Prof. Dr. Rico Maggi, Prof. Dr. Reto Hofstetter, and Salvatore Maione on 28.11.2014 and confirmed during a meeting with Stephan Osterwald (SBB Kommunikation; Verkehrsökonomie, Statistik, Forschungszusammenarbeit), Sean Schwegler (SBB Personenverkehr, Preis und Sortiment), Roberta Marcionni (SBB Personenverkehr, Preis und Sortiment), Prof. Dr. Reto Hofstetter (USI), Salvatore Maione, Lisa Maria Schiestel on 17.12.2014 in Bern.

[8] This decision was made via email communication with Dr. Silvio Sticher (SBB Personenverkehr, Preis und Sortiment) on 18.07.2016.

8.1 Experimental Design

Choice behavior can be influenced by two different sources: (product) attributes and (individual) characteristics (Hensher, Rose, & Greene, 2005). Attributes are related to the description of a specific product (type of access, subscription duration, etc.), whereas characteristics are related to the description of the individual through socio-economic variables and latent variables (e.g., measuring attitudes).

Concerning the attributes, two main types of choice data can be collected according the choice literature: revealed preference (RP) and stated preference (SP) data. RP data are data collected from choices made in real situations, whereas SP data are collected from choices made in hypothetical situations. Both data have advantages and disadvantages. The advantage of RP data is that they contain actual choices of individuals and the resulting preference estimates are highly valid. Since the alternatives shown in an RP study need to be actually sold, they need to actually exist. This is a problem, e.g., for surveys measuring product innovations, because the alternatives are typically at the idea or concept stage and not yet developed or ready to be sold. SP studies alleviate this problem but may suffer from biased responses (Miller & Hofstetter, 2009). Individuals may pay less attention to how they respond to SP surveys, as the choices they indicate are not consequential. This is less of a problem, however, if respondents are highly involved into the product category (Hofstetter, Miller, Krohmer, & Zhang, 2013) and if relative and not absolute preference values are interpreted (Miller, Hofstetter, Krohmer, & Zhang, 2011). In our project, we intended to measure preferences for hypothetical offerings and thus chose an SP approach. Customers of SBB are typically highly involved with the brand and its offerings, which is why we believe this approach could still generate meaningful values that are indicative of consumers' preferences. Nevertheless, the resulting absolute values (such as WTP values for alternatives) should be interpreted with caution, as they may suffer from hypothetical bias.

For properly setting up a SP choice experiment, the stages of the so-called experimental design process (as explained in Hensher et al., 2005) need to be followed in line with the statistical model that is planned to be estimated. The process is composed of eight stages: (1) problem definition, (2) stimuli refinement as composed of alternative, attribute, and attribute level identification, (3) experimental design consideration, (4) experimental design generation, and (5) allocating attributes to design columns, (6) generation of the choice design, (7) randomization of choice sets, and (8) construction of the survey instrument. We have already partly described steps one and two in the previous chapter and we will go into detail again for each individual project later in the document. We will also outline steps six to eight later per individual project. Therefore, we will only outline step 3 here.

In the experimental design consideration stage (stage 3), a distinction between unlabeled and labeled experiments must first be made. Unlabeled experiments adopt generic titles for the alternatives (i.e., they are called alternative 1, alternative 2, etc.). They are used when the objective of the research concerns the evaluation of individual attributes and the number of possible alternatives is large. In labeled experiments, specific labels are assigned to each alternative (i.e., brands, product names, etc.). Labelled experiments are used when the alternatives have different attributes (some of them might not be available for some alternatives) and/or different ranges of levels for one or more attributes. Moreover, they make the choice more realistic.

In order to avoid assumptions made by a decision-maker on omitted attributes based on the labels attached to the alternatives (de Bekker-Grob et al., 2010) but retain the flexibility of a labeled experiment, we adopted an approach in between the labeled and the unlabeled. In the second study of the Train Section Access Project and the study of the Rush Hour Access Project, alternatives have alternative-specific attributes and generic labels (i.e., alternative 1). In the first study of the Train Section Access Project, we adopted an unlabeled choice experiment.

The experimental design consideration stage (stage 3) also involves the definition of the number of choices that a decision-maker has to face. This number depends on the type of factorial design chosen. Literature here makes the main distinction between full factorial designs and fractional factorial designs (Hensher et al., 2005; Rose and Bliemer, 2009). Full factorial designs use all possible combinations (choice tasks) coming from the number of attributes and attribute levels adopted in the choice experiment. Increasing the number of alternatives, alternative attributes, or attribute levels dramatically increases the number of combinations (based on the formula L^{MA}, where L is the number of attributes' levels, M is the number of alternatives in the choice set, and A is the number of attributes per alternative), and consequently the cognitive burden on respondents. Fractional factorial designs, instead, use only a subset of the total number of combinations. Hence, each respondent faces only a (random) selection of combinations from the total number of possible combinations. There exist three categories of fractional factorial designs as defined by Hensher et al. (2005) and Rose and Bliemer (2009): random designs, orthogonal designs, and efficient designs. In our studies, we adopted an efficient design selecting subsets of combinations that minimize the standard errors associated with the parameter estimates (Huber & Zwerina, 1996).

To reduce further the number of combinations shown to respondents and the related cognitive burden, we adopted a blocking technique that breaks down the design into different segments (blocks). Blocking a design does not reduce its size; rather it only reduces the number of choice sets a respondent has to face. All the choice designs have been developed using Ngene software (ChoiceMetrics, 2014).

8.2 Discrete and Hybrid Choice Models

We applied a so-called hybrid choice modeling approach. As hybrid choice models are an enhancement of discrete choice models, we will first give an overview over the discrete choice methodology followed by the hybrid choice methodology.

From an economic perspective, choice models have been widely used within the context of random utility theory to predict choice behavior (Ben-Akiva et al., 2002). These models assume that an individual chooses the alternative that maximizes his/her utility between a set of alternatives based on his/her socio-economic characteristics and on the attributes of the alternatives available (Tversky & Kahneman, 1975). Discrete choice analysis (DCA) analyzes the choice process that involves discrete alternatives that are mutually exclusive. It bases on the random utility theory (RUT) proposed by Thurstone (1927). McFadden (1973) expanded it to a multiple choices version. The underlying idea of RUT is that individual's utility associated with each alternative is a variable not directly observable by researchers (latent variable) and the observed choices are indicators (manifestations) of these utilities (Ben-Akiva et al., 1999).

These utilities, one for each alternative available during the choice process, can be divided into two parts: systematic and random. The former includes the explanatory variables, such as alternative attributes and individual characteristics, whereas the latter takes into account all the unidentified factors that influence choices (Bolduc & Alvarez-Daziano, 2010). Concerning the random part, Manski (1977) has identified several sources of uncertainty: attributes of alternatives not included, unobservable changes in respondent's taste, measurement errors, and instrumental variables. This uncertainty arises from the partial and incomplete information that the researcher has about the factors that drive the decision-making process. This implies that choices could be explained using a probabilistic framework only. Based on the assumptions associated with the distribution of the random part of the utility function, it is possible to derive different choice models (Ben-Akiva & Lerman, 1985). One of the models is the multinomial logit model (MNL) (McFadden, 1973), which assumes the homogeneity of preferences across respondents and that the variance of the random part is independent and identically distributed.

In the context of discrete choice models, the study of preferences focuses on the analysis of available options information and individual constraints. Due to their focus, several literatures criticized these models for the inability to describe the heterogeneity of human behavior. In particular, sociologists, behavioral economists, and cognitive psychologists have demonstrated that individuals often violate most of the assumptions defined by rational behavior (Kahneman & Tversky, 1979, 1984). Behavioral scientists have focused on understanding how decisions are formed and in analyzing the nature of the decision-making process based on psychology theory that not always satisfies that assumption of rationality. McFadden (1986) acknowledged already in the 1980's that there are several interactions of psychological factors when an individual chooses an alternative. Forward (2004) and Domarchi, Tudela, and González (2008) have shown that the presence of a relationship between attitudes and behavior can help to understand the decision process that generates choices. In this context, behavioral choice analysis focuses on the decomposition of the decision-making process and the identification of potential irregularities, whereas predictive choice models have the goal of predicting the respondent's decisions highlighting regularities in the process (Ben-Akiva, et al., 2002).

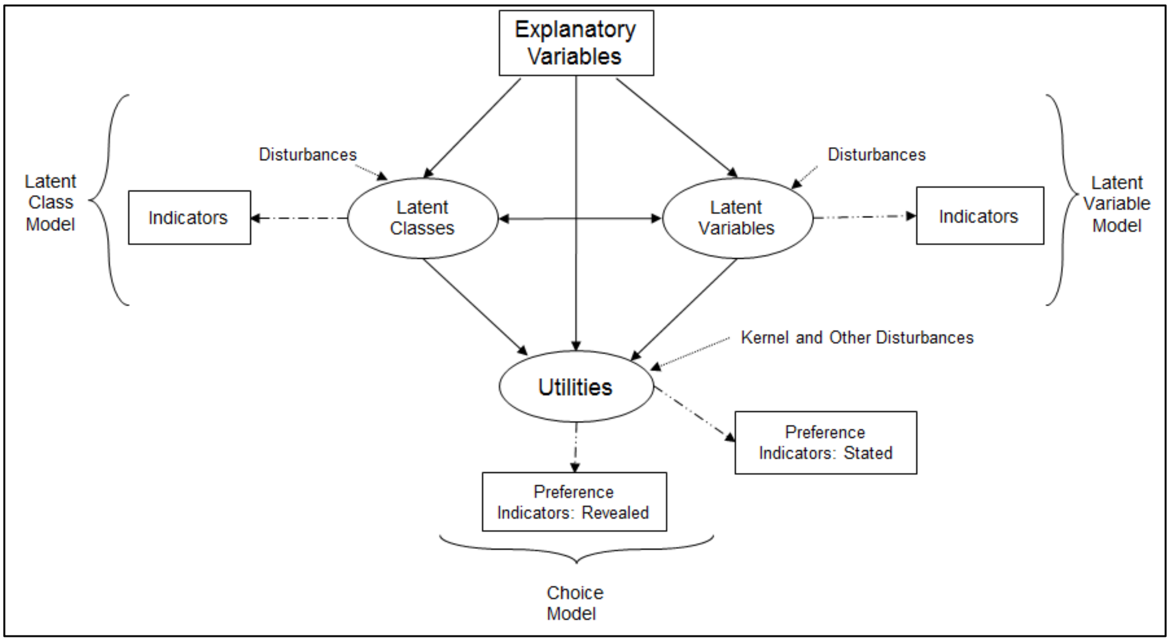
Therefore, in order to reduce the gap between the two fields mentioned above, researchers in the field of discrete choice models have worked on the development of these models in order to introduce the process of preference formation as well as psychological factors that determine human decisions (Bentler, 1980; Jöreskog, 1970; Keesling, 1973; Wiley, 1973). Researchers have developed more integrative approaches that account for both perspectives (Ben-Akiva, et al., 2002). For instance, substantial research has been conducted related to incorporating psychographics into discrete choice models. This integration is possible using so-called hybrid choice models, a methodology in which latent (unobservable) variables are directly incorporated in the choice model via observable variables called indicators (Ben-Akiva, et al., 1999; Walker, 2001).

In particular, three different methods have been identified to introduce psychological latent variables in a discrete choice model (Walker, 2001): (1) introducing psychological indexes directly in the utility functions (Green, 1984; Harris & Keane, 1998); (2) performing a factor analysis on psychological indices and introducing the fitted variables obtained in the utility functions (Madanat, Yang, & YING-MING, 1995); and (3) inferring latent attributes of the alternatives as well as consumer preferences from choice data and, then, using indicators to explain latent variables (Elrod, 1991; Elrod & Keane, 1995).

In this work, psychological indexes have been directly added in the utility functions of the discrete choice framework considering these variables source of heterogeneity. Figure 2 shows a general representation of a hybrid choice model (Walker & Ben-Akiva, 2002).

Figure 2

General Representation of the Hybrid Choice Model



Technically, latent variables are incorporated through an extension of the standard random utility model. The utility values U are latent variables and preference indicators y are manifestations of these underlying utilities (Walker & Ben-Akiva, 2002).

The utility equation for each decision-maker n and alternative i can be written as:

$$U_{in} = V(X_{in};\ \beta) +\ \varepsilon_{in} \tag{1}$$

where U_{in} represents the benefits of alternative i [I = 1, …, J_n] perceived by decision-maker n [n = 1, …, N] (U_n is a vector of utilities for decision-maker n); X_{in} is a vector of explanatory variables describing characteristics of alternative i and characteristics of decision-maker n (X_n is a matrix of explanatory variables describing all alternatives' characteristics that decision-maker n has faced); β is a vector of unknown parameters; V is a function of the explanatory variables X_{in} and the unknown parameters β; ε_{in} is a random disturbance for i and n, where $\varepsilon_n \sim D(\theta_\varepsilon)$ with θ_ε as unknown parameters. RUM assumes that each individual chooses a specific alternative if, and only if, this alternative maximizes his/her own utility. In other words, decision maker n chooses alternative i if, and only if, the utility of this alternative (U_{in}) is greater than or equal to the utility of an alternative j (U_{jn}) for all the alternatives faced by n. Based on this criterion, the choice probability equation is:

$$P(i|X_n; \beta, \theta_\varepsilon) = Prob[U_{in} \geq U_{jn}, \forall j \in C_n] \tag{2}$$

Each alternative has a specific indicator y_{in} that assumes values: (0,1); 1 when decision maker n chooses that alternative (i), 0 for all the other alternatives present in the set of alternatives C_n faced by n. From the previous equations, the following likelihood function is derived:

$$P(y_n|X_n;\ \beta, \theta_\varepsilon) = \prod_{i\,\in\,C_n} P(i|X_n; \beta, \theta_\varepsilon)^{y_{in}} \tag{3}$$

Concerning the aforementioned latent variables, there are techniques that allow the incorporation of these variables in the model. The hypothesis is that, although these latent constructs cannot be observed and measured directly, their effects on indicators (measurable variables) can be observed. The objective is to introduce explicitly these relationships providing information on the unobservable variables, such as attitudes and perceptions, in the model.

By introducing the latent constructs, the generalized decision model becomes a two-component model: the choice model, previously defined, and additionally the latent variables model. The benefits can be represented, including the matrix X^*_n of unobservable explanatory variables in Equation 4, as follows:

$$U_n = V(X_n, X_n^*; \beta) + \varepsilon_n \tag{4}$$

Assuming that these latent variables were added, the conditional probability of y_n given X^*_n would be defined as:

$$P(y_n|X_n, X_n^*; \beta, \theta_\varepsilon) \tag{5}$$

To obtain the unconditional probability of y_n, the latent variable structural model must be defined and, afterwards, the conditional probability must be integrated over the distribution of these latent variables. Therefore, the latent variable structural model is:

$$X_n^* = X_n^*(X_n; \lambda) + \omega_n \tag{6}$$

where: the latent variable X^*_n is a function of a set of explanatory variables directly observed X^*_n, a set of parameters λ and a disturbance $\omega_n \sim D(\theta_\omega)$.

From this model, the density function of the latent variables, $f(X^*|X_n; \lambda, \theta_\omega)$, could be derived and used to calculate the unconditional probability equation from Equation 5:

$$P(y_n|X_n;\ \beta, \lambda, \theta_\varepsilon, \theta_\omega) = \int P(y_n|X_n, X_n^*; \beta, \theta_\varepsilon) f(X^*|X_n;\ \lambda, \theta_\omega)\, dX^* \tag{7}$$

Unfortunately, the estimation of this model is difficult due to the latent psychological factors. Therefore, psychometric data are used as indicators of these unobservable constructs through the latent variable measurement model:

$$I_n = I(X_n^*; \alpha) + \nu_n \tag{8}$$

where: I_n represents a vector of indicators related with the unobservable constructs; X^*_n represents a matrix of latent variables; α is a set of parameters; ν_n is a disturbance, $\nu_n \sim D(\theta_\nu)$. From this model, as done before with Equation 6, the density function of the indicators is $f(I_n|X^*; \alpha, \theta_\nu)$. Integrating this density function in the previous model (Equation 7), the final form of the integrated choice and latent variable model is:

$$P(y_n, I_n | X_n;\ \beta, \alpha, \lambda, \theta_\varepsilon, \theta_\nu, \theta_\omega) = \int P(y_n | X_n, X_n^*; \beta, \theta_\varepsilon) f(I_n | X^*;\ \alpha, \theta_\nu) f(X^* | X_n;\ \lambda, \theta_\omega)\, dX^* \qquad (9)$$

This methodology has already been used for many applications, e.g., for modelling intercity mode choices, including comfort and convenience as latent variables (Morikawa, Ben-Akiva, & McFadden, 2002) or for modelling the recreational choices of young people involving attitude towards alcohol consumption as unobservable construct (Scagnolari & Maggi, 2010). This survey and the relative data analysis above allow insight into the dynamic relationships between existing and innovative product offers in the SBB product line.

Unlike previous studies, where the focus is to analyze the interdependencies between different “Mobility Tools” (Ciari, Marmolejo, Stahel, & Axhausen, 2014; Scott & Axhausen, 2006; Vrtic, Schüssler, Axhausen, & Erath, 2011), the aim of this project is purely on the different offers of SBB in the public transport scenario.

9 Train Section Access Project

In the Train Section Access Project, we investigate whether it could make sense for SBB to separately price access to dedicated sections on the train. By definition, public transportation leads to social encounters. Especially during rush hour, travelers often need to stay physically close to one another in crowded trains. Travelers are heterogeneous and differ on a multitude of dimensions, such as their behaviors on the train, their needs on the train, or their trip purposes. For some travelers, this diversity itself may create value. For others, it may create disutility since they feel restricted or at unease due to other people that show different behaviors on the train. These individuals may prefer separate sections on the train, including business, silent, family, or other sections that allow them to travel with alike individuals and stay separate from others with different travelling needs. We test this possibility in this project and ask the following research question: Do dedicated train sections that create separate spaces for people with different travel needs and habits provide value to travelers?

To investigate this research question, we measured and analyzed travelers’ preferences for travel cards with access to either common (i.e., section for all kind of travelers) or common plus dedicated (i.e., section for travelers with certain needs) sections. We examined how both demographics, special traveler characteristics, and psychographics drive the preference for dedicated sections. Most importantly, we investigate the explanatory power of the latent construct of out-group derogation, i.e., a tendency to ascribe negative characteristics to individuals that are not part of one’s own social group (Dasgupta, 2004). We expected that individuals that have a high tendency towards out-group derogation would show a higher preference for the dedicated over the common section only. If this is the case, providing targeted offers with dedicated section access could be a viable strategy for SBB to increase revenues.

In the following sections, we will first shortly review the literature on social influence. Second, we will introduce the conceptual framework of the project. Third, we will give a short overview over other latent constructs used in transportation research. Fourth, we will outline the research design and report the results of the two studies we conducted. Finally, we will summarize the results and offer recommendations for SBB.

9.1 Literature Review

9.1.1 Social Influence in Transportation

Transportation choices are not only influenced by individuals’ intrinsic preferences, but also by their social environment. Social influences have manifested in several domains of transportation choice. A substantial body of research has already investigated the relative strength of social influence compared with other factors driving travel choice (Ferdous, Pendyala, Bhat, & Konduri, 2011; Gaker, Zheng, & Walker, 2010; Kinateder et al., 2014; Sherwin, Chatterjee, & Jain, 2014; Von Sivers, Templeton, Köster, Drury, & Philippides, 2014). Others have explored the role of social identity

(Fielding, McDonald, & Louis, 2008; Lois, Moriano, & Rondinella, 2015) and social norms (Dieplinger & Fürst, 2014; Forward, 2009; Huth & Gelau, 2013; Paris & Van den Broucke, 2008; Riggs, 2017; Schade & Schlag, 2003; Zhang, Schmöcker, Fujii, & Yang, 2016) when it comes to traveling. None of this prior research, however, has looked into the preferences related to the social mixing of individuals on the train, which is the focus of our investigation.

9.2 Conceptual Framework

Conceptually, we utilize social identity theory (Tajfel & Turner, 1979) and research related to intergroup biases (Hewstone, Rubin, & Willis, 2002). People generally favor the social group they belong to (the in-group) and try to distinguish themselves from other social groups (the out-groups) (Dasgupta, 2004; Hogg, 1996; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). In a similar vein, travelers also belong to different travel-related groups. We propose that travelers who have a higher tendency to distinguish themselves from different social groups on the train are more likely to derive utility from being able to travel in a space where they are separated from their out-group.

9.2.1 Social Identity Theory, the In-Group, and the Out-Group

For a specific individual, the in-group refers to the group that the individual is a member of and the out-group to the group he/she is not a member of (Hewstone et al., 2002). This can be a cultural group, a religious group, or more generally, a so-called psychological group, which is based on psychological traits, that are independent of external features. Groups often share beliefs, behavioral norms, and expectations, which can be clearly distinguished from other groups (Efferson, Lalive, & Fehr, 2008). How distinctive two different groups are depends on the perceived dissimilarity between those groups on a specific comparison dimension (Jetten, Spears, & Manstead, 2001).

Social identity theory explains how individuals identify their membership of a certain group. According to this theory, psychological group formation is a process of self-categorization. Self-categorization is an individuals' attraction towards a group based merely on the group label and not on the interaction with individuals of the group (Hogg & Turner, 1985). This process is thus based on group-prototypes and not on an individual basis (Hogg, Hardie, & Reynolds, 1995). A prototype of a specific group is an abstract representation of average, stereotypical, or normative characteristics of group members in comparison with the average characteristics of non-group members (Hogg et al., 1995). Group prototypes are formed through depersonalization, a process in which cognition, perception, and behavior are defined by the standards of the group, i.e., the group norms, group stereotypes, and group prototypes instead of by personal standards (Hogg & Hardie, 1992; Hogg et al., 1995; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). Individuals of a certain group, usually the in-group, are then liked not because of their individual characteristics, but rather because they are the "embodiments of the group" and the more similar an individual is to the group prototype, the more it is liked (Hogg & Hains, 1996). Davis (1984) shows that individuals' attraction to a group increases in relation to the level of similar attitudes of the group and the individual. How similar attitudes are perceived depends on a multitude of factors, such as external factors that include the evaluations of the group's intelligence (Davis, 1984). Hence, how much a person can identify with a particular group directly influences social attraction.

Individuals have a general tendency to ascribe more positive characteristics to their in-groups than to their out-groups (Dasgupta, 2004). This phenomenon is called in-group favoritism and it is omnipresent in human societies (Lewis & Bates, 2010). On the other hand, out-group derogation describes the opposite perspective of the same phenomenon, i.e., that people have a tendency to ascribe negative characteristics more easily to their out-groups (Dasgupta, 2004). This phenomenon is also often called intergroup bias, which is defined as a more favorable evaluation of the in-group compared with the out-group (Hewstone et al., 2002; Levin & Sidanius, 1999). Intergroup biases influence judgments, decisions, and behaviors (Dasgupta, 2004). This leads to individuals feeling connected to their in-group and wanting to separate from their out-groups (Hogg, 1996; Turner et al., 1987). Intergroup biases are positively influenced by intergroup competition since it renders the distinction between in- and out-group more salient (Brewer, 1979). Literature also evidenced that individuals differ in their tendency towards in-group favoritism and out-group derogation (Jost, Glaser, Kruglanski, & Sulloway, 2003; McGregor, Haji, & Kang, 2008; Stangor & Thompson, 2002).

9.2.2 How Social Identity Drives Travel Choice

We argue that the in- and out-groups do matter to travelers on the train. Each traveler is member of a specific travel-related socio-psychological group as defined by psychographic and demographic characteristics that may differ from the socio-psychological groups of other travelers on the train. Travelers who do not belong to the same group (i.e., are considered as being part of the out-group), may be perceived as disturbing. In particular, they might interfere with a person's individually preferred way of traveling. This leads to a general tendency to separate oneself from the out-group (Brewer, 1979). In addition, the mere awareness of different groups being present on the train as signaled by different behaviors may lead to some form of intergroup conflict (Tajfel & Turner, 1979). Thus, mixing such different travelers together may cause dissatisfaction.

The creation of special sections on the train that are dedicated to a special group of travelers allows travelers to self-categorize into their respective social groups. The label given to the train section (i.e., business, lifestyle, family, or silence) functions as an indicator of the social group, allowing travelers to draw inferences about the prototype person in that section. Based on the self-categorization process, travelers should thus classify themselves into the section to which they feel most socially attracted to in order to minimize intergroup conflicts. Therefore, we propose:

H1a: When choosing between travel card offerings, travelers have a higher utility for travelcards that offer additional access to dedicated sections (vs. access only to common section).

On the train, travelers are relatively unlikely to engage in active interpersonal interaction. They consider sitting with members of the in-group as being less important than sitting separately from out-group members. Hence, they choose a train section based on who they do not want to sit with (negational categorization) rather than who they want to sit with (affirmative categorization). Where affirmative categorization relates to in-group favoritism, negational categorization relates to out-group derogation (Zhong, Phillips, Leonardelli, & Galinsky, 2008). Consequently, the stronger the tendency towards out-group derogation, the stronger the desire to separate from the out-group, and the higher the likelihood to choose a travel card with dedicated section access (Ajzen, 1985). Therefore, we propose:

H1b: When choosing between travel card offerings, travelers with a high (vs. low) tendency towards out-group derogation derive a higher utility from travel cards that offer additional access to dedicated sections (vs. access only to common section).

9.2.3 Other Relevant Psychological Constructs in Transportation

The transportation literature has already investigated the role of numerous psychological constructs for transportation choices; however, none has focused on out-group derogation. These constructs are typically introduced into statistical models in the form of latent variables. They comprise attitudes, perceptions, lifestyle variables, and personality traits. We briefly summarize these constructs and the related research below.

An attitude is "a feeling or opinion about something or someone, or a way of behaving that is caused by this" (Cambridge Dictionary, 2017a). Attitudes have shown impact on various decisions in the transportation field. Redmond and Mokhtarian (2001) showed that having a positive perception of travel helped to explain an increased utility of commuting. On the contrary, they found that a higher family or community orientation led to a lower commuting utility. Choo and Mokhtarian (2004) investigated the effect of, among other things, attitudes on the choice of car type and found that individuals who dislike traveling more would rather drive luxury cars and that individuals who prefer to live in urban neighborhoods prefer smaller cars. Johansson, Heldt, and Johansson (2006) showed that attitudes toward comfort and flexibility influenced choices of transportation mode. Bolduc, Boucher, and Alvarez-Daziano (2008) indicated that introducing appreciation of new car features as a variable into a model for new car choices in Canada increased explanatory power. Kamargianni and Polydoropoulou (2013) found that students' attitudes toward walking and cycling had an impact on the choice of these modes. Kuppam, Pendyala, and Rahman (1999) even discovered that attitude variables have a greater explanatory power than demographic variables in their mode choice.

A perception is “a belief or opinion, often held by many people and based on how things seem” (Cambridge Dictionary, 2017c). For example, the perceptions of walkability of the route to work influence the mode choice for the school commute of teenagers (Kamargianni & Polydoropoulou, 2013). Redmond and Mokhtarian (2001) found that introducing perceived commute benefits as a variable into a model estimating the utility of commuting increased explanatory power.

A lifestyle is “someone’s way of living; the things that a person or particular group of people usually do” (Cambridge Dictionary, 2017b). Travelers with different lifestyles tend to make different decisions. Choo and Mokhtarian (2004) found that less frustrated individuals were more likely to drive luxury cars, workaholics (status seekers) were less (more) likely to drive small cars and sports cars. Finally, those who like traveling by car were more likely to invest more into cars. However, they stated that the direction of causality is ambiguous. Redmond and Mokhtarian (2001) showed that status seeking and being a workaholic helped to explain a higher utility of commuting. Temme, Paulssen, and Dannewald (2008) discovered that with an increasing desire for flexibility, the propensity to avoid public transport also increased. On the other hand, with the increasing importance of a convenient and comfortable commute, the propensity to use public transport increased.

A personality trait is a way of behaving or a tendency that is typical for a specific person (Myers, 2008). Such traits can inform transportation behavior in different ways. For instance, Johansson et al. (2006) found that being pro-environmentally inclined influenced travel mode choice. Similarly, Bolduc et al. (2008) showed that environmental concern helped to explain new car choices in Canada. Further, Bekhor and Albert (2014) investigated the impact of a different personality trait, sensation-seeking, and showed that it influenced route choice.

9.3 Study 1

The goal of Study 1 was to test our two hypotheses (H1a and H1b) related to the basic effect of offering dedicated sections (vs. only common sections) and the moderating role of out-group derogation.

9.3.1 Methodology

9.3.1.1 Choice Design

In order to maximize the richness of the data without creating a complex and elaborate choice experiment, we developed a blocked choice design. The design consists of five blocks with 12 choice tasks per each block to ensure an equal distribution of attribute levels within each attribute. Respondents were randomly assigned to one of five blocks. In each block, the order of the choice tasks was randomized. In each task, we included three product alternatives and a non-choice option. We used an “unlabeled” approach, meaning labels were not used to identify the alternatives, and each is the combination of all attributes listed below.

Each alternative had four attributes: “train section access”, “geographical access”, “travel during rush hour (7:00 – 8:30 and 17:00 – 18:30)[9]”, and “price” (see Table 2 for details).

The “train section access” attribute describes sections on the train to which each traveler has access through a travel card. This attribute had two levels: “common section access” and “common + dedicated section access”. “Common section access” defines access to the common sections of the train. These sections are accessible by any traveler holding a valid ticket. The level “common + dedicated section access” defines access to dedicated sections of the train (in addition to access to the common section). These sections differ from each other in order to satisfy the needs and habits of the travelers. There are different sections dedicated to the traveling needs and habits related to (a) business, (b) silence, reading, and relaxing, (c) families, and (d) lifestyle, music, and media. With a “common + dedicated section access” travel card, it is possible to choose a section and change between sections during each trip. The type of people present in the different sections produces the

[9] The decision about this rush hour interval was made during a meeting with Stephan Osterwald (SBB Kommunikation; Verkehrsökonomie, Statistik, Forschungszusammenarbeit), Sean Schwegler (SBB Personenverkehr, Preis und Sortiment), Roberta Marcionni (SBB Personenverkehr, Preis und Sortiment), Prof. Dr. Reto Hofstetter (USI), Salvatore Maione, and Lisa Maria Schiestel on 17.12.2014 in Bern.

substantial difference between the two categories of access. Travelers with "common section access" cannot access the dedicated sections, whereas travelers with "common + dedicated section access" have complete access to all train sections. We will refer to the "common + dedicated section access" as simply "dedicated section" from now on for simplicity reasons. We provide the detailed instructions we provided also to respondents in Appendix Figure 24.

The "geographical access" attribute describes the geographical extension in which the subscription is valid. It had six levels: "area small (zone)" identifies access to an area large as two zones; "area medium (region, canton)" identifies access to an area as large as an entire region/canton; "route (> 10 km)" identifies access to a Point-to-Point subscription longer than 10 km; "area small (zone) + route (> 10 km)" identifies access to an area as large as two zones and access to a Point-to-Point subscription longer than 10 km; "area medium (region, canton) + route (> 10 km)" identifies access to an area as large as an entire region canton; and "area big (country)" represents access to public transport throughout Switzerland.

The "travelling during rush hour (7:00 – 8:30 and 17:00 – 18:30)" attribute describes the subscription validity during the rush hour and it had two levels: "no" identifies a subscription valid outside the rush hour only and travelers holding that travel card are not permitted to take the train during rush hour; "yes" identifies a subscription with no time restrictions and it can be used during rush hour.

The "price" attribute describes the economic outlay to purchase a specific travel card. It had four levels ("CHF 1'000.-", "CHF 2'500.-", "CHF 4'000.-", and "CHF 5'500.-"), which cover the range of prices of existing products provided by SBB.

Table 2

Attributes and Attribute Levels for Train Section Access Project (Study 1)

Attribute	**Number of levels**	**Description**
Train section access	2	Common section access; common + dedicated section access (further referred to as "dedicated section" for simplicity reasons)
Geographical access	6	Area small (zone); area medium (region, canton); route (> 10 km); area small (zone) + route (> 10 km); area medium (region, canton) + route (> 10 km); area big (country)
Traveling during rush hour	2	No; yes
Price	4	CHF 1'000.-; CHF 2'500.-; CHF 4'000.-; CHF 5'500.-

9.3.1.2 Latent and Other Variables

We began developing the scale to measure the tendency towards out-group derogation based on an existing scale that measures the tendency towards in-group favoritism related to different social groups by Lewis and Bates (2010). This scale uses three items related to the strength of identification with the group, the preference for affiliating with in-group members, and the importance placed on marrying within the group items[10] of which the first two are particularly relevant for us. Based on these two items, we extended the scale to additional social groups, such as economic groups, cultural groups, and status groups. We did so in order to be able to measure the concept in general and not only based on one single group dimension. Additionally, we generated new items to measure in-group favoritism, particularly in the train context, i.e., regarding traveling needs and behaviors, in order to account for the particular context of our research. Based on the discussions in several focus groups, we adjusted and validated all scale items. Finally, we conceptually reversed the items to render them consistent with the definition of out-group derogation. That is, instead of asking for a preference to be with similar people or a preference for an affiliation with similar people, we asked for a preference to distance oneself from different people or a preference not to affiliate with different people. The resulting scale has 12 items, as shown in Figure 3.

[10] For example, for the religious group, the items were worded as follows: "How closely do you identify with being a member of your religious group?", "How much do you prefer to be with other people who are the same religion as you?", "How important do you think it is for people of your religion to marry other people who are the same religion?".

Figure 3
Out-Group Derogation Scale (Studies 1 and 2)

Please indicate how much you agree with the following statements.

	I strongly disagree. 1	2	3	4	5	6	I strongly agree. 7
When I am travelling alone on the train, I distance myself from people ...							
... who have a different type of work than me.							
... who have a different family status than me.							
... who are from a different social / economic class than me.							
... who are culturally different from me.							
When I am travelling alone, I separate from people ...							
... who have different personal characteristics than me.							
... who do not share my beliefs / values.							
... who have different interests than me.							
... who behave differently than me.							
When I am travelling alone, I prefer not to be on the train with people ...							
... who have different travel needs than me.							
... who have different purposes of travelling than me.							
... who travel in different ways than me.							
... who travel a distance different from mine.							

We also measured different trait variables that prior research has identified as relevant. These measures can later serve as controls in the analysis, if needed. We measured travelers' lifestyle with four different scales. First, we measured the degree to which a traveler has a frustrated lifestyle on a four-item scale by Redmond (2000). We also used the four-item scale to measure a family/community related lifestyle as well as the five-item scale to measure a workaholic lifestyle by Redmond (2000). Whether a traveler leads a status-seeking lifestyle was measured on a three-item scale derived from Eastman, Goldsmith, and Flynn (1999). Further, we measured to what extent a traveler values hedonism on a three-item scale developed by Temme et al. (2008). A seven-item scale to measure the time-consciousness of travelers was derived from Kleijnen, De Ruyter, and Wetzels (2007). We also measured travel-liking (four-item scale), commute benefits (five-item scale), and travel stress (five-item scale) (Redmond, 2000), the desire for comfort (four-item scale), and for flexibility (three-item scale) (Johansson et al., 2006). Finally, we measured whether travelers consider traveling as utilitarian or hedonic on a three-item scale (Wakefield & Inman, 2003). All the above-mentioned variables were measured on seven-point scales. The Cronbach's alphas of all scales are reported in Table 3 and the correlations between the latent variables are reported in Appendix Table 12.

Table 3
Cronbach's Alpha of Latent Variables (Study 1)

Variable	Cronbach's alpha
Out-group derogation	.95
Family /community oriented lifestyle	.67
Workaholic lifestyle	.63
Status-seeking lifestyle	.90
Frustrated lifestyle	.58
Travel-liking	.49
Hedonism	.84
Time-consciousness	.85
Desire for comfort	.67
Desire for flexibility	.74
Traveling hedonic (vs. utilitarian)	.81
Commute benefits	.64
Travel stress	.79

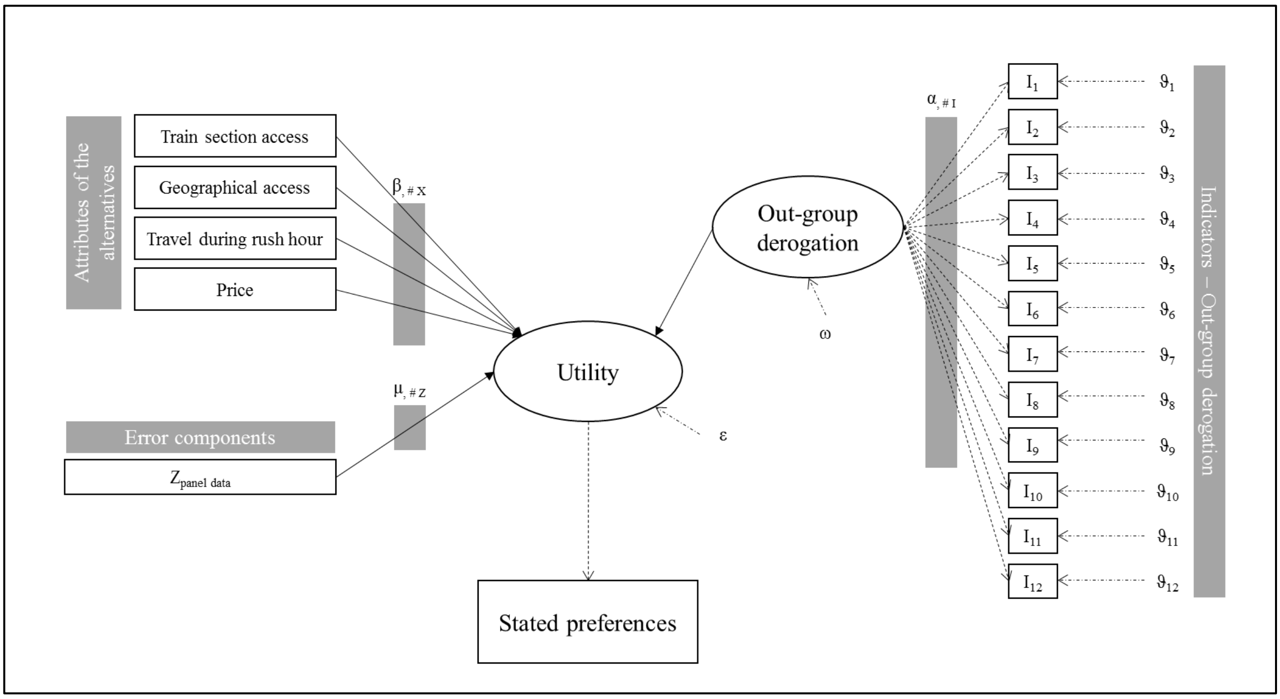
Additionally, we measured a set of variables that were part of the SBB segmentation studies in order to link to the existing segments possible in follow-up analyses (SBB, 2013). These variables included the trip purpose (commuting to and from place of work, commuting to and from an educational institution, leisure trip without overnight stay (excursion, cinema, sports, visit), private vacation trip with at least one overnight stay, everyday tasks (consultation of a doctor, grocery shopping, picking somebody up), business trip, other), the predominant travel class (first class, second class), the need for commuting as well as the commuting habits, and the habits when engaging in leisure trips.

9.3.1.3 Model Specification and Estimation

We applied a hybrid choice framework (Walker, 2001) to the data we collected, estimating two different models: a basic discrete choice model without latent variable (Model 1) and a hybrid choice model (Model 2). Specifically in Model 2, we combined a discrete choice model with the latent variable out-group derogation to one joint model. Figure 4 shows the hybrid choice model framework we used. This path diagram completely describes the relationships among the explanatory variables and the respective partial models through a set of structural and measurement equations. The dashed arrows represent the measurement equations (i.e., the evaluation of the latent variable) and the solid arrows describe the structural equations.

Figure 4

Full Path Diagram of the Hybrid Choice Model (Study 1)



In order to have high flexibility in the definition of the choice model (McFadden & Train, 2000) and to take the panel structure of the dataset into account (Bierlaire & Fetiarison, 2009), we adopted a mixed logit with a normally distributed error component (EC).

The basic model, Model 1 (Appendix Table 19), is such an EC model with the error component for the panel structure of the dataset and without the latent variable. In this model, as well as in Model 2, we have three utility functions (U_1, U_2, U_3) according to the number of alternatives defined in the choice design (see Chapter 9.3.1.1). The utility functions are specified as follows:

$$U_{n1t} = \beta_0 + \beta_1 \times Train\ Section\ Access_{n1t} + \beta_2 \times Geographical\ Access, area\ small\ (zone)_{n1t} + \cdots + \beta_6 \times Geographical\ Access, area\ medium\ (region, canton)\ and\ route\ (> 10\ km)_{n1t} + \beta_7 \times Travelling\ during\ rush\ hour_{n1t} + \beta_8 \times Price_{n1t} + \mu \times Z_{panel\_data,n} + \varepsilon_{n1t} \quad (10)$$

$$U_{n2t} = \beta_0 + \beta_1 \times Train\ Section\ Access_{n2t} + \beta_2 \times Geographical\ Access, area\ small\ (zone)_{n2t} + \cdots + \beta_6 \times Geographical\ Access, area\ medium\ (region, canton)\ and\ route\ (> 10\ km)_{n2t} + \beta_7 \times Travelling\ during\ rush\ hour_{n2t} + \beta_8 \times Price_{n2t} + \mu \times Z_{panel\_data,n} + \varepsilon_{n2t} \quad (11)$$

$$U_{n3t} = \beta_0 + \beta_1 \times Train\ Section\ Access_{n3t} + \beta_2 \times Geographical\ Access, area\ small\ (zone)_{n3t} + \cdots + \beta_6 \times Geographical\ Access, area\ medium\ (region, canton)\ and\ route\ (> 10\ km)_{n3t} + \beta_7 \times Travelling\ during\ rush\ hour_{n3t} + \beta_8 \times Price_{n3t} + \mu \times Z_{panel\_data,n} + \varepsilon_{n3t} \quad (12)$$

In each equation, n identifies the respondent, t the choice task and ε_{nt} is a random disturbance over people and choice tasks (see previous explanation in Chapter 8.2.).

The hybrid choice model, Model 2 (Appendix Table 20), is an extension of Model 1 that uses the latent variable in the utility functions to understand if it increases the explanatory power of the model (Walker, 2001). We defined 12 equations for this model, one for each indicator of out-group derogation. Then, concerning the choice model, we included the latent variable in each utility function as an interaction with the train section access attribute. We omitted these equations from the document.

We estimated these models using the maximum simulated likelihood (MSL) approach implemented in the free software, PythonBiogeme 2.4 (Bierlaire, 2016). Adopting random draws from the probability distributions of the error components and the latent variables, the MSL technique can estimate the maximum likelihood by replacing the multidimensional non-closed integral with a smooth simulator (Train, 2003).

Following procedures suggested by Ben-Akiva, Walker, et al. (2002) and Bhat (2001), we used Halton draws instead of the uniform random draws in order to speed up the estimation. In fact, at the same level of accuracy of the simulator, models with Halton sequences adopt a lower number of draws compared with models with uniform draws. For our models, we adopted 5'000 Halton draws and we did not increase this number for two reasons: the parameter estimates were quite stable and the computational costs increased considerably.

9.3.1.4 Procedure

With the help of the market research agency Intervista AG, we recruited 207 travelers in the German-speaking part of Switzerland for our survey. Only individuals that were planning to purchase a public transport subscription in Switzerland or renew their current one within the next year and who were paying for their subscription by themselves were eligible to participate in the survey. Our sample was stratified by age to represent the Swiss population according to SBB's marketing research standards (Swiss Federal Statistical Office, 2014).

Travelers were asked to answer a survey lasting approximately 20 minutes. The survey was structured as follows. First, they were introduced to the general procedure of the survey. Second, they were asked a set of questions related to their travel behavior and their travel preferences as defined by the SBB segmentation study (SBB, 2013). Third, they needed to complete the choice experiment. Fourth, they had to complete questions related to the latent variables. Finally, they had to fill out a section related to their demographic characteristics. The entire survey was conducted in German. Details concerning the procedure of the choice experiment are provided below.

Before the actual choice experiment, travelers were familiarized with the concept of a travel card. In the choice experiment, each travel card provided access to public transportation in Switzerland for one year. Different travel cards have different access options to the public transport in Switzerland as defined by the previously outlined attributes and attribute levels.

Travelers were then asked to imagine that they were about to purchase a new travel card online and that in the following 12 pages they would face 12 different purchase situations (i.e., choice tasks) in which the website would offer them a different set of travel cards from which they could choose. They were also informed that in each purchase situation, they would have four purchase options. That is, they could either choose one of the three displayed travel card options or leave the store without purchasing a travel card by clicking "None". An exemplary choice task is shown in Figure 5. In the legend, each attribute and its respective levels were again described in detail.

Figure 5

Exemplary Choice Task (Study 1)

If these were the travel card options offered to you, would you buy any of those and if yes which one?

Choose by clicking on one of the buttons below:

	Travel Card Nr. 1	Travel Card Nr. 2	Travel Card Nr. 3	None
Train Section Access	Common Section Access	Common + Dedicated Section Access	Common Section Access	**I would not choose any of these.**
Geographical Access	Area Small (Zone)	Area Small (Zone) + Route (> 10 km)	Area Medium (Region, Canton) + Route (> 10 km)	
Travel during rush hour (7:00 – 8:30 and 17:00 – 18:30)	Yes	No	Yes	
Price	CHF 5'500.-	CHF 1'000.-	CHF 4'000.-	

LEGEND (Click on the attribute name to see the description)

- **Train Section Access**
- **Geographical Access**
- **Travel during rush hour (7:00 – 8:30 and 17:00 – 18:30)**
- **Price**

9.3.2 Description of Sample

Of the 207 travelers we recruited, 101 were female (49 percent) and the average age was 45.02 years. Most of the respondents in the sample owned a Half-Fare travel card (63 percent), followed by the regional travel cards (23 percent), the general subscription (GA, 22 percent), and the Point-to-Point travel cards (6 percent). Six percent of the sample did not have a current subscription. The most frequent purposes of travelling by train of respondents in our sample were leisure trips without overnight stays (80 percent), followed by everyday tasks (46 percent). Forty-five percent of the survey respondents indicated that they were commuting by train to work and 14 percent of the survey respondents were commuting by train to an educational institution. Forty-two percent or the respondents were engaging in vacation trips with at least one overnight stay and 21 percent were taking business trips.

9.3.3 Results from Choice Modeling

Model 1 (Appendix Table 19) shows the coefficient estimates of the basic model that included all attribute levels. Each coefficient represents the contribution that its specific attribute level has on the overall utility of the alternative. In line with this, the y-axis of all graphs measures the utility contribution of the attribute level represented.

The results show that broader geographical access provides higher utility to travelers ($\beta_{\text{area small}} = -1.12$, $p < .01$; $\beta_{\text{area small + route}} = -.96$, $p < .01$; $\beta_{\text{route}} = -.46$, $p < .01$; $\beta_{\text{area medium}} = .26$, $p < .05$; $\beta_{\text{area medium + route}} = .31$, $p < .05$). For a better interpretability, the utilities associated to the geographical access are represented in Figure 6. The utilities of the attribute levels correspond to the values of the relative coefficients (e.g., $U_{\text{area small}} = \beta_{\text{area small}}$) except for the attribute reference level.[11] For example, we calculated the utility of the attribute level area big (country), reference level of the attribute geographical access, as follows:

$$U_{area\ big} = (-1) \times \beta_{area\ small} + (-1) \times \beta_{area\ small + route} + (-1) \times \beta_{route} + (-1) \times \beta_{area\ medium} + (-1) \times \beta_{area\ medium + route}$$

Plugging in the coefficient estimates, we obtain the following value:

[11] We coded this variable using the so-called effect coding technique (Hensher et al., 2005). With this procedure, we obtained the value of the reference level by summing up the coefficients (multiplied by a factor of -1) associated with other levels.

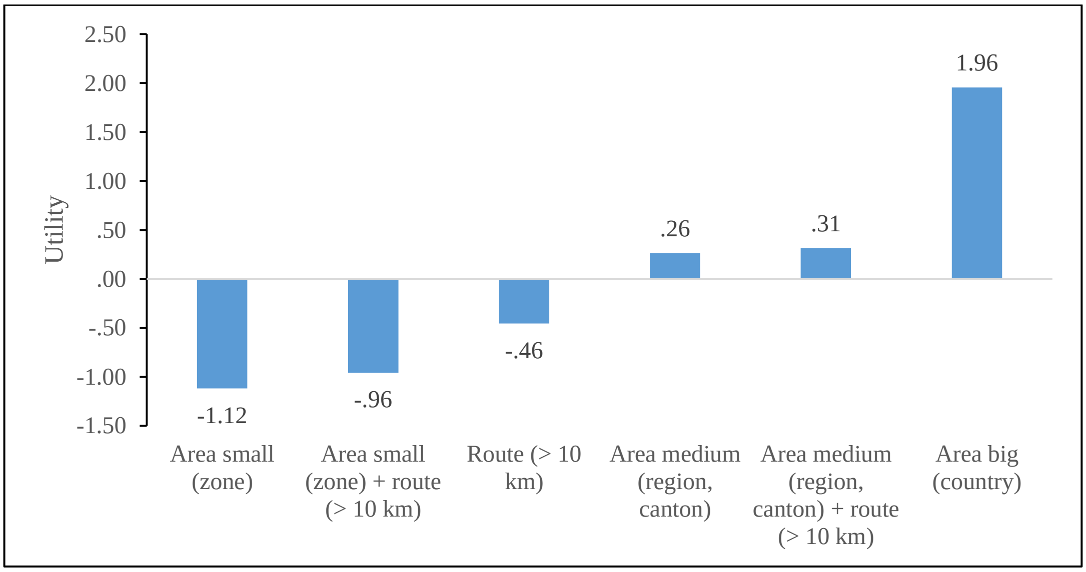
$$U_{area\ big} = (-1) \times (-1.12) + (-1) \times (-.96) + (-1) \times (-.46) + (-1) \times (.26) + (-1) \times (.31) = 1.96$$

Being allowed to travel during the rush hour provides higher utility vs. not being allowed to do so ($\beta_{rush\ hour} = 1.82$, $p < .01$, Figure 7). Higher prices provide a lower utility than lower prices as shown by the price coefficient ($\beta_{price} < -.01$, $p < .01$[12]). Having access to the dedicated section provides a higher utility than having access only to the common section, confirming H1a. This difference is only marginally significant, however ($\beta_{train\ section\ access} = .15$, $p = .10$, Figure 8).

Travelers are willing to pay CHF 4’209.- more for access to the big area (country) than for access only to the small area (zone). They are willing to pay CHF 2’490.- more for access to the rush hour. Finally, they are willing to pay CHF 209.- more for additional access to the dedicated sections.

Figure 6

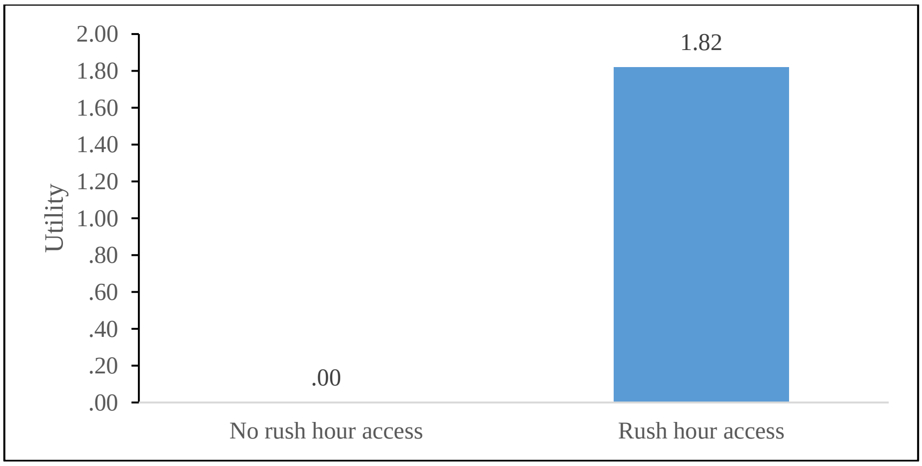
The Wider the Geographical Access, the Higher the Utility



Note: Area big (country) represents the reference level for this attribute (calculated as explained above).

Figure 7

Access to the Rush Hour Increases Utility

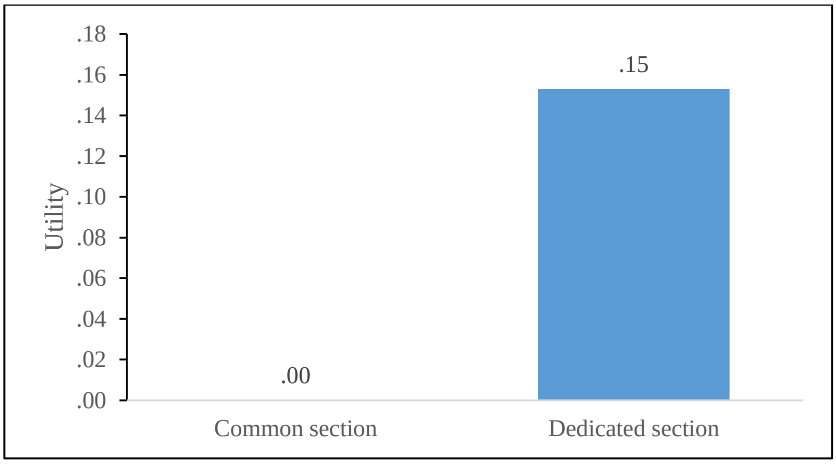


Note: Rush hour access – no access represents the reference level for this attribute (here, fixed to zero).

[12] Price is continuous in the model. Therefore, we do not show it graphically.

Figure 8

Access to the Dedicated Sections Increases Utility



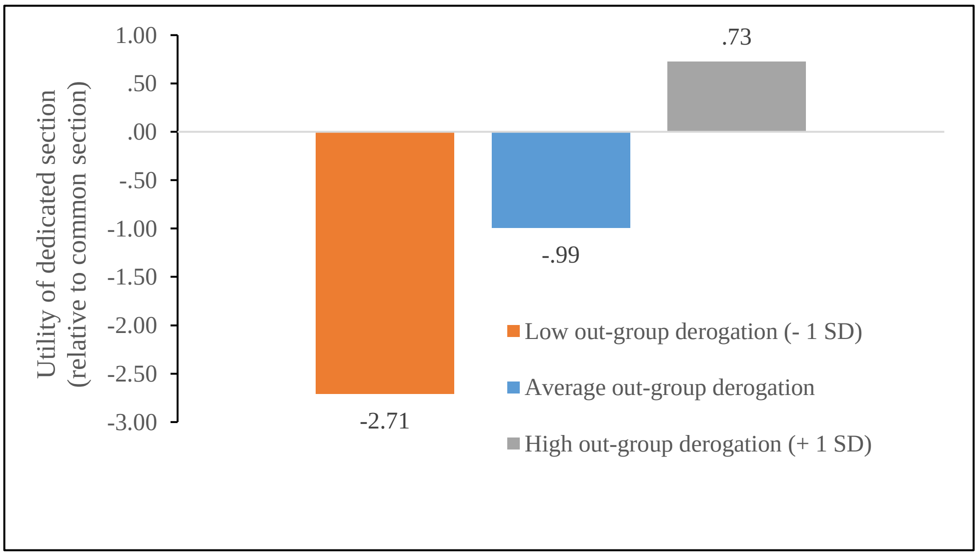
Note: Common section represents the reference level for this attribute (here, fixed to zero).

Model 2 (Appendix Table 20) shows the coefficient estimates of the hybrid choice model. Out-group derogation moderates the effect of the train section access on utility ($\beta_{\text{out-group derogation} \times \text{train section access}} = 1.35$, $p < .05$). This confirms our hypothesis H1b. The coefficient for train section access is now negative because the interaction with the latent variable completely absorbed the positive effect that it had in Model 1 ($\beta_{\text{train section access}} = -.99$, $p < .05$). The marginally significant positive utility associated to the access to dedicated section shown in Model 1 was owed to the effect of the interaction between out-group derogation and the access to dedicated section. For a better interpretability, the coefficients of the train section access interacted with the out-group derogation are represented in Figure 9.

Travelers who have a tendency to separate themselves from dissimilar other groups (high tendency towards out-group derogation) are willing to pay CHF 2’609.- more for access to the dedicated sections (vs. only the common section).

Figure 9

The Preference for a Travel Card Including Dedicated Section Access (vs. Common Section Access Only) Increases With an Increasing Tendency Towards Out-Group Derogation



Note: common section represents the reference level for this attribute (here, fixed to zero).

9.3.4 Exploratory Analysis of the Out-Group Derogation Trait

In the hybrid choice model, we found that out-group derogation moderated the effect of the train section access on utility. Therefore, we explored how travelers with a high tendency towards out-group derogation differ from travelers with a low tendency towards out-group derogation in terms of psychographics (latent variables, Appendix Table 13), travel-related variables (Appendix Table 14), and selected demographics (Appendix Table 15). For this analysis, we performed a median split[13] of the out-group derogation variable.

Most importantly, we found that travelers with a high (vs. low) tendency towards out-group derogation lead a more workaholic lifestyle ($t = -1.77$, $p < .10$) and perceive higher travel stress ($t = -4.41$, $p < .01$). This might explain why they have a stronger preference for the dedicated sections. If they need to work on the train and, at the same time, experience stress, they feel more bothered by other travelers that behave differently. The result that travelers with a high (vs. low) tendency towards out-group derogation perceive less commute benefits supports this notion ($t = 3.09$, $p < .01$). They do not see how they could use commuting time productively. Similarly, they are more time-conscious. Thus, they might want to use their time productively on the train, but the current setting does not allow them to do so. The dedicated sections, however, would give them the possibility to use their travel time in the way they would like to use it. Finally, the positive relation to a status-seeking lifestyle ($t = -3.51$, $p < .01$) confirms existing literature that stated that high-status groups are likely to have a stronger intergroup bias (Dasgupta, 2004; Levin & Sidanius, 1999).

Different from our expectation, we did not find a relation between out-group derogation and travel-related variables. We found, however, that travelers with a high (vs. low) tendency towards out-group derogation were younger ($t = 3.21$, $p < .01$) and more likely to be students (vs. any other occupation, $t = -1.67$, $p < .10$). A possible explanation for these results might be that students want to study on the train and, thus, prefer to separate themselves from others that might disturb them.

9.3.5 Summary and Discussion

We found that the average traveler only has a marginally significant preference for the dedicated section access, partly confirming H1a. This effect is moderated by the travelers' out-group derogation trait, confirming H1b. We further found that the explanatory power of the model increased after including out-group derogation as shown by an increase of 13 points in $\bar{\rho}^2$, suggesting that this personality trait can indeed explain travel card choices to some extent. Travelers with a low tendency towards out-group derogation prefer the common section access, whereas travelers with a high tendency towards out-group derogation prefer the dedicated section access. Hence, travelers with a high tendency towards out-group derogation have a higher preference for a travel card that provides the opportunity to travel in a dedicated section of the train. Travelers with a high tendency towards out-group derogation (one standard deviation higher than the average out-group derogation), are willing to pay CHF 2'609.- more for having access to both the common and the dedicated sections (relative to the common section only).

In an exploratory follow-up analysis, we found that travelers high in out-group derogation have a more negative image of traveling in general as shown by higher travel stress and the perception of fewer commute benefits. Their lifestyle can be described as frustrated and workaholic. By offering the dedicated sections, they might perceive more value in their travel time, which increases utility for them in line with their lifestyle characteristics for which they are willing to pay more. The finding that they have a more status-seeking lifestyle suggests that they may see having access to the dedicated sections as exclusive.

In order to obtain greater insight into the preferences for specific types of dedicated sections that are implementable by SBB, we conducted a second study where we investigated the preferences for dedicated sections divided into dedicated sections: business, lifestyle, silence, and family.

9.4 Study 2

9.4.1 Methodology

9.4.1.1 Choice Design

We used the same block design as in Study 1 with 5 blocks and 12 choice tasks per block. Respondents were again randomly assigned to one of 5 blocks. In each block, the order of the choice

[13] The average out-group derogation over the sample is 2.02, the standard deviation is 1.16, and the median lies at 1.75.

tasks was randomized. Different from Study 1, the “price” attribute range was shifted upward to allow for testing of possible price increases. Further, the number of levels of the “geographical access” attribute was reduced to allow for a more balanced design. The period of the “rush hour access” attribute was changed from the original intervals to the intervals from 7:00 to 8:00 and from 17:00 to 18:00 to be consistent with the narrow rush hour interval definition of the Rush Hour Access Project. We introduced an additional attribute as a specification of the “common section + dedicated section” attribute level. Fifth, each choice task had one alternative for the “common section only” attribute level, two alternatives for the “common section + dedicated section” attribute level, and the “none” option.

Each alternative had four attributes: “train section access”, “geographical access”, “rush hour access (7:00 – 8:00 and 17:00 – 18:00)”, and “price” (see Table 4 for details).

The “train section access” access describes sections on the train to which each traveler has access through a travel card. This attribute had two levels: “common section only” and “common section + dedicated section”. “Common section only” defines access to the common sections of the train only. These sections are accessible from any traveler holding a valid ticket. “Common section + dedicated section” defines access to dedicated sections of the train (in addition to access to the common ones). The type of people present in the different sections provides the substantial difference between the two categories of access. Travelers with “common section only” cannot access the dedicated sections, whereas travelers with “common section + dedicated section” have access both to their dedication section and to the common one.

Additionally, alternatives with “common section + dedicated section” level of the attribute “train section access” have an attribute specifying the type of the dedicated section. This attribute had four levels: “business”, “silence”, “family”, and “lifestyle”. For simplicity reasons, we will refer to “common section + dedicated section” as “dedicated section” from now on. The detailed description we provided to travelers in the survey is shown in Appendix Figure 25.

The “geographical access” attribute describes the geographical extension in which the subscription is valid. It had three levels: “area small (zone)” identifies access to an area large as two zones; “area medium (region, canton)” identifies access to an area large as an entire region/canton; “area big (country)” represents access to public transport throughout Switzerland.

The “rush hour access (7:00 – 8:00 and 17:00 – 18:00)” attribute describes the subscription validity during the rush hour and it had two levels: “no (outside rush hour only)” identifies a subscription valid outside the rush hour only and does not permit the traveler to take the train with that subscription during rush hour; “yes (no time restrictions)” identifies a subscription with no time restrictions and it can be used during rush hour.

The “price” attribute describes the economic outlay to purchase a specific travel card. It had four levels (“CHF 1’500.-”, “CHF 3’000.-”, “CHF 4’500.-”, and “CHF 6’000.-”).

Table 4

Attributes and Attribute Levels for Train Section Access Project (Study 2)

Attribute	**Number of levels**	**Description**
Train section access	2	Common section only; common section + dedicated section (further referred to as “dedicated section” for simplicity reasons)
Dedicated section access (specification)	4	Business; silence; family; lifestyle
Geographical Access	3	Area small (zone); area medium (region, canton); area big (country)
Traveling during rush hour	2	No; yes
Price	4	CHF 1’500.-; CHF 3’000.-; CHF 4’500.-; CHF 6’000.-

9.4.1.2 Latent and Other Variables

As in Study 1, we adopted the same 12-item scale to measure the tendency towards out-group derogation. In addition, the other latent variables we measured are identical. The Cronbach's alpha statistics are reported in Table 5. The correlations between the latent variables are reported in Appendix Table 15.

Table 5
Cronbach's Alpha of Latent Variables (Study 2)

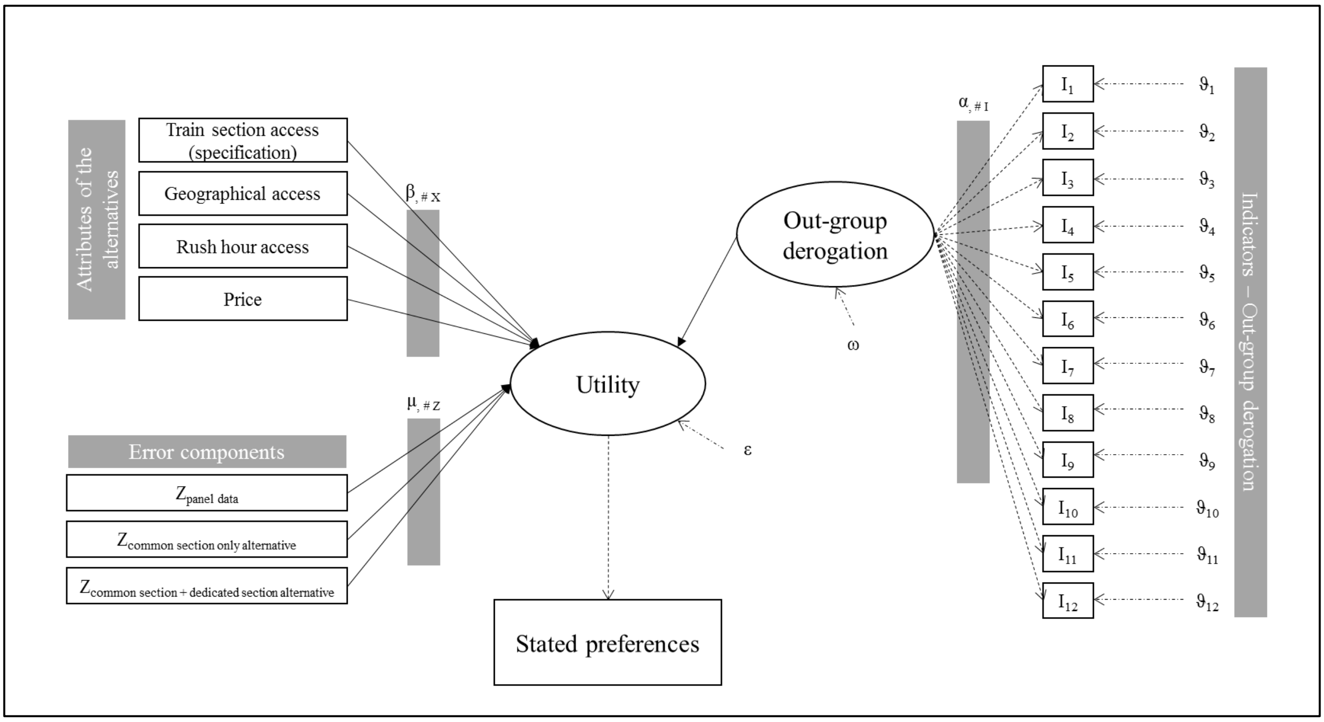
Variable	Cronbach's alpha
Out-group derogation	.94
Family /community oriented lifestyle	.56
Workaholic lifestyle	.62
Status-seeking lifestyle	.60
Frustrated lifestyle	.81
Travel-liking	.51
Hedonism	.90
Time-consciousness	.79
Desire for comfort	.55
Desire for flexibility	.77
Traveling hedonic (vs. utilitarian)	.83
Commute benefits	.66
Travel stress	.78

Additionally, we measured a set of variables that were part of the SBB segmentation studies to link to the existing segments possible in follow-up analyses (SBB, 2013). These variables included the trip purpose (commuting to and from place of work, commuting to and from an educational institution, leisure trip without overnight stay (excursion, cinema, sports, visit), private vacation trip with at least one overnight stay, everyday tasks (consultation of a doctor, grocery shopping, picking somebody up), business trip, other), the predominant travel class (first class, second class), the need for commuting as well as the commuting habits, and the habits when engaging in leisure trips.

9.4.1.3 Model Specification and Estimation

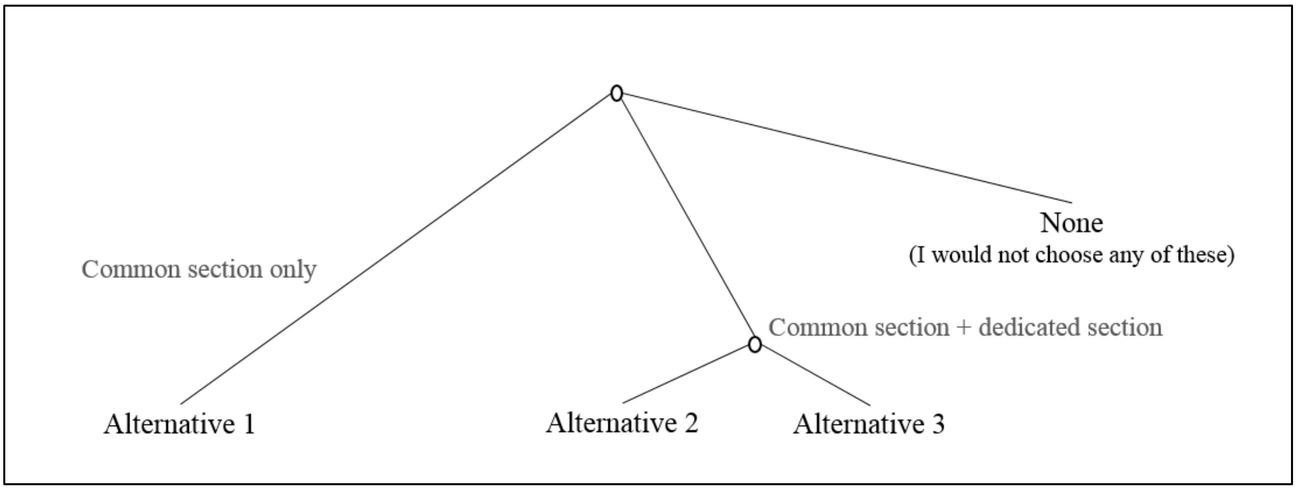
Mirroring the analysis of Study 1, we estimated two different models: a basic discrete choice model without latent variable (Model 1) and a hybrid choice model (Model 2). In the hybrid choice model, we combined a discrete choice model with the latent variable out-group derogation. Figure 10 shows the hybrid choice model framework we used with the partial models, measurement, and structural equations.

Figure 10
Full Path Diagram of the Hybrid Choice Model (Study 2)



We adopted a mixed logit with an error component (EC model) for both models as in Study 1. In contrast with Study 1, in this study, we introduced two error components to measure the correlation patterns between alternatives in the choice sets obtaining a model similar to a nested logit (Train, 2003). Graphically, the hierarchical structure is represented in Figure 11.

Figure 11
Hierarchical Structure of the Choice Model (Study 2)



In Model 1 (Appendix Table 21) and Model 2 (Appendix Table 22), we have three utility functions (U_1, U_2, U_3) according to the number and the type of alternatives defined in the choice design (see Chapter 9.4.1.1). U_1 refers to the utility function of the alternative with common section only access, whereas both U_2 and U_3 refer to the utility function of the alternatives with dedicated section access. These utility functions are specified as follows:

$$U_{n1t} = \beta_{0com.sec.only} + \beta_4 \times Geographical\ Access, area\ small\ (zone)_{n1t} + \beta_5 \times Geographical\ Access, area\ medium\ (region, canton)_{n1t} + \beta_6 \times Rush\ Hour\ Access_{n1t} + \beta_7 \times Price_{n1t} + \mu_1 \times Z_{panel\_data,n} + \mu_2 \times Z_{com.sec.only,n} + \varepsilon_{n1t} \quad (14)$$

$$U_{n2t} = \beta_{0com.sec.ded.sec.} + \beta_1 \times Train\ Section\ Access, Dedicated\ Section\ (Business)_{n2t} + \cdots + \beta_3 \times Train\ Section\ Access, Dedicated\ Section\ (Life-style)_{n2t} + \beta_4 \times Geographical\ Access, area\ small\ (zone)_{n2t} + \beta_5 \times Geographical\ Access, area\ medium\ (region, canton)_{n1t} + \beta_6 \times Rush\ Hour\ Access_{n1t} + \beta_7 \times Price_{n1t} + \mu_1 \times Z_{panel\_data,n} + \mu_3 \times Z_{com.sec.ded.sec,n} + \varepsilon_{n2t} \quad (15)$$

$$U_{n3t} = \beta_{0com.sec.ded.sec.} + \beta_1 \times Train\ Section\ Access, Dedicated\ Section\ (Business)_{n3t} + \cdots + \beta_3 \times Train\ Section\ Access, Dedicated\ Section\ (Life-style)_{n3t} + \beta_4 \times Geographical\ Access, area\ small\ (zone)_{n3t} + \beta_5 \times Geographical\ Access, area\ medium\ (region, canton)_{n3t} + \beta_6 \times Rush\ Hour\ Access_{n3t} + \beta_7 \times Price_{n3t} + \mu_1 \times Z_{panel\_data,n} + \mu_3 \times Z_{com.sec.ded.sec,n} + \varepsilon_{n3t} \quad (16)$$

In each equation, n identifies individual respondents, t the choice task, and ε_{nt} is a random disturbance over people and choice tasks (see also previous explanation in Chapter 8.2).
As in Study 1, Model 2 (Table 22), is an extension of Model 1 that uses the latent variable in the utility functions to understand if it increases the explanatory power of the model (Walker, 2001). We estimated these models using the maximum simulated likelihood (MSL) approach implemented in the free software, PythonBiogeme 2.4 (Bierlaire, 2016), using 5'000 Halton draws.

9.4.1.4 Procedure

We recruited 505 travelers in the German-speaking part of Switzerland for our survey with the help of Intervista AG. Only individuals that were planning to purchase a public transport subscription in Switzerland or renew their current one within the next year and who are paying for their subscription by themselves were eligible to participate in the survey. Our sample was stratified by age in order to represent the Swiss population according to SBB's marketing research standards (SBB, 2013). The rest of the procedure of Study 2 is identical to the procedure of Study 1. An exemplary choice task is shown in Figure 12.

Figure 12
Exemplary Choice Task (Study 2)

If these were the travel card options offered to you, would you buy any of those and if yes which one?

Choose by clicking one of the buttons below:

	Travel Card Nr 1	Travel Card Nr 2	Travel Card Nr 3	None
Train Section Access	Common Section Only	Common Section + Dedicated Section (Business)	Common Section + Dedicated Section (Family)	**I would not choose any of these.**
Geographical Access	Area Big (Country)	Area Small (Zone)	Area Medium (Region, Canton)	
Rush Hour Access (7:00-8:00 and 17:00-18:00)	Yes (no time restrictions)	No (outside rush hour only)	No (outside rush hour only)	
Price	CHF 3'000.-	CHF 4'500.-	CHF 3'000.-	

LEGEND (Click on the attribute name to see the description)

- Train Section Access
- Geographical Access
- Rush Hour Access (7:00-8:00 and 17:00-18:00)
- Price

9.4.2 Description of Sample

Of the 505 travelers we recruited, 192 were female (38 percent) and the average age was 44.90 years. Most of the travelers in the sample own a Half-Fare travel card (64 percent), followed by general subscription (GA, 25 percent), regional travel cards (25 percent), Point-to-Point travel card (7 percent), and the Track 7 travel card (2 percent). Four percent of the respondents in our sample did not own a travel card.

The most frequent purposes of travelling by train of travelers in our sample were leisure trips without overnight stays (79 percent), followed by everyday tasks (52 percent). Fifty percent of the travelers indicated that they were commuting by train to work and 13 percent of the survey respondents were commuting by train to an educational institution. Forty-seven percent of the travelers indicated that they were travelling by train for vacation trips and 22 percent for business trips.

9.4.3 Results from Choice Modeling

We first estimated the basic discrete choice model to investigate the utilities of the attributes of the alternatives and then we estimated a hybrid choice model with the interaction of the out-group derogation. Each coefficient represents the contribution that its specific attribute level has on the overall utility of the alternative. In line with this, the y-axis of all graphs measures the utility contribution of the attribute level represented.

Model 1 (Appendix Table 21) estimates the coefficients of all attribute levels for the entire sample. Broader geographical access provides higher utility to travelers ($\beta_{\text{area small}} = -1.06$, $p < .01$; $\beta_{\text{area medium}} = -.15$, $p < .01$). For a better interpretability, the utilities associated to the geographical access are represented in Figure 13. The utilities of the attribute levels correspond to the values of the relative coefficients (e.g., $U_{\text{area small}} = \beta_{\text{area small}}$) except for the attribute reference level[14]. We calculated the utility of the attribute level area big (country), reference level of the attribute geographical access, as follows:

$$U_{area\ big} = (-1) \times \beta_{area\ small} + (-1) \times \beta_{area\ medium}$$

Plugging in the coefficient estimates, we obtain the following value:

$$U_{area\ big} = (-1) \times (-1.06) + (-1) \times (-.15) = 1.21$$

Confirming the results of Study 1, we find that access to the rush hour provides higher utility than no access to the rush hour ($\beta_{\text{rush hour access}} = 1.34$, $p < .01$, Figure 14). Higher prices provide a lower utility than lower prices as shown by the price coefficient ($\beta_{\text{price}} < -.01$, $p < .01$[15]).

The common section and the dedicated section (silence) provide higher utility compared with the remaining train section options ($U_{\text{common section}} = \beta_{\text{common section}} = -.39$, $p < .05$, $U_{\text{dedicated section (silence)}} = -.39$[16]). Having access to the dedicated section (family) provides the lowest utility ($U_{\text{dedicated section (family)}} = -.71$, see Figure 15).[17] The dedicated sections (business) and (lifestyle) do not differ in their utility ($U_{\text{dedicated section (business)}} = -.55$, $U_{\text{dedicated section (lifestyle)}} = -.55$).[18]

Travelers are willing to pay CHF 3’409.- more for access to the big area (entire country) than only the small area (zone). They are willing to pay CHF 2’009.- for access to the rush hour. Finally, compared with the common section, they are willing to pay CHF 4.- less for additional access to the dedicated section (silence), CHF 246.- less for additional access to the dedicated section (business) as well as the dedicated section (life-style), and CHF 487.- less for additional access to the dedicated section (family).

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[14] We coded this variable using the so-called effect coding technique (Hensher et al., 2005). With this procedure, we obtained the value of the reference level by summing up the coefficients (multiplied by a factor of -1) associated with other levels.

[15] Price is continuous in the model. Therefore, we do not report it graphically.

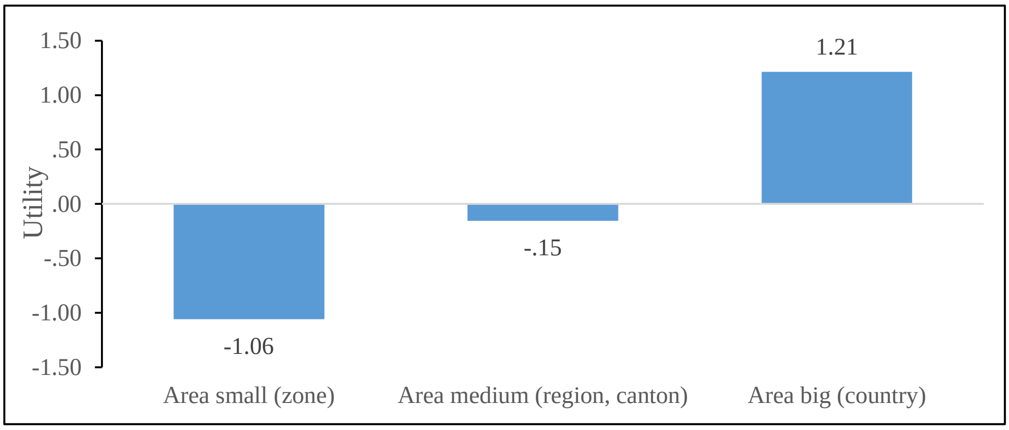
[16] This coefficient is calculated by adding the coefficient of the dedicated section (silence) to the alternative specific constant of the dedicated section access. $U_{\text{dedicated section (silence)}} = \beta_{\text{dedicated section}} + \beta_{\text{dedicated section (silence)}}$

[17] $U_{\text{dedicated section (family)}} = \beta_{\text{dedicated section}} + (-1) \times \beta_{\text{dedicated section (silence)}} + (-1) \times \beta_{\text{dedicated section (business)}} + (-1) \times \beta_{\text{dedicated section (lifestyle)}}$

[18] As the coefficients for the dedicated section (business) and the dedicated section (lifestyle) are not significant, the utilities associated do not differ from the value of the alternative specific constant of the dedicated sections.

Figure 13

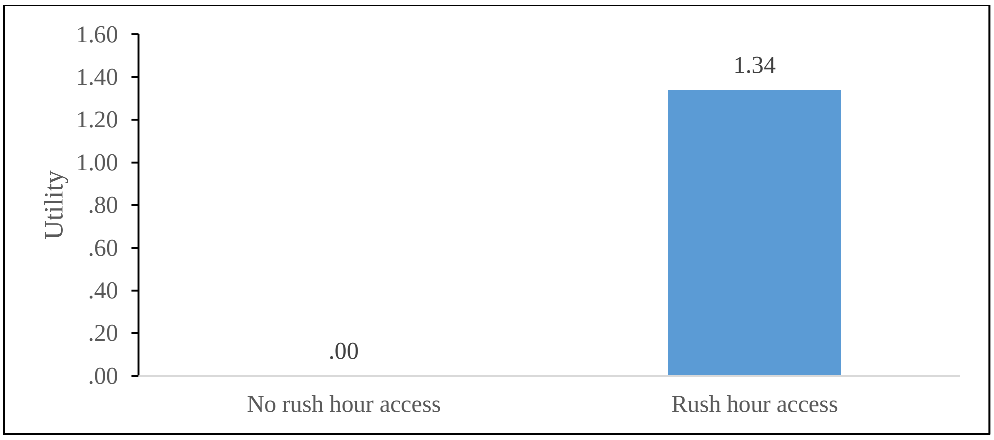
The Wider the Geographical Access, The Higher the Utility



Note: Area big (country) represents the reference level for this attribute (calculated as explained above).

Figure 14

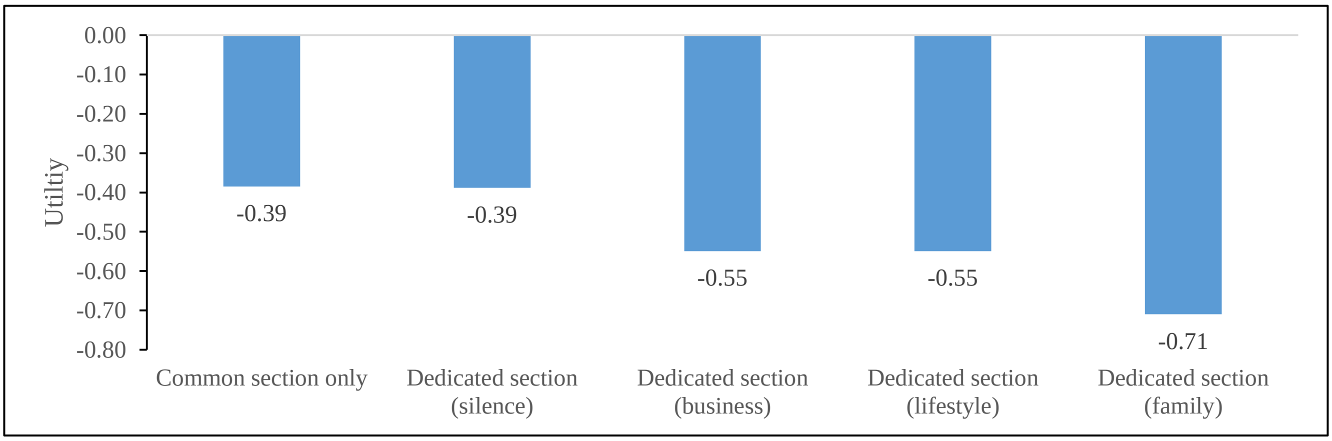
Access to the Rush Hour Increases Utility



Note: No rush hour access represents the reference level for this attribute (here, fixed to zero).

Figure 15

Among the Dedicated Sections, the Silence Section Provides the Highest Utility



Model 2 (Appendix Table 22) is a hybrid choice model since it includes the latent variable out-group derogation[19] in the estimation process to increase the explanatory power of the model. Out-group derogation moderates the utility for dedicated sections ($\beta_{\text{out-group derogation x dedicated section}}$ = .35, p <

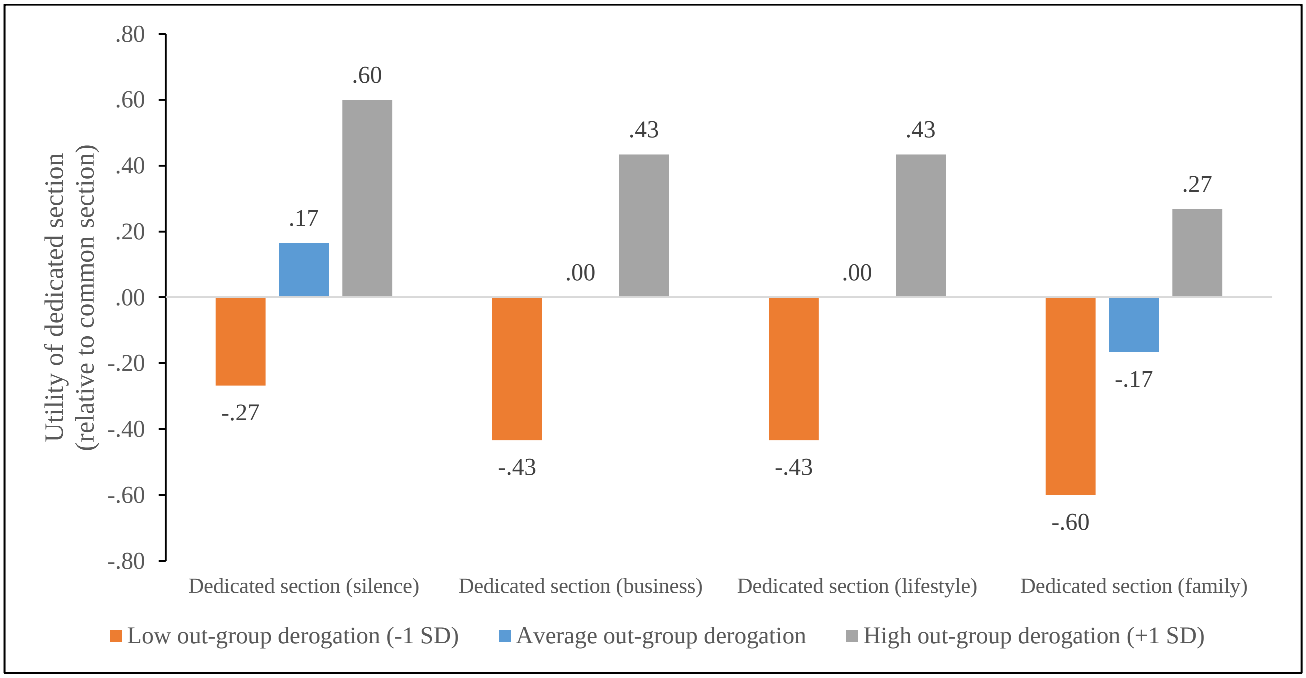
[19] The average out-group derogation over the sample is 2.23, the standard deviation is 1.25, and the median lies at 2.00.

.10) as shown in Table 22. However, this moderation does not differ between the different dedicated sections (see insignificant interactions with the dedicated sections in Appendix Table 22). For clear interpretability, the coefficients of the train sections access interacted with the out-group derogation are represented in Figure 16.

Travelers with a high tendency towards out-group derogation (plus one standard deviation) are willing to pay CHF 664.- more for additional access to the dedicated section (business), CHF 918.- more for additional access to the dedicated section (silence), CHF 664.- more for additional access to the dedicated section (life-style), and CHF 410.- more for additional access to the dedicated section (family) compared with common section access only.

Figure 16

The Utility of the Dedicated Sections Increases Relative to the Common Section with Increasing Out-Group Derogation



Note: The utility for each of the dedicated sections increases to the same extent with increasing out-group derogation.

9.4.4 Subgroup Analysis

The previous analyses showed that travelers high (vs. low) in out-group derogation have a stronger preference for the dedicated sections. In addition, we wanted to understand what other traveler characteristics may drive the choice for each of the dedicated sections. Understanding which types of travelers prefer a certain dedicated section could inform targeted product offerings in the future.

In order to do so, we analyzed their choices and linked them to their demographics, psychographics (latent variables), and the variables from the SBB segmentation studies. We observed how travelers expressed their preferences between the different available alternatives and created one dummy variable per possible alternative (i.e., common, dedicated section (silence), dedicated section (business), dedicated section (lifestyle), and dedicated section (family)). Then, we ran several logistic regressions using each dummy as the dependent variable. Below, we report a summary of the main statistically significant insights.

The probability to choose the common section over any of the dedicated sections is higher for women (vs. men, $\beta_{male} = -.23$, $p < .10$). It is also higher for pensioners (vs. travelers with any another occupation, $\beta_{pensioner} = -.90$, $p < .05$). The probability to choose the common section is also higher for people that currently own (vs. not) a regional travel card ($\beta_{regio} = .30$, $p < .01$). Additionally, it is higher for respondents that currently own a second class travel card (vs. a first class travel card, $\beta_{common} = .55$, $p < .01$). When looking at commuters only, the probability for commuters to choose the common section increases with an increasing percentage of trips made by train (relative to other means of transportation, $\beta_{train.percent} = .11$, $p < .01$).

The probability to choose the dedicated section (business) over any other section is higher for men (vs. women, $\beta_{male} = .34$, $p < .10$) and increases with age ($\beta_{age} = .01$, $p < .10$). It decreases with an increasing the number of people in the household ($\beta_{num.household} = -.13$, $p < .05$). The probability to choose the dedicated section (business) is also lower for respondents that currently own a second class travel card (vs. a first class travel card, $\beta_{second\_class} = -.39$, $p < .05$). Looking into the latent variables, we found that the probability to choose the dedicated section (business) increases with increasing hedonism of travelers ($\beta_{hedonism} = .12$, $p < .05$), desire for comfort ($\beta_{comfort} = .13$, $p < .05$), and time consciousness ($\beta_{time\_consciousness} = -.12$, $p < .05$). For commuters only, the probability to choose the dedicated section (business) increases with an increasing commuting trip distance ($\beta_{trip.distance} = .37$, $p < .01$).

The probability to choose the dedicated section (silence) over any other section only differs by certain factors when looking at commuters. For commuters, the probability to choose the dedicated section (silence) increases with increasing trip duration ($\beta_{trip.duration} = .16$, $p < .01$) and with an increasing number of trips made during the rush hour ($\beta_{comm.rush.hours} = .07$, $p < .05$).

The probability to choose the dedicated section (lifestyle) over any other section is lower for travelers who own a regional travel card ($\beta_{regional} = -.42$, $p < .01$) and if their travel card provides access to the second class (vs. a first class, $\beta_{second\_class} = -.46$, p-value $< .05$). Moreover, the probability to choose the dedicated section (lifestyle) is lower for commuters than for non-commuters ($\beta_{commuters} = -.23$, $p < .05$).

The probability to choose the dedicated section (family) over any other section is higher for pensioners (vs. travelers with any other occupation, $\beta_{pens} = 1.71$, p-value $< .01$). Analyzing the effect of the latent variables, we found that the probability of choosing the dedicated section (family) decreases with an increase in status-seeking lifestyle ($\beta_{status} = -.12$, p-value $< .05$), the more a traveler likes traveling ($\beta_{travel.liking} = -.23$, $p < .01$), and the higher a traveler's desire for comfort ($\beta_{comfort} = -.20$, $p < .05$). It also increases the more a traveler perceives traveling as hedonic (vs. utilitarian, $\beta_{hedonic} = .11$, $p < .05$).

9.4.5 Summary and Discussion

In contrast to Study 1, we do not find a stronger preference for travel cards that offer additional access to the dedicated sections overall, rejecting H1a. Nevertheless, the preference for having access to one of the dedicated sections shows a marginally significant tendency to increase for travelers with higher out-group derogation, confirming H1b. Travelers with a high tendency towards out-group derogation (16 percent of the population) were willing to pay on average CHF 664.- more for access to one of the dedicated sections. Specifically, they were willing to pay CHF 664.- more for additional access to the business section, CHF 918.- more for additional access to the silence section, CHF 664.- more for additional access to the life-style section, and CHF 410.- more for additional access to the family section. This is in line with study 1, where travelers with a high tendency toward out-group derogation were willing to pay CHF 2'609.-[20] more for having additional access to all dedicated sections.

This result could have occurred due to the specific way we designed the dedicated sections; they can be seen as almost mutually exclusive, which means travelers who like one of them is likely to dislike the others. Our subgroup analysis supports this argument. The dedicated section (business) is preferred by older travelers that currently have a first class travel card, are more time conscious, have a stronger desire for comfort, and are more hedonistic. Conversely, the dedicated section (family) is preferred by pensioners, travelers with a less status-seeking lifestyle, like traveling less, and have a lower desire for comfort.

[20] Summing up the WTP for all dedicated sections in Study 2 leads to a value of CHF 2'656.- which is in line with the WTP of CHF 2'609.- for all dedicated sections that we found in Study 1.

9.5 Recommendations for SBB

In summary, our results confirm that the dedicated sections on the train provide value to different segments of travelers. We found that none of the sections provides value to everyone, but rather each of them appeals to specific types of travelers. However, we found that the more a traveler wants to separate from dissimilar traveler groups (higher tendency towards out-group derogation), the higher the preference for one of the dedicated sections. These results are theoretically supported by social identity theory (Tajfel & Turner, 1979). The different sections on the train represent a choice of socio-psychological groups into which a traveler can self-select based on what he defines as his in-group or his out-groups, respectively. This way, travelers with a higher tendency toward outgroup derogation may be able to reduce their perceived travel stress and use their travel time more productively.

These findings imply that separately pricing (on average CHF 664.- more for access to one dedicated section than for common section only in order to target 16 percent of the population) these dedicated sections may allow the generation of additional revenues for SBB. However, a highly targeted approach is required. Additionally, pricing the sections may be operationally feasible as some of them are already implemented (silent, business, and family sections).

More research is certainly needed to arrive at a final decision about whether and how to provide targeted offerings related to dedicated section access. For instance, future research should better define the target segments and link them to SBB’s current customer segmentation, the actual price points should be specified in detail, and market simulations should be utilized to gauge the potential market share of such travel cards. Finally, future research should additionally measure perceptions of fairness of such offerings.

10 Rush Hour Access Project

Trains are typically highly congested during rush hour, harming the satisfaction of SBB customers (Riedener, 2012). Thus, an important question is how more travelers could be motivated to be more flexible in their traveling times. This can potentially be achieved through product and pricing strategies that limit access to the rush hour. Instead of always allowing full access to all travelers, less expensive travel cards that restrict access could be offered. The lower price of such cards may cause travelers to accept limited traveling times. This strategy bears two main questions that we investigated in this research project. First, are travelers really willing to accept travel cards with limited access to rush hour and how much less would they be willing to pay? Second, how should rush hour limits be defined to be effective? These questions are most relevant to travelers who commute and who are mostly affected by the negative consequences of congestion (Bloch, 2011; Ungricht, 2010; Zemp, 2014).

Additionally, we explored different types of external influences on commuting time choices. Some commuters are faced with official formal constraints at their commuting destination, such as working times that are defined in their work contracts. Moreover, there may be social norms that influence commuting time choices. Social norms are the guidelines for the behavior that is accepted in a group without the existence of any official, formal, or written rules. They develop due to mutual interaction, are understood by the group members, and deviations thereof are socially sanctioned within the group (Cialdini & Trost, 1998). We examined whether commuters faced social norms at their commuting destination regarding their flexibility or the duration of their working time and whether they influenced travel card choices. We also examined the role of formal constraints. Additionally, we examined whether commuters faced formal constraints and social norms in their private environment.

In what follows, we will first shortly review the literature related to how commuters make time-related traveling decisions. Then, we will introduce the methodology we used and outline how we applied it. Finally, we will report the results followed by a discussion of the implications for SBB.

10.1 Related Literature

How constraints influence departing time decisions has already investigated, especially for commuting by car. Chang and Mahmassani (1988) looked at how commuters make their departing time decisions and travel time estimations with regard to their latest possible arrival time by estimating a dynamic model of departure time adjustment. Another study, while building on prospect theory, found that being late had a different impact on commuters' utility than being early (Senbil & Kitamura, 2004, 2005). Senbil and Kitamura (2004) defined three time reference points in the commuting time decision, which are the earliest permissible arrival time (since one does not wish to arrive at work too long before starting), the ideal arrival time, and work start time which is usually the latest possible arrival time. Similarly, in a study defining two reference points for commuter decisions, Jou, Kitamura, Weng, and Chen (2008) showed that commuters reacted asymmetrically to gains and losses with losses being defined as arrivals outside the range of acceptable arrival times.

As these constraints lead many commuters to travel during the same time interval, literature has also broadly investigated the effectiveness of instruments incentivizing rush hour avoidance. Both rewards and punishments were investigated as policy instruments to distribute travelers more equally over the time of a day. Based on a discrete choice experiment, Knockaert, Tseng, Verhoef, and Rouwendal (2012) discovered that rewards for avoiding travel during the rush hour are effective means to influence departure time choice. When comparing rush-avoidance rewards to rush-use pricing, Tillema, Ben-Elia, Ettema, and van Delden (2013) cautiously concluded that rewards were more effective in moving commuters out of the rush hour.

Ozbay and Yanmaz-Tuzel (2008) adopted a different perspective on the problem. They were not concerned with studying the effectiveness of different policy instruments, but instead they chose to estimate individuals' value of travel time by estimating a model based on individuals' travel time decisions as a reaction to time-of-day toll pricing. They concluded that people's value of travel time (i.e., their willingness to pay for reducing travel time) on average ranged between $15 and $20 per hour depending on departure time choice and trip purpose with higher values for individuals doing work related trips.

To our knowledge, very few studies have reviewed instruments to incentivize peak hour avoidance for public transport. One study evidenced that giving rewards for rush-hour avoidance has a positive effect on moving trips out of the rush hour in the Beijing subway during morning commutes (Zhang, Fujii, & Managi, 2014). An applied study on how rush hour trains could be relieved was the Work Anywhere study undertaken by the SBB in cooperation with Swisscom (Weichbrodt et al., 2013). They allowed 264 employees to arrange their working day between their home and their workplace to allow them to travel during off-peak hours. This flexibility moved 66 percent of travel time out of the peak hours.

10.2 Our Research and Practical Contribution

Different from prior literature, we did not investigate the value of saving one hour of travel time. Instead, we examined the value of being allowed (vs. not) to travel during a certain time interval. We accomplished this by studying the utility for travel cards that do not provide access to the rush hour or only some form of limited access to the rush hour in comparison with travel cards that provide unlimited access to the rush hour. This can then be used as a basis to design an effective instrument to incentivize rush hour avoidance.

We further contribute to the body of literature on commuting in public transportation. Commuters that are commuting by train (vs. by car) are faced with less uncertainty with respect to their travel time, since trains have fixed schedules. However, they have the same constraints regarding work start time. Prior literature studied different time points of these constraints. We are the first to explore the influence of different types of constraints (formal constraints and social norms in the professional and private environment) on time-related traveling decisions and on the utility for some form of access to the rush hour.

10.3 Study

We first introduce the methodology by explaining the choice experiment, the variables we measured, and the model. Second, we will explain the procedure of the study. Third, we describe our sample. Finally, we show the resulting choice models and finally we discuss our results and offer recommendations for SBB.

10.3.1 Methodology

10.3.1.1 Choice Experiment

As in the Train Section Access Project, a blocked choice design with five blocks and 12 choice tasks per block was developed. Respondents were randomly assigned to one of five blocks. In each block, the order of the choice tasks was randomized. The choice experiment utilized a “labelled” design to identify the alternatives. Each alternative is a specific combination of the attributes listed below.

Each alternative had four attributes: “geographical access”, “comfort level”, “rush hour (access)”, and “price” that were agreed upon with SBB[21] (see Table 6 for details).

The “geographical access” attribute describes the geographical extension in which the subscription is valid. It had four levels: “area small (zone)” represents a subscription that provides complete access in a small size home (or destination) area; “area medium (region, canton)” represents a subscription that provides complete access in a medium size home (or destination) area; “area medium (region, canton) + route > 10 km” represents a subscription with area-route combination and provides complete access in a medium size home (or destination) area and an access to a specific route; and “area big (country)” represents a subscription with access to public transport throughout Switzerland.

The “comfort level” attribute describes sections on the train with different qualities of services. It had two levels: “first class” represents a subscription with access to sections on the train with high-quality services; “second class” represents a subscription with access to sections on the train with basic services.

The “rush hour (access)” attribute describes the types of access during rush hour. It had three levels: “unlimited access” represents a subscription with access to public transport without restrictions; “Limited access” represents a subscription with no access to the defined rush hour interval except for a specific number of trips; “No Access” represents a subscription with no access to the defined rush hour interval.

The “price” attribute describes the economic outlay to purchase a specific travel card. It had four levels (“CHF 1’500.-”, “CHF 3’000.-”, “CHF 4’500.-”, “CHF 6’000.-”).

Additionally, alternatives with levels “limited access” and “no access” for the “rush hour (access)” attribute have an additional attribute: “rush hour (time frame)”. It represents the time intervals in which the subscription is valid for a limited number of trips and not valid anymore after having completed these trips (“limited access”) or is not valid (“no access”). It had two levels: “7:00 – 8:00 and 17:00 – 18:00 (narrow)”; and “6:00 – 9:00 and 16:00 – 19:00 (wide)”. Outside these intervals, there are no restrictions.

Finally, alternatives with the “limited access” level for the “rush hour (access)” attribute have an additional attribute: “rush hour (number of trips)”. This represents the number of trips allowed with a subscription with limited access during rush hour and it had two levels: “20 trips per year”, which provides access to the defined rush hour interval for 20 trips per year; and “30 trips per year. After having used the defined number of trips during the rush hour, travelers with a “limited access” travel card are not permitted to use public transport during the rush hour. The description of all rush hour access attributes that was provided to travelers during the survey is shown in Appendix Figure 26.

[21] The decision about these attributes and attribute levels was made during a meeting with Prof. Dr. Reto Hofstetter, Dr. David Blatter (SBB Personenverkehr, Preis und Sortiment), and Dr. Silvio Sticher (SBB Personenverkehr, Preis und Sortiment) on the 22.04.2016 in Bern.

Table 6
Attributes and Attribute Levels for Rush Hour Access Project

Attribute	Number of levels	Description
Geographical access	4	Area small (zone); Area medium (region, canton); area medium (region, canton) + route > 10 km; area big (country)
Comfort level	2	First class; second class
Rush hour (access)	3	Unlimited access; limited access; no access
Rush hour (time frame)	2	7:00 – 8:00 and 17:00 – 18:00 (narrow); 6:00 – 9:00 and 16:00 – 19:00 (wide)
Rush hour (number of trips)	2	20 trips per year; 30 trips per year
Price	4	CHF 1’500.-; CHF 3’000.-; CHF 4’500.-; CHF 6’000.-”

10.3.1.2 Latent and Other Variables

In this survey, we also added variables related to the SBB segmentation studies (SBB, 2013) because they would allow linking to segments at a later time. We extended those with further measures regarding commuting-time decisions. We also included demographics and other typically used latent variables as possible controls into the survey. In contrast to prior literature, we added different types of measures for factors that could constrain travel time choices. These include soft factors, such as social norms and perceived constraints due to social norms and hard factors, such as formal time constraints.

The variables of the SBB segmentation studies included the trip purpose (commuting to and from place of work, commuting to and from an educational institution, leisure trip without overnight stay (excursion, cinema, sports, visit), private vacation trip with at least one overnight stay, everyday tasks (consultation of a doctor, grocery shopping, picking somebody up), business trip, other), the predominant travel class (first class, second class), the need for commuting as well as the commuting habits, and the habits when engaging in leisure trips. We additionally measured how much they could deviate from their commuting time.

Since we measured a list of variables in this study, we did not want to overload respondents and thus reduced the number of scales compared with the Train Section Access Project and, in some scales, the number of items that we measured was reduced compared with the original scales. The Cronbach’s alphas of the multiple-item measures are reported in Table 7.

Finally, only for travelers that self-identified as commuters, we measured a set of latent variables regarding the type of constraint commuters faced, which we expected to add explanatory power for the choices between the different levels of the “rush hour (access)”, “rush hour (time frame)”, and “rush hour (number of trips)” attributes.

First, with a 14-item scale that we adapted from Bizer, Magin, and Levine (2014), we measured whether respondents have an individual tendency to comply with and value social norms at their commuting destination (e.g., workplace, university, school, etc.). We adapted the same scale to measure whether respondents have an individual tendency to comply with and value social norms in their private environment (e.g., family, sports club, etc.). We will refer to these variables as “social norms compliance (professional)” and “social norms compliance (private)” in the rest of the document.

Second, we measured with a seven-point, three-item scale to what extend respondents feel constrained in their commuting behavior by the social norms at their commuting destination. We will refer to this variable as “perceived constraints due to professional social norms”.[22] Similarly, we measured to what extend respondents feel constrained in their commuting behavior by the social norms in their private environment with a seven-point, three-item scale. We will refer to this variable as “perceived constraints due to private social norms”.

Third, for the social norms at the commuting destination, we measured whether respondents face social norms regarding the duration of the time of presence at the commuting destination with a

[22] The three items for a commuter commuting to work were worded as follows: “What other people at my workplace think about when one should arrive and leave constrains my commuting behavior strongly.”, “I feel strongly constrained in my commuting behavior by the expectations of other people at my workplace.”, “My commuting behavior is constrained by what other people at my hello expect from me.”. For commuters commuting to a place of education, “workplace” was replaced with “place of education”. If commuters indicated another commuting destination, that destination was shown in the scale item instead. The items were worded accordingly for the private environment.

seven-point, three-item scale[23]. That is, we measured whether it is a social norm at the commuting destination to arrive earlier and leave later than officially required. We will further refer to this variable as “duration norms”.

Fourth, we measured whether they face social norms regarding the flexibility of the time of presence at the commuting destination with a seven-point, three-item scale[24]. That is, we measured whether it is a social norm at the commuting destination to always be present during the same time interval and not to vary times of presence. We will further refer to this variable as “flexibility norms”.

Fifth, we measured the descriptive social norms regarding duration and flexibility by asking whether people at the respondent’s commuting destination actually spend more time at the commuting destination than officially required (further referred to as “descriptive duration norm”) and whether people at the respondent’s commuting destination are actually always present during the same time interval (further referred to as “descriptive flexibility norm”). The Cronbach’s alphas of these measures are also reported in Table 7.

Finally, as mentioned previously, we used two binary variables to measure whether respondents face official formal time constraints at their commuting destination (e.g., workplace, university, school, etc.) or in their private environment (e.g., fixed training schedules sports clubs, picking up kids at school, etc.) that influence their commuting behavior (“professional formal constraints” and “private formal constraints”). The correlations between all latent variables are reported in Appendix Tables 17 and 18.

Table 7

Cronbach’s Alpha of Latent Variables

Variable	Cronbach’s alpha
From Previous Literature	
Family/community oriented lifestyle	.65
Workaholic lifestyle	.65
Frustrated lifestyle	.63
Commute benefits	.68
Time-consciousness	.76
Desire for comfort	.51
Desire for flexibility	.75
Traveling hedonic (vs. utilitarian)	.85
Travel stress	.78
Social norms compliance (professional), adjusted	1.00
Social norms compliance (private), adjusted	1.00
New	
Perceived constraints due to professional social norms	.85
Perceived constraints due to private social norms	.92
Duration norms	.85
Flexibility norms	.84

10.3.1.3 Model Specification and Estimation

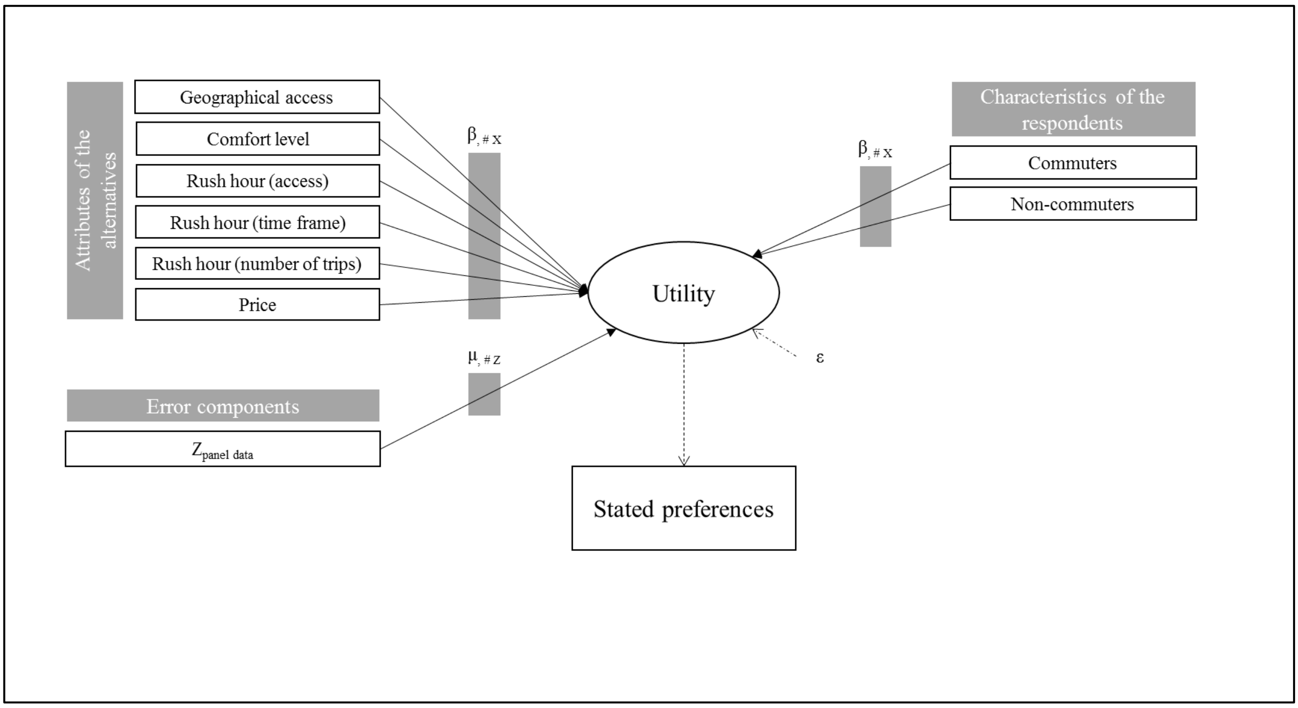
Applying the discrete choice model framework to the data we collected in this project, we estimated two similar models. In Model 1 (Appendix Table 23), we analyzed travelers’ preferences without taking into account any distinction between them. In Model 2 (Appendix Table 24), we

[23] We first explained the concept of social norms to travelers and then had them indicate their degree of agreement to the following three statements: “It is a social norm at my workplace to leave later than officially required.”, “It is a social norm at my workplace to arrive earlier than officially required.”, “It is a social norm at my workplace to be present beyond the officially required working time.”.

[24] We first explained the concept of social norms to travelers and then had them indicate their degree of agreement to the following three statements “It is a social norm at my workplace that everybody is always present at the same time.”, “It is a social norm at my workplace that everybody always starts at the same time.”, “It is a social norm at my workplace that everybody always leaves at the same time.”.

distinguish between commuters and non-commuters to extrapolate the differences in utility among the groups. Figure 17 shows the discrete choice model framework used.

Figure 17
Full Path Diagram of the Choice Model



We adopted a mixed logit with an error component (EC model) for both models as in the Train Section Access Project (Chapters 9.3.1.3 and 9.4.1.3).

In Model 1 (Appendix Table 23) and Model 2 (Appendix Table 24), we have three utility functions (U_1, U_2, U_3) according to the number and the type of alternatives defined in the choice design (see Chapter 10.3.1.1). Given that we adopted a "labeled" choice design, each utility function is associated with a specific product based on the levels of the rush hour (access) attribute. U_1 refers to the utility function of alternatives with no access during the rush hour, U_2 to alternatives with limited access during the rush hour, and U_3 to alternatives with no time restrictions (unlimited access). These utility functions are specified as follows:

$$\begin{aligned} U_{n1t} = \beta_{0no.access} &+ \beta_1 \times Geographical\ Access, area\ small\ (zone)_{n1t} + \cdots + \beta_3 \\ &\times Geographical\ Access, area\ medium\ (region, canton)\ and\ route(>10\ km)_{n1t} + \beta_4 \\ &\times Comfort\ Level_{n1t} + \beta_5 \times Rush\ Hour\ (time\ frame)_{n1t} + \beta_7 \times Price_{n1t} \\ &+ \mu \times Z_{panel\_data,n} + \varepsilon_{n1t} \end{aligned} \tag{18}$$

$$\begin{aligned} U_{n2t} = \beta_{0limited.access} &+ \beta_1 \times Geographical\ Access, area\ small\ (zone)_{n2t} + \cdots + \beta_3 \\ &\times Geographical\ Access, area\ medium\ (region, canton)\ and\ route(>10\ km)_{n2t} + \beta_4 \\ &\times Comfort\ Level_{n2t} + \beta_5 \times Rush\ Hour\ (time\ frame)_{n2t} + \beta_6 \\ &\times Rush\ Hour\ (number\ of\ trips)_{n2t} + \beta_7 \times Price_{n2t} + \mu \times Z_{panel\_data,n} + \varepsilon_{n2t} \end{aligned} \tag{19}$$

$$\begin{aligned} U_{n3t} = \beta_{0unlimited.access} &+ \beta_1 \times Geographical\ Access, area\ small\ (zone)_{n3t} + \cdots + \beta_3 \\ &\times Geographical\ Access, area\ medium\ (region, canton)\ and\ route(>10\ km)_{n3t} + \beta_4 \\ &\times Comfort\ Level_{n3t} + \beta_7 \times Price_{n2t} + \mu \times Z_{panel\_data,n} + \varepsilon_{n3t} \end{aligned} \tag{20}$$

In each equation, n identifies the individual respondents, t the choice task and, ε_{nt} is a random disturbance over people and choice tasks (see also previous explanation in paragraph 8.2). Introducing the commuting habits in the Model 2 (Appendix Table 24), each utility function has two betas per each attribute level, one for commuters and one for non-commuters. In practice, we interacted each component of the utility functions (except for the error components and the error term) mentioned above with two dichotomous variables (one per group).

We estimated these models using the maximum simulated likelihood (MSL) approach implemented in the free software, PythonBiogeme 2.4 (Bierlaire, 2016), using 5’000 Halton draws.

10.3.1.4 Procedure

With the help of the market research agency Intervista AG, we recruited 504 travelers in the German-speaking part of Switzerland for our survey. Only individuals who were planning to purchase a public transport subscription in Switzerland or renew their current one within the next year and who are paying for their subscription by themselves were eligible to participate in the survey. Our sample was stratified by age in order to represent the Swiss population according to SBB’s marketing research standards (Swiss Federal Statistical Office 2014). The rest of the procedure of this study was identical to the procedure of the two studies in the Train Section Access Project. An exemplary choice task is shown in Figure 18.

Figure 18
Exemplary Choice Task

If these were the travel card options offered to you, would you buy any of those and if yes which one?

Choose by clicking on one of the buttons below:

	Travel Card Nr. 1	Travel Card Nr. 2	Travel Card Nr. 3	None
Geographical Access	Area Small (Zone)	Area Medium (Region, Canton)	Area Medium (Region, Canton) + Route (> 10 km)	**I would not choose any of these.**
Comfort Level	1st class	1st class	2nd class	
Rush Hour Access	No Access during 6:00 – 9:00 and 16:00 – 19:00 (Wide)	Limited Access for 30 trips per year during 7:00 – 8:00 and 17:00 – 18:00 (Narrow)	Unlimited Access	
Price	CHF 4'500.-	CHF 4'500.-	CHF 1’500.-	

LEGEND (Click on the attribute name to see the description)

- **Geographical Access**
- **Comfort Level**
- **Rush Hour Access**
- **Price**

10.3.2 Description of Sample

Of the 504 travelers we recruited, 267 were female (53 percent) and the average age was 44.37 years. Most of the respondents in the sample own a Half-Fare travel card (66 percent), followed by general subscriptions (GA, 24 percent) and regional travel cards (20 percent). Six percent of respondents owned a Point-to-Point travel card, three percent owned a Track 7 travel card, and three percent had no current subscription. The most frequent purposes of travelling by train of respondents in our sample were leisure trips without overnight stays (83 percent), followed by vacation trips with at least one overnight stay (49 percent). Forty-six percent of the survey respondents indicated that they were commuting by train to work and 17 percent of the survey respondents were commuting by train to an educational institution. Forty-eight percent of respondents used the train to complete everyday tasks and 18 percent for business trips.

Most of the commuters (train or car) were commuting to work (78 percent), followed by commuting to an educational institution (19 percent). The most frequent trip distance commuters were covering lies between 15 and 50 kilometers (49 percent). Most commuters indicated that their commuting trip last approximately 45 minutes or 1 hour (42 percent). Ninety-one percent of commuters were doing at least 10 percent of their commuting trip during the wide rush hour interval (6:00 to 9:00 and 16:00 to 19:00). Fifty-six percent of the commuters that usually travel during the rush hour indicated that they could deviate their commuting time by more than 30 minutes.

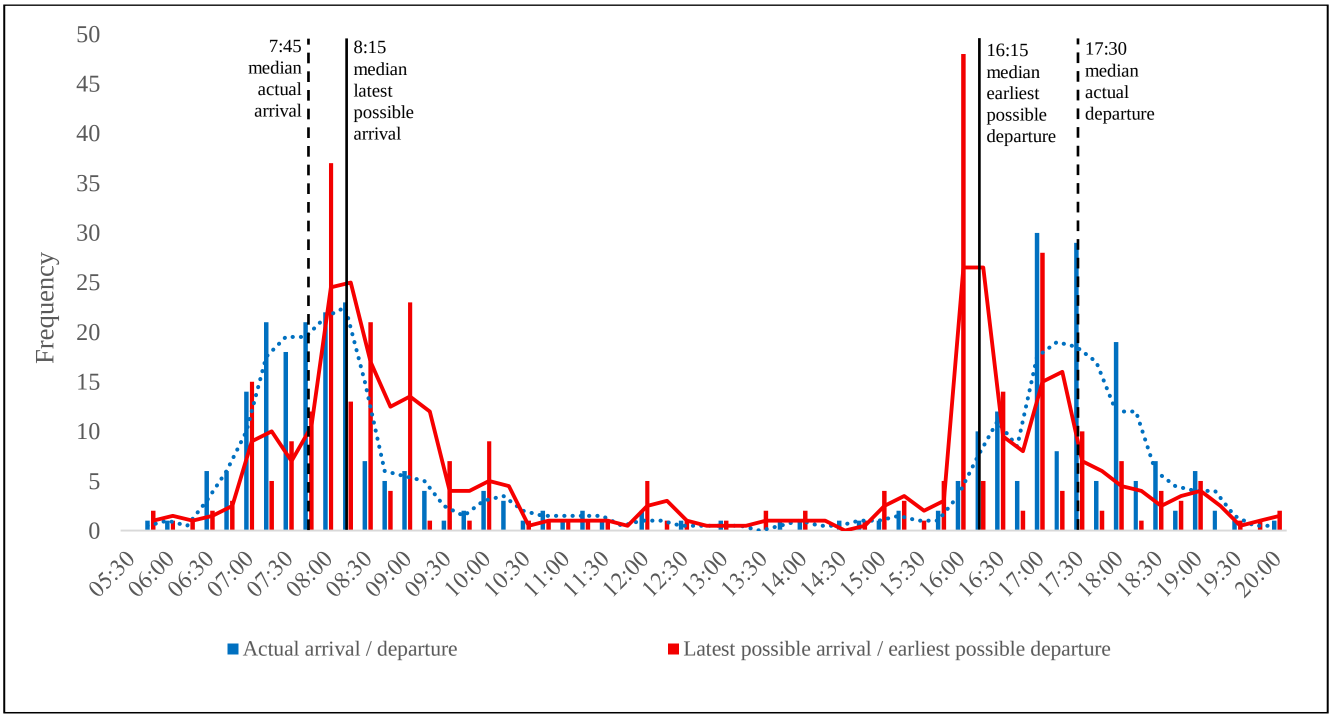
Seventy-four percent of commuters were faced with professional formal time constraints at their commuting destination (e.g., contracts at the workplace, fixed schedules at school or in university) that influence their commuting behavior. Only 33 percent of commuters were faced with private formal time constraints (e.g., fixed training schedules sports clubs, picking up kids at school, etc.) that influence their commuting behavior. Those commuters that were faced with formal time constraints (professional) were also more likely to additionally perceive constraints in their commuting behavior due to social norms ($\beta = .68$, $p < .01$). Moreover, younger respondents perceived stronger constraints in their commuting behavior due to social norms at the commuting destination ($\beta = -.01$, $p < .01$).

We further found less variance around the peak time of the rush hour both in the morning ($\sigma_{morning\_no\_constraints} = 8.54$, $\sigma_{morning\_ constraints} = 6.94$, $F(60,170) = 1.51$, $p < .05$) and in the evening ($\sigma_{evening\_no\_constraints} = 13.12$, $\sigma_{evening\_constraints} = 9.31$, $F(60,170) = 1.98$, $p < .01$) for commuters with (vs. without) formal constraints. Additionally, the commuters with (vs. without) formal constraints were leaving approximately one hour later from the commuting destination to return home ($t(230) = -2.61$, $p < .01$).

Figure 19 looks only at those commuters with professional formal time constraints at their commuting destination. It compares the latest possible arrival times with their actual arrival times and the earliest possible departure times from their commuting destination with their actual departure time. The distributions show that many commuters arrive earlier and leave later than officially required. The median of the actual arrival time at the commuting destination is at 7:45 (dashed line), and the median of the latest possible arrival time is at 8:15 (solid line). The median actual departure time is 17:30 (dashed line), and the median of the earliest possible departure time is at 16:15[25] (solid line). It may be possible that commuters are anticipating train delays during the rush hour and are self-insuring against these delays by leaving earlier.

Figure 19

Commuters with Formal Constraints Spend More Time at their Commuting Destination than Officially Required by Formal Constraints



Finally, commuters to an educational education (vs. commuters to work and to other commuting destinations) perceived less flexibility in varying their arrival and departure times due to

[25] We also tested the mean differences and found significant results both for arrival time ($t(170) = 4.77$, $p < .01$) and departure time ($t(170) = -5.14$, $p < .01$).

the social norms at their commuting destination ($F(2, 229) = 7.29$, $p < .01$). The older a commuter, the weaker is the perception that he or she is expected to be at the commuting destination always during the same time interval ($\beta < -.01$, $p < .01$).

10.3.3 Results from Choice Modeling

Model 1 (Appendix Table 23) estimates the coefficients of all attribute levels for the entire sample. Each coefficient represents the contribution that its specific attribute level has on the overall utility of the alternative. In line with this, the y-axis of all graphs measures the utility contribution of the attribute level represented. It shows that more geographical access provides higher utility to travelers ($\beta_{area\_small} = -.90$, $p < .01$; $\beta_{area\_medium} = -.20$, $p < .01$; $\beta_{area\_medium\_route} = .08$, $p > .10$). For a better interpretability, the coefficients of the geographical access are represented in Figure 20. The utilities of the attribute levels correspond to the values of the relative coefficients (e.g. $U_{area\ small} = \beta_{area\ small}$) except for the attribute reference level[26,27].

Results indicate that second class provides higher utility than first class ($\beta_{comfort\ level} = .37$, $p < .01$, Figure 21). Higher prices provide a lower utility than lower prices as shown by the price coefficient ($\beta_{price} < -.01$, $p < .01$[28]). Looking at the rush hour access, we find that unlimited access to the rush hour provides the highest utility, followed by no access to the narrow rush hour, and limited access to the narrow rush hour for 20 trips per year ($\beta_{unlimited\_access} = .10$, $p = .50$; $\beta_{no\_access} = -.79$, $p < .01$; $\beta_{no\_access} = -1.16$, $p < .01$). If the rush hour interval is defined as wide (vs. narrow), the utility for a travel card with limited access decreases even more ($\beta_{time\ frame\ -\ limited\ access} = -.25$, $p < .05$). This decrease is even stronger for travel cards with no access to the rush hour ($\beta_{time\ frame\text{-}no\ access} = -.57$, $p < .01$). Additionally, when the number of trips that is allowed per year with a travel card that provides limited access to the rush hour increases from 20 to 30, the utility of that travel card increases ($\beta_{number\ of\ trips\ –\ limited} = .27$, $p < .05$). In order to have an overview of the alternatives proposed (unlimited access during rush hour, limited access during wide rush hour with 20 trips per year, limited access during wide rush hour with 30 trips per year, etc.), we calculated the utility of each combination by summing up the utilities of their elements (Figure 22). For example, we calculated the utility of the alternative limited access during wide rush hour with 30 trips as follows:

$$U_{lim.wide.30trips} = \beta_{0limited.access} + \beta_5 \times Rush\ Hour\ (time\ frame)_{limited.access} \\ +\beta_6 \times Rush\ Hour\ (number\ of\ trips)_{limited.access}$$

Plugging in the coefficient estimates, we obtain the following value:

$$U_{lim.wide.30trips} = -1.16 - .246 + .272 = -1.134$$

Based on this model, we were also able to calculate the willingness to pay differences between those attribute levels per attribute that provide the highest utility and the lowest utility. Travelers would be willing to pay CHF 3’631.- more for a travel card with access to the entire country (vs. only access to a maximum of two zones). They would also be willing to pay CHF 2’109.- more for a travel card with unlimited access to the rush hour (vs. with limited access to the narrow time frame, 20 trips per year) and they would also be willing to pay CHF 1’431.- more for the unlimited access compared with no access to the narrow time frame. When having limited access to the rush hour, they would be willing to pay CHF 447.- less for a travel card with a width rush hour definition from 06:00 to 09:00 and from 16:00 to 19:00 (vs. narrow from 07:00 to 08:00 and from 17:00 to 18:00). When having no access to the rush hour, they would be willing to pay CHF 1’031.- less for a travel card with a wide rush hour definition from 06:00 to 09:00 and from 16:00 to 19:00 (vs. narrow from 07:00 to 08:00 and from 17:00 to 18:00). Increasing the number of trips permitted during the rush hour from 20 to 30

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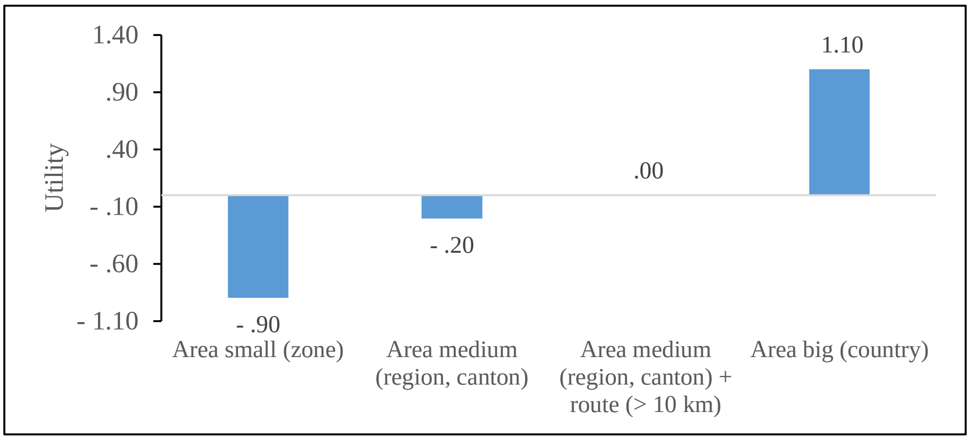
[26] We coded this variable using the so-called effect coding technique (Hensher et al., 2005). With this procedure, we obtained the value of the reference level by summing up the coefficients (multiplied by a factor of -1) associated with other levels.
[27] $U_{area\ big} = (-1) \times \beta_{area\ small} + (-1) \times \beta_{area\ medium}$. The coefficient associated with area medium (region, canton) + route (> 10 km) is not significantly different from zero and, for this reason, we do not use it to calculate the utility of area big (country).
[28] Price is continuous in the model. Therefore, it is not reported graphically.

increases the willingness to pay by CHF 495.-. Travelers would further be willing to pay CHF 664.- more for a second class (vs. first class) travel card.

Figure 20

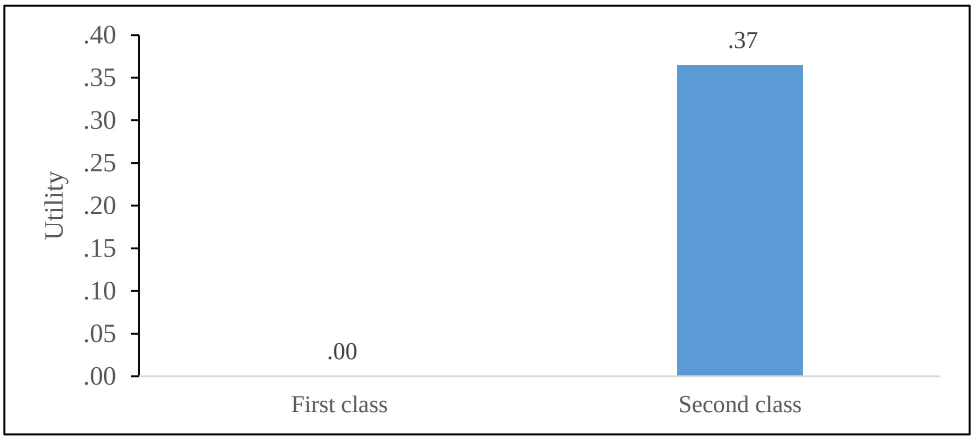
The Wider the Geographical Access, the Higher the Utility



Note: The utility associated with area medium (region, canton) + route (> 10 km) is not represented because the relative coefficient is not significantly different from zero.

Figure 21

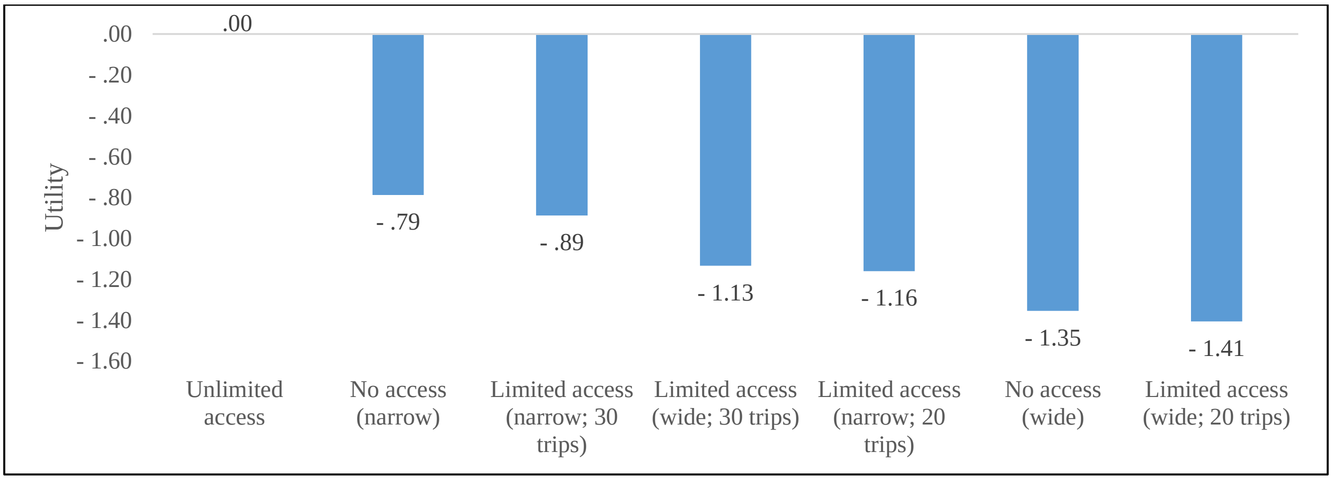
Travelers Prefer Second Class to First Class



Note: First class represents the reference level for this attribute (here, fixed to zero).

Figure 22

Unlimited Access Provides the Highest Utility



Note: The utility associated with unlimited access is not represented because the relative coefficient is not significantly different from zero. We calculated the other values combing the coefficients associated with the attribute levels (as explained in the previous page).

Model 2 (Appendix Table 24) estimates the coefficients for all attributes and attribute levels split between commuters and non-commuters. We found that commuters (vs. non-commuters) derive a higher utility from a travel card with unlimited access to the rush hour ($\beta_{unlimited\_commuters} = .61, p < .01$; $\beta_{unlimited\_non\text{-}commuters} = -.31, p > .10$). Commuters (vs. non-commuters) also derive a higher utility from a travel card with limited access for 20 trips when the rush hour is defined as lasting from 7:00 to 8:00 and 17:00 to 18:00 (narrow) ($\beta_{limited\_commuters} = -.70, p < .05$; $\beta_{limited\_non\text{-}commuters} = -1.50, p < .01$) and without access to the rush hour with the rush hour defined as lasting from 7:00 to 8:00 and from 17:00 to 18:00 (narrow) ($\beta_{noaccess\_commuters} = -.29, p > .10$; $\beta_{noaccess\_non\text{-}commuters} = -1.17, p < .01$).

While it does not make a difference for non-commuters how the rush hour is defined when having limited access ($\beta_{noaccess\_timeframe\_non\text{-}commuters} = -.11, p > .10$), for commuters a wider definition of the rush hour from 6:00 to 9:00 and 16:00 to 19:00 (vs. narrow 7:00 to 8:00 and 17:00 to 18:00) leads to a lower utility ($\beta_{limited\_timeframe\_commuters} = -.45, p < .01$). When the travel card provides no access to the rush hour, the definition of the time frame plays a stronger role for commuters ($\beta_{noaccess\_timeframe\_commuters} = -.74, p < .01$; $\beta_{noaccess\_timeframe\_non\text{-}commuters} = -.44, p < .05$). For non-commuters (vs. commuters) being allowed 30 (vs. 20) trips with a travel card that allows limited access to the rush hour provides a slightly higher utility ($\beta_{limited\_trips\_commuters} = .27, p < .10$; $\beta_{limited\_trips\_non\text{-}commuters} = .29, p < .05$). In order to have an overview of the alternatives proposed divided by commuters or non-commuters (unlimited access during rush hour, limited access during wide rush hour with 20 trips per year, limited access during wide rush hour with 30 trips per year, etc.), we calculated the utility of each combination by summing up the utilities of their elements (Figure 23). For example, we calculated the utility of the alternative limited access during wide rush hour with 30 trips for commuters as follows:

$$U_{lim.wide.30trips\_commuters} = \beta_{0limited.access_{commuters}} + \beta_5 \times Rush\ Hour\ (time\ frame)_{limited.access_{commuters}} + \beta_6 \times Rush\ Hour\ (number\ of\ trips)_{limited.access\_commuters}$$

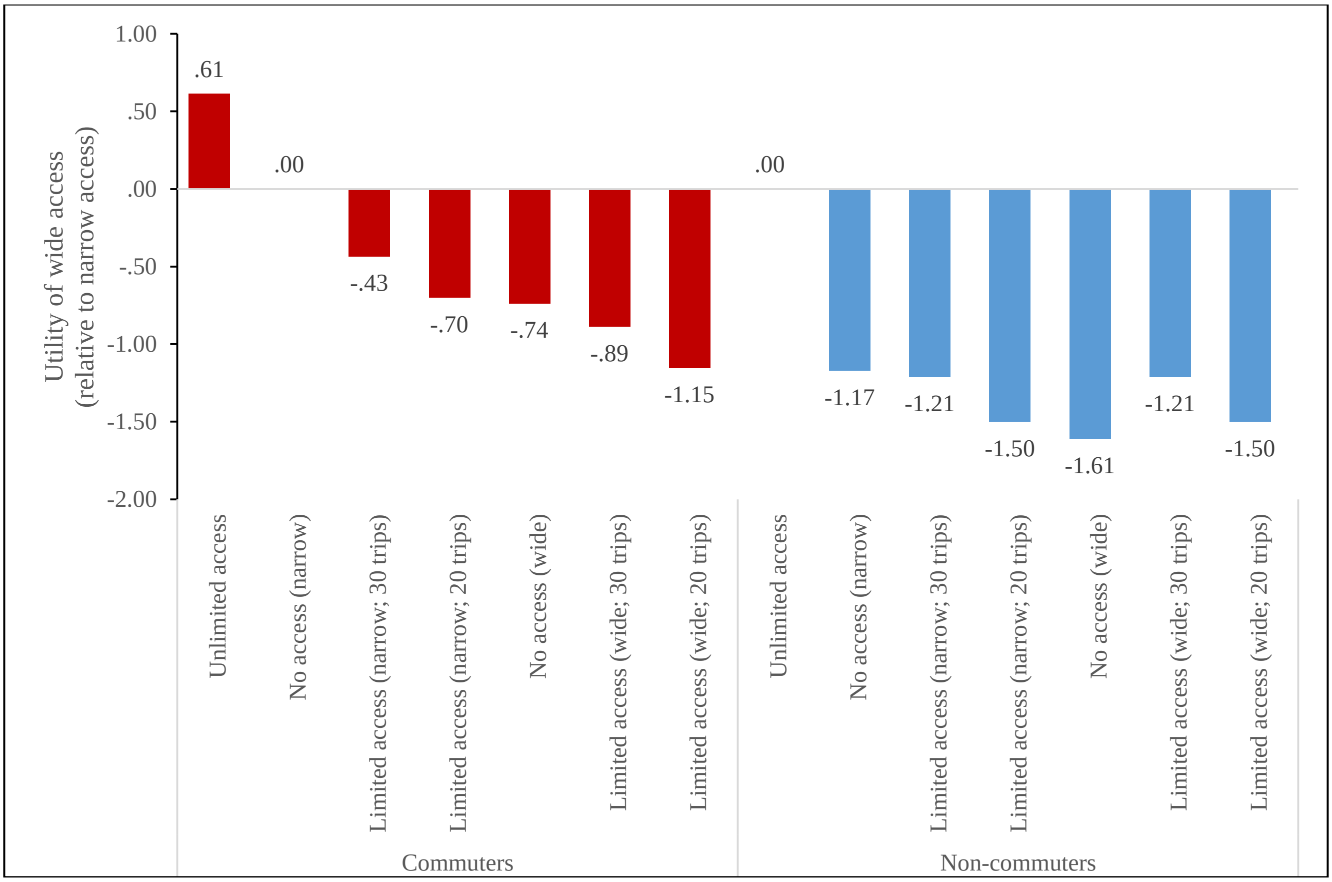
Plugging in the coefficient estimates, we obtain the following value:

$$U_{lim.wide.30trips\_commuters} = -.70 - .45 + .27 = -.88$$

Based on this model, we were also able to calculate the willingness-to-pay differences between those levels per attribute that provide the highest and lowest utility. Commuters would be willing to pay CHF 2’480.- more for a travel card with unlimited access to the rush hour (vs. with limited access to the narrow time frame, 20 trips per year), whereas non-commuters would be willing to pay CHF 2’618.- more. Moreover, commuters would be willing to pay CHF 1’157.- more for unlimited access to the rush hour compared with no access during the narrow time frame, whereas non-commuters would be willing to pay CHF 2'042.- more. When having limited access to the rush hour, commuters would be willing to pay CHF 854.- less for a travel card with a rush hour definition from 06:00 to 09:00 and from 16:00 to 19:00 (vs. from 07:00 to 08:00 and from 17:00 to 18:00), whereas there was not a difference in willingness-to-pay for non-commuters. When having no access to the rush hour, commuters would be willing to pay CHF 1'393.- less for a travel card with a rush hour definition from 06:00 to 09:00 and from 16:00 to 19:00 (vs. from 07:00 to 08:00 and from 17:00 to 18:00), whereas non-commuters would be willing to pay CHF 766.- less. Increasing the number of trips that are allowed during the rush hour from 20 to 30 increases the willingness to pay by CHF 503.- for commuters and by CHF 506.- for non-commuters.

Figure 23

Commuters Derive a Higher Utility from All Access Options to the Rush Hour



Note: The utility associated with no access (narrow) for commuters and unlimited access for non-commuters are not represented because the relative coefficients are not significantly different from zero.

10.3.4 Subgroup Analysis

As in the previous project, we observed how travelers expressed their preferences between the different available alternatives and created one dummy variable per possible alternative for this purpose (i.e., no access, limited access, and unlimited access). Then, we ran several logistic regressions using each dummy as the dependent variable. Below, we report a summary of the main statistically significant insights.

The probability to choose a travel card with unlimited access during rush hour (vs. any other) is higher for commuters (vs. non-commuters, $\beta_{commuters} = .48$, $p < .01$) that commute to and from work ($\beta_{comm.work} = .29$, $p < .05$) or use the train for their business trips ($\beta_{bus.trips} = .32$, $p < .05$). This confirms the results of the choice model that distinguishes between commuters and non-commuters. When looking only at commuters, the probability to choose this alternative increases when they have private formal constraints ($\beta_{priv.formal\ constr.} = .46$, $p < .05$). We also found that the probability to choose this alternative increases with a decreasing duration norm (i.e., the perception that it is a social norm to arrive earlier and leave later than officially required, $\beta_{duration\ norm} = -.26$, $p < .01$). It also increases the less workaholic the lifestyle of a traveler is ($\beta_{workaholic} = -.16$, $p < .05$) and the lesser a traveler's desire for comfort ($\beta_{trav.comfort} = .14$, $p < .05$). It also increases the less a traveler perceives traveling as hedonic (vs. utilitarian, $\beta_{hedonic} = -.13$, $p < .01$).

The probability to choose a travel card with limited access to the rush hour (vs. any other) is higher for pensioners ($\beta_{pensioner} = .86$, $p < .05$). This probability is also higher for non-commuters (vs. commuters, $\beta_{commuters} = -.44$, $p < .01$), with decreasing hedonism of travelers ($\beta_{hedonism} = -.17$, $p < .01$) and with an increasing workaholic lifestyle of a traveler ($\beta_{workaholic} = .15$, $p < .05$). Moreover, it increases the higher a traveler's perception of commute benefits ($\beta_{comm.benefits} = .17$, $p < .05$) and the lesser a traveler's desire for comfort ($\beta_{comfort} = -.16$, $p < .01$). It also increases the more a traveler perceives traveling as hedonic (vs. utilitarian, $\beta_{travel.hedonic} = .16$, $p < .01$).

The probability to choose a travel card with no access during rush hour (vs. any other) is higher for travelers that currently own (vs. not) a Half-Fare travel card ($\beta_{half\text{-}fare} = .52$, $p < .05$) and for people that do not own a subscription ($\beta_{no.subscription} = .78$, $p < .05$).

10.3.5 Summary and Discussion

In the first model, we found that travelers had a strong preference for travel cards that provided unlimited access to the rush hour compared with travel cards that provided limited access or no access. On average in the sample, travelers would be willing to pay CHF 2'556.- more for a travel card with unlimited access to the rush hour than for the least preferred limited travel card, a card that provided access for 20 trips per year to the wide rush hour. Similarly, they would be willing to pay CHF 2'462.- more for a travel card with unlimited access than for a travel card with no access to the wide rush hour. A possible interpretation of this finding is that for most travelers, access to the rush hour is indispensable. The result that the utility for limited access to the rush hour is lower than the utility for no access to the rush hour is rather surprising. It may be that travelers do not want limits on their travel cards for convenience reasons. Having to count the number of trips one has left during the rush hour may be perceived as cumbersome. Not choosing travel cards with limited access over travel cards with no access would be an attitude expression regarding that perception. Nevertheless, travelers are rational regarding the number of trips; they are willing to pay CHF 495.- more for a travel card with limited access for 30 than for 20 trips. Thus, having less access to the rush hour makes an economically relevant difference in the willingness-to-pay for travel cards.

Counter to our expectation, we found that travelers derive a lower utility from a travel card with access to the first class (vs. second class). A possible explanation for this result may be overcrowded first class sections during rush hour. If travelers have to stand, even in the first class, it does not provide the additional utility it is meant to provide compared with second class.

In the second model, we found that commuters (vs. non-commuters) have a higher utility for all rush hour access options. This shows that they are in general more likely to purchase a travel card than non-commuters. It is interesting that this is valid even for travel cards with no access to the rush hour. However, commuters (vs. non-commuters) are more sensitive to the definition of the rush hour time frame. Some commuters may be able to travel outside the narrow rush hour, but if the travel card does not allow them to travel during the entire wide rush hour time frame, it significantly loses value for them (for a travel card with no access to the rush hour, the willingness to pay drops by CHF 1'393.-). This is supported also by our descriptive analysis showing that the median formal constraints of commuters lie in the wide rush hour time frame (and outside the narrow rush hour time frame). Non-commuters, on the other hand, are more sensitive to the number of trips permitted with a limited access travel card. This shows that there may be some value for limited access travel cards for non-commuters. Future research could examine different designs of the limited access travel cards that meet the needs of non-commuters.

Further, in a subgroup analysis, we analyzed in detail which individual characteristics drive the choice of each of the access options to the rush hour. Travel cards with unlimited access to the rush hour are more attractive to travelers with a more utilitarian travel purposes, i.e., for commuters that commute to work and have exact working times or travelers doing business trips. Travel cards with limited access to the rush hour are preferred by pensioners and other non-commuters (confirming the previous results). They are also preferred by travelers with a more workaholic lifestyle. This may be explained by the notion that workaholics have working hours that go beyond the rush hour. Thus, they do not frequently travel during the rush hour. The probability of choosing a limited access travel card also decreases the more a traveler regards traveling as utilitarian. Travel cards with no access to the rush hour are most attractive to seldom travelers as defined by their current travel card ownership.

Also counter to our expectation, we could not find conclusive evidence of an influence of formal constraints or social norms on the choice between different rush hour access options. We ran a set of additional models (which we do not report here) to analyze possible effects of both types of constraints, but found no clear direction in the effects. A possible reason may be that we measured formal constraints and social norms in an overly generic way. There may different types of formal constraints and social norms at the commuting destination or in the private environment that differently influence travel card choices. Future research could explore these in detail. Additionally, it might be possible that the access difference between unlimited access and the limited access options we defined as well as no access was too large to allow for variation due to constraints. If the limited access had been more similar to the unlimited access in terms of the degree of access it allows, more travelers may actually have had the opportunity to choose a travel card with limited access. Therefore, different designs of limited access that allow for greater access than defined in this survey may be a fruitful avenue for future research.

10.4 Recommendations for SBB

Limiting access to the rush hour to 20 trips per year during the wide rush hour heavily decreases the utility of a travel card compared with unlimited access (the willingness-to-pay decreases of CHF 2’556.-). Surprisingly, the willingness to pay decreases less when completely removing the access to the wide rush hour (no access, willingness to pay decreases by CHF 2’462.-). A possible explanation for this result is the notion that travelers perceive the limitation in form of the number of trips as inconvenient. Travelers want either unlimited access or no access at a significantly lower price. Therefore, given these strong sensitivities related to constraining travelling, we cannot recommend pricing strategies that impose strong traveling constraints or that financially exploit travelers’ strong need to travel during rush hours over higher prices.

Our results also showed that commuters are generally more likely to purchase a travel card than non-commuters, which is an intuitive result. However, having no access to the wide (vs. the narrow) rush hour reduced the value of a travel card more for commuters than for non-commuters. A travel card with no access to the narrow rush hour may be an option for some commuters. However, when the rush hour is defined as wide, it became almost useless for them. Implementing limited access travel cards with a wide rush hour definition are thus likely to attract significantly less travelers. Further, being allowed a higher number of trips during the rush hour increased utility more for non-commuters than for commuters. Therefore, the design of the limited access travel cards should be studied further while focusing on non-commuters.

The results of our subgroup analysis also hint that there exists a niche market for travel cards with limited access to the rush hour. Before implementing such a travel card, however, different design options for the limited access travel card should be examined. Once having these results, the implementation requires a highly targeted approach.

11 Conclusion

For both projects, we followed the typical stage-gate process of product innovation management, in which large numbers of opportunities are first identified and then sequentially screened out until the most promising ones remain, after which they are subsequently introduced to the market (Terwiesch & Ulrich, 2009). We identified two potential product innovations in the first stage, which we empirically investigated further. The first product innovation idea investigated the utility for dedicated sections on the train where only travelers with similar travel needs and habits travel together. The second product innovation idea investigated the utilities of different access options to the rush hour. In the second stage, we generated insights about these two product innovations in two separate projects by measuring consumer preferences.

In the Train Section Access Project, we found evidence in two studies that there is no general preference for additionally having access to a dedicated section relative to a common section only.

Nevertheless, there exists a specific group of people that prefer access to a specific dedicated section (compared with all other sections). Additionally, the preference for the dedicated sections (vs. the common section) increases with an increasing tendency towards out-group derogation. People that evaluate other people that are different from them negatively, prefer to travel in a section of the train where they can be separated from those individuals. This way, they are not disturbed by other travelers that show different behaviors. Thus, a mere separation of different types of people creates utility for a subgroup on the market who would be willing to pay for that separation. This may be a possibility for SBB to generate additional revenue with a low financial investment. As these dedicated sections only provide utility to a specific subgroup of travelers as defined by their demographics, travel characteristics, and psychographics, pricing the dedicated section requires a highly targeted approach. Future research could segment the market based on the preferences for a specific dedicated section and run market simulations. Market simulations can help define price points.

In the Rush Hour Access Project, we found that travelers have a very strong preference for an unlimited access to the rush hour compared with all other options. They want to travel freely with no time constraints and there is a high willingness to pay for that convenience. This shows also that for most travelers, being able to travel during the rush hour is crucial. As travelers prefer no access over limited access, an implementation of the limited access travel cards as defined in our experiment is not recommendable for SBB. Nevertheless, specific subgroups of travelers exist that prefer travel cards with limited access to the rush hour respectively over travel cards with unlimited access. Thus, improving the design of the limited access travel cards in future research and then implementing them with a highly targeted approach may still be profitable. We also found that commuters were more sensitive to the definition of the rush hour time frame, while non-commuters were more sensitive to the number of trips allowed with a limited access travel card. This finding in combination with the results of our subgroup analysis showed that it might be worthwhile to investigate the design of the limited access travel card further while focusing on the relevant traveler segment.

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13 Appendix

13.1 Appendix A: Ideation Session

Table 8

Top Ten Ideas According to the Degree of Innovativeness

Degree of Innovativeness		
Rank	**Idea**	**Average Innovativeness**
1	Books for rent (from station to station)	6.33
2	Spooky train, e.g. as a Halloween event tour	6.33
3	Social wagon to get in touch with others / silent wagon	6.00
4	Party trips with dance and drink/bar wagons	6.00
5	SBB-assistant for kids travelling alone	5.67
6	Ticked the price of which is based on the distance (e.g. CHF 1.- per km)	5.67
7	More price differentiation by travel time and destination	5.67
8	Mobile app for passengers to communicate	5.67
9	package service by train (from station to station)	5.67
10	Playground for kids at the track	5.67

Table 9

Top Ten Ideas According to the Expected Utility for the Target Segment

Expected utility for the target segment		
Rank	**Idea**	**Average Rating**
1	Free Wi-Fi in the trains	7.00
2	Loyalty program to collect points	6.67
3	Push messages on the phone for delayed trains	6.67
4	Wi-Fi in the train	6.67
5	‘rail & fly’ tickets, e.g. in cooperation with Swiss Air	6.33
6	Cheaper tickets for trips that are booked a long time in advance.	6.33
7	Ticket that is valid for a certain route for a certain number of times.	6.00
8	Power outlets in the train.	6.00
9	Digital information system in the train (stops, delays, etc.)	6.00
10	Ticketing machine in the train	6.00

Table 10

Top Ten Ideas According to the Impact on the Brand Image

Impact on the brand image		
Rank	**Idea**	**Average Rating**
1	Special tickets for special days (mother's day, Valentine's day etc.)	6.33
2	SBB-assistant for kids on their trips	6.33
3	Pick up service for women until late in the night	6.00
4	Assistance for seniors	6.00
5	Free music and e-books for SBB passengers	5.67
6	Free Wi-Fi in the trains	5.67
7	'rail & fly' tickets, e.g. in cooperation with Swiss Air	5.67
8	Digital library in the trains	5.67
9	Books for rent (from station to station)	5.67
10	Bike sharing programs	5.67

Table 11

Top Ten Ideas According to the Degree of Innovativeness, Expected Utility for the Target Segment, Impact on the Brand Image

Overall evaluation		
Rank	**Idea**	**Average Rating**
1	SBB-assistant for kids on their trips	5.78
2	Loyalty program to collect points	5.67
3	Free Wi-Fi in the trains	5.56
4	'rail & fly' tickets, e.g. in cooperation with Swiss Air	5.56
5	Digital library in the trains	5.44
6	Partner card at half fare for travel partner	5.33
7-9	Ticked the price of which is based on the distance (e.g. CHF 1.- per km)	5.22
	Pick up service for women until late in the night	5.22
	Books for rent (from station to station)	5.22

31.2 Appendix B: Descriptive Results

Table 12

Correlation Between Latent Constructs (Train Section Access Project, Study 1)

	Out-group derogation	Family oriented life-style	Status-seeking life-style	Workaholic life-style	Frustrated life-style	Time-consciousness	Hedonism	Travel liking	Commute benefits	Travel stress	Desire for comfort	Desire for flexibility	Travelling hedonic vs. utilitarian
Out-group derogation													
Family oriented life-style	.14[c]												
Status-seeking life-style	.36[c]	.25[c]											
Workaholic life-style	.29[c]	< -.01	.18[c]										
Frustrated life-style	.43[c]	.37[c]	.43[c]	.19[c]									
Time-consciousness	.33[c]	.24[c]	.31[c]	.35[c]	.37								
Hedonism	.06[c]	.21[c]	.15[c]	-.23[c]	.10[c]	.21[c]							
Travel liking	-.18[c]	.05[c]	-.13[c]	-.21[c]	-.14[c]	-.03	.20[c]						
Commute benefits	-.24[c]	-.09[c]	-.15[c]	-.13[c]	-.32[c]	-.21[c]	.07[c]	.50[c]					
Travel stress	.51[c]	.16[c]	.39[c]	.27[c]	.48[c]	.34[c]	-.06[c]	-.42[c]	-.40[c]				
Desire for comfort	.14[c]	.27[c]	.14[c]	< .01	.23[c]	.21[c]	.21[c]	.13[c]	.04[a]	.01			
Desire for flexibility	.14[c]	.23[c]	.20[c]	.06[c]	.21[c]	.14[c]	.03	< .01	.04[b]	.25[c]	.23[c]		
Travelling hedonic vs. utilitarian	.07[c]	.13[c]	.11[c]	.01	-.05[b]	-.12[c]	.10[c]	.25[c]	.17[c]	-.04[a]	< -.01	.12[c]	

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

Table 13

Relation of Out-Group Derogation to Other Psychographics (Train Section Access Project, Study 1)

Variable	Relation	Mean at low out-group derogation	Mean at high out-group derogation	t-value[29]	p-value
Latent variables					
Family /community oriented life-style		4.26	4.49	-1.21	> .10
Workaholic life-style	+	2.99	3.19	-1.77	< .10[a]
Status-seeking life-style	+	2.09	2.82	-3.51	< .01[c]
Frustrated life-style	+	2.59	3.31	-4.33	< .01[c]
Travel-liking		5.00	4.85	1.20	> .10
Hedonism		5.52	5.59	-.39	> .10
Time-consciousness	+	4.05	4.76	-4.10	< .01[c]
Desire for comfort		4.69	4.93	-1.44	> .10
Desire for flexibility		2.99	3.28	-1.32	> .10
Traveling hedonic (vs. utilitarian)		3.08	3.25	-.83	> .10
Commute benefits	-	4.62	4.13	3.09	< .01[c]
Travel stress	+	1.99	2.69	-4.41	< .01[c]

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

[29] The degrees of freedom for all analyses are 205 if not indicated differently.

Table 14

Relation of Out-Group Derogation to Travel-Related Variables (Train Section Access Project, Study 1)

Variable	Relation	Mean at low out-group derogation	Mean at high out-group derogation	t-value[30]	p-value
Trip purpose					
Commuting to and from work		.43	.47	-.49	> .10
Commuting to and from an educational institution		.12	.16	-.73	> .10
Leisure trip without overnight stay		.79	.81	-.37	> .10
Private vacation trip with at least one overnight stay		.40	.45	-.70	> .10
Everyday tasks		.42	.51	-1.36	> .10
Business trip		.22	.19	.52	> .10
Other trip purpose		.04	.04	.30	> .10
Travel card ownership					
GA travel card		.23	.21	-.26	> .10
Half-Fare travel card		.62	.65	-.44	> .10
Point-to-Point travel card		.05	.06	-.33	> .10
Track 7 travel card		< .01	.01	-1.10	> .10
Regional travel card		.19	.28	-1.39	> .10
Travel class					
Second class (vs. first class) predominant travel class		1.90	1.93	-.58	> .10
Commuting trip					
Commuting days per week (only commuters)[31]		4.24	4.39	-.59	> .10
Trip distance (only commuters)[32]		2.02	2.13	-.71	> .10
Commuting during rush hour (vs. not)[33]		.86	.92	-.87	> .10
Commuting with formal time constraints at commuting destination (vs. no commuting and commuting without formal time constraints)		.27	.38	-1.81	< .10[a]
Leisure trip					
Frequency[34]		3.32	3.16	1.16	> .10
Trip distance[35]		2.68	2.81	-1.25	> .10

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

[30] The degrees of freedom for all analyses are 205 if not indicated differently.
[31] The degrees of freedom for this analysis are 104.
[32] The degrees of freedom for this analysis are 104.
[33] The degrees of freedom for this analysis are 104.
[34] Lower values mean higher frequency, but variable is ordinal.
[35] Replaced values “don’t know” and “not applicable” with the mean.

Table 15
Relation of Out-Group Derogation to Selection of Demographics (Train Section Access Project, Study1)

Variable	**Relation**	**Mean at low out-group derogation**	**Mean at high out-group derogation**	**t-value**[36]	**p-value**
Demographics					
Age		48.07	41.37	3.21	< .01
Gender male (vs. female)		1.50	1.52	-.24	> .10
Last completed education: compulsory school (vs. other)		.02	.04	-.63	> .10
Last completed education: professional school / apprenticeship / vocational school (vs. other)		.26	.29	-.49	> .10
Last completed education: middle school / high school (vs. other)		.19	.19	-.10	> .10
Last completed education: higher schools like universities / institutes of technology / technical college / higher vocational schools (vs. other)		.53	.48	.74	> .10
Number of people in household		2.41	2.56	-.91	> .10
Employment percentage		4.42	4.17	.43	> .10
Main occupation: employed		.66	.64	.38	> .10
Main occupation: student	+	.05	.12	-1.67	< .10[a]
Main occupation: housewife / homemaker		.06	.07	-.36	> .10
Main occupation: pensioner		.15	.13	.46	> .10
Main occupation: unemployed		.02	.01	.42	> .10
Main occupation: other		.05	.03	.74	> .10

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

Table 16
Correlation Between Latent Constructs (Train Section Access Project, Study 2)

	Out-group derogation	Family oriented life-style	Status-seeking life-style	Workaholic life-style	Frustrated life-style	Time-consciousness	Travel liking	Hedonism	Commute benefits	Travel stress	Desire for comfort	Desire for flexibility
Out-group derogation												
Family oriented life-style	.02[a]											
Status-seeking life-style	.34[c]	.13[c]										
Workaholic life-style	.22[c]	-.06[c]	.25[c]									
Frustrated life-style	.32[c]	.22[c]	.34[c]	.25[c]								
Time-consciousness	.22[c]	.22[c]	.16[c]	.21[c]	.35[c]							
Travel liking	-.19[c]	.08[c]	-.07[c]	-.15[c]	-.20[c]	-.14[c]						
Hedonism	< .01	.24[c]	.10[c]	-.19[c]	.08[c]	-.14[c]	.16[c]					
Commute benefits	-.19	-.10[c]	-.09[c]	-.08[c]	-.33[c]	-.17[c]	.37[c]	-.04[c]				
Travel stress	.49[c]	.15[c]	.34[c]	.26[c]	.45[c]	.35[c]	-.37[c]	.03[b]	-.38[c]			
Desire for comfort	.12[c]	.29[c]	.08[c]	.06[c]	.14[c]	.25[c]	.08[c]	.10[c]	.14[c]	.12[c]		
Desire for flexibility	.17[c]	.30[c]	.22[c]	.12[c]	.31[c]	.29[c]	< .01	.18[c]	.02[a]	.21[c]	.25[c]	
Travelling hedonic vs. utilitarian	< .01	-.02	.02[a]	< -.01	-.07[c]	-.12	.28[c]	.04[c]	.18[c]	-.02[a]	-.06[c]	.02

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

[36] The degrees of freedom for all analyses are 205 if not indicated differently.

Table 17

Correlation Between Latent Constructs (Rush Hour Access Project, Part 1)

	Perceived constraints (professional)	Perceived constraints (private)	Social norms compliance (professional)	Social norms compliance (private)	Duration norm	Flexibility norm	Descriptive duration norm	Descriptive flexibility norm	Family oriented life-style	Status-seeking life-style	Workaholic life-style	Frustrated life-style
Perceived constraints (professional)												
Perceived constraints (private)	1.00[c]											
Social norms compliance (professional)	1.00[c]	1.00c										
Social norms compliance (private)	1.00[c]	1.00[c]	1.00[c]									
Duration norm	1.00[c]	1.00[c]	1.00[c]	1.00[c]								
Flexibility norm	1.00[c]	1.00[c]	1.00[c]	1.00[c]	1.00[c]							
Descriptive duration norm	1.00[c]	1.00[c]	1.00[c]	1.00[c]	1.00[c]	1.00[c]						
Descriptive flexibility norm	1.00[c]	1.00[c]	1.00[c]	1.00[c]	1.00[c]	1.00[c]	1.00[c]					
Family oriented life-style	.12[c]	.11[c]	.11[c]	.11[c]	.12[c]	.11[c]	.12[c]	.11[c]				
Status-seeking life-style	-.01	-.01	-.01	-.01	-.01	-.01	-.01	-.01	.02			
Workaholic life-style	.02[a]	.02[a]	.03[b]	.03[b]	.02[a]	.02[a]	.02	.02[a]	< -.01	.21[c]		
Frustrated life-style	.17[c]	.17[c]	.16[c]	.17[c]	.17[c]	.16[c]	.17[c]	.16[c]	.25[c]	.16[c]	.28[c]	
Time-consciousness	.04[c]	.04[c]	.04[c]	.04[c]	.04[c]	.04[c]	.04[c]	.04[c]	.21[c]	.07	.22[c]	.33[c]
Travel liking	.14[c]	.14[c]	.13[c]	.14[c]	.14[c]	.14[c]	.14[c]	.14[c]	.05	.10[b]	.13[c]	.34[c]
Hedonism	-.01	-.01	-.01	-.02	-.01	-.01	-.01	-.01	.17[c]	.09[a]	-.21[c]	-.09[a]
Commute benefits	.16[c]	.16[c]	.17[c]	.16[c]	.16[c]	.16[c]	.17[c]	.16[c]	< .01	-.01	-.03	-.24[c]
Travel stress	.04[c]	.04[c]	.03[c]	.04[c]	.04[c]	.04[c]	.03[c]	.04[c]	.06	.07	.21	.41[c]
Desire for comfort	.05[c]	.05[c]	.05[c]	.05[c]	.05[c]	.04[c]	.05[c]	.04[c]	.27	-.02	.04	.09[b]
Desire for flexibility	< .01	< .01	< .01	< .01	< .01	< .01	< .01	< .01	.19[c]	.13[c]	.08[a]	.15[c]
Travelling hedonic vs. utilitarian	-.31[c]	-.31[c]	-.31[c]	-.31[c]	-.31[c]	-.31[c]	-.31[c]	-.31[c]	-.07	-.01	-.06	-.13[c]

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

Table 18

Correlation Between Latent Constructs (Rush Hour Access Project, Part 2)

	Time-consciousness	Travel liking	Hedonism	Commute benefits	Travel stress	Desire for comfort	Desire for flexibility
Travel liking	.09[b]						
Hedonism	.12[c]	-.08[a]					
Commute benefits	-.09[a]	-.49[c]	< .-01				
Travel stress	.13[c]	.46[c]	-.15[c]	-.38[c]			
Desire for comfort	.34[c]	-.05	.17[c]	.08[a]	-.09[b]		
Desire for flexibility	.21[c]	-.02	< .01	.01	.06	.24[c]	
Travelling hedonic vs. utilitarian	-.19[c]	-.31[c]	-.03	.15c	-.07	-.06	.07

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

13.3 Appendix C: Survey Instructions

Figure 24

Description of Train Section Access (Train Section Access Project, Survey 1)

Train Section Access

Train Section Access describes sections on the train to which you only have access through your travel card. You can have a different access to these sections as described below:

Train Section Access	*Description*
Common Section Access	With the **Common Section Access** travel card you can access the common sections on the train. The common sections are accessible to everybody and you will travel together with individuals with diverse traveling needs and habits.
Common + Dedicated Section Access	With the **Common + Dedicated Section Access** travel card you can also access the dedicated sections on the train in addition to the common section. Only people with this travel card can access the dedicated sections. There are different sections dedicated to the following traveling needs and habits: - Sections dedicated to business - Sections dedicated to silence, reading, and relaxing - Sections dedicated to families - Sections dedicated to life-style, music, and media You can choose in which section you want to be yourself and change between sections on each of your trips. In these dedicated sections, you will travel together with individuals with similar traveling needs and habits, as defined by the scope of the section. E.g. in the business section, you will be travelling with other business travelers, in the family section with other families, and so on. Importantly, you can only access these dedicated sections if you have a Common + Dedicated Section Access travel card. People with the Common Section Access travel card **cannot** access the dedicated sections.

Note: The service quality is equal in all types of sections. The type of service, however, differs between the different sections to meet the traveling needs and habits of the section.

Figure 25

Description of Train Section Access (Train Section Access Project, Survey 2)

Train Section Access

Please spend 1-2 minutes to read carefully the instructions below. They are crucial for the choices that you will face in the next pages.

Train Section Access describes sections on the train to which you only have access through your travel card.

The service quality level is equal in all types of sections. I.e. the service quality level in the common section is the same as in all of the dedicated sections (same seat size, same seat comfort, etc.).
The distinction here is not the same as between the currently existing 1st and 2nd class, where service quality levels differ, but between the different sections where there are different people with specific traveling needs and habits.

With your travel card, you can access to the train sections as described below.

Either you have access to the Common Section Only:

Train Section Access	*Description*
Common Section Only	With the **Common Section Only** travel card you can access to common sections ONLY and not to dedicated sections on the train. Everybody has access to the common sections and you will travel together with very diverse types of people with dissimilar traveling needs, habits and behaviors.

Or with your travel card you can access one of the Dedicated Sections listed below, IN ADDITION to the Common Section.
Note that with such a travel card you can always sit in the Common Section and YOU DO NOT HAVE TO STAY IN THE DEDICATED SECTION, but you can if you like to.

In each of the Dedicated Sections, YOU TRAVEL WITH PEOPLE WHO HAVE SIMILAR TRAVEL PREFERENCES AS YOU.
E.g. in the Business Section you travel with other business people, in the Silence Section you travel with other people who like to travel quietly, in the Family Section you travel with other families, and in the Life-style Section you travel with other lifestyle-oriented people.

Train Section Access	*Description*
Common Section + Dedicated Section (Business)	With the **Common Section + Dedicated Section (Business)** travel card, additionally to the Common Section, you can access to dedicated business section where there are passengers with the Common Section + Dedicated Section (Business) travel card only. (People with all other 4 types of section access travel cards cannot access this section.)
Common Section + Dedicated Section (Silence)	With the **Common Section + Dedicated Section (Silence)** travel card, additionally to the Common Section, you can access to dedicated silence section where there are passengers with the Common Section + Dedicated Section (Silence) travel card only. (People with all other 4 types of section access travel cards cannot access this section.)
Common Section + Dedicated Section (Family)	With the **Common Section + Dedicated Section (Family)** travel card, additionally to the Common Section, you can access to dedicated family section where there are passengers with the Common Section + Dedicated Section (Family) travel card only. (People with all other 4 types of section access travel cards cannot access this section.)
Common Section + Dedicated Section (Life-style)	With the **Common Section + Dedicated Section (Life-style)** travel card, additionally to the Common Section, you can access to dedicated life-style section where there are passengers with the Common Section + Dedicated Section (Life-style) travel card only. (People with all other 4 types of section access travel cards cannot access this section.)

Figure 26

Description of Rush Hour Access (Rush Hour Access Project)

Rush Hour Access

Rush Hour Access describes type of accesses during rush hours you have with your travel card, the time intervals of the rush hour in which the travel card is valid and the number of rush hour trips per year that you have included in your travel card.

All subscriptions allow you to travel outside rush hours intervals with no limits.

You can have different accesses as described below:

Rush Hour Access	*Description*
Unlimited Access	With the **Unlimited Access** option in your travel card, you can travel the entire day, every day, without any limitations.
Limited Access	With the **Limited Access** option in your travel card, you can travel during specific rush hour intervals and for the number of trips defined. ▪ With **Limited Access for 20 trips per year during 7:00 – 8:00 and 17:00 – 18:00 (Narrow)**, you can travel only 20 times per year between 07:00 and 08:00 and between 17:00 and 18:00, and with no restrictions outside these intervals. After having undertaken these 20 trips, you are not allowed to travel during these time intervals with your travel card anymore. ▪ with **Limited Access for 30 trips per year during 7:00 – 8:00 and 17:00 – 18:00 (Narrow)**, you can travel only 30 times per year from 07:00 to 08:00 and from 17:00 to 18:00, and with no restrictions outside these intervals. After having undertaken these 30 trips, you are not allowed to travel during these time intervals with your travel card anymore. ▪ with **Limited Access for 20 trips per year during 6:00 – 9:00 and 16:00 – 19:00 (Wide)**, you can travel only 20 times per year from 06:00 to 09:00 and from 16:00 to 19:00, and with no restrictions outside these intervals. After having undertaken these 20 trips, you are not allowed to travel during these time intervals with your travel card anymore. ▪ with **Limited Access for 30 trips per year during 6:00 – 9:00 and 16:00 – 19:00 (Wide)**, you can travel only 30 times per year from 06:00 to 09:00 and from 16:00 to 19:00, and with no restrictions outside these intervals. After having undertaken these 30 trips, you are not allowed to travel during these time intervals with your travel card anymore.
No Access	With the **No Access** option in your travel card, you cannot travel during specific rush hour intervals. ▪ with **No Access during 7:00 – 8:00 and 17:00 – 18:00 (Narrow)**, you can travel with no restrictions during the entire day except between 07:00 and 08:00 and between 17:00 and 18:00. ▪ with **No Access during 6:00 – 9:00 and 16:00 – 19:00 (Wide)**, you can travel with no restrictions during the entire day except between 06:00 and 09:00 and between 16:00 and 19:00.

13.4 Appendix D: Choice Models

13.4.1 Train Section Access Project (Study 1)

Table 19

Train Section Access Project (Study 1) – Basic discrete choice model

Parameter Description	coeff.	std. error	t-stat	p-value
Alternative Parameters				
Alternative constant	-3.42	.49	6.96	.00 [c]
Geographical access, area small (zone)	-1.12	.19	-5.88	.00 [c]
Geographical access, area small (zone) + route (> 10 km)	-.96	.16	-5.86	.00 [c]
Geographical access, route (> 10 km)	-.46	.14	-3.23	.00 [c]
Geographical access, area medium (region, canton)	.26	.12	2.13	.03 [b]
Geographical access, area medium (region, canton) + route (> 10 km)	.31	.11	2.96	.00 [c]
Travelling during rush hour (7:00 – 8:30 and 17:00 – 18:30)	1.82	.26	7.07	.00 [c]
Train section access	.15	.09	1.62	.10
Price	< -.01	< .01	-6.90	.00 [c]
Scale Parameters[37]				
Scale effect, Lake Geneva region	.71	.17	4.12	.00 [c]
Scale effect, Swiss Plateau	.95	.14	6.65	.00 [c]
Scale effect, North-west Switzerland	.93	.15	6.16	.00 [c]
Scale effect, Eastern Switzerland	.76	.15	4.95	.00 [c]
Scale effect, Central Switzerland	.73	.15	4.95	.00 [c]
Error Component Parameters				
Error component parameter (panel data)	2.44	.34	7.28	.00 [c]

Summary Statistics

$\mathcal{L}(\beta_0)$	=	-3198.98	ρ^2	=	.44
$\mathcal{L}(\hat{\beta})$	=	-1793.39	$\bar{\rho}^2$	=	.44
$-2[\mathcal{L}(\beta_0) - \mathcal{L}(\hat{\beta})]$	=	2811.18			

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

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[37] In all the models of this document, we introduced scale parameters based of the different macro regions to control for the heterogeneity of the unobserved effects (Train, 2003). Each scale parameter is the inverse function of the standard deviation of these effects associated with a specific region. The reference macro region is Zurich.

Table 20

Train Section Access Project (Study 1) – Hybrid choice model with out-group derogation

Parameter Description	**coeff.**	**std. error**	**t-stat**	**p-value**	
Alternative Parameters					
Alternative constant	-1.44	.59	-2.44	.01	b
Geographical access, area small (zone)	-.96	.16	-5.98	.00	c
Geographical access, area small (zone) + route (> 10 km)	-.75	.14	-5.44	.00	c
Geographical access, route (> 10 km)	-.46	.13	-3.61	.00	c
Geographical access, area medium (region, canton)	.25	.11	2.17	.03	b
Geographical access, area medium (region, canton) + route (> 10 km)	.28	.10	2.83	.00	c
Travelling during rush hour (7:00 – 8:30 and 17:00 – 18:30)	1.62	.22	7.35	.00	c
Train section access	-.99	.37	-2.70	.01	b
Price	< -.01	< .01	-7.16	.00	c
Latent Variables					
Interaction, out-group derogation on train section access	1.35	.51	2.62	.01	b
Scale Parameters[37]					
Scale effect, Lake Geneva region	.71	.17	4.12	.00	c
Scale effect, Swiss Plateau	.95	.14	6.65	.00	c
Scale effect, North-west Switzerland	.93	.15	6.16	.00	c
Scale effect, Eastern Switzerland	.76	.15	4.95	.00	c
Scale effect, Central Switzerland	.73	.15	4.95	.00	c
Error Component Parameters					
Error component parameter (panel data)	2.44	.30	7.28	.00	c

Summary Statistics

$\mathcal{L}(\beta_0)$	=	-13740.02	ρ^2	=	.57
$\mathcal{L}(\hat{\beta})$	=	-5932.89	$\bar{\rho}^2$	=	.57
$-2[\mathcal{L}(\beta_0) - \mathcal{L}(\hat{\beta})]$	=	15614.25			

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

13.4.2 Train Section Access Project (Study 2)

Table 21

Train Section Access Project (Study 2) – Basic discrete choice model

Parameter Description	coeff.	std. error	t-stat	p-value	
Common Parameters					
Geographical access, area small (zone)	-1.06	.10	-10.68	.00	c
Geographical access, area medium (region, canton)	-.15	.05	-3.14	.00	c
Rush hour access (7:00 – 8:00 and 17:00 – 18:00)	1.34	.15	9.13	.00	c
Price	< -.01	< .01	-11.11	.00	c
Alternative Parameters (Common Section Only)					
Common section only – alternative-specific constant	-.39	.19	-2.06	.04	b
Alternative Parameters (Dedicated Section)					
Dedicated section, alternative-specific constant	-.55	.17	-3.31	.00	c
Dedicated section (business)	.04	.07	.61	.54	
Dedicated section (life-style)	-.05	.06	-.88	.38	
Dedicated section (silence)	.16	.06	2.86	.00	c
Scale Parameters[37]					
Scale effect, Lake Geneva region	3.38	1.26	2.68	.01	b
Scale effect, Swiss Plateau	1.31	.14	9.20	.00	c
Scale effect, North-west Switzerland	.95	.13	7.09	.00	c
Scale effect, Eastern Switzerland	.91	.13	6.82	.00	c
Scale effect, Central Switzerland	1.31	.16	8.02	.00	c
Error Component Parameters					
Error component parameter (panel data)	1.83	.16	11.15	.00	c
Error component parameter (common section only)	-.68	.21	-3.21	.00	c
Error component parameter (dedicated section)	.94	.15	6.51	.00	c

Summary Statistics

$\mathcal{L}(\beta_0)$	=	-7998.08	ρ^2	=	.45
$\mathcal{L}(\hat{\beta})$	=	-4427.03	$\bar{\rho}^2$	=	.44
$-2[\mathcal{L}(\beta_0) - \mathcal{L}(\hat{\beta})]$	=	7142.12			

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

Table 22

Train Section Access Project (Study 2) – Hybrid choice model with out-group derogation

Parameter Description	**coeff.**	**std. error**	**t-stat**	**p-value**	
Common Parameters					
Geographical access, area small (zone)	-1.04	.09	-11.04	.00	c
Geographical access, area medium (region, canton)	-.13	.05	-2.67	.00	c
Rush hour access (7:00 – 8:00 and 17:00 – 18:00)	1.32	.14	9.49	.00	c
Price	< -.01	< .01	-11.62	.00	c
Alternative Parameters (Common Section Only)					
Common section only, alternative-specific constant	.11	.24	.47	.63	
Alternative Parameters (Dedicated Section)					
Dedicated section, alternative-specific constant	-.12	.27	-.52	.60	
Dedicated section (business)	.05	.08	.61	.54	
Dedicated section (life-style)	-.05	.07	-.70	.48	
Dedicated section (silence)	.17	.07	2.53	.01	b
Latent Variable					
Interaction – out-group derogation on common section only alternative	-.21	.20	-1.05	.29	
Interaction – out-group derogation on dedicated section alternative	.35	.20	1.76	.08	a
Interaction – out-group derogation on dedicated section (business)	.01	.08	.12	.91	
Interaction – out-group derogation on dedicated section (life-style)	.02	.08	.21	.83	
Interaction – out-group derogation on dedicated section (silence)	-.01	.07	-.15	.88	
Scale Parameters[37]					
Scale effect, Lake Geneva region	2.60	.60	4.33	.00	c
Scale effect, Swiss Plateau	1.26	.13	9.51	.00	c
Scale effect, North-west Switzerland	.93	.13	7.31	.00	c
Scale effect, Eastern Switzerland	.88	.12	7.19	.00	c
Scale effect, Central Switzerland	1.24	.15	8.27	.00	c
Error Component Parameters					
Error component parameter (panel data)	-2.22	.21	-10.78	.00	c
Error component parameter (common section only)	1.23	.23	5.26	.00	c
Error component parameter (dedicated section)	.03	.14	.20	.84	

Summary Statistics

$\mathcal{L}(\beta_0)$	=	-21949.57	ρ^2	=	.35
$\mathcal{L}(\hat{\beta})$	=	-14179.26	$\bar{\rho}^2$	=	.35
$-2[\mathcal{L}(\beta_0) - \mathcal{L}(\hat{\beta})]$	=	15540.62			

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

13.4.3 Rush Hour Access Project

Table 23

Rush Hour Access Project - Basic discrete choice model

Parameter Description	coeff.	std. error	t-stat	p-value
Common Parameters				
Geographical access, area small (zone)	-.90	.09	-9.59	.00 [c]
Geographical access, area medium (region, canton)	-.20	.05	-3.83	.00 [c]
Geographical access, area medium (region, canton) + route (> 10 km)	.08	.05	1.44	.15
Comfort level (first class -> second class)	.37	.07	5.10	.00 [c]
Price	< -.01	< .01	-12.13	.00 [c]
Alternative Parameters (No Access During Rush Hour)				
No Access during rush hour, alternative-specific constant	-.79	.27	-2.94	.00 [c]
No Access during rush hour, rush hour access (time frame)	-.57	.15	-3.81	.00 [c]
Alternative Parameters (Limited Access During Rush Hour)				
Limited access during rush hour, alternative-specific constant	-1.16	.25	-4.62	.00 [c]
Limited access during rush hour, rush hour access (time frame)	-.25	.10	-2.38	.02 [b]
Limited access during rush hour, rush hour access (number of trips)	.27	.10	2.74	.01 [b]
Alternative Parameters (Unlimited Access During Rush Hour)				
Unlimited Access during rush hour – alternative-specific constant	.10	.15	.68	.50
Scale Parameters[37]				
Scale effect, Lake Geneva region	1.46	.42	3.46	.00 [c]
Scale effect, Swiss Plateau	1.06	.10	10.41	.00 [c]
Scale effect, North-west Switzerland	1.11	.11	10.33	.00 [c]
Scale effect, Eastern Switzerland	.97	.12	8.22	.00 [c]
Scale effect, Central Switzerland	1.19	.15	8.10	.00 [c]
Error Component Parameters				
Error component parameter (panel data)	1.84	.14	13.10	.00 [c]

Summary Statistics

$\mathcal{L}(\beta_0)$	=	-8140.73	ρ^2	=	.44
$\mathcal{L}(\hat{\beta})$	=	-4554.37	$\bar{\rho}^2$	=	.44
$-2[\mathcal{L}(\beta_0) - \mathcal{L}(\hat{\beta})]$	=	7172.73			

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.

Table 24

Rush Hour Access Project - Discrete choice model with interaction for commuters

Parameter Description	coeff.	std. error	t-stat	p-value	
Common Parameters					
Geographical access – area small (zone) (commuters)	-.88	.13	-6.58	.00	c
Geographical access – area small (zone) (non-commuters)	-.93	.12	-8.00	.00	c
Geographical access – area medium (region, canton) (commuters)	-.21	.08	-2.73	.01	b
Geographical access – area medium (region, canton) (non-commuters)	-.21	.07	-2.92	.00	c
Geographical access – area medium (region, canton) + route (> 10 km) (commuters)	.05	.08	.69	.49	
Geographical access – area medium (region, canton) + route (> 10 km) (non-commuters)	.12	.08	1.55	.00	c
Comfort level (first class -> second class) (commuters)	.27	.09	3.11	.00	c
Comfort level (first class -> second class) (non-commuters)	.45	.11	4.11	.00	c
Price (commuters)	< -.01	< -.01	-9.95	.00	c
Price (non-commuters)	< -.01	< -.01	-10.06	.00	c
Alternative Parameters (No Access During Rush Hour)					
No access during rush hour – alternative-specific constant (commuters)	-.29	.34	-.85	.40	
No access during rush hour – alternative-specific constant (non-commuters)	-1.17	.40	-2.90	.00	c
No access during rush hour – rush hour access (time frame) (commuters)	-.74	.20	-3.63	.00	c
No access during rush hour – rush hour access (time frame) (non-commuters)	-.44	.20	-2.18	.03	b
Alternative Parameters (Limited Access During Rush Hour)					
Limited access during rush hour – alternative-specific constant (commuters)	-.70	.35	-2.02	.04	b
Limited access during rush hour – alternative-specific constant (non-commuters)	-1.50	.36	-4.19	.00	c
Limited access during rush hour – rush hour access (time frame) (commuters)	-.45	.15	-2.93	.00	c
Limited access during rush hour – rush hour access (time frame) (non-commuters)	-.11	.14	-.79	.43	
Limited access during rush hour – rush hour access (number of trips) (commuters)	.27	.15	1.81	.07	a
Limited access during rush hour – rush hour access (number of trips) (non-commuters)	.29	.13	2.16	.03	b
Alternative Parameters (Unlimited Access During Rush Hour)					
Unlimited access during rush hour – alternative-specific constant (commuters)	.61	.21	2.93	.00	b
Unlimited access during rush hour – alternative-specific constant (non-commuters)	-.35	.22	-1.60	.11	
Scale Parameters[37]					
Scale effect, Lake Geneva Region	1.41	.45	3.14	.00	c
Scale effect, Swiss Plateau	1.10	.11	10.38	.00	c
Scale effect, North-West Switzerland	1.11	.11	9.87	.00	c
Scale effect, Eastern Switzerland	.97	.13	7.61	.00	c
Scale effect, Central Switzerland	1.15	.15	7.82	.00	c
Error Component Parameters					
Error component parameter (panel data)	1.82	.14	12.66	.00	c

Summary Statistics

$\mathcal{L}(\beta_0)$	=	-7331.53	ρ^2	=	.38
$\mathcal{L}(\hat{\beta})$	=	-4519.48	$\bar{\rho}^2$	=	.38
$-2[\mathcal{L}(\beta_0) - \mathcal{L}(\hat{\beta})]$	=	5624.11			

Note: [a] Significant at 10% level; [b] Significant at 5% level; [c] Significant at 1% level.