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Transportation service bundling – for whose benefit? Consumer valuation of pure bundling in the passenger transportation market

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Abstract

Novel approaches to service bundling in the passenger transportation market are enabled by technology driven innovations and give rise to so called "Mobility as a Service" (MaaS) concepts. These approaches promise to increase service quality of existing public transportation, decrease car ownership, reduce private vehicle miles and lower the environmental burden of the transportation system. However, the potential effects of service bundles in the passenger transportation market are still largely unclear.

In a competitive market, the potential success of transportation service bundles follows consumer valuation of the bundles as compared to valuation of stand-alone services. Thus, the difference between the bundle and sum-of-parts willingness to pay (WTP) is an indicator of service integration valuation, which effects the competitiveness of the service bundles. In this study, several discrete choice experiments were conducted to indirectly estimate consumers' WTP and service integration valuation.

The results indicate that public transportation, car-sharing, and park and ride services are valuated significantly higher when offered in a bundle instead of as a stand-alone service. Bicycle-sharing, electrical bicycle (e-bike) sharing and taxi services are valuated lower. Potential consumers also exhibit a high WTP for a smartphone application that integrates the services and manages ticketing and payment.

Consequently, pure bundles for all transportation modes may not the optimal strategy for mobility providers. Instead, it may be better to bundle public transportation with car-sharing and park and ride to exploit the higher WTP and offer (electric) bicycle-sharing and taxi services on a pay-as-you-go basis. In this way, profitability of a public transportation system could be increased.

Keywords:
Mobility as a Service, service bundling, willingess to pay, mixed logit, consumer valuation, discrete choice experiment

1. Introduction

Mobility as a service (MaaS) describes the bundling of services in the passenger transportation market into a single coherent service. Mobility services are offered on a digital platform that acts as a gateway, providing a journey planner or mobility assistant with a single mode of payment and a single ticket. Service bundling enabled by internet and communication technology (ICT) systems better matches supply to demand and may render multimodal trips more efficient. Transportation service bundling is thus expected to decrease transaction costs between mobility providers and consumers. A mobility assistant that analyzes long-term travel behavior could add additional value by personalizing the service. The assistant could provide individuals with suggestions to optimize the journey, while taking personal goals into account (e.g. cost reduction or a recommended distance by foot or bicycle per week). In bundles with public transportation at the core, efficiency gains could lead to an increased market share for public transportation and a decrease in private vehicle ownership. The associated environmental benefits (through fewer *private* vehicle-miles travelled) are also in the best interest of the public; reducing the environmental burden of the transportation system is highly relevant (i.e. reducing emissions of greenhouse gases, carbon monoxide, nitric oxide, fine particles and volatile organic compounds). Bundling, however, requires a high level of organization and coordination among several mobility providers (which may be in competition with one other). Efficiency gains and the added value of transportation service bundling must clearly outweigh coordination costs. If coordination costs are higher than the efficiency gains and the added value, it would not be profitable to offer transportation service bundles.

Bundling has been the focus of a rich economic literature, especially in the subfields of production economics and marketing. Examples for bundling are the combination of airline tickets with a meal on board or software bundles such as Microsoft Office. Bundling of products and services can result in numerous advantages for firms. Bundling can serve as a measure to implement corporate strategies (e.g. to introduce new products or to deter competitors from entering a market). Under certain conditions, bundling can also be an effective tool for price discrimination when knowledge about consumer preferences is limited (McAfee et al., 1989; Sheikhzadeh and Elahi, 2013; Vamosiu, 2018). For transportation service bundling and MaaS, the goal is not a vertical integration by a monopoly provider, but an integration of mobility services across different mobility providers. Whether consumers valuate a bundle higher than the sum of its parts depends on whether the integration is viewed as performance enhancing. For transportation service bundling, the difference in valuation between bundles and sum-of-parts is of key importance to profitability and the competitive positioning compared to traditional services. In a competitive market, the bundling of transportation services thus directly follows consumer valuation of the bundling and the value added by the mobility platform. Knowledge about the added value of integration must therefore be determined and discussed.

In order to investigate how consumers valuate transportation services and service bundles, an online survey was conducted in the canton of Zurich in May 2018. The introductory part of the survey gathered information about study participants' demand for mobility, current consumption of mobility services, ownership and usage of mobility tools, personal mobility budget, socio-demographic information and attitudes toward public transportation, cycling and car-ownership. Several discrete choice experiments (DCE) were embedded in the survey: for each transportation service, a DCE was conducted to estimate indirectly the willingness to pay (WTP). The WTP for service bundles containing the same services were also determined in a separate DCE in order to be able to calculate the WTP differences and thus the consumers' valuation of integration. The experiment allows for the following questions to be answered: Is there a perceived utility of the ICT platform; i.e. the smartphone application? Do consumers view bundling of transportation services as utility enhancing? Are consumers more likely to consume new mobility services (such as park and ride or bicycle-sharing) when offered in a bundle? The analysis also reveals which mobility services are perceived as complements or substitutes and thus determines which services should be offered together.

2. Background

2.1. Literature Review

Existing literature in transportation research is grouped into three main streams: case studies of trials of ICT-enabled transportation service bundling (i.e. UbiGo in Gothenburg), DCEs investigating consumer demand for hypothetical bundles and literature reviews of potential consequences from bundling. Surprisingly, transportation studies have completely neglected bundling literature in the fields of production economics and marketing.

(Only Heikkilä (2014) has looked beyond the confines of transportation.) This also explains why the terminology used in product bundling has not been used in the transportation literature. Product and service bundling is common practice in several industries, including airlines, telecommunications and information technology (IT). ICT solutions are naturally used for the integration of bundled services when conducive to the integration process. Bundling in the passenger transportation market is comparable to bundling in other sectors and consequently, the general bundling literature is used to fill in the information gaps.

Sochor et al. (2014) investigated the case of UbiGo, one of the first operational trials of an integrated mobility service. The factors motivating and hindering adoption were assessed using a mixed methods approach that included surveys, interviews, focus groups and workshops. The results showed that users' motivation for participating in the operational trial in the first place was merely curiosity. Curiosity was replaced by convenience, flexibility and economic considerations as the study progressed. This is expected, as curiosity naturally fades, and as the study unfolded, the convenience and price could be better assessed. Incentive systems, where awarded points could be used for sponsor services, only played a minor role and could not compensate for economic disadvantages. Factors hindering user adoption were the price (more expensive than current mobility choices), the accessibility of alternative transportation options, and not enough demand for mobility services (Sochor et al., 2014). However, this study must be taken with a grain of salt, as the survey techniques are untraceable from the report, and no statistical modelling was conducted. There was no control group (non-participants were not surveyed during and after the trial) and a counterfactual was missing. Thus, it is unclear whether external factors contributed to the change in the stated motives.

Matyas and Kamargianni (2017) conducted a stated preference (SP) experiment to investigate the choice process of purchasing transportation service bundles. Study participants were presented with three "fixed" bundles (which in marketing terms would be called "pure bundles") and a "menu option" (a mixed bundle). The bundles included public transportation, bicycle-sharing, taxi and car-sharing. Additional features were also included; e.g. access to a minivan in the car-sharing option, or a 10 minute pickup guarantee for the taxi service. The survey process included an introductory survey, GPS tracking and a survey after tracking for the SP experiment. In the experiment, each respondent was presented with four choice tasks. In total, 80 participants completed the whole survey including the SP experiment. The results were analyzed using a multinomial logit model (MNL) that included 236 choice observations. Public transportation was found to be the core element of transportation service bundles. However, the study exhibits a number of limitations. More advanced modelling was recommended for later work. Indeed, an MNL was not the correct choice given the panel structure of the data. As each respondent completed four choice tasks, the data most likely exhibited correlations of unobserved factors of the decision makers and the MNL would not be suitable in this case. Furthermore, there was no investigation of the WTP for the elements of the bundles. Additionally, it is unclear if the GPS tracking of the subject was necessary for investigating transportation service bundling. GPS tracking requires significant effort (i.e. recruitment, data cleaning etc.) and therefore the sample size is often limited. Reproducibility of a study also suffers in these cases because the tools are often not openly available and not standardized. A travel diary or survey is sufficient to collect information about current mobility behavior in most cases. The questions raised by Matyas and Kamargianni (2017) were interesting and important given the potential effects of transportation service bundling on the wider transportation system. It would be worthwhile to conduct similar studies in several countries in order to gain robust insights into the potential of service bundling in the transportation market.

Kamargianni et al. (2016) assessed several integrated mobility schemes around the world with regard to the level of integration along three dimensions: ticket and payment, prepayment option ("mobility package") and ICT integration. Several operational systems with a high integration level were identified: Hannovermobil, EMME in Montpellier, and three systems in the Netherlands that are directed at business travelers (Mixx, NS-Business, Radiuz Total Mobility). SHIFT in Las Vegas, UbiGo in Gothenburg, and the Helsinki model were listed as highly integrated systems that offer a prepayment option. An integration measure and ranking system were also constructed within this study. The categories of "ticket integration", "payment integration", "ICT integration", and "mobility package integration" were equally weighted for the integration measure. However, equal weights for the categories may not have been justified. For example, ICT and ticket integration should be much more important than payment integration, as payment for the individual services could also be handled via credit card. It is also unclear as to whether "Mobility package integration" (the ability to prepay a certain amount) is a necessary element of MaaS.

Hensher (2017) discussed the implications of ICT-enabled transportation service bundling on future bus services. The author argued that there are contexts where bundling may not be appropriate (such as school bus services). Thus, it is more likely that several transportation services will coexist in the future, and bundling will complement the landscape of services. Although some claims of the effects of MaaS were overexaggerated, it is possible that with further ICT solution availability, the broker role in passenger transportation market could become more important. It is too early to speculate on the possible effects of bundling on modal shares or car ownership. Vehicle sharing as a part of transportation service bundles, however, may lead to more efficient utilization of existing infrastructure. This however, highly depends on the services that are part of the bundle. The question of scalability was also raised, and must be addressed prior to potential effects due to mode shifts and car ownership.

An important stream of literature on bundling that is also relevant for the passenger transportation market can be found in the fields of marketing and production economics. Previous research in these fields provides accurate and concise terminology for different types of product and service bundles. Investigated topics have included the role of complementarity and substitutability of the bundled services (McAfee et al., 1989; Yan et al., 2014) as well as optimal bundling strategies in different competitive situations; i.e. perfect and imperfect competition (Adams and Yellen, 1976; Vamosiu, 2018). The incentive to bundle when consumers' valuation are non-additive (Armstrong, 2013), the implications of bundling on marketing (Stremersch and Tellis, 2002) and bundling as an instrument to deter competitors from entering a market (Eppen et al., 1991) have also been investigated. Other studies have looked into bundling for specific industries (Hui et al., 2012; Sobolewski and Kopczewski, 2017). Sobolewski and Kopczewski (2017) investigated complementarity and subsitutability of service components in telecommunication bundles. The WTP of stand-alone services versus bundled services were also investigated through a direct survey. This approach is problematic though, as the resulting WTP estimates could be highly biased (Breidert et al., 2006).

A clear definition of bundling terms and strategies was provided by Stremersch and Tellis (2002, p. 57). Bundling was defined as "...the sale of two or more separate products in one package". The two main dimensions of bundling are price bundling and product bundling. Price bundling is "the sale of two or more separate products as a package at a discount, without any integration of the products". Product bundling refers to the integration of the products at any price. Another important classification is between "pure bundles" and "mixed bundles." Pure bundling refers to a situation where a firm only sells bundles and the bundled products are not offered separately. In a mixed bundle the products can also be purchased separately. These two dimensions of bundling could also be used in transportation research to classify bundles in the passenger transportation market. The legality and optimality of bundling strategies, the effect of competition on the bundling decision, and consumers' perception of bundles were discussed. These issues have not yet been investigated for the case of transportation service bundles and are thus still unclear.

The theoretical foundation of behavioral bundling research and investigations into the likelihood of purchase are particularly relevant for a consumer valuation study. Stremersch and Tellis (2002) showed that behavioral research on bundling is rooted in prospect theory (Kahneman and Tversky, 1979) and mental accounting (Thaler, 1985). Price sensitivity decreases and purchase likelihood increases when consumers are presented with a single bundle price instead of a list of prices (Drumwright, 1992; Gaeth et al., 1990; Yadav, 1994). Thus, the "menu plan" (mixed bundle) investigated by Matyas and Kamargianni (2017) for transportation services would not be an optimal strategy for firms. Consumers perceive a list of prices as multiple losses, which negatively affects purchase likelihood. This also implies that price sensitivity for a bundle should be lower than for the sum of the prices of the stand-alone services. Furthermore, Eppen et al. (1991) showed that product and service bundling can be used as a strategy to introduce new products. In the transportation market, this could be used for the introduction of new transportation options, such as bicycle-sharing or car-sharing.

2.2. MaaS as a Concept and the Definition of MaaS

The concept of MaaS has been used to describe a special case of service bundling in the passenger transportation market. It was introduced in a Master's thesis for the city of Helsinki by Heikkilä (2014) and investigated the potential of ICT to make the transportation system more efficient. MaaS was originally defined as "a system, in which a comprehensive range of mobility services are provided to customers by mobility operators" (Heikkilä, 2014). This system would therefore be a service itself. MaaS, as a term, has since been widely accepted by most transportation researchers. However, a clear definition of when a service can be regarded as "MaaS" is still lacking. Kamargianni et al. (2016) stated that MaaS "... is one of the novel mobility concepts that could assist in achieving seamless mobility" and that MaaS "stands for buying mobility services instead of buying the means of transportation". The idea of replacing individually owned vehicles with the consumption of mobility services was introduced. Kamargianni et al. (2016) also stated that MaaS is based on three main elements: ticket and payment integration, the mobility package and ICT integration. It is clear that ticket and payment integration is necessary to provide customer-friendly service bundling and that the use of modern ICT applications with location-based services (LBS) are key to the concept. It is unclear, however, how the "mobility package" (described as the ability to prepay services) is a main element. Prepayment is not a necessary condition, as customers could also be charged by credit card or by monthly bill. The UbiGo users found prepayment to be a limitation of the service (Sochor et al., 2014). Hensher (2017) defined MaaS as a service that "combines transportation services from public and private transportation providers through a unified gateway that creates and manages the trip, which users can pay for with a single account". This definition is concise and stresses bundling, while avoiding unnecessary elements such as prepayment. The definition also excludes single services without bundling (e.g. Uber) and avoids ambiguity and its consequences (e.g. a shift away from privately owned vehicles).

While the definition above is general and concise enough to describe a large number of systems, the term "MaaS" is still misleading, because public transportation, taxis, car-sharing, bicycle-sharing etc. are already services in an economic sense (i.e. they are intangible, cannot be stored, and are produced and consumed at the same time). "Mobility as a Service" would indicate "the ability to move as a service", which is exactly what existing public transportation services offer. Calling the concept "transportation as a service" does not resolve the issue. A term that describes the bundling of transportation services with an ICT system at its core should therefore stress the bundling aspect or the fact that bundling is achieved through ICT, not the service[1]. Thus, the term "transportation service bundling" will be used.

[1] The term "MaaS" seems to be inspired by the term "Software as a Service" or "SaaS". SaaS describes the provision of software on a subscription basis that is hosted centrally instead of on customers' computers. The functions are accessed over a thin client, e.g. a web browser. In the case of SaaS, the term is appropriate because it describes a shift from delivery as a software product to a centrally provided service that allows accessing the software's functions. Bundling of different software products is not necessarily part

If the ICT aspect of the system must be stressed, then the concept will be referred to as "ICT-enabled transportation service bundling".

The ICT system that provides the gateway to the bundled transportation services increases accessibility of those services by providing information about spatiotemporal availability that is tailored to the customer's location. On a software-level, such services are commonly referred to as location-based services (LBS), which are clearly at the core of ICT-enabled transportation service bundling. The ICT system should also be able to identify possible transportation options or a combination thereof, as well as additional details such as trip time and cost to the user. In the future, the market may also increasingly adopt Internet of Things (IoT) solutions that may render the interaction between transportation services and the user more efficient and comfortable (e.g. such that the user interaction time is minimized). Examples of this include more efficient automated check-in for public transportation vehicles (e.g. for pricing purposes) that does not solely rely on GPS data provided by the user, or the consideration of battery charge of on shared electric vehicles or e-bikes by the mobility platform.

3. Methods

3.1. Survey Instrument

In order to investigate ICT-enabled transportation service bundling, an online survey was conducted in the canton of Zurich, Switzerland[2]. The survey consisted of an introductory part, six DCEs for transportation services in the canton as stand-alone, and one DCE for a mobility service bundle that included the same services as the first six DCEs. The last part of the survey was a 12-item measure for technological commitment (Neyer et al., 2016) and a nine-item scale to capture environmental attitudes (Diekmann et al., 2009). All participants were asked to complete the whole survey. The first

of SaaS. MaaS is not appropriate an analogy because for example in the case of public transportation, there is no shift from a product to a service and bundling is the main idea. Adding to the confusion is the different usage of the term "service" in IT and economics. In IT, "service" refers to a software functionality, while in economics it describes an immaterial exchange of value.

[2]The canton of Zurich has a population of approximately 1.5 million people. With a population density of approximately 860 persons/km^2, the canton is mostly urbanized, but it also includes rural parts.

part of the survey contained questions on sociodemographics, participants' current consumption of mobility services, kilometers driven by private car and current mobility expenditures. The survey instrument was designed such that the average response time did not exceed 30 minutes.

The survey was geographically constrained to the canton of Zurich, Switzerland, in order to ensure that all participants faced the same options for mobility. (Each canton usually has its own local public transport providers with different pricing schemes.) Participants were recruited by a private company, Intervista[3], which maintains a panel of registered persons who have consented to participating in surveys. The survey was completed by 1000 participants with a response rate of 23.6%. Quotas were set on age, education, gender and public transportation season ticket ownership such that the sample was comparable to the population of the canton of Zurich in the Swiss household travel survey "Mikrozensus Mobilität und Verkehr" (MZMV) (Swiss Federal Statistical Office (BFS), 2017).

Table 1 shows a comparison of a selected set of variables of this survey with the MZMV. When considering the sociodemographic attributes of gender, age and income, the two samples are very similar. Driver's license holders were slightly overrepresented in this survey (by 5.1%), as well as holders of the GA travel card from the national train company (SBB) that allows unrestricted travel access on all public transportation networks (by 5.9%). Holders of the half-fare ticket were underrepresented (by 10.3%).

[3]Company website: `https://survey.intervista.ch/`, last accessed: July 2018.

Table 1: Comparison of survey sample with the Swiss household travel survey (MZMV 2015)

Variable	Value	Survey	MZMV 2015 (Canton Zürich)
Gender	Female	50.9%	48.1%
	Male	49.1%	51.9%
Age	18-35	25.6%	20.7%
	36-50	29.2%	29.4%
	51-65	25.2%	27.4%
	66+	20.1%	22.5%
Income/mo	Below CHF 4000	17.5%	18.0%
	CHF 4'001 - 8'000	39.9%	40.1%
	CHF 8'001 bis 12'000	23.8%	24.8%
	More than CHF 12000	18.8%	16.2%
Driver's license	Yes	85.9%	80.8%
	No	14.1%	19.2%
PT season ticket	Half-fare card	48.3%	38.0%
	GA travel card	15.7%	9.8%
	None	31.1%	29.4%

3.2. DCE Design

Table 2 shows the attributes and attribute levels of the DCEs for the stand-alone transportation services, and table 3 shows the service bundles. All choice tasks included an opt-out option (i.e. a way to decline the offer) and the designs were constrained in order to exclude unreasonable prices. (The values in a DCE are a design choice and should be as realistic as possible. It would for example not make sense to offer the choice of a public transportation season ticket for the whole country for CHF 20 when it is priced at CHF 340 in the real market.) For all experiments, D-optimal designs were constructed with the software "NGENE" (Rose et al., 2014). Each experiment for the stand-alone services included two attributes: the cost and a description of the extent (minutes travelled, kilometers, etc.). For the stand-alone services, the respective price ranges were derived from real market prices in the canton. Costs were denoted in Swiss francs (CHF) (1 CHF $\approx$ 1 USD or 0.85 EUR as of May 2018). An example for the choice situations is shown in figure 1. The wording of the introductory texts for the DCEs can be found in the appendix.

For public transportation, the second attribute is the number of zones[4] (i.e. geographical units for pricing purposes). The price for season tickets in the canton increases linearly with the number of included zones (CHF 30 per additional zone for a second class ticket). The price was capped at five zones, because tickets with more than five zones are valid in the whole canton. The GA travelcard is valid for the whole country. Real market prices for monthly season tickets range from CHF 65 to 550[5], and the prices in the experiment ranged from CHF 20 to 650.

The car-sharing service included a prespecified number of kilometers per month. The local car-sharing company "Mobility" charges by time and distance. Only distance was chosen as a measure to simplify the experiment and because it is the main cost driver of the service. Constraints were imposed on the design such that the displayed attribute levels imply a cost per kilometer of 0.4 - 2.8 CHF/km. The local car-sharing company charges from CHF 0.55 to 1.05 CHF/km (depending on the type of car). The cost was higher in the experiment in order to cover a higher WTP range and because

[4]Public transportation services in the canton of Zurich are united in a public transportation association, "ZVV". ZVV offers season tickets that are valid for a certain number of zones. Within the purchased zones, all public transportation services can be used.

[5]See `https://www.zvv.ch/` and `https://www.sbb.ch/` for price information.

time was ignored as a factor.

Bicycle-sharing was included as a monthly subscription service with cost and included hours per month as attributes. Two free-floating bicycle-sharing companies, “LimeBike” and “O-Bike”, were active in Zurich in May 2018 with prices of CHF 2 and CHF 3 per hour. PubliBike, a station-based service, was priced at CHF 6 per hour (without annual subscription). CHF 1.4 - 6.7 was chosen as the range of implied prices for the experiment.

E-bike-sharing in Zurich is provided by two companies “PubliBike” and “Smide,” the latter being directed at the high-end market (and only available in the city of Zurich, not in the whole canton). Without a subscription, prices range from CHF 9 - 15 per hour. CHF 5 - 43 per hour was chosen for the experiment.

The park and ride service in the experiment included a prespecified number of days at all SBB train stations. Park and ride parking spots in the canton of Zurich that were included cost CHF 0 - 15 per day. The attribute levels implied prices of CHF 1.4 - 14.2 per day.

The price per minute for taxi services in Zurich ranges from CHF 1 (UberX) to CHF 2.5 (Uber Black, which is comparable to other taxi services). The prices in the experiment range from CHF 0.5 to CHF 5.

The car-sharing and park and ride experiments were only displayed to study participants with a driver’s licence. For the bundles, the car-sharing and the park and ride attribute were interacted with driver’s licence ownership in the statistical model in order to make the WTP values comparable.

Table 3 shows the attributes and attribute levels of the DCE for transportation service bundles. Participants completed 18 choice tasks. The number of attribute levels was reduced to limit the number of choice tasks (in order to limit the total response burden of the survey).

Table 2: DCEs for stand-alone transportation services: attributes and attribute levels. All participants completed all DCEs, participants without driver's licence were excluded from the DCE for park and ride and car-sharing.

Experiment	Attributes	Levels	# Choice tasks
1. Public transportation	Cost (CHF/mo)	50, 120, 180, 240, 360, 500, 650	18
	Validity (level)	1-2, 3, 4, 5, all, GA	
2. Car-sharing	Cost (CHF/mo)	30, 70, 100, 200, 350	10
	Kilometres included	50, 75, 125, 150	
3. Park and Ride	Cost (CHF/mo)	10, 20, 50, 100, 150, 200	12
	Days/mo	4, 7, 14	
4. Bicycle-sharing	Cost (CHF/mo)	5, 10, 20, 30, 40, 60	12
	Hours/mo included	3, 5, 7, 10	
5. E-bike-sharing	Cost (CHF/mo)	20, 60, 100, 150, 200, 300	12
	Hours/mo included	3, 5, 7, 10	
6. Taxi	Cost (CHF/mo)	15, 30, 60, 150, 300, 600	12
	Minutes/mo included	30, 60, 120	

Table 3: DCE for transportation service bundles (pure bundles): attributes and levels.

Experiment	Attributes	Unit	Levels
Bundle	Cost	CHF/mo	150, 200, 300, 400, 900, 1800
	Smartphone App	Dummy	0,1
	Public Transportation	Validity (zones)	1-2, 3, 4, 5, all, GA
	Car-sharing	Kilometres included	50, 125
	Park and Ride	Days/mo	7, 14
	Bicycle-sharing	Hours/mo included	3, 5
	E-bike-sharing	Hours/mo included	3, 5
	Taxi	Minutes/mo included	30, 60

Example e-bike-sharing

	Variante 1	Variante 2
Abokosten (pro Monat)	CHF 20	CHF 100
Stunden pro Monat	3 h	10 h

Ihre Auswahl:

- Variante 1
- Variante 2
- Ablehnen

(a)

Example bundle

	Variante 1	Variante 2
Preis (pro Monat)	CHF 400	CHF 300
Smartphone App	Ja	Nein
ÖV Abo (2. Klasse)	ZVV 4 Zonen	ZVV alle Zonen
Car Sharing (Kilometer pro Monat)	125 km	50 km
Bike Sharing (Stunden pro Monat)	5 h	3 h
E-Bike Sharing (Stunden pro Monat)	3 h	5 h
Parkplatz Abo (Tage pro Monat)	7 Tage	14 Tage
Taxi Abo	60 min	30 min

Ihre Auswahl:

- Variante 1
- Variante 2
- Ablehnen

(b)

Figure 1: Example choice situations for individual services (a) and service bundles (b).

3.3. Statistical Modelling and WTP Calculation

To analyze the results of the experiment, a mixed logit model was used. The advantage of mixed logit is that it does not exhibit the restrictive independence of the irrelevant alternatives property and can be generalized to accommodate repeated choices by decision makers. Thus, correlations of unobserved factors from the decision makers can also be accommodated. As shown by Train (2009), the panel structure of the data can be taken into account by letting coefficients vary over decision makers, but not over choice situations. Thus, the utility of an alternative j for decision maker n in choice situation t can be expressed as $U_{njt} = \beta_n x_{njt} + \epsilon_{njt}$. The conditional likelihood that a participant makes a sequence of choices in time periods $\boldsymbol{i} = \left\{i_i, ..., i_T\right\}$ can then be written as $L_{n\boldsymbol{i}}(\beta) = \prod_{t=1}^{T}\left[\frac{e^{\beta_n x_{ni_t t}}}{\sum_j e^{\beta_n x_{njt}}}\right]$ and the unconditional probability is $P_{n\boldsymbol{i}} = \int L_{n\boldsymbol{i}}(\beta) f(\beta) d\beta$.

The estimation of the WTP in the case of the mixed logit model is not as straightforward as in the multinomial logit case, as the parameters are random variables. Sillano and Ortúzar (2005) discussed four methods for estimating the the WTP from population parameters: a) ratio of population means, b) simulation, c) log-normal distribution for WTP and d) fixing the cost coefficient. Taking the ratio of population means does not result in a mean WTP value, but a WTP for the average individual and thus the approach is only recommended to test model specification. Using a log-normal distribution for parameters is also not recommended as this tends to result in very large WTP values. The simulation approach involves taking random draws from the parameters' distributions, calculating the ratio, and repeating the process many times to sample the WTP distribution. The spread of the WTP distribution obtained by simulation can be very large and thus, researchers often constrain the distribution in practice. Hensher and Greene (2003) showed that there is no behavioral justification for constraining the distribution except for the sign of the WTP and that using the constrained distribution is not better or worse than using the unconstrained distribution. Sillano and Ortúzar (2005) criticized the approach not because of this issue, but because of the fact that values are simulated for people that do not exist in the first place. In the models estimated by Sillano and Ortúzar (2005), fixing the cost coefficient led to an overestimation of the WTP distribution. However, Revelt and Train (2000) put forward the following arguments for fixing the cost coefficient: (1) mixed logit models tend to be unstable when all parameters are random, (2) with a fixed price coefficient, coefficient ratios follow the same distribution as the coefficient of the attribute, and (3) as the price coefficient is necessarily negative, the choice of the respective distribution can be problematic (a log-normal distribution may result in extremely high WTP values). Sillano and Ortúzar (2005) themselves estimated individual-level parameters using the Bayesian approach and stressed the advantage that the approach may allow identification of study participants that did not respond seriously. Greene et al. (2005) pointed out that using a classical approach to estimate individual WTP values were as straightforward as the Bayesian approach and both approaches have merit. Another approach to investigate WTP is to estimate models in WTP space instead of preference space. The concept was first introduced by Cameron and James (1987) and Cameron (1988) and was investigated in Train and Weeks (2005). Train and Weeks (2005) found that models in preference space fit the data better, but models in WTP space resulted in more reasonable distributions of WTP.

In this paper, a fixed cost coefficient was used and thus, the WTP distribution was derived from the distributions of the non-cost coefficients. The mean and standard deviation of the WTP distribution were the mean and standard deviation of the non-cost coefficient divided by the cost coefficient. The reason for using a fixed cost coefficient was the greater stability of the models, because a consistent and robust method was required to estimate all seven DCE models.

4. Results

4.1. Model Estimation: Stand-Alone Services and Bundled Services

Table 4 shows the result of the mixed logit model estimations for the stand-alone transportation services. The cost coefficient was fixed, and the coefficients describing the respective extent of service and the opt-out coefficient were assumed to follow a normal distribution. The model fit compared to the null model was good for public transportation (pseudo R^2 of 0.38), and very good for the other services (pseudo R^2 greater than 0.5 for all services). The cost coefficients were negative for all experiments, which was expected. The coefficients for the respective services were all positive, except for the taxi subscription.

Table 5 shows the estimation results for the transportation service bundles. All coefficients were highly significant. The coefficients for the extent of service were positive for the smartphone application, public transportation, car-sharing and park and ride, which was expected. For bicycle-sharing, e-bike-sharing and taxi, the coefficients were negative. The model fit was very good with a pseudo R^2 of 0.62.

Table 4: Model estimates for stand-alone services (mixed logit).

	PT	Car-sharing	Bicycle-sharing	E-bike-sharing	Park and Ride	Taxi
Cost	-0.01^{***}	-0.02^{***}	-0.14^{***}	-0.03^{***}	-0.04^{***}	-0.02^{***}
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Validity	0.47^{***}	-	-	-	-	-
	(0.03)					
SD_{Validity}	-0.73^{***}	-	-	-	-	-
	(0.04)					
Kilometers	-	0.01^{***}	-	-	-	-
		(0.00)				
$SD_{\text{Kilometers}}$	-	0.03^{***}	-	-	-	-
		(0.00)				
Hours	-	-	0.11^{***}	0.09^{***}	-	-
			(0.03)	(0.03)		
SD_{Hours}	-	-	0.53^{***}	0.47^{***}	-	-
			(0.04)	(0.05)		
Days	-	-	-	-	0.11^{***}	-
					(0.02)	
SD_{Days}	-	-	-	-	0.26^{***}	-
					(0.04)	
Minutes	-	-	-	-	-	-0.02^{***}
						(0.00)
SD_{Minutes}	-	-	-	-	-	0.04^{***}
						(0.00)
Opt-out	0.36^{***}	1.22^{***}	2.20^{***}	2.78^{***}	2.19^{***}	0.98^{***}
	(0.26)	(0.21)	(0.51)	(0.27)	(0.74)	(0.20)
$SD_{\text{opt-out}}$	-4.33^{***}	4.77^{***}	-6.12^{***}	5.91^{***}	6.19^{***}	4.66^{***}
	(0.27)	(0.30)	(0.39)	(0.37)	(0.61)	(0.22)
# of parameters	5	5	5	5	5	5
# of respondents	974	851	991	990	851	988
# of choice obs.	17532	8510	11892	11880	10212	11856
# of draws	1000	1000	1000	1000	1000	1000
LL(null)	-19260	-9349	-13064	13051	-11219	-13025
LL(final)	-11986	-3520	-4962	-3901	-4473	-5484
McFadden R2	0.38	0.62	0.62	0.70	0.60	0.58
AIC	23983	7050	9935	7813	8957	10979
BIC	24022	7085	9972	7849	8993	11016

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 5: Mixel logit model for transportation service bundles.

Attribute	Coef.	SE
Cost	-0.00^{***}	(0.00)
App	0.46^{***}	(0.06)
SD_{App}	0.41^{***}	(0.13)
PT Validity	0.53^{***}	(0.03)
$\text{SD}_{\text{PT Validity}}$	0.43^{***}	(0.02)
Car-sharing	0.01^{***}	(0.00)
$\text{SD}_{\text{Carsharing}}$	0.00	(0.00)
Bicycle-sharing	-0.07^{**}	(0.03)
$\text{SD}_{\text{Bicycle-Sharing}}$	-0.03^{**}	(0.02)
E-bike-sharing	-0.08^{***}	(0.02)
$\text{SD}_{\text{E-Bike Sharing}}$	0.04	(0.04)
Park and Ride	0.03^{***}	(0.01)
$\text{SD}_{\text{Park and Ride}}$	0.02	(0.02)
Taxi	-0.01^{***}	(0.00)
SD_{Taxi}	0.00	(0.01)
Opt-out	3.41^{***}	(0.26)
$\text{SD}_{\text{Opt-out}}$	-4.30^{***}	(0.21)
# of parameters	17	
# of respondents	998	
# of choice obs.	17879	
# of draws	1000	
LL(null)	-19642	
LL(final)	-7539	
McFadden R2	0.62	
AIC	15113	
BIC	15246	

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

4.2. WTP Estimation and Comparison

Table 6 shows the WTP values for the stand-alone services and for the same services in a pure bundle. WTP1 is the mean value of the full WTP distribution, but for WTP2 only the positive values of the WTP distribution were considered. Public transportation, car-sharing and park and ride were valuated higher in a bundle than as stand-alone services. Bicycle-sharing, e-bike-sharing and taxi were valuated lower. The average WTP for taxi services was negative, indicating that the average consumer did not wish to purchase a monthly taxi subscription (neither as stand-alone service, nor bundled with other services). The sum of the valuations were CHF 51.6 and CHF 102.2 (WTP1 and WTP2, respectively) for the stand-alone services and CHF 93.7 and 155.9 for the bundled services. The WTP for the smartphone application that integrates all services into a journey planner and acts as the ticketing and payment system was valuated at CHF 104 and CHF 127 (WTP1 and WTP2, respectively).

Figure 2 and figure 3 show the density functions of the WTP distributions for the stand-alone services and the bundled services, respectively. The plots indicated that for the bundled services, bicycle-sharing, e-bike-sharing and taxi were not suitable because only a small fraction of WTP values were positive.

Table 6: WTP comparison: stand-alone services versus bundled services

	Stand-alone services		Pure bundle	
Attribute	WTP1	WTP2	WTP1	WTP2
Smartphone App	-	-	103.9	127
Public Transportation	46	77.4	120.2	139.7
Car-sharing	0.5	1.2	2.3	2.3
Park and Ride	2.9	6.7	7.6	7.9
Bicycle-sharing	0.8	3.4	-15.2	(2.6)
E-bike-sharing	2.6	11.9	-18.8	(3.3)
Taxi	-1.2	1.6	-2.4	(0.1)

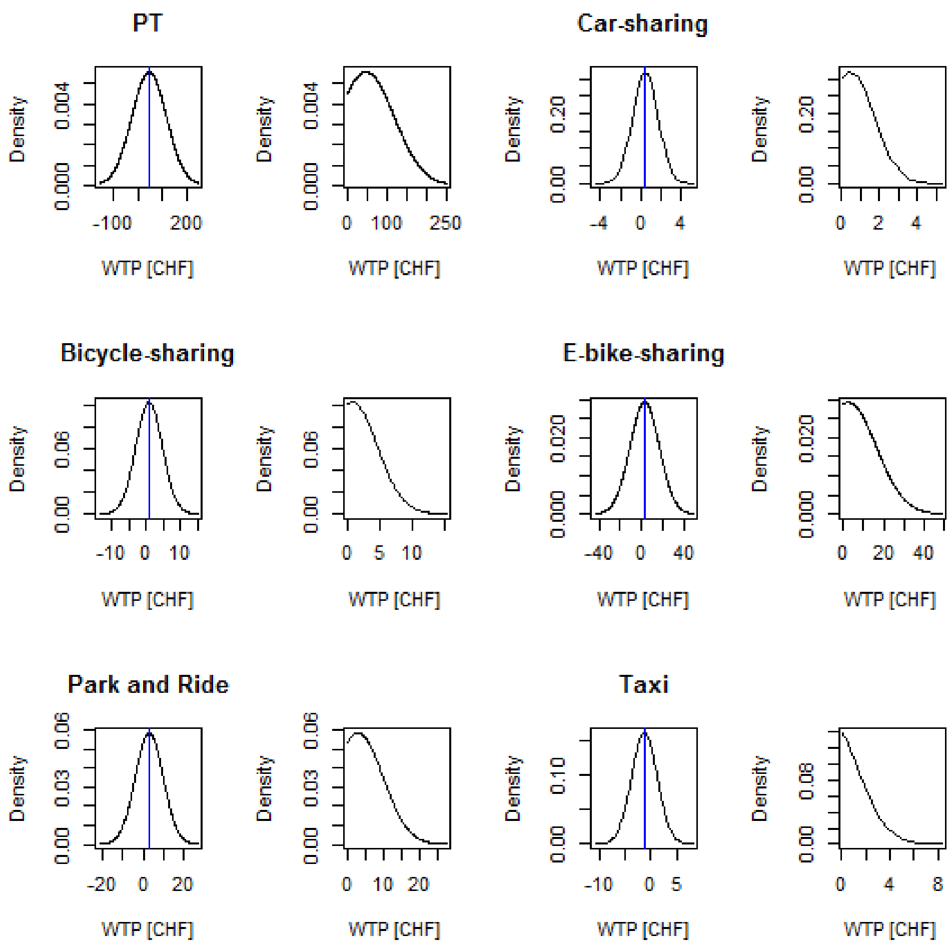

Figure 2: WTP distributions of stand-alone transportation services.

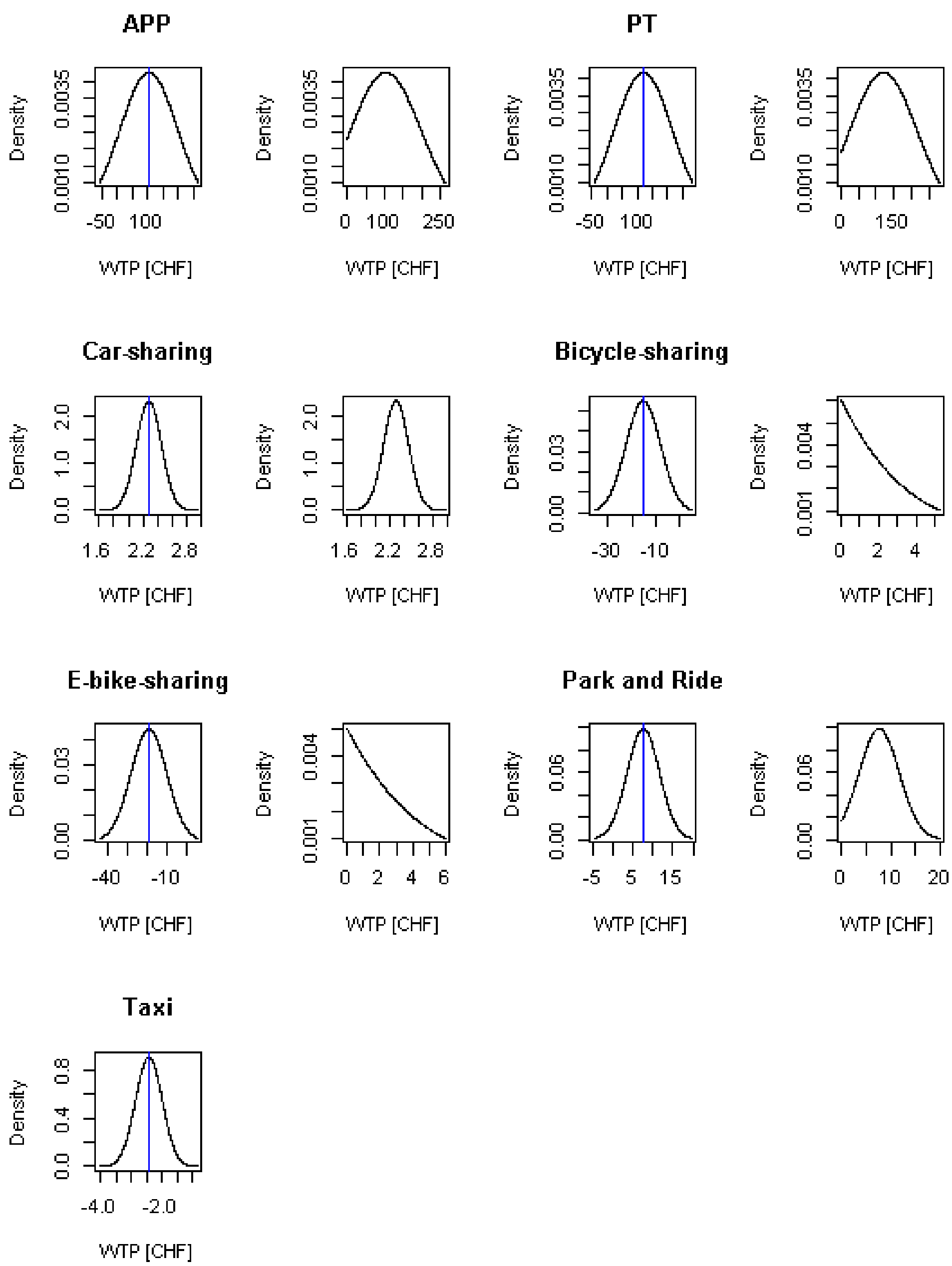

Figure 3: WTP distributions of bundled transportation services.

5. Discussion

The results of the WTP estimation indicated that the sum of the valuations of the services were higher in bundles than as stand-alone services. This is mainly due to the significantly higher valuation of public transportation in the bundles. Car-sharing and park and ride were also valuated higher in bundles than as stand-alone services. This is most likely due to the fact that public transportation, car-sharing, and park and ride services are complementary services. In most cases, park and ride is only feasible in combination with public transportation. Car-sharing complements public transportation for destinations with low public transportation service quality, for leisure trips, and for the transportation of heavy goods. This is consistent with the observation that shared modes rely on high quality public transportation systems (Stillwater et al., 2009; Becker et al., 2017). The valuation of bicycle-sharing, e-bike-sharing and taxi services were lower in a bundle and the WTP1 values for these services in bundles were even negative. The negative WTP values are a result of the assumption that coefficients are normally distributed. However, the negative coefficients are not necessarily behaviorally unreasonable. If a service provides no utility to a consumer but is part of a bundle, consumers may perceive the price of the bundle as too high, and may even subtract the valuation of the service from the price of the bundle. Thus, a larger extent of service that provides no utility may be perceived as negative. Not all study participants will exhibit such choice behavior. However, if some do, this could be an explanation for the negative sign. Furthermore, bicycle-sharing, e-bike-sharing, and taxi were all services with a very low market share. It is therefore likely that these services indeed provide no utility for the majority of users in the sample. This could be due to individual preferences or due to limited availability of the these services in the main activity space of the consumers.

Consequently, offering pure bundles that include low-share transportation modes may not be an optimal strategy for mobility providers. As an alternative strategy, a bundle of only public transportation, car-sharing and park and ride could be offered and the smartphone application that integrates the services could be designed such that low-share transportation modes can be purchased on a pay-as-you-go basis. By bundling products in such a way, the higher WTP for public transportation in bundles could still be exploited. For consumers that choose the bundle, the advantage is guaranteed access to the bundled services without the burden of thinking of the loss each time a service is consumed. The notion that multiple losses are perceived as more negative than a single loss is illuminated by prospect theory and mental accounting (Drumwright, 1992; Gaeth et al., 1990; Yadav, 1994). The higher WTP of consumers for bundled services could therefore be rooted in avoiding multiple losses. This would be interesting to test in future research on individuals with a higher income, and thus a lower price sensitivity.

The WTP for the smartphone application is comparatively high, even for the Swiss price level. There are two conceivable reasons for this: the features of the app, or the fact that participants attached too much weight to the app compared to the other attributes. The description of the app included the following features: ICT and price integration of all services, ticket integration, a comprehensive multimodal jouney planner and the analysis of travel behavior in the background to provide suggestions to optimize personal travel (e.g. in terms of cost). The app was also described as being able to show the positions of shared vehicles and the occupancy of parking spots. The comprehensive set of features that are not yet part of any journey planner in Switzerland could be the reason for the high WTP. However, it cannot be excluded that participants simply attached to much weight to the attribute because it was the first attribute or because it was the only attribute participants do not have experience with (as all other services of the bundle exist in the real market in a similar form).

In Switzerland, there are no examples of comprehensive product bundling, but there are trials with price bundling. The national train company (SBB) offers a mobility package called "SBB Greenclass"[6] (Becker et al., 2018). Greenclass includes a 1st class GA travelcard, a BMW i3, park and ride, carsharing, bicycle-sharing, and vouchers for taxi journeys (total value of CHF 250). The price of SBB Greenclass for a contract period of one year is CHF 1310 per month and it is thus directed at high income customers. The standalone services cost CHF 1389 per month without the parking subscription (the price of which highly depends on the location). It would cost CHF 599 for an equivalent BMW i3 subscription from a different provider, CHF 525 for the 1st class GA travelcard, CHF 15 for an equivalent car-sharing and bicycle-sharing subscription and CHF 250 for the taxi vouchers. There is

[6]Prices for the current offer that are slighly different than in the reference given above can be found here: `www.sbb.ch/en/travelcards-and-tickets/railpasses/greenclass.html`, last accessed: July 2018.

no significant integration of the services, thus SBB Greenclass is an example of price bundling. Although the price is clearly lower than the sum of the stand-alone prices, the individual services cannot be consumed at the same time (thus for many customers the price may be too high relative to the ability to utilize the services). Nevertheless, the trial of SBB Greenclass was a success, which indicates that there are customer groups with a significant WTP for bundles. The reason could also include the aforementioned low price sensitivity of high income customers, combined with a WTP for a "carefree" solution.

Traditional public transportation season tickets are already bundles if they include several public transportation services. For example, the GA travel card in Switzerland is valid for passenger boats, as well as funicular railways, buses, trams and trains and existing journey planners integrate these services. In Switzerland and in many other places, ticket, price and ICT integration is thus already a reality for collective public transportation. The difference to MaaS schemes is that MaaS also integrates personal transportation services that are available to the public (i.e. taxi, car-sharing, bicycle-sharing etc.), which necessitates more advanced ICT solutions. Supply of personal transportation services is more distributed, and availability cannot readily be predicted by the customer. ICT systems provide utility by filling the information gap and by assisting coordination between customers and mobility service providers.

6. Conclusion

In this paper, the WTP differences between stand-alone and bundled services were investigated. The results indicated that the WTP for public transportation, car-sharing and park and ride services were higher in bundles. Bicycle-sharing, e-bike-sharing and taxi services in a bundle were valuated lower compared to stand-alone counterparts. The results have implications for mobility providers that seek to offer transportation service bundles. Offering pure bundles that include low-share transportation modes, which are not perceived directly as complementary to public transportation were not effective. Instead, low-share transportation modes should be included on a pay-as-you-go basis. The results also indicate that consumers exhibit a comparatively high WTP at CHF 104 - 127 for a smartphone application that integrates the services, manages ticketing and payment and makes suggestions to optimize personal travel.

So called "Mobility as a Service" concepts can be seen as a special case of service bundling and previous research in marketing and production economics should be taken into account. Literature on product and service bundling provides concise terminology and bundle classification methodology.

The effects of mobility behavior, attitude toward to the environment and technological commitment were not yet investigated and will be subject to future research, as each relates to the purchase likelihood of bundles. Furthermore, different user segments could in the future be considered. Additional research on the topic of ICT-enabled service bundling could draw from questions raised in the bundling literature. These topics include the legality and optimality of bundling strategies, the effect of competition on the bundling decision, and consumers' perception of bundles.

Furthermore, the environmental impact of transportation service bundling is still unclear. On the one hand, ICT-enabled transportation service bundles could lead to a reduction of private vehicle-miles and reduce car ownership (and thereby reduce the associated life-cycle emissions). On the other hand, they could also invite overconsumption of mobility services, which could offset potential positive environmental effects. This should be investigated before claims about positive effects of transportation service bundling are made.

7. References

Adams, W., Yellen, J. L., 1976. Commodity Bundling and the Burden of Monopoly. The Quarterly Journal of Economics 90 (3), 475–498.

Armstrong, M., 2013. A more general theory of commodity bundling. Journal of Economic Theory 148 (2), 448–472.

Becker, H., Ciari, F., Axhausen, K. W., 2017. Modelling free-floating car-sharing use in Switzerland: A spatial regression and conditional logit approach. Transportation Research Part C 81, 286–299.

Becker, H., Loder, A., Schmid, B., Jonietz, D., Bucher, D., Axhausen, K., Raubal, M., 2018. Usage patterns and impacts of a mobility flat rate traced with a Smartphone App. In: paper presented at the 15th International Conference on Travel Behavior Research (IATBR 2018). Santa Barbara.

Breidert, C., Hahsler, M., Reutterer, T., 2006. A Review of Methods for Measuring Willingness-to-pay. Innovative Marketing, 1–32.

Cameron, T. A., 1988. A new paradigm for valuing non-market goods using referendum data: Maximum likelihood estimation by censored logistic regression. Journal of Environmental Economics and Management 15 (3), 355–379.

Cameron, T. A., James, M. D., 1987. Efficient Estimation Methods for "Closed-Ended" Contingent Valuation Surveys. The Review of Economics and Statistics 69 (2), 269–276.

Diekmann, A., Meyer, R., Mühlemann, C., Diem, A., 2009. Schweizer Umweltsurvey 2007 - Analysen und Ergebnisse (Swiss environmental survey - Analyses and results). Tech. rep., BAFU.

Drumwright, M. E., 1992. A Demonstration of Anomalies in Evaluations of Bundling. Marketing Letters 3 (4), 311–321.

Eppen, G. D., Hanson, W. A., Martin, R. K., 1991. Bundling - new products, new markets, low risk. Sloan Management Review v32 (n4), p7(8).

Gaeth, G. J., Levin, I. P., Levin, A. M., 1990. Consumer Evaluation of Multi-Product Bundles : An Information Integration Analysis. Marketing Letters 2 (1), 47–57.

Greene, W. H., Hensher, D. A., Rose, J. M., 2005. Using Classical Simulation-Based Estimators to Estimate Individual WTP Values. Springer Netherlands, Dordrecht, pp. 17–33.

Heikkilä, S., 2014. Mobility as a Service A Proposal for Action for the Public Administration.

Hensher, D. A., 2017. Future bus transport contracts under a mobility as a service (MaaS) regime in the digital age: Are they likely to change? Transportation Research Part A: Policy and Practice 98, 86–96.

Hensher, D. A., Greene, W. H., 2003. The Mixed Logit model: The state of practice. Transportation 30 (2), 133–176.

Hui, W., Yoo, B., Choudhary, V., Yan, K., 2012. Sell by bundle or unit? Pure bundling versus mixed bundling of information goods. Decision Support Systems 53 (3), 517–525.

Kahneman, D., Tversky, A., 1979. Prospect Theory: An Analysis of Decision under Risk. Econometrica 47 (2), 263–291.

Kamargianni, M., Li, W., Matyas, M., Schäfer, A., 2016. A Critical Review of New Mobility Services for Urban Transport. Transportation Research Procedia 14 (0), 3294–3303.

Matyas, M., Kamargianni, M., 2017. Stated Preference Design for Exploring Demand for "Mobility as a Service" Plans. 5th International Choice Modelling Conference, 16.

McAfee, R. P., McMillan, J., Whinston, M. D., 1989. Multiproduct Monopoly, Commodity Bundling, and Correlation of Values. The Quarterly Journal of Economics 104 (2), 371–383.

Neyer, F. J., Felber, J., Gebhardt, C., 2016. Kurzskala zur Erfassung von Technikbereitschaft (technology commitment). Zusammenstellung sozialwissenschaftlicher Items und Skalen.

Revelt, D., Train, K., 2000. Customer-Specific Taste Parameters and Mixed Logit: Households' Choice of Electricity Supplier. Economics Working Papers E00-274, University of California at Berkeley.

Rose, J. M., Collins, A. T., Bliemer, M. C., Hensher, D. A., 2014. Ngene.

Sheikhzadeh, M., Elahi, E., 2013. Product bundling: Impacts of product heterogeneity and risk considerations. International Journal of Production Economics 144 (1), 209–222.

Sillano, M., Ortúzar, J. d. D., 2005. Willingness-to-pay estimation with mixed logit models: Some new evidence. Environment and Planning A 37, 525–550.

Sobolewski, M., Kopczewski, T., 2017. Estimating demand for fixed-line telecommunication bundles. Telecommunications Policy 41 (4), 227–241.

Sochor, J., Strömberg, H., Karlsson, I. C. M., 2014. Travellers' motives for adopting a new, innovative travel service: insights from the UbiGo field operational test in Gothenburg, Sweden, 21st World Congress on Intelligent Transportation Systems, Detroit.

Stillwater, T., Mokhtarian, P. L., Shaheen, S. A., 2009. Carsharing and the Built Environment: Geographic Information System-Based Study of One U.S. Operator. Transportation Research Record 2110, 27–34.

Stremersch, S., Tellis, G. J., 2002. Strategic Bundling of Products and Prices: A New Synthesis for Marketing. Journal of Marketing 66 (1), 55–72.

Swiss Federal Statistical Office (BFS), 2017. Mobilität in der Schweiz - Ergebnisse des Mikrozensus Mobilität und Verkehr 2015. Tech. rep., Swiss Federal Statistical Office (BFS), Neuchatel.

Thaler, R., 1985. Mental Accounting and Consumer Choice. Marketing Science 4 (3), 199–214.

Train, K., 2009. Discrete Choice Methods with Simulation. Cambridge University Press.

Train, K., Weeks, M., 2005. Discrete Choice Models in Preference Space and Willingness-to-Pay Space. Springer Netherlands, Dordrecht, pp. 1–16.

Vamosiu, A., 2018. Optimal bundling under imperfect competition. International Journal of Production Economics 195 (September 2017), 45–53.

Yadav, M. S., 1994. How Buyers Evaluate Product Bundles: A Model of Anchoring and Adjustment. Journal of Consumer Research 21 (2), 342–353.

Yan, R., Myers, C., Wang, J., Ghose, S., 2014. Journal of Retailing and Consumer Services Bundling products to success : The in fl uence of complementarity and advertising. Journal of Retailing and Consumer Services 21, 48–53.

Appendix A. DCEs: introductory information for participants

Each experiment was introduced with an introductory text. The following subsections contain the translated texts.

Appendix A.1. Stand-alone service: general introduction

Please read the following information carefully.
You will be presented with two different mobility services (option 1 and option 2). Please decide whether you would purchase the service at the given price or not (i.e. decline).

Remarks:

- Please try to decide the same way as you would in the real world. Decline offers that you would not purchase.
- Assume that you could only purchase the service at the given price and that there would be no other way to purchase the service.

Tip:

- If you are using a smartphone to complete the survey, please use it in landscape mode.

Appendix A.2. Stand-alone service: public transportation

Possible choices:

- Validity: ZVV area (1-2 zones, 3 zones, 4 zones, 5 zones, all zones) or the whole country (GA travel card).

- Second class ticket

Remarks:

- The zones for the cities of Winterthur (120) and Zurich (110) count as two zones.
- In case you already possess a public transportation season ticket, assume that it expired and that the offer is to renew it.

(Figure: map of pt zones)

Appendix A.3. Stand-alone service: car-sharing

The car-sharing season ticket provides access to a car-sharing service. The service allows you to access 3000 vehicles at 1500 locations in the whole country. The vehicles can be booked in advance. The service includes a credit of 50, 75, 125 or 150 kilometers per month.

Possible choices:

- Credit: 50, 75, 125 or 150 kilometers per month.

Remark:

- In case you already possess a car-sharing subscription, assume that it expired and that the offer is to renew it.

Appendix A.4. Stand-alone service: park and ride

A subscription for all park and rail parking spots at SBB train stations. The service includes access to 500 parking spots in the whole country and allows for parking at train stations to transfer to the train. The stations Zurich HB, Zurich Oerlikon and Winterthur are not included.

Possible choices:

- Credit: 4, 7 or 14 days per month.

Appendix A.5. Stand-alone service: bicycle-sharing

A subscription for bicycle-sharing services in the whole country with 2000 bicycles in the canton of Zurich. The service includes a monthly credit. Bicycles can be left anywhere on public ground and are repositioned several times per week by the operator such that they are located at central locations.

Possible choices:

- Credit: 3, 5, 7 or 10 hours per month.

Appendix A.6. Stand-alone service: e-bike-sharing

A subscription for e-bike-sharing services in the whole country with 400 bicycles in the canton of Zurich. The service includes a monthly credit. Bicycles can be left anywhere on public ground and are repositioned several times per week by the operator such that they are located at central locations.

Possible choices:

- Credit: 3, 5, 7 or 10 hours per month.

Appendix A.7. Stand-alone service: electric bicycle-sharing

A monthly credit for taxi services in the whole country (in minutes).

Possible choices:

- Credit: 30, 60, 120 minutes per month.

Appendix A.8. Service bundles

Please read the following information carefully.
You will be presented with two bundles of mobility services. Please decide whether you would buy the bundle at the given price or not. If you are already using one of the services that is included in the bundles, please assume that you would be reimbursed for that service.
The following services are included in the bundles:

Possible choices:

- Public transportation: ZVV area (1-2 zones, 3 zones, 4 zones, 5 zones, all zones) or the whole country (GA travel card).
- Car-sharing: The car-sharing season ticket provides access to a car-sharing service. The service includes a credit of 50, 125 kilometers per month. The service allows you to access 3000 vehicles at 1500 locations in the whole country.
- Bicycle-sharing: A subscription for bicycle-sharing services in the whole country with 2000 bicycles in the canton of Zurich. The service includes a monthly credit of 3 or 5 hours per month. Bicycles can be left anywhere on public ground and are repositioned several times per week by the operator such that they are located at central locations.
- E-bike-sharing: A subscription for e-bike-sharing services in the whole country with 400 bicycles in the canton of Zurich. The service includes a monthly credit of 3 or 5 hours per month. Bicycles can be left anywhere on public ground and are repositioned several times per week by the operator such that they are located at central locations.
- Parking sports at train stations (park and ride): A subscription for all park and rail parking spots at SBB train stations. The service includes access to 500 parking spots in the whole country and allows for parking at train stations to transfer to the train. The service includes 4, 7 or 14 days of parking.
- Taxi subscription: A taxi credit for 30 or 60 minutes for taxi trips in the whole country.
- Smartphone app: The app provides a journey planner (similar to Google maps) that combines the services optimally for each journey. Car-sharing, bicycle-sharing and parking spots are displayed on a map (incl. availability and the possibility to book them). Your mobility behavior is analyzed in the background and you are presented with suggestions to reach your destinations faster or at a lower cost. You can also indicate personal preferences like walking a prespecified distance by foot or with a bicycle per week. Payment is managed by the app. Tickets can be displayed by the app. You also receive a plastic card as a ticket.

Remarks:

- Please try to decide the same way as you would in the real world. Decline offers that you would not purchase.
- Assume that you could still buy the services in the usual way.