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Demystifying the "Sunk Cost Fallacy": When Considering Fixed Cost in Decision-Making is Reasonable

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Abstract - *Economic theory explains that when making decisions, historical costs should be irrelevant. When people are influenced by sunk costs in their decision-making, they are said to be committing the "sunk cost fallacy", summarized by Kelly (2004) as the conjunction of two claims: (1) individuals often do give weight to sunk costs in their decision-making, and (2) it is irrational for them to do so. Based on three studies both aspects are investigated (Amazons loyalty program Prime, German railways discount card BahnCard and decisions to use the own car when making long-haul trips). There are strong indicators that in all three examples fixed costs play a crucial role when consumers make decisions; and doing so is not necessarily irrational.*

General Terms - *sunk cost fallacy; decision making; fixed cost; behavioral economics; bounded rationality*

Keywords - *sunk cost fallacy; Amazon Prime; BahnCard; online survey; heuristics*

1. INTRODUCTION

For more than three decades behavioral economists explain that the consumers' behavioral biases often lead to bad bargains, further exploited by firms to their profit. As Grubb (2015)[20] describes consumers often fail to choose the best price because they search too little, become confused comparing prices, and/or show excessive inertia through too little switching away from past choices or default options. Despite a body of literature on nudging people toward better decision-making (Thaler and Sunstein, 2009)[42] there are not many real interventions successfully de-biasing consumers in mentioned inept decision-making (Houdek, 2016)[24]. There is extensive evidence that real-world decision makers violate the predictions of standard economic theory. Among these violations, the sunk cost bias in pricing decisions stands out for a number of reasons (Al-Najjar, Baliga, and Besanko, 2005)[1]. The origin of this theory dates back to Thaler (1980)[41] stating economic theory implies that "only incremental costs and benefits should affect decisions. Historical costs should be irrelevant. But do (non-economist) consumers ignore sunk costs in their everyday decisions? … I do not believe that they do." That sunk costs are not relevant to rational decision-making is often presented as one of the basic principles of economics. As an example Georg Tacke (Tacke, 2015)[39] the CEO of the world-leading pricing consultancy Simon-Kucher, compared the competitive situation between using a train or car in Germany and describes that"the (BahnCard) price is considered sunk costs - they are gone. They no longer flow into the customer's decision whether they are traveling by train or by car." Other economists argue in a similar way when describing rational decision-making in a firm. For example, for most database marketing decisions Blattberg, Kim and Neslin, (2008)[8] propose that the Customer Lifetime Value (LTV) should be calculated using just variable costs, not considering any cost which were related to customer acquisition. In a more recent article Bendle and Bagga (2016)[7] support this view. When pricing a product, variable costs per item are regarded as the lowest possible price from the suppliers perspective in case a short-term "variable costing" philosophy is adopted (Guilding, Drury and Tayles, 2005)[21]. When people are influenced by sunk costs in their decision-making, they are said to be committing the "sunk cost fallacy". This could be described as "throwing good money after bad".

Hammond, Keeney, and Raiffa (1998)[23] describe the effect as "making choices in a way that justifies past, flawed choices" and explain this by an example of a banker who originates problem loans keeps advancing more funds to the debtors, to protect his earlier decisions. Although, the loans defaults anyway. According to Arkes & Blumer (1985)[2] sunk-cost fallacy is the "tendency to continue an endeavor once an investment in money, effort, or time has been made". It often underlies escalation of commitment (Staw, 1976)[38] or entrapment (Brockner & Rubin, 1985)[11]. Although disastrous military campaigns (Staw, 1976) and over budget public-works projects (Ross & Staw, 1993) are publicly visible cases, the sunk cost bias also manifests itself on a smaller scale for people during everyday life (Hafenbrack, Kinias and Barsade, 2014)[22]. For example, it turns out to be surprisingly difficult to sell a stock that has fallen in value

(Odean, 1998)[34], to ignore bad advice that one has paid for (Gino, 2008), or to delete carefully written text from a manuscript. Explanations for the sunk cost bias include loss aversion (Kahneman and Tversky, 1979)[25], self-justification (Aronson, 1968)[3], and the desire not to appear wasteful (Arkes and Blumer, 1985)[2]. In older papers cognitive dissonance (Festinger, 1957)[16] or self-justification (Aronson and Mills, 1959)[4] are seen as an underlying mechanism.

As already described, the sunk cost fallacy is not restricted to consumer behavior or economic decision-making, but extends to many other decisions, including policy making. Nevertheless, the aim of this paper is to focus on consumers´ cost perception and decision-making. Here, the challenge is to further investigate and understand the core elements of the sunk cost fallacy, summarized by Kelly (2004)[26] as the conjunction of two claims: (1) individuals often do give weight to sunk costs in their decision-making, and (2) it is irrational for them to do so.

2. RESEARCH METHOD

As Baumol and Willig (1981) emphasized in the long run all sunk cost is zero. To analyze the sunk cost effect, this paper focuses on repeated decisions of consumers in a short to medium perspective dealing with situations where money has been invested (i.e. purchase or subscription). In the following three different cases are investigated:

- Amazon customers who decide to subscribe to Amazon Prime
- German Rail customers who purchase and use a discount card (BahnCard 50)
- Car owners who consider alternative modes of transport for a journey.

2.1 Amazon Prime

For years, Amazon has been obsessed with growth. Total revenues tripled from $34bn (2010) to $107bn (2015). A core element of Amazon´s business model is to trade off short-term profit against long-term cash flow. Its key strategic aim is to be able to capture the largest market share and scale possible that will allow it to drive down costs and increase profitability in the future (Krämer and Kalka, 2016)[30]. In this context Amazon Prime plays a crucial role. The program was introduced in 2004. It is estimated that Prime members increase their purchases on the site by about 150 % after they join and may be responsible for as much as 20 % of Amazon's overall sales in the U.S. According to a study by RBC Capital Market, 39 % of Prime members had expenditures of more than $200 in the past 90 days and for 25 % expenditures were between $101 and $200. The corresponding figures for non-Prime-customers were lower. 49 % of first-year Prime members and 68 % of year-four subscribers spend at least $800 on Amazon each year (DiChristopher, 2015)[14]. In recent years, Amazon has not only improved the portfolio of Amazon Prime (in addition to the free delivery, Prime also includes the possibility to stream music and videos), but also increased the prices. For the U.S. the annual fee was increased from $79 to $99 in 2014. In November 2016, the company announced to increase its subscription fee in Germany from EUR 49 to EUR 69. Compared with other industries and companies a price increase of more than 40 % is rather unusual (Krämer and Hercher, 2016)[29].

2.2. BahnCard 50

The BahnCard is a popular German customer loyalty instrument that Deutsche Bahn, the major German railway operator, introduced in 1992, reaching almost 5 million members in 2014. The BahnCard 50 is the oldest type (since 2003 the BahnCard 25 and BahnCard 100 models are also offered).

Similar to Amazon Prime, the BahnCard 50 follows a subscription model (Krämer and Kalka, 2016)[30]. The fee for the card is EUR 255 per year (target groups have reduced tariffs). The owner of a BahnCard 50 receives a 50 % discount on the regular rail fare ("flex price"). Explaining the success of the BahnCard, Tacke and Firner (1992) describe that the purchasers of the BahnCard regard the card costs (such as the fixed costs of car ownership) as "sunk costs". Due to a 50 % discount on the standard rail fare using the train becomes more favorable, since the out-of-pocket-costs are on a similar level to using a car. The customer behaves as if he received a 50 percent discount, ignoring the cost of the BahnCard (FAZ, 2014). Regarding the cost to purchase the discount card as sunk, only the reduced fare becomes essential. Lower fees per travelled mile encourage more traffic, as Schmale, Ehrmann and Dilger (2013)[35] point out. Brandes explains the theory of incremental costs and states that the sinking of costs results in a reduction in marginal costs. As a result, demand increases (Brandes, 2001)[10]. Correspondingly, empirical studies show that the average price, which is considered cheap by (potential) rail customers, is in the range of 50 % of the regular price (Krämer, 2015). Butscher (1999)[12] confirms this theory of sunk cost related to the BahnCard and points out that "there is a strong incentive to maximize its use as this means saving more money."

2.3. Using the own car

Economic theory teaches that in the case of a short-term decision, only the variable costs of car use are decisive; fixed (e.g. depreciation) or quasi-fixed cost components (for example, costs for inspection) do not play a relevant role. In this case, the relevant costs would be between EUR 0.08 and 0.12 per kilometer in Germany 2016, depending on the vehicle and engine, and thus about one third of the full cost per kilometer.

All three examples are characterized by the fact that consumers make investments and thus shape their usage for a certain period of time. The extent to which sunk costs are included in the decision and how irrational the

decisions are in this case was examined based on consumer surveys (see Table 1).

Table 1. Study design

Study	Sample	Field	Target group
Study #1 (Amazon Prime)	n=500 (online)	July 2016	German population (18+years)
Study #2 (BahnCard)	n=700 (online)	August 2016	Railway users
Study #3 (Car usage)	n=4.500 (online)	August 2016	D-A-CH population (18+years)

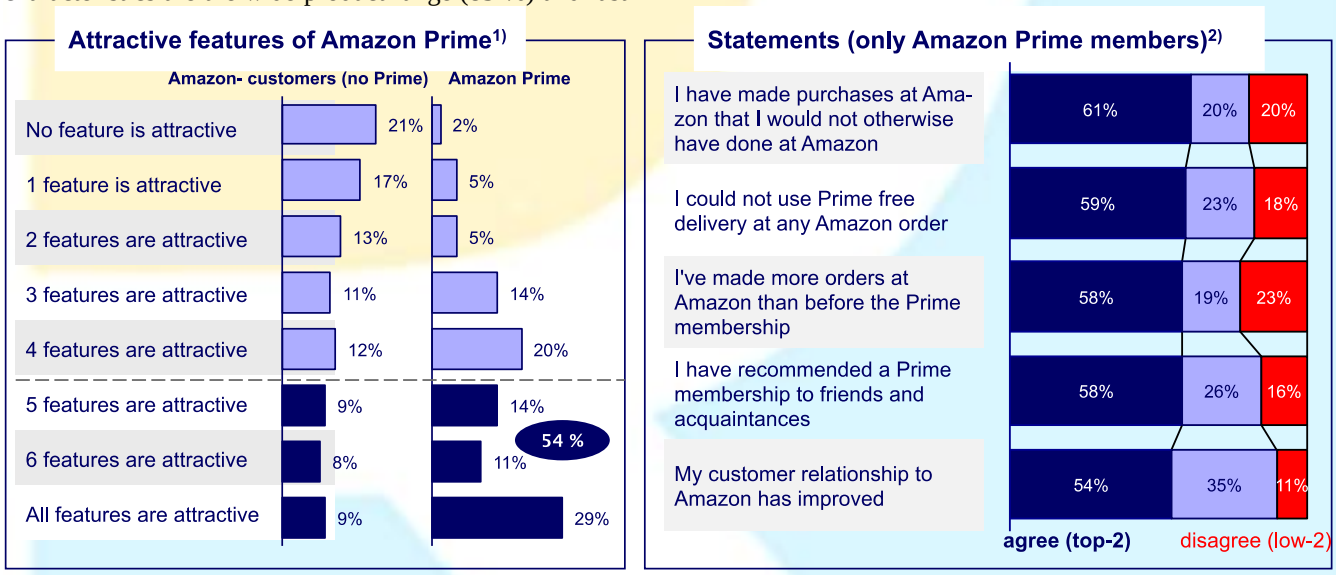
The focus of the study is the decision-making behavior of consumers and the perception of costs.

3. RESULTS FROM EMPIRICAL STUDIES

3.1 Amazon Prime´s Effect on Consumption

As recent research confirmed (Krämer and Kalka, 2016), for Amazon's customers the most important performance characteristics are the wide product range (85 %) and fast delivery (80 %), followed by a transparent customer account (55 %). Astonishingly, the factor "low price" is not a top criterion (53 %). This reflects the fact that German consumers are not primarily focused on getting the lowest possible price on Amazon, but rather that service elements receive a clear preference.

As soon as consumers have become accustomed to the customer-friendly processes (transparent product presentation, easy ordering and payment), simplification processes take place in the customers' decision-making. Consumers recognize that they do not need multiple search portals to find the right product because Amazon offers a comprehensive service. If the customers opt for a Prime subscription, the effect of a reduced relevant set is enhanced. As Figure. 1 illustrates, additional purchases occur and consequently higher sales. 61 % of Amazon Prime customers agree with the statement "I have made purchases at Amazon that I would not otherwise have done at Amazon". The decision for Prime is driven by a bundle of attractive features (Fig. 1, left side).



1) Which of the following Amazon Prime features are attractive for you? 2) What are the consequences of your Prime membership? Scale 1 = I completely agree to 6 = I completely disagree.

Fig 1: Attractiveness of Amazon Prime features and statements concerning effects of Prime membership

We see different explanations for a stronger commitment and an intensified usage, once consumers have subscribed to the service. First, consumers might enjoy their usage more on a flat rate than on a payment per use. This is often referred to the Taximeter effect (the pleasure of a taxi ride is reduced by the ticking of the taximeter) and corresponds with mental accounting, which assumes that consumers set up and work with mental accounts and budgets (Heath and Soll, 1996; Thaler, 1985)[40]. For Amazon customers, paying the delivery costs for each order reduces the joy from ordering online because consumers attribute the cost and, thus, the pain of paying to consumption at the time of usage. Instead, when paying the Prime subscription fee consumption from payment is decoupled (the costs are mentally prepaid at beginning of the Prime subscription period). Second, Amazon Prime customers might believe that choosing among different e Commerce platforms is inconvenient and in order to minimize information cost, they might prefer to focus on Amazon as their preferred online dealer. Such a heuristic corresponds with the theory of bounded rationality, described by Simon (1956; 1972)[36][37]. Even if there is a theoretical chance to find a better deal outside the "Amazon-world", this search process means additional expenses. Therefore, the act of satisficing can be explained as a rational approach. Third, once consumers

feel committed and subscribe to Prime, there is a certain rationality trying to reach a break-even soon (the subscription fee equals the savings due to free delivery of goods). One of two Prime customers indicates that the customer relationship with Amazon has improved through the subscription.

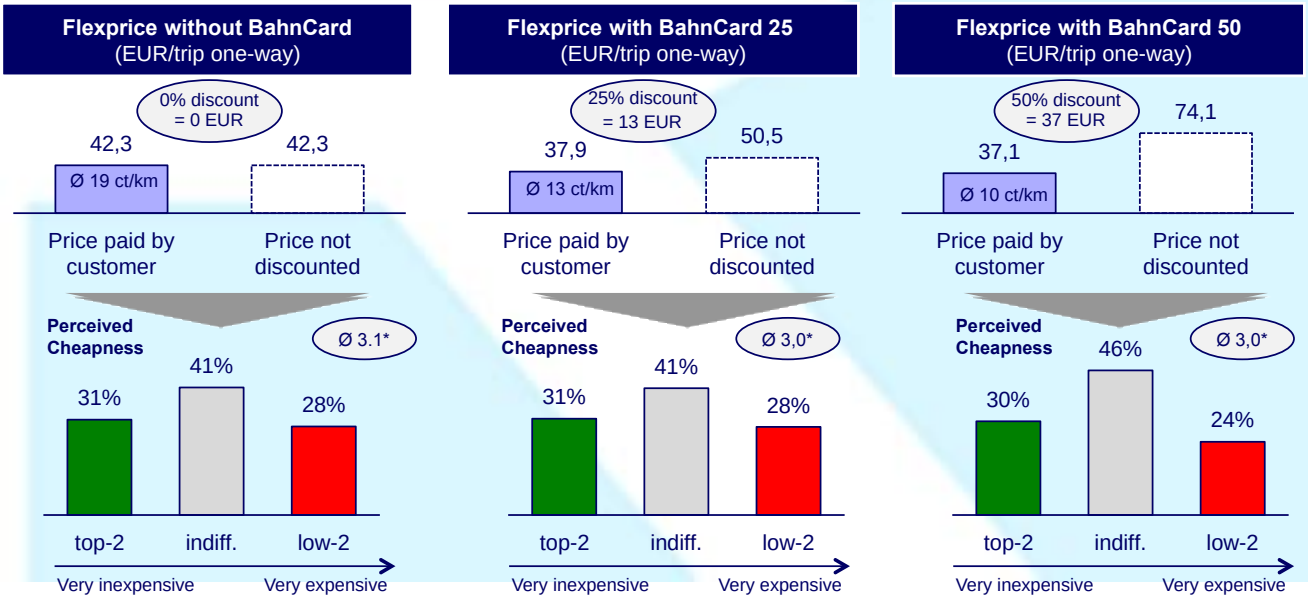
Table 2. Statements concerning the effects of a Prime membership (% top-2 agreement)

Statements	All respondents	Prime member <1 year	Prime member 1+ year
I have made purchases at Amazon that I would not otherwise have done at Amazon,	61%	70%	56%
I could not use Prime at any Amazon order	59%	65%	56%
I've made more orders at Amazon than before the Prime Membership	58%	65%	54%
I have recommended a Prime membership to friends and acquaintances	58%	45%	65%
My customer relationship to Amazon has improved	54%	52%	56%

In Table 2 the results of the statement evaluation are differentiated for two subgroups: (a) Prime membership started later than 1 year ago and (b) Prime membership started earlier than 1 year ago. Especially during the start-up phase of the membership, increased consumption is confirmed. This can be explained on one hand by the included free delivery, and on the other hand due to precommitment.

3.2 Customer Discount Card (BahnCard 50)

For railway customers, the purchase of the discount card provides a possibility to significantly reduce the fare (50 % discount on the regular price). If the regular price is a known parameter, this means that the customer is able to plan with respect to the final price of the ticket. In case that a customer has already planned a certain number of trips, there are good opportunities to significantly reduce the travel budget. This kind of non-linear pricing (annual fee plus reduced price per ticket) is favorable for customers with a high travel volume. Although, for most BahnCard owners there is always the risk attached that the break-even of the BahnCard will not be reached (for example if the number of trips per year is uncertain or changes in the overall mobility occur after the purchase of the BahnCard). Nevertheless, previous studies indicate significant increases in railway´s modal share, once a BahnCard is purchased (Böhrs et al., 2009)[9]. Again, it is not clear whether this is due to pre-commitment or a perceived fare reduction. Similar to Amazon Prime a process of self-selection takes place.



1) How much did you pay for your rail ticket with the flex price from ... to ...? And: How do you rate the fare of ... Euro on a scale from 1 = very cheap to 5 = very expensive? * No significant differences across segments (p>0.10).

Fig 2: Average fare per train journey (one-way) and price evaluation by customers (2nd class)

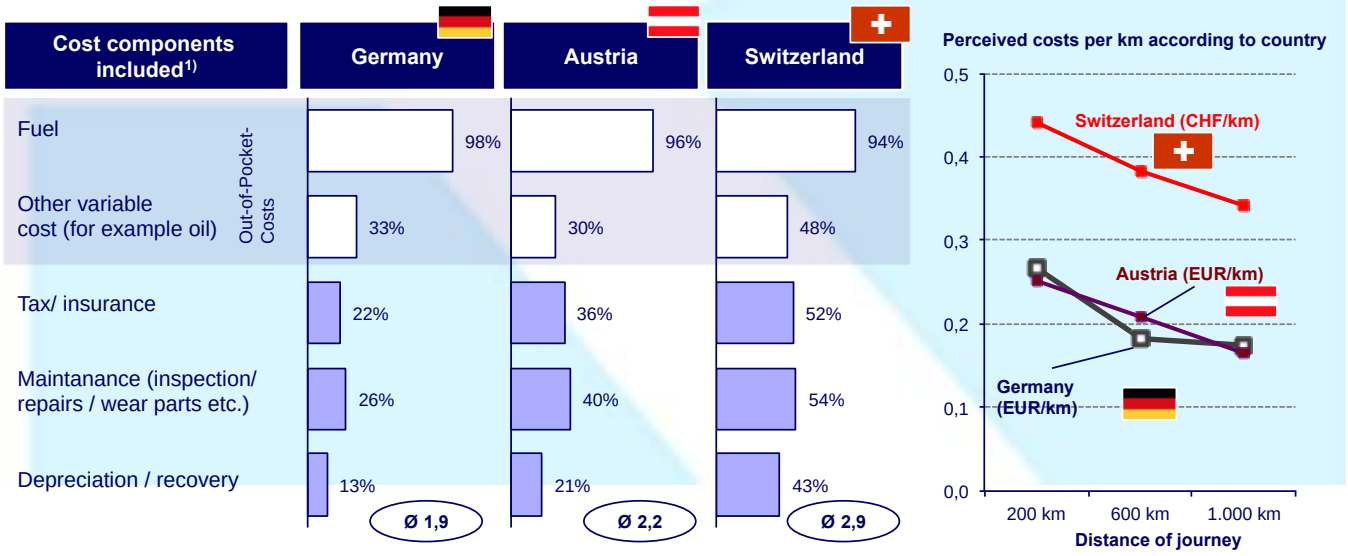
In the course of a survey of railway customers who purchased online a regular price ("Flexprice"), the effective prices paid for the railway trip were determined. Here, different segments could be considered: (a) persons

without a BahnCard (they pay the full fare); (b) persons who own a BahnCard 25 (they receive a 25 % discount) and (c) persons who own a BahnCard 50 (they receive a 50 % discount on the full fare). Converted to the kilometers traveled, the costs vary between EUR 0.19 per km in segment 1 without BahnCard and EUR 0.10 per km in the segment with BahnCard 50. This also confirms the assumption that due to a 50 % discount railway tickets become competitive compared with the variable costs to use the own car (Figure 2). Using the train at EUR 0.10 per km becomes equally expensive as using the car, when only considering the variable costs (see 2.3). In a second step, ticket buyers were requested to rate the ticket price on a 5-point scale (1=very inexpensive to 5=very expensive). If only the prices actually paid had been included in this rating, the results would be expected to differ across the segments: the best results for the BahnCard 50 customers (they effectively pay the lowest fares) and the worst results for customers without a special discount (they pay the full fare) would be consistent with the variation in fares. However, the presumed dependencies are not confirmed by empirical data. On the contrary, the price level evaluation between the segments is not significantly different, despite considerable differences in fares and discounts.

3.3 Perceived costs of using the private car

During the third study focusing on the D-A-CH-region (Germany, Austria and Switzerland), drivers were surveyed with regard to the perceived cost of a car journey with different travel distances. Three groups of car owners were randomly formed: (a) 200 km of total distance, (b) 600 km of total distance and (c) 1,000 km of total distance. In July 2016, participants estimated average costs of approximately EUR 53 for the short car journey of 200 km. For the distances of 600 km and 1000 km the costs were estimated to be EUR 110 and EUR 174 respectively. The perceived costs per kilometer are declining from short distances (EUR 0.27 per km) over medium distances (0.18 EUR per km) to longer distance (EUR 0.17 per km). The perceived average costs of around EUR 0.20 / km already indicate that not only fuel costs (depending on consumption and fuel between EUR 0.08 and EUR 0.12 / km) determine the cost perception but also other cost elements. These results are consistent with earlier results reported by Wilger (2004)[46]. However, the average perceived costs are also well below the full cost level: for most common car types those range from EUR 0.30 to 0.50 per km (Krämer 2016)[28].

In addition to the estimate of the total costs for the trip by car, the participants were asked about the cost components taken into account (in total 5 cost items were presented). Fuel costs and other variable costs (e.g. oil) may be referred to as out-of-pocket costs. Nearly two third of car users in Germany report only these variable costs as the main cost components in their estimate. More than one third of car users also allocated further cost items. Almost 10 % of respondents confirmed to consider all cost elements. While results for Austria are similar to Germany, clear differences are observed for Switzerland. This concerns the absolute level of the cost estimate as well as the structure of the cost components for using the privately owned car. As Fig. 3 (right part) depicts, the average cost estimate in Switzerland is about twice as high as in Germany and Austria, which are relatively similar in terms of cost function across different distances.



1) Imagine you are planning a trip by car. How much do you estimate the cost of a journey of 200/600/1000 km (one-way * 2)? What costs did you consider in your estimation?

Fig 3: Perceived costs of using the own car in Germany, Austria and Switzerland (D-A-CH-region)

The differences, however, are not only due to the higher price level in Switzerland or the exchange rate EUR-CHF, but also to the different perception of cost elements. While in Germany two third of the car users only include variable costs in their estimation, this is diametrical in Switzerland: 31 % of car owners calculate only with variable costs, 69 % relate at least partially fixed costs to the cost estimation. Almost a quarter of the Swiss car drivers incorporate all five cost positions. In the segment of seniors (60+ years) this share is more than 40 %. It could even be argued that senior car owners in Switzerland have a more rational approach when estimating the cost of using their own car. Their perspective seems to be more conservative and long-term oriented.

4. DISCUSSION

When summarizing their empirical findings on sunk cost effects Friedman, et al. (2007) state that "there are at least two distinct psychological mechanisms that might create an irrational regard for sunk costs".

First, self-justification (or cognitive dissonance) induces people who have sunk resources into an unprofitable activity to irrationally revise their beliefs about the profitability of an additional investment. Doing so avoids someone from making an unpleasant acknowledgment. Furthermore, this is consistent with the findings from Lambrecht and Skiera (2006)[31] emphasizing, "that many users prefer a flat rate even though their billing rate would be lower with a pay-per-use tariff (flat-rate bias).

Our findings lead to the assumption that precommitment plays a crucial role when explaining consumers´ decision. Axhausen, Simma and Golob (2001)[5] come to the conclusion that a model including the pre-commitments of the travellers should be an essential part of any modeling. There are product or service categories – as

Once consumers realize their status, there is a tendency to justify the subscription by intensifying usage. Second, and even worse, loss aversion (with respect to a reference point fixed before the costs were sunk) can lead people to choose an additional investment, although its incremental return has a negative expected value.

5. OUTLOOK

The high popularity of the research results covering behavioral economics leads to the impression in science and practice that human decisions are mostly irrational (Bauer and Koth, 2014)[6]. That is, decision-making is determined by heuristics and biases both leading to errors in judgments and inaccurate decisions. This paper does not attempt to refute the fact that there are situations where bad (irrational) decisions are made based on the consideration of fixed costs. However, there are legitimate doubts that this is always the case.

online ordering, using the train or owning and driving a car - where consumers want to predetermine a certain level of usage (Nunes, 2000[33]; Wertenbroch, 1998)[45]. Amazon customers who subscribe to Prime feel a strong commitment towards Amazon and are willing to order and spend more.

As Fleischer (2001)[18] pointed out when explaining the decision process for a BahnCard, at any given time the traveler cannot see far into the future, so unfortunately his decision when to buy a BahnCard is made with a high degree of uncertainty. This also can explain that, on the one hand, often sunk cost are relevant when making short term decisions and, on the other hand, doing so is not necessarily irrational (see Table 3).

Table 3. Overall evaluation of sunk cost relevance and irrationality when considering sunk costs

Study	Sunk cost considered …	Irrationality of considering sunk costs
Study #1 (Amazon Prime)	Assumed yes, but no clear proof; customers´ share of wallet is increased	Subscription is not necessarily irrational; most customers with a high customer surplus
Study #2 (Bahn-Card)	Yes; clear indication; no improved price perception for customers using a BahnCard 50	Rational decision to consider BahnCard costs as they drive usage of railway; once the break-even is reached, the customer is better off with the BahnCard
Study #3 (Car usage)	Yes, clear evidence for significant share of car users (especially Switzerland)	If consumer have a long term perspective, they should incorporate fix costs in their budgeting

As has been shown, there are situations where the consideration of previous investment decisions does not necessarily lead to irrational decisions. As McAfee, Mialon, and Mialon stated "although reacting to sunk costs is rational in many situations, ignoring sunk costs is rational in others. According to our models, ignoring sunk costs is rational in any situation in which past investments are not informative, reputation concerns are unimportant, and budget constraints are not salient." Based on the own empirical findings, the explanation approach of Bounded Rationality appears to be a better approach to explain decisions under uncertainty. Here, it is important to emphasize that bounded rationality is not an inferior form of rationality, as Gigerenzer and Selten (2001)[19] point out: "theories of bounded rationality should not be confused with theories of irrational decision making". Since two of the three studies investigate situations with characteristics of a flat rate, is has to be mentioned that there is also a certain irrationality in a subscription, in

case that consumers who would save money with a pay-per-use tariff often prefer a flat rate. This preference has been dubbed the "flat-rate bias" (Train 1991)[43].

The impression of an irrational consumer, led by false heuristics and distorted perceptions, is as false as the image of the Homo Oeconomicus. The theory of Bounded Rationality seems to be a good bridge for connecting both worlds.

Finally, the norms that are the starting point for the determination of biases and judgment errors must also be questioned. Thus the repeated orientation to variable costs leads to a decision paradox. If a rational short-term decision is repeated (without considering the fixed costs), the decisions appear unreasonable after a while (because the fixed costs are not covered). To illustrate this, an example related to studies 2 and 3 is used. Assuming that the variable cost of using the own car is EUR 0.10 per km and a train ticket (full fare) costs EUR 0.20 per km, there is clear evidence that using the car is more rational in the short run. Sunk costs should be irrelevant, as we learnt, and the consumer chooses the option, which provides the best ratio between costs and benefits (we further assume, the perceived comfort level is similar for train and car and that there are no other alternatives as airlines etc.). The distance is 500 km per trip (1.000 km per round-trip). If the decision is repeated once a week for two years it becomes obvious that a single decision might be rational while the sum of all single decisions favoring the car is questionable. After approximately 100 single rational decisions the total mileage of the privately owned car sums up to more than additional 100.000 km. Now, it is time to think about a new car. And it becomes clear: the so-called sunk costs should be relevant. Perhaps buying a BahnCard would have been the better decision.

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