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## Sticky rebates: rollback rebates induce non-rational loyalty in consumers ; experimental evidence

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**Sticky Rebates:  
Rollback Rebates Induce  
Non-Rational Loyalty in  
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Alexander Morell / Andreas Glöckner / Emanuel Towfigh

July 2009

# **Sticky Rebates: Rollback Rebates Induce Non-Rational Loyalty in Consumers – Experimental Evidence**

by

**Alexander Morell, Andreas Glöckner & Emanuel Towfigh\***

## **Abstract**

We investigate whether and how targeted rebates impede rational switching of consumers from an incumbent to an outside option (e.g., market entrant). In a real trading problem, participants repeatedly buy tokens and can enter a target rebate scheme. Buying in a rebate scheme considerably reduces the likelihood that they switch to a higher-payoff outside option later. We conclude that targeted rebates might have an underestimated potential to foreclose consumer markets. The stickiness effect increases with the increasing number of previous buying in the rebate scheme, but not with the size of the rebate. Prospect Theory can partially account for these effects.

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## I. Introduction

The US and Europe are divided over pennies. US antitrust law is based on an image of vigilant buyers who can fend for themselves, even if dominant firms try to seduce them with rebates. European antitrust authorities are more skeptical. They worry about the “psychologically weak position”<sup>2</sup> buyers are placed in by rebates and are concerned about buyers being at the mercy of the “suction effect” of rebates. This is why rebates that would be perfectly legal in the US are prohibited for market-dominant firms on the other side of the Atlantic. While the US enforcement agencies implicitly model buyers as rational maximizers, the European Commission has been more open to a behavioral perspective. Which of these images actually holds to be true — or is at least closer to reality — is ultimately an empirical question. In a laboratory experiment, we show that rebates are indeed sticky beyond what would be rational, and that the effect is grounded in boundedly rational behavior. Policy implications will be drawn from the experiment and will be discussed.

US Courts have taken a rather lenient position towards rebates, stressing their efficiency-enhancing potential, for example in *Concord Boat v. Brunswick*. The position of US authorities towards rebates is far from settled, though. In an official statement, the Federal Trade Commission and the Department of Justice solicit the Supreme Court not to review the *LePage v. 3M* case because the economics of rebates requires further research before a sound test can be set out (Olson et. al, 2002). In Europe, the EU has suppressed many forms of rebates if applied by dominant companies, stressing their potential to foreclose markets (*Hoffmann-LaRoche v. Commission*; *Michelin v. Commission I.*; *British Airways v. Commission*; *Michelin v. Commission II.*; *Intel v. Commission*). The Directorate General Competition Discussion Paper of 2005 and equally so the European Commission’s Guidance Paper 2009 made rebates a central issue in its review of the enforcement of Art. 82 EC. They suggested evaluating the legality of rebates on a case-by-case basis (DG Competition, 2005; European Commission, 2009), challenging the European Court of Justice’s (ECJ) per-se approach. The ECJ did not follow the Commission’s suggestions in *British Airways v. Commission*, although it seemed to be willing to consider potential efficiency-enhancing effects of rebates more seriously (*British Airways v. Commission*, no. 86). This paper is a contribution to the research assessing the potential foreclosure effects of rebates in dominated markets.

As the cases discussed in this section show, targeted threshold rebates are frequently used on retail markets. But they are common on consumer markets as well. Airlines offer miles or points that can be traded for “free” flights once enough miles or points have been collected by flying with the same airline repeatedly. Once certain amounts of miles per year are transgressed special statuses are awarded. European fashion boutiques (Anson’s, Peek & Cloppenburg) run a threshold rebate scheme that sets several increasing targets, yielding increasing rebates. This aims at obtaining targets close to total requirements during the reference period when facing heterogeneous consumer demand. A German supermarket chain (Tengelmann) is offering target rebates

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<sup>2</sup> COMP/E-2/36.041/PO — Michelin, no. 224.

with a fixed threshold in turnover that consumers can reach several times during one reference period. An example for a consumer rebate managing well to set a target close to total expected demand for all heterogenous consumers is a scheme applied by Lufthansa, a German airline: In its “setting goals” program, Lufthansa asks consumers to set a target stating how many miles they will fly during the next three months. If consumers reach the target, they earn an additional amount of bonus miles that is bigger the higher the target was set. This gives customers an incentive to set the threshold at their truly expected demand for the three-month period. This scheme falls within a safe harbor of European law. From a Commission decision, it is concluded that rollback rebates with a reference period equal to or shorter than three months are not illegal (*Michelin v. Commission II*, no. 216). Given that Lufthansa is dominant on several routes to and from Germany, this could suggest that Lufthansa was aware that its consumer rebate would have violated European antitrust law had it had a longer reference period.

But consumers might not be certain about their exact demand. Ultimately, deciding about how reasonable it is for them to buy into the rebate scheme involves risk. We will investigate how consumers react to buying in targeted threshold rebate schemes. We report findings from an experiment that was designed to find out whether individuals stick to targeted consumer rebate schemes even when remaining in the rebate scheme yields less expected payoff than switching to a fixed price scheme. In a line of consecutive decisions, subjects can choose between buying a token in a rebate scheme and an outside option. The outside option yields a constant immediate payoff. The token yields a constant certain payoff that is lower than that of the outside option but conveys the chance to acquire a rebate granted at the end of the experiment. The rebate is granted on condition that a minimum number of tokens are purchased. In the beginning of the experiment, the expected payoff of buying tokens exceeds the expected payoff of choosing the outside option. During the experiment, an external shock can reduce the likelihood that the subject will be able to buy the minimum amount of tokens required to get the rebate. This shock reduces the expected payoff of buying tokens below that of choosing the outside option. In case a negative shock occurs, subjects striving to maximize their expected payoff should exit the rebate scheme and choose the outside option for the remaining consecutive decisions. In contrast, we find the existence of a stickiness effect of target rebates. Subjects do not leave the rebate scheme even if it becomes obvious that their expected requirements make reaching the rebate target unlikely. This effect becomes stronger the longer subjects have been in the rebate scheme before the shock arises. Given these results, this experiment is the first to show a stickiness effect in a consumer setting and the first to show that the stickiness of a rebate increases in the length of its reference period.

We discuss implications for competition law, but also aim to investigate which circumstances influence the stickiness of rollback rebates in consumer settings. For this, we consider Prospect Theory (Kahneman/Tversky, 1979), which in combination with mental accounting has been suggested as a model to explain the sunk cost effect (Thaler, 1999) as well as the attraction of rebate schemes (Beckenkamp/Maier-Rigaud, 2006).

We proceed as follows: in the next section, we review the existing literature in the field. The third section explains how uncertainty can create stickiness of rebates on consumer markets and derives three hypotheses. In section four, we introduce our experimental paradigm. Section five reports the results. In the sixth section, we discuss our results. The last section concludes with some policy implications.

## II. Literature

We look at a type of rebate commonly referred to as “target rebate”, “all-unit discount”, “roll-back rebate” or “threshold rebate”, each name stressing a different feature of basically the same rebate type. In the remainder of this paper, we will use these names interchangeably to describe a pricing scheme that grants a significant price reduction on all units bought during a certain reference period if the customer transgresses a certain threshold within that reference period. The threshold is defined in terms of turnover or quantity. Such rebates place the customer in a situation of risk or even uncertainty<sup>3</sup> about the price if he cannot predict his demand during the reference period with sufficient precision.

Conventionally, threshold rebates are associated with potential market foreclosure because of their “suction effect”, which is caused by very low – possibly negative – prices at the margin (Gifford/Kurdle, 2008, p. 36; Kallaugher/Sher, 2004, p. 267; OECD, 2002, 132; DG Competition, 2005, no. 153): For the last unit that makes the buyer reach the rebate threshold he pays the price but gets the rebate. The rebate may be larger than the price for many individual units rendering the price for the last orders negative. This can lead to market foreclosure if there is a significant asymmetry between the entrant and the incumbent. Examples would be capacity constraints on the part of the entrant, a bundled rebate by the incumbent that includes a monopoly product or reputation advantages. This suction effect is one reason why rebates have been shown to have a significant potential to cause inefficient exclusion of rivals if there are switching costs and at least one seller is financially constrained (Ordovery/Shaffer, 2007). Rollback rebates can also have the effect of an exclusive dealing contract (Gual et al, 2005), which can lead to inefficient foreclosure if entry is uncertain (Aghion/Bolton, 1984) or buyers face a coordination problem (Rasmusen et al. 2006). The length of the reference period has been identified to be irrelevant if all agents are rational payoff maximizers (Maier-Rigaud, 2005). Nonetheless, the length of the reference point plays a prominent role in the assessment of rebates by the European Court of Justice. The effects of rollback rebates can be exacerbated in terms of welfare, if there is intense competition between entrants, which can cause the incumbent to sell inefficiently high quantities before entry occurs (Feess/Wohlschlegel, 2007). Threshold rebates can lead to higher prices because they can lower the incentive to compete for free buyers if every price reduction on free buyers means a price reduction for buyers in the rebate scheme, too (Elhaug, 2008).

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<sup>3</sup> We distinguish risk from uncertainty in that under risk probabilities are known at least in reasonable approximation while under uncertainty probabilities are unknown.

While the above studies point out negative effects, there might be positive effects associated with rollback rebates as well. They can eliminate inefficiencies like double marginalization and arise profitably even without any exclusionary purpose (Kolay/Ordover/Shaffer, 2004). So welfare effects seem to be ambiguous (see as well, with similar conclusions, Greenlee/Reitman/Sibley, 2008 and Greenlee/Reitman, 2004).

A widely overlooked feature of threshold rebates is their similarity to sunk cost situations. The extensive literature on sunk cost shows that people are reluctant to abandon a project in which they have sunk cost, even if the project turns bad (Arkes/Blumer, 1985). Retailers might choose to buy the product at a higher price from the incumbent if the latter promises to grant a rebate in case the retailer manages to reach a certain threshold in turnover with the said product. The price difference between the high price with the incumbent and the low price with the entrant thus becomes a sunk investment into the project of attaining the rebate and the higher profit coming with it. Notwithstanding this feature of threshold rebates, all literature on rebates cited above assumes fully rational buyers that maximize payoffs. So the predictions of these models might be flawed because it is not unlikely that they do not correspond to actual human behavior.

Behavior vis-à-vis sunk cost has been studied to some extent in the context of mail-in rebates, where it was shown that a mixture of naïveté about self-control, sunk cost and regret can explain why people are unable to redeem their rebates as intended (Drago/Kadar 2006; Edwards 2007; Soman/Gourville 2005).

Our study is the first to investigate targeted consumer rebates experimentally, particularly taking into account the absence of salient losses and the transparency of the task. It is also the first to identify the length of the reference period as one of the factors increasing the stickiness of rebates.

There is only one experiment that studied non-rational attraction effects of threshold rebates. Beckenkamp and Maier-Rigaud (2006) found first support that in complex, simulated retail markets subjects stick to a rebate scheme, even if maximizing the expected payoff would suggest exiting. Although being a first intriguing approach to tackle the problem, the study does not investigate what circumstances influence this effect and it has some severe limitations preventing the results to generalize beyond the specific retail context of the experiment.

While the Beckenkamp/Maier-Rigaud- retailer simulation was highly complex, consumer settings often are simple and transparent, making it easy to realize changes that require a change of behavior. In our experiment we used very simple consumer decisions with the external shock being very salient. Furthermore, our experiment is the first one to investigate which factors cause rebates to be sticky. Knowing these factors can help to target enforcement measures appropriately, thereby preventing over- and under-enforcement.



### III. Uncertainty and Stickiness

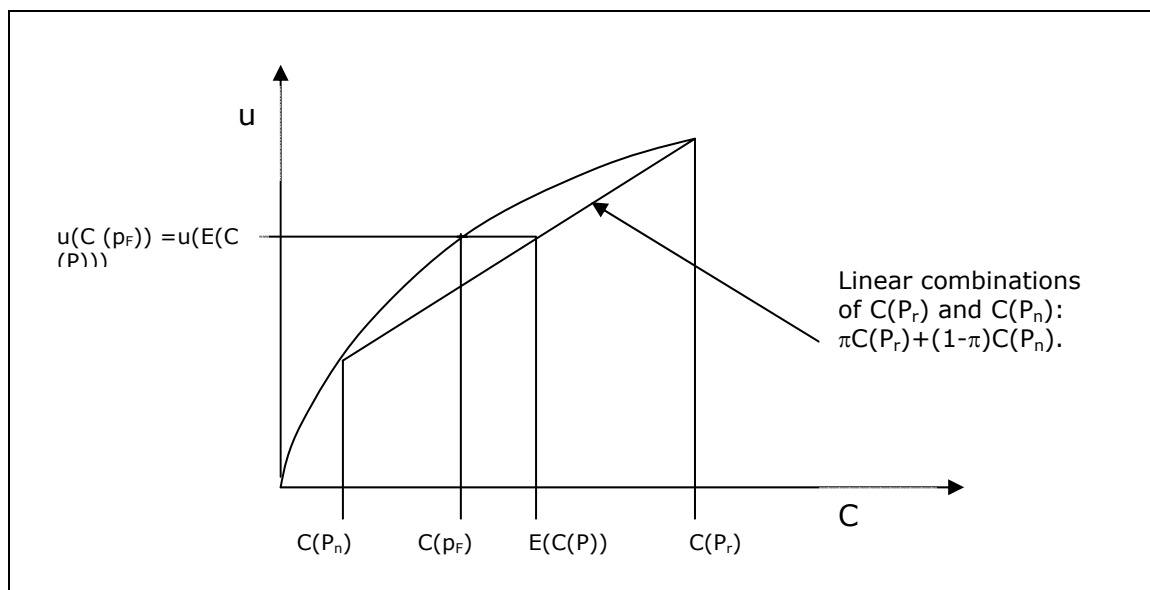
In this study we focus on the question if rebates are sticky once the consumer has entered the rebate scheme. The question how consumers choose to enter a rebate scheme will not be center stage in this paper. It might be an interesting issue for further research, once the question has been settled, whether buying in a rebate scheme impedes rational switching (cf. Beggs/Klemperer, 1992).

In the context of market dominant firms, customers will more or less inevitably buy some quantity from the dominant firm. If the dominant firm only offers this quantity in a rebate scheme, most, if not all, consumers will buy some quantity in a rebate scheme.

It has been argued that it is time to start thinking about what implications the insights of behavioral economics have for competition enforcement (Stucke, 2007; Tor, 2002). In the United States, any non-rational reaction of buyers towards rebate schemes seems to have been neglected so far. In Europe, on the other hand, there are several statements by enforcement agencies and Courts that might reflect that non-rational behavior has greater weight in European competition law enforcement. In its decision in the case *Michelin II. v. Commission (at no. 224)*, the Commission explicitly refers to the psychological state into which the rebate system puts buyers, thus buttressing the abusiveness of the rebate scheme in question.. Both in *Michelin v. Commission I.* and *Michelin v. Commission II.*, the Court follows the Commission's reasoning that the uncertainty induced by rebates increases the market-foreclosing effect of rebates (*Michelin v. Commission I., no. 78; Michelin v. Commission II., no. 50*). This view is repeated in the Commission's discussion paper of 2005. Neither in the decisions nor in the discussion paper does the Commission state reasons for this view.

#### **The ban on specific targeted rebates from a rational choice perspective**

From a classic rational choice (RC) perspective, the claim of the Commission and the Courts does not hold. According to RC models, and under the common assumption of decreasing marginal utility of wealth, rebates that induce uncertainty about the price should even be less attractive to consumers than a fixed price scheme yielding the same expected value. Rebates induce a splitting of the possible outcomes in wealth in a high and a low one (i.e., reach the rebate or not). The expected utility of buying in the rebate scheme will always be smaller than the utility of an alternative that offers a safe payoff equal to the expected value of the rebate scheme. To yield the same utility as a fixed price scheme, a rebate scheme would have to offer an expected consumer surplus higher than the surplus offered by the fixed price scheme (see Figure 1). Hence, splitting an offer in two uncertain outcomes, for example by offering a rebate, should make a pricing scheme less, not more, attractive. Thus following RC a rebate scheme by the incumbent should lead to less instead of more foreclosure. Notwithstanding the fact that the longer a consumer has bought in the rebate scheme the more likely attaining the rebate becomes, the exposed reasoning will be the same before entering the rebate scheme and after.



**Figure 1.** This figure shows a utility function of consumer surplus ( $C$ ) with decreasing marginal utility ( $u$ ). A rebate scheme can result in a low price ( $P_r$ ) yielding a high consumer surplus with a probability  $\pi$  or a high price ( $P_n$ ) yielding a low consumer surplus with probability  $(1-\pi)$ . This leads to an expected price  $E(P)$  yielding the expected consumer surplus  $E(C(P))$ . We consider a fixed price ( $p_F$ ) yielding an intermediate consumer surplus. Given a concave utility function to be as attractive as the rebate, the fixed price can be lower than the expected price in the rebate scheme.

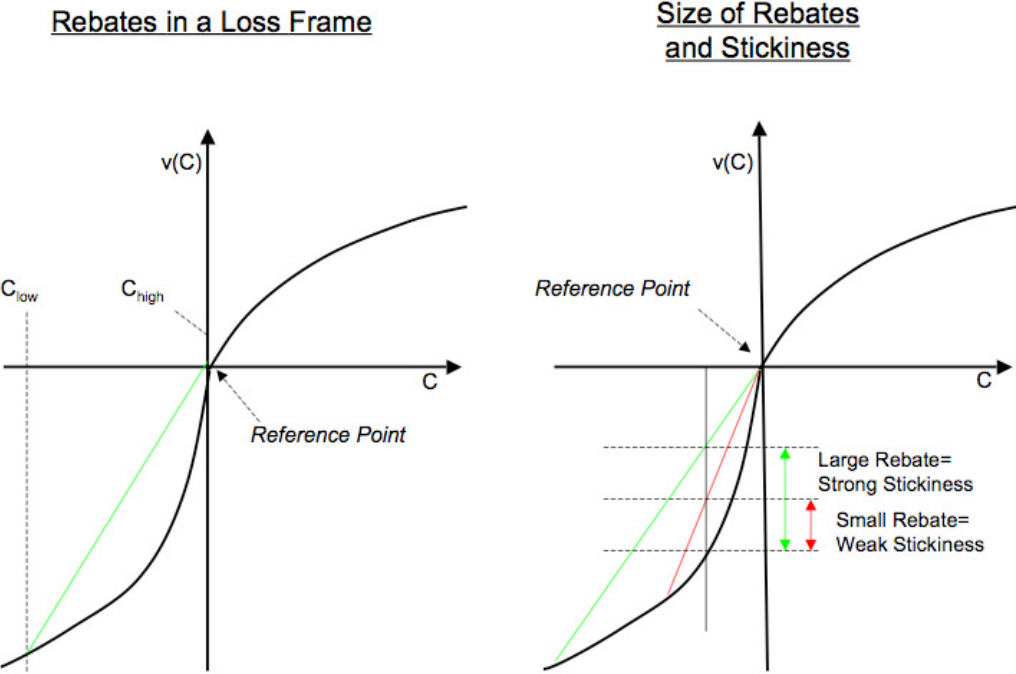
### Alternative Explanations: The behaviorally informed perspective

A sunk cost effect could explain what the European Courts and the Commission have in mind implicitly when stating that uncertainty might increase a foreclosure effect.

Prospect Theory is probably the most prominent behavioral model of decision making that accounts for sunk cost effects (Thaler, 1999). In contrast to expected utility models (von Neumann/Morgenstern, 1944; Savage, 1954), Prospect Theory (Tversky/Kahneman, 1979) suggests that individuals evaluate decision outcomes with respect to a reference point, which is usually the status quo. Negative deviations are coded as losses, positive deviations as gains. Losses loom larger than gains. Individuals are risk-averse in the domain of gains while they seek risks in the domain of losses.

Particularly in a Prospect Theory framework, specific reference point shifts would lead to the prediction of a stickiness of rebates: Applied to our rebate scenario, Prospect Theory predicts stickiness under the condition that at least the lower outcome is considered a loss and the higher outcome is closer to the reference point than the lower is. This would lead to risk-seeking behavior: Splitting the outcomes into two uncertain ones (a high outcome if the rebate is reached, a low one if it is missed) will increase the attractiveness of the “split” option and thus make a rebate scheme more attractive than a fixed price if both offer the same expected value. More technically speaking, if both prices are considered to be losses, they fall in the domain where the util-

ity function is convex, indicating risk-seeking behavior. Here, all linear combinations lie above the curve (Figure 2).



**Figure 2.** The consequences of rebates in the loss frame (left) and the influence of the size of the rebate on its stickiness according to the predictions of Prospect Theory.  $C$  denotes consumer surplus and  $v(C)$  denotes the value function of Prospect Theory for the consumer surplus.

On consumer markets, however, it does not seem plausible to assume that individuals act in the loss frame simply because they pay prices. It seems more compelling to assume that consumers normally integrate the benefits and costs of a purchase and thus see most acquisitions as gains. But it also seems plausible that consumers, once they have entered the rebate scheme, shift their reference point to the outcome, which includes the rebate. So stickiness would occur once customers have entered the rebate scheme. Reference point shifts are still difficult to predict. But it has been shown that setting goals can shift a person’s reference point (Early: Payne/Laughunn/Crum, 1981; see as well: Heath/Larik/Wu, 1999). Similarly, hope could shift a reference point (Thaler, 1985; Tversky/Kahneman, 1981; Kahneman/Tversky, 1979). Recently lagged rational expectations have been proposed to switch reference points as well (Kőszegi/Rabin, 2006). It seems natural to assume that consumers start seeing the rebate as a goal they want to reach and hope for reaching it. Equally, they may expect to reach the rebate, only adapting their expectations with some time lag once an external shock has made reaching the rebate unlikely.

According to the Prospect Theory value function, the stickiness of rebates should depend on the difference between the reference point and the lower outcome which is coded as a loss: if we neglect the probability weighting function for simplicity, a risky option yielding a payoff of A with probability  $\pi$  and a payoff B with probability  $(1-\pi)$  has a utility that corresponds to a linear combination of the utility of A and the utility of B. Because of the convexity of the value function below the reference point, the utility generated by the linear combinations of A and B lie above the utility function on a straight line (see Figure 2, left). The utility difference between a risky option and a certain payoff with the same expected payoff becomes bigger with an increasing difference between the two possible payoffs (see Figure 2, right). Hence, according to Prospect Theory, the stickiness of a target rebate should increase with an increasing absolute price of each single unit, with an increasing number of units that have to be bought to reach the threshold, and with an increasing percentage of the discount rate.

As explained above (see Figure 2, right), the option yielding the split outcome becomes more attractive in the loss frame the bigger the difference between the possible outcomes for getting the rebate is. In our experiment, this difference is dependent on the number of units bought ( $D$ ), the discount rate ( $R$ ), and the price ( $P_n$ ). We have indirectly manipulated the number of units bought ( $D$ ), constituting our sunk costs proxy by offering more opportunities to buy. Furthermore we have manipulated the price ( $P_n$ ) together with the discount rate ( $R$ ), constituting the factor variance.

We derive the following hypotheses:

- 1) After entering a rebate scheme, participants continue buying in a rebate scheme even if switching to an outside option would yield a higher expected payoff.
- 2) More people will get stuck in the rebate scheme the more costs buyers have sunk into getting the rebate before.
- 3) The stickiness increases if the size of the rebate (difference between the profit if the rebate is attained and the profit if the rebate is missed) is increased, which can be reached by increasing the price per unit prior to the deduction of the rebate and a higher discount rate.

Testing the first hypothesis is particularly difficult with field data. In natural purchasing decisions, consumers' surplus is calculated as the difference between the willingness to pay and the price paid. The willingness to pay is usually not known *ex ante* but elicited from purchasing behavior. Therefore, if there is a pattern of distorted consumer behavior, which leads consumers to buy in the rebate scheme despite a lower expected surplus, a field study could tend to interpret this as a preference for the product offered in the rebate scheme. In an experimental setting, we can induce the willingness to pay and do not need to elicit it from the purchasing behavior. In this way we can clearly see whether "rebates are sticky".

## IV. The Experiment

Our experimental setup is meant to test whether buyers indeed maximize expected payoff. It models purchases in a rebate scheme.<sup>4</sup> Buyers choose between a token and an outside option in every round. In each round, they have the same willingness to pay for the token. If the round is omitted, however, they can neither buy a token nor opt for an outside option. This is supposed to mirror regular buying behavior, including the possibility that even if a consumer buys a good on a regular basis, there will be times when he does not need it. An example would be plane tickets. Even if you have planned your travel activities for the whole year, you might be forced to cancel a flight at short notice. Buyers' demand in omitted rounds is zero. Seen over all rounds played, the subject's payoff in a rebate scheme can be either high or low:

$$\Pi_r = D(W - P_n) + P_n DR \quad \text{if } D \geq \theta \quad (1)$$

$$\Pi_n = D(W - P_n) \quad \text{if } D < \theta \quad (2)$$

$\Pi_r$  denotes the payoff that buying in the rebate scheme yields in case the rebate is attained. Accordingly  $\Pi_n$  denotes the payoff of buying in the rebate scheme in case the rebate is missed.  $D$  (demand) denotes the number of units bought;  $\theta$  denotes the threshold for the rebate.  $W$  denotes the maximum willingness to pay for each unit, which for reasons of simplicity is induced to be constant by paying subjects a fixed amount for every token bought (Smith, 1976).  $P_n$  denotes the price paid for the good if there is no deduction by a rebate and  $R$  denotes the discount rate, i.e., the percentage of price reduction the rebate would grant.

Thus, the difference between  $\Pi_r$  and  $\Pi_n$  is  $P_n D_H R + (D_H - D_L)(W - P_n)$ .  $D$  here is indexed H or L depending on whether it is weakly larger than  $\theta$  (H for high) or strictly smaller (L for low). It is obvious that this difference increases in  $R$  and  $D_H$ . Depending on the parameters, the difference between  $\Pi_r$  and  $\Pi_n$  can increase in  $P_n$  as well. This is the case if  $D_H R > D_H - D_L$  because the first derivative of the difference between  $\Pi_r$  and  $\Pi_n$  with respect to  $P_n$  is  $D_L - D_H + D_H R$ . This derivative is positive if  $D_H R > D_H - D_L$ . This condition was fulfilled in our experiment. In the experiment we manipulated the maximum  $D_H$  that could be reached,  $R$  and  $P_n$ .

### Participants and design

The experiment was conducted in October 2008 at the Max Planck Institute in Bonn. Participants were recruited from a subject pool of about 900 individuals using ORSEE (Greiner, 2004). The majority of participants were university students, from a wide variety of subject backgrounds. A total of 64 participants (mean age: 24, 37 female) took part in the 6 sessions. The study lasted between 60 and 90 minutes and participants received a performance-contingent payoff (range:

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<sup>4</sup> Note that the following is not a theoretical model but an explanation of the fundamental logic of our experiment.

0.94 € to 17.80 €)<sup>5</sup> in exchange for their participation. Participants were randomly assigned to one of the four conditions.

## Procedure

Apart from the experimental instructions and a control questionnaire, the experiment was fully computerized. First, participants read the experimental instructions and answered a control questionnaire to ensure that they had understood the instructions. Payoffs in the experiment were stated in Euro. Subjects were provided with pocket calculators they could use at any time during the entire experiment. After the actual experiment we elicited the subjects' risk aversion using the Holt/Laury (2002) scale<sup>6</sup> and their loss aversion using the Gächter/Johnson/Herrmann (2007) scale<sup>7</sup>.

In our experiment, participants decide in each of several repeated purchase situations (rounds) whether they want to buy a token or take an outside option (Figure 3 below). We induce the willingness to pay for tokens by paying subjects a predefined amount  $W$  per token at the end of the experiment. Tokens are sold for a price  $P_n < W$ . If the subject manages to buy tokens at least up to the rebate threshold, she receives a rebate of  $P_n DR$ ,  $D$  standing for the number of tokens bought and  $R$  denoting the discount rate. The rebate threshold  $\theta$  is equal to the maximum number of rounds played minus one, which we denote as  $\theta = D_{\max} - 1$ .  $D_{\max}$  denotes the maximum number of tokens a subject can buy and is equal to the maximum number of rounds played because a subject can buy a maximum of one token in each round.

Choosing the outside option yields a fixed positive payoff that we call  $O$  with

$$O > W - P_n \quad (3)$$

Choosing the outside option does not contribute to reaching the rebate threshold.

Risk with respect to whether the subject can reach the rebate threshold is induced by the fact that two rounds can be omitted with a known probability: the round that emerges five rounds before the end (which we call the "critical round") and the last round. If a round is omitted, subjects can neither buy a token nor opt for the outside option, thus receiving a payoff of 0. The critical round takes place with a probability of  $\pi_C = 83\%$ . The last round is played with a probability of  $\pi_L = 15\%$ . The random draws which realize  $\pi_L$  and  $\pi_C$  are independent. This was common knowledge to all

<sup>5</sup> These payoffs include the gains and losses subjects incurred when they chose and played the lotteries measuring their risk preferences and loss aversion.

<sup>6</sup> Holt/Laury (2002) propose a way to measure risk aversion by letting subjects choose one lottery from each of ten pairs of lotteries. Each pair contains a low-risk lottery yielding 2 € with probability  $\pi$  and 1.60 € with probability  $1 - \pi$  and a high risk lottery yielding 3.85 € and 0.10 € with the same probabilities.

<sup>7</sup> The Gächter/Johnson/Herrmann-Scale is based on six choices between playing a lottery or rejecting it. Each lottery has a fifty-fifty chance of winning 6 € or losing between 2 and 7 €. A  $\lambda > 2$  means that the subject is not willing to play a lottery offering a 50% chance of winning 6 € and a 50% chance of losing 3 € or more.

subjects. The possibility of rounds being omitted reflects the possibility that expected purchases turn out not to be needed.

Ex ante, consistently buying in the rebate scheme for the whole experiment yields an expected payoff of

$$E(\Pi_R) = (D_{\max} - 2)(W - P_n) + \pi_C(\pi_L(2(W - P_n) + P_n D_{\max} R) + (\pi_C(1 - \pi_L) + (1 - \pi_C)\pi_L)((W - P_n) + P_n(D_{\max} - 1)R) \quad (4)$$

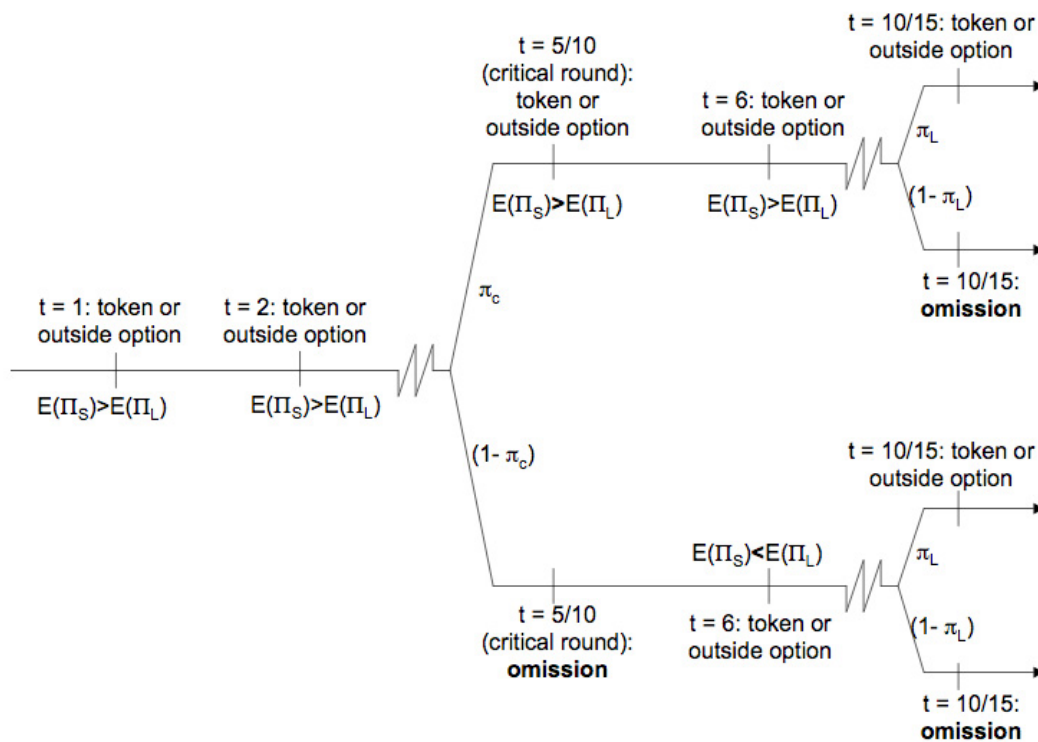
Seen from the first round, the expected payoff of consistently choosing the outside option can be written as

$$E(\Pi_O) = (D_{\max} - 2)O + \pi_C \pi_L 2O + (\pi_C(1 - \pi_L) + (1 - \pi_C)\pi_L)(D_{\max} - 1)O \quad (5)$$

We chose parameters such that  $E(\Pi_R) > E(\Pi_O)$ . Thus, a maximizer of expected payoffs should start buying the tokens in the rebate scheme from the first round on. Only a person with quite a pronounced risk aversion should start not buying tokens but choosing the outside option. Switching from tokens to the outside option yields an increase in immediate payoff of  $O - (W - P_n) > 0$ , but this does not compensate sufficiently for the decrease in probability of attaining the rebate. Thus, switching back and forth between buying a token and not buying a token (outside option) is not a reasonable strategy for a maximizer of expected payoffs in our experiment.<sup>8</sup>

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<sup>8</sup> A subject that has only bought tokens up to the “critical round” – the first round that can be omitted – reaches the rebate with a probability of  $\pi_C + (1 - \pi_C)\pi_L = 0.8555$  if she goes on only buying tokens. This is because the rebate threshold is  $(D_{\max} - 1)$  in all treatments. As a consequence, subjects at least have to buy a rebate scheme token in all but one rounds to attain the rebate. Thus, if they buy a rebate scheme token every time they can, they get the rebate unless two rounds are omitted. Switching to the outside option and back only once before the critical round reduces the probability of getting the rebate to  $\pi_C \pi_L = 0.1245$ , i.e., if only one more round is omitted, the rebate is lost. Similarly, it is not worth switching back from the outside option to buying rebate scheme tokens once an outside option has been chosen because the rebate scheme tokens yield a smaller immediate payoff, and the probability to attain the rebate is so low after one such switch that the subject should decide by immediate payoffs and opt for the outside option.



**Figure 3.** Procedure of the rebate experiment.  $E(\Pi_R)$  here stands for expected payoff of consistently buying tokens in all remaining rounds,  $E(\Pi_O)$  stands for expected payoff of consistently choosing the outside option in all remaining rounds,  $t$  gives the number of the round. Starting with the critical round  $t$  takes the first value in treatment 1 and 3 and the second value in treatments 2 and 4, respectively.

The payoffs and probabilities are set in such a way that if the critical round was omitted for a subject who bought tokens in each previous round, the probability of reaching the rebate would decrease from  $\pi_C + (1 - \pi_C)\pi_L = 0.8555$  to  $\pi_L = 0.15$ . From this moment on, the expected payoff of buying tokens would be lower than that of choosing the outside option. Before it was randomly determined whether the critical round would be omitted or not, we had subjects commit to what they would do both in case the critical round was omitted and in case it took place. We chose this approach because stickiness only matters if the critical round is omitted, so that the expected payoff of staying in the rebate scheme is lower than the payoff of exit. This situation will only arise with some of the subjects. Letting subjects commit themselves to their decision for both possible events allows us to elicit a decision where stickiness matters from every subject.

Our 2 (variance)  $\times$  2 (number of rounds/sunk costs) design resulted in four treatment conditions, which will now be described in detail (see also Table 1 for an overview).

### Treatment 1: low sunk cost, low variance

In treatment 1, subjects play a maximum of  $D_{\max} = 10$  rounds. Rounds 5 and 10 can be omitted. Each token has  $W = 1.30$  €, which is paid to participants at the end of the experiment for every



token they bought. Each token can be bought for  $P_n = 1.10$  €, yielding an immediate minimum payoff of 0.20 €. If the rebate threshold  $\theta = 9$  tokens is reached or transgressed, a discount rate of  $R = 49\%$  is granted in the end on the full price paid for all tokens bought during the experiment, thus granting a payoff of at least  $9 \times 0.74$  € = 6.66 € (max.  $10 \times 0.74$  € = 7.40 €) in case the rebate was reached. In each round in which subjects choose the outside option, they are awarded an immediate fixed payoff of  $O = 0.44$  € (totaling in 4.40 € when consistently opting for the outside option). The opportunity costs sunk until the critical round are  $4(O - P_n) = 0.96$  € (12.97% of the maximum payoff in the rebate scheme).

### **Treatment 2: high sunk cost, low variance**

Treatment 2 is set up in the same way as treatment 1, but subjects play  $D_{\max} = 15$  decision rounds instead of 10. Therefore  $\theta = 14$ . Round 10 and 15 can be omitted in the same way as in treatment 1. The discount rate is reduced to  $R = 31.5\%$  to keep expected payoffs equal to the situation when round five is omitted in treatment 1. This results in more “sunk opportunity cost” in the rebate, because subjects who aim for the rebate will have to choose a lower immediate payoff over a high one more often (nine times instead of four) before they decide what they will do in case round ten is omitted. The payoff of consistently buying tokens can vary between  $13 \times 0.20$  € = 2.60 € if the threshold is missed and at least  $14 \times 0.546$  € = 7.651 € (max.  $15 \times 0.546$  € = 8.19 €) if it is reached. The outside option fixed payoff remains  $O = 0.44$  € (or 6.60 € in total when consistently opting for the outside option). The opportunity costs sunk until the critical round are  $9(O - P_n) = 2.16$  € (26.37% of the maximum payoff in the rebate scheme).

### **Treatment 3: low sunk cost, high variance**

Treatment 3 corresponds to treatment 1, but shifts payoff for buying tokens from the immediate payoff to the rebate. Therefore the price of tokens in this treatment is  $P_n = 1.25$  € while the discount rate is  $R = 80.01\%$ . This results in a lower payoff if the rebate is missed ( $8 \times 0.05$  € = 0.40 €) and in a higher payoff if the rebate is attained (at least  $9 \times 1.05$  € = 9.45 €, max. 10.50 €). The outside option fixed payoff remains  $O = 0.44$  € (4.40 € over 10 rounds). The opportunity costs sunk until the critical round are  $4(O - P_n) = 1.56$  € (14.85% of the maximum payoff in the rebate scheme).

### **Treatment 4: high sunk cost, high variance**

Treatment 4 corresponds to treatment 2, but increases the price for tokens to  $P = 1.25$  € and sets the discount rate to  $R = 51.43\%$ . Thus, the payoff for consistently buying tokens is  $13 \times 0.05$  € = 0.65 € if the threshold is missed and at least  $14 \times 0.69$  € = 9.70 € when it is reached; the outside option remains, again, at a value of  $O = 0.44$  € immediate payoff per choice (6.60 € over 15

rounds). The opportunity costs sunk until the critical round are 9 ( $O - P_n$ )=3.51 € (33.91% of the maximum payoff in the rebate scheme).

For a subject who has consistently bought tokens up to the critical round, the expected payoff of remaining in the rebate scheme is held constant over all treatments for the decision right after the critical round has been omitted. The same accounts for the expected payoff of exiting the rebate scheme for the outside option. In this situation, the expected payoff of remaining in the rebate scheme is 1.56 €. The expected payoff of leaving the rebate is 1.83 €.

**Table 1:** Manipulations and Expected Payoffs

	T 1	T 2	T 3	T 4
Sunk Costs	Low	High	Low	High
Variance	Low	Low	High	High
$D_{\max}$ (maximal # of rounds to play)	10	15	10	15
$\theta$ (# of rounds to get the rebate)	9	14	9	14
$P_n$ (price without rebate)	1.10 €	1.10 €	1.25 €	1.25 €
R (discount rate in percent)	49 %	31.5 %	80.01 %	51.43 %
W (induced willingness to pay for token)	1.30 €	1.30 €	1.30 €	1.30 €
Expected payoff of staying in rebate scheme immediately after critical round was omitted*	1.56 €			
Expected payoff of leaving the rebate scheme immediately after critical round was omitted **	1.83 €			

\*given by:

$$4(W - P_n) + p_L((W - P_n) + P_n(D_{\max} - 1)R) \quad (6)$$

\*\* given by:

$$4O + p_L O \quad \text{where } O = 0.44 \text{ Euro} \quad (7)$$

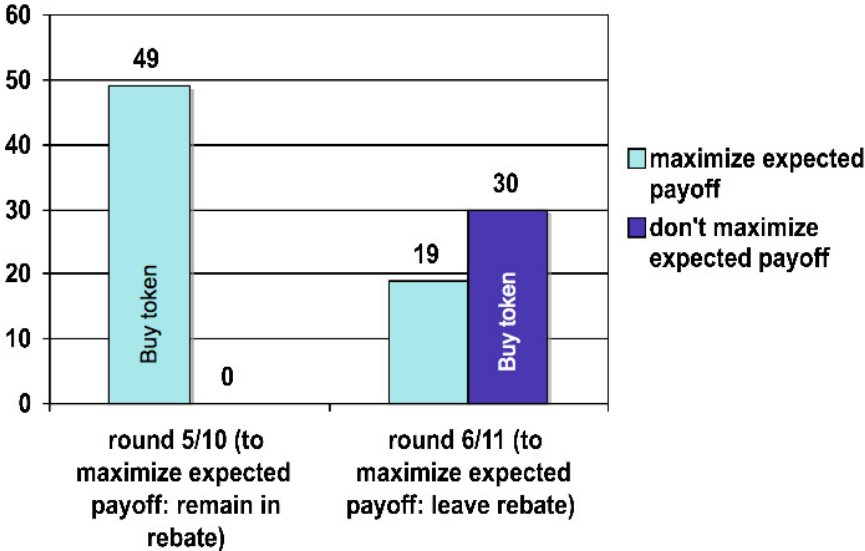
Thus, for all treatments a subject who always chooses the option with the highest expected value would start buying rebate scheme tokens until the critical round. In case the critical round is omitted, she would not buy tokens in the remaining rounds. In case the critical round takes place, she knows she has attained the rebate for sure and would go on to buy tokens for the rest of the task.

Each subject played only one treatment task to prevent subjects from playing meta-strategies or diversifying risk over several tasks.

## V. Results

Only four subjects did not buy a token in round one and kept choosing the outside option consistently until the last round. This behavior is consistent with a strong risk aversion (see Table 3, below) By far the most subjects started buying rebate scheme tokens, which is consistent with maximizing expected payoff.<sup>9</sup>

Our analysis focuses on the behavior of subjects who entered the rebate scheme (Figure 4, right). We investigate behavior for the subjects' choices immediately after it is determined whether the critical round takes place or not. As explained, for those 49 subjects who have bought tokens in the rebate scheme consistently up to the critical round, it yields a higher expected payoff to buy a rebate scheme token than choosing the outside option in case the critical round takes place. If the critical round is omitted, the outside option yields a higher expected payoff for any subject, including even those who have bought tokens consistently up to the critical round.



**Figure 4.** Choices of subjects accepting the rebate in the critical and the following round. Accepting the rebate in round 5 or 10 respectively meant maximizing expected payoff, while in round 6 and 11 the expected payoff was maximized by exiting the rebate scheme.

The first result of the experiment is that if the critical round takes place, i.e., in situations when maximizing expected payoff would suggest buying a token in the critical round, 49 out of 49 times we observed the expected payoff maximizing choice to buy a token. If the critical round was omitted, however, 30 of these participants chose the rebate option in the round following the

<sup>9</sup> 11 of these subjects switched back and forth between the rebate and the fix price scheme at least once before the critical round. 4 of these 11 subjects chose the outside option more than once before the critical round, indicating that they had trouble understanding the task.

critical round, thus not maximizing expected payoffs. The rebate scheme thus descriptively creates an effect of stickiness.

To test whether this change might be due to random fluctuations, we calculated  $\chi^2$ -tests of independence on the observed choice frequencies. We tested whether buying or not buying was independent of whether it meant maximizing expected payoffs to do so or not. The test turned out to be highly significant,  $\chi^2(1, N = 98) = 43.2, p < .001$ . Including rebate avoiders and undecided participants in the analysis essentially leads to the same result,  $\chi^2(1, N = 128) = 44.54, p < .001$ . Hence, we found strong support for our first hypothesis that rollback rebates are sticky. Our subjects opted for the choice that yielded greater risk and lower expected payoff. This cannot be explained by an unusually risk-seeking sample. Our subjects were mainly risk-averse on the Holt/Laury (2002) scale (6.03 on average, indicating risk aversion).<sup>10</sup> Moreover, subjects were quite loss-averse with a  $\lambda = 2.18$  on the Gächter/Johnson/Herrmann (2007) scale.<sup>11</sup>

The fact that subjects did not understand that omitting the critical round dramatically reduces the probability of reaching the rebate cannot explain our findings either. We asked subjects for their beliefs about how likely it was that they would reach the rebate if the critical round was omitted. People were rewarded if their answer matched the true probability, which was 15%. Of the 36 subjects who bought a token although the critical round was omitted, only 11 overestimated the probability of reaching the rebate.<sup>12</sup>

A pure status quo bias is not likely to explain our results either. Subjects took a new decision every round and were unable to activate a default option. To keep subjects from mindlessly clicking through the experiment, a due waiting period was installed between all rounds. The external shock was clearly visible. It was even highlighted by a change in the mode of decision making from just clicking a button to committing to a decision for two different contingencies. Even the layout of the screen changed significantly.

To strengthen our results, we conducted an incentivized online study in which 131 persons from the same subject pool choose twice between two lotteries, which according to probability and outcome exactly matched the critical decisions in our rebate study (i.e., the decision whether to remain in the rebate after the critical round was cancelled).

Of 262 decisions, 156 were in favor of the option that maximized expected value (corresponding to the decision to exit the rebate scheme if the critical round was cancelled). 106 decisions were

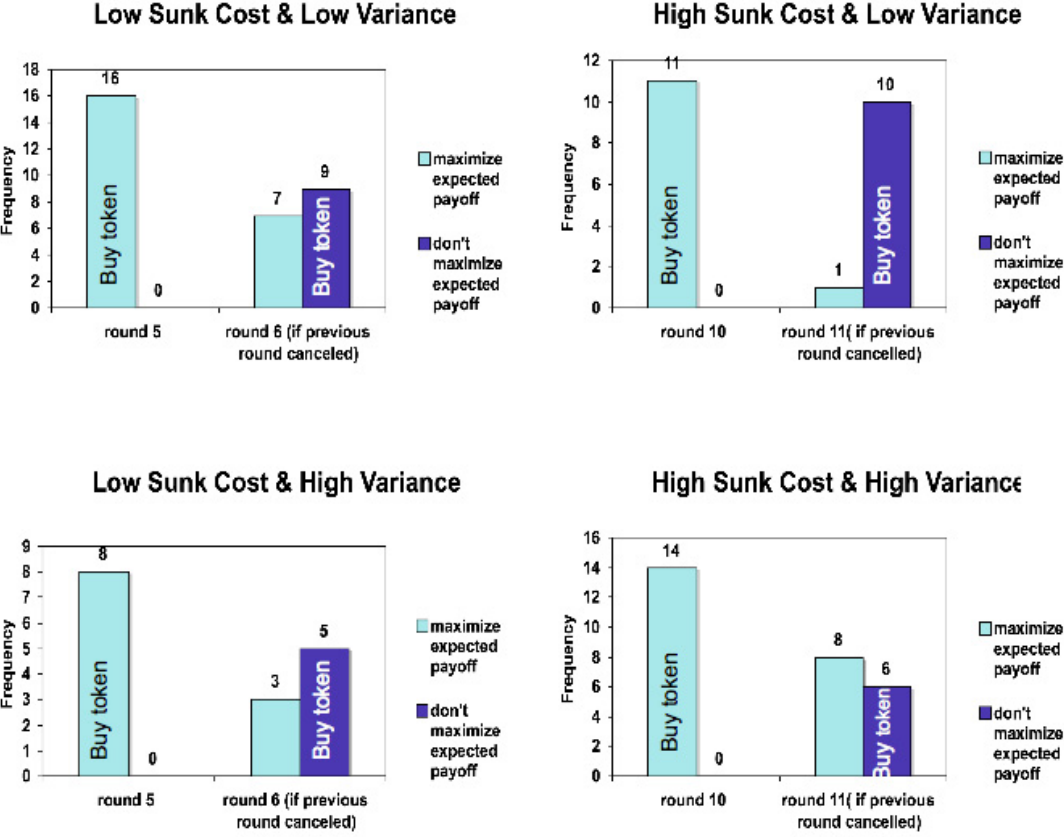
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<sup>10</sup> Seven subjects shied away from a risky lottery although they had opted for the same lottery with less beneficial probabilities beforehand, thus behaving inconsistently. Our subjects showed on average six consistent safe choices (i.e.,  $0.41 < r < 0.68$ ;  $r$  refers to relative risk aversion) which means: The subject would prefer the low risk lottery for all  $\pi$  that are smaller or equal to 60% but would prefer the high risk lotteries for all  $\pi$  that are greater or equal to 70%.

<sup>11</sup> Here five subjects behaved inconsistently by accepting a lottery despite having rejected a more advantageous one beforehand.

<sup>12</sup> If we only include these subjects in our analysis who did not overestimate the probability of achieving the rebate, the stickiness effects stays significant at a level of  $p < .001$ ,  $\chi^2(1, N = 82) = 35.96$ , vis-à-vis the decisions in case the critical round took place. The results stay significant as well at a level of  $p < .02$ ,  $\chi^2(1, N = 304) = 6.08$ , vis-à-vis the choices from the lotteries presented further down.

in favor of the option not to maximize expected payoffs. With a  $\chi^2$ -test we tested whether choice behavior was different between the lotteries and the equivalent decisions in rebate study. The test showed that people choosing in the rebate environment decided significantly less often according to maximizing expected payoffs, compared to people in the lottery selection tasks,  $\chi^2(1, N = 311) = 7.23, p < .01$ .



**Figure 5.** Choices in critical and following round, separated by condition.

To test our second and third hypothesis, which states that stickiness increases with sunk costs and increasing variance, we analyzed choice behavior in the critical round separately for the four treatments (Figure 5). First of all, the significant difference in choice behavior can be found in all four treatments (all  $p < .01$ , treatment 1:  $N=32$ , treatment 2:  $N=22$ , treatment 3:  $N=16$ , treatment 4:  $N=28$ ), indicating that the stickiness effect is generally robust.

To investigate the second and third hypothesis statistically, we conducted a logistic regression<sup>13</sup> with buying choices not maximizing expected payoff in the critical round (after the previous round was omitted) for the 49 rebate accepters (Table 2). In a first step, we included our manipu-

<sup>13</sup> We estimated the equation  $\dot{Y} = \beta_0 + \beta_1 X_1 + \dots + \beta_n X_n + \varepsilon$  with logit. A value of  $Y=1$  indicated the decision to keep buying in the rebate scheme,  $Y=0$  indicated the decision not to buy in the rebate scheme. The variables  $X_1$  to  $X_7$  are the variables and interactions listed in the regression Table 2.

lated factors variance, and sunk costs as well as their interaction. Then we controlled for gender and age, and finally we also took into account individuals' risk aversion and loss aversion.

**Table 2:** Logistic Regression for Buying Not Maximizing Expected Payoff

	(1) Irrational <sup>14</sup> Buying	(2) Irrational Buying	(3) Irrational Buying
Sunk Costs High (0-no, 1-yes)	2.051 <sup>+</sup> (1.76)	2.511 <sup>*</sup> (1.99)	2.479 <sup>+</sup> (1.87)
Variance High (0-no, 1-yes)	0.260 (0.29)	0.167 (0.17)	-0.487 (-0.44)
IE Sunk Costs*Variance	-2.850 <sup>+</sup> (-1.93)	-3.167 <sup>*</sup> (-1.98)	-2.992 <sup>+</sup> (-1.72)
Gender (0-female, 1-male)		-1.806 <sup>*</sup> (-2.32)	-2.283 <sup>*</sup> (-2.41)
Age		0.103 (0.83)	0.0959 (0.70)
Holt Risk Score			0.238 (0.66)
Loss Aversion ( $\lambda$ )			-0.520 (-0.75)
Constant	0.251 (0.50)	-1.385 (-0.51)	-1.004 (-0.31)
Observations	49	49	45
Pseudo R <sup>2</sup>	0.11	0.20	0.29

Logistic regression on buying choices in the following round (i.e., 6 or 11) after the critical round (i.e., 5 or 10) was omitted. Buying indicates stickiness preventing subjects from maximizing expected pay-offs.

z-statistics in parentheses

<sup>+</sup>  $p < 0.10$ , <sup>\*</sup>  $p < 0.05$ , <sup>\*\*</sup>  $p < 0.01$ , <sup>\*\*\*</sup>  $p < 0.001$

In line with hypothesis 2, we find a (marginally) significant effect of sunk cost on the stickiness of the rebate. Stickiness increases with increasing sunk costs. In contrast, for the third hypothesis, we find no effect of our variance manipulation.

Interestingly we do find a (marginally) significant interaction effect of variance and sunk costs, which was not predicted. Higher sunk cost, combined with higher variance, decreases the stickiness of a rebate. A closer investigation of this effect should be subject to further research.

Additionally we find a significant gender effect. Female subjects were more inclined to stick to the rebate than male subjects, once they had entered the rebate scheme.

<sup>14</sup> We use "irrational" as an abbreviation for non-payoff-maximizing.

In line with the argumentation in the introduction, the logistic regression suggests that risk aversion and loss aversion had no effect on stickiness after the person entered the rebate. As pointed out above, risk aversion seems, however, to play a role in the decision to enter a rebate or not. One would expect that the Holt/Laury risk aversion score should differ between persons who enter the rebate, as compared to those who do not. In a regression, we find such a difference (Table 3). As predicted, highly risk-averse subjects tended to opt for the (safe) outside option from the first round on.

**Table 3: OLS Regression for Risk Aversion**

	(1) Holt Risk Aversion Score
Rebate Avoided (1=yes, 0=no)	1.454* (2.12)
Constant	5.796*** (30.76)
Observations <sup>15</sup>	53

*t* statistics in parentheses

+  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

In sum, our results support the hypothesis that consumer rebates are sticky and lead individuals to keep buying from the supplier who offers the rebate scheme even if this choice does not maximize the consumer's rent.

We do find at least marginal support for the second hypothesis that stickiness increases with increasing sunk costs. No support is found for the third hypothesis that variance in payoffs increases the stickiness of rebates.

## VI. Discussion

Our experiment is the only one we know of to imply a comprehensive task mirroring the particularities of consumer purchases. We find that consumers do not switch out of a rebate scheme in the way they would if they behaved like maximizers of expected payoffs. Rather, they keep buying in the rebate scheme even if the expected payoff of exit is higher. We identify sunk cost as a factor that reinforces the stickiness effect of rollback rebates.

Because the design of our experiment shares the crucial features of buying in rebate schemes, apart from being abstract and simple, its results can cautiously be generalized to retail markets, too. Especially when retail units are small and dominated by individual decision processes, our results should apply. It seems that this condition was fulfilled in the Michelin cases where among the customers of Michelin apparently there were a significant amount of very small car repair

<sup>15</sup> The number of observations here differs from that in Table 2 because we additionally analyze the four subjects who consistently avoided the rebate scheme.

shops. The European Commission therefore appears to be right not to have ignored the psychological state of buyers in its decision.

Ex post the interaction effect of payoff variance and sunk cost could be explained by assuming that high risk and high stakes result in a state of being highly alert to changes in the environment. The fact that subjects know that they act in an environment of risk where they can earn much or go home empty-handed makes the necessity to act vigilantly extremely salient.

This result underlines the significance of the tradeoff a firm faces when constructing a rebate scheme. If it overdoes the induction of uncertainty and combines it with putting lots of consumer surplus in the rebate, its program might end up lowering consumer loyalty.

In our experiment, subjects act in an environment of risk, knowing precisely all of the probabilities involved in the procedure. In repeated purchasing situations outside of the lab, this will hardly ever be the case. Buyers will rather act under uncertainty – not knowing the probabilities with which they reach a demand set. Similarly, they do not know whether a cheaper offer will be available in the future. It seems reasonable to assume, though, that a finding of non-rational behavior under risk will generalize to an environment of uncertainty, as a decision in a less transparent situation (such as one of uncertainty) is more difficult to handle for the individuals, and its actions are thus even more likely to deviate from rationality than in a rather well-structured risk situation.

Furthermore, our experiment was one shot. This was to prevent subjects from playing strategies of diversification, believing they could diminish the risk they faced, and to induce subjects to take the one shot they had as seriously as possible. Diversification strategies would render the data noisy and divert the findings from what we actually wanted to investigate. Our method could trigger the argument that in one-shot-experiments subjects could not learn on the task. We took great care, however, that our subjects would understand the task immediately from the instructions. We let them calculate the expected payoffs of some strategies before the experiment started and pointed out that whether the critical round took place or not was a crucial piece of information for their decision. We modified the screen that subjects saw when taking the decision for the round after it was determined whether the critical round would take place or not. We equally modified the mode of decision making from pressing a button to ticking a box for this decision. This, too, highlighted the importance of the decision in this round and made subjects aware of the significance of the omission of the critical round.

The use of the strategy method might appear problematic. We asked subjects to determine how they decided both once the critical round had taken place and once it had been omitted before they knew whether the critical round would actually take place or not. Our design lets subjects decide at a point in time when reaching the threshold is still very likely (before it is determined whether the critical round will be omitted or not) for a situation when reaching the threshold will be very unlikely (if the critical round is omitted). Including the true expectation of getting the rebate for sure if the critical round takes place might shift the reference point up artificially when



subjects decide on what to do in case the critical round is cancelled. We do not find this point to be a caveat. It is known that people who decide to take part in a gamble and plan to stop once they lose are extremely bad at following this plan, tending instead to gamble on after the first loss (see lately Andrade/Iyer 2009). The omission of the critical round in our rebate scheme corresponds exactly to the first loss in a gamble. Thus, considering this gambling effect, our finding should be even stronger if we let people decide if they actually are in the situation where they should exit the rebate scheme.

## **VII. Conclusion**

The first and most important conclusion is that targeted rebates with a threshold close to expected total demand have a significant stickiness effect. A model that assumes agents to maximize expected payoffs is not well suited to predict the effects of targeted rebates on consumers. This fact increases the potential of targeted rebates to foreclose consumer markets to entrants. The entrant has to compensate the additional attraction of rebates that we call stickiness by selling his product even more cheaply than he would have to otherwise. The stickiness does not increase consumer welfare because consumers will end up with less rent on average than they would end up with in the absence of the rebate scheme.

We do find that the longer reference period had an effect on stickiness. This might suggest that the ECJ's opinion that a longer reference period increases the potential for market foreclosure by rebates could have some merit even if a rational choice perspective would conclude that the length of the reference period has no significance with respect to market foreclosure (Maier-Rigaud, 2005; Faella, 2007).

Although Prospect Theory can account for the stickiness effect and is hence supported by our data, we did not find support for the third hypothesis that stickiness increases with shifting payoff from the immediate difference between price and willingness to pay to the rebate payment (i.e., difference between getting and not getting the rebate). This means two things. First, we did not find support for the Commission's opinion that more uncertainty (understood as variance in payoffs) leads to more potential market foreclosure through rebates. Second, it moderates the explanatory power of Prospect Theory of which the hypothesis was derived. Of course, not rejecting a null hypothesis might be due to several factors.

We conclude that the stickiness phenomenon is robust, but further research is necessary to investigate the determinants of its strength and to explore possible underlying processes.

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See: [http://ec.europa.eu/competition/antitrust/cases/index/by\\_nr\\_75.html#i37\\_990](http://ec.europa.eu/competition/antitrust/cases/index/by_nr_75.html#i37_990)  
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