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# Self-Rewards and Personal Motivation\*

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## Abstract

Self-administered rewards are ubiquitous. They serve as incentives for personal accomplishments and are widely recommended to increase personal motivation. We show that in a model with time-inconsistent and reference-dependent preferences, self-rewards can be a credible and effective tool to overcome self-control problems. We also characterize the type of self-rewards that can be used, such as vice goods and virtue goods, and analyze which types of goods will be preferred by the individual.

**JEL Classification:** D03, D81, D91

**Keywords:** Quasi-hyperbolic discounting, reference-dependent preferences, loss aversion, self-control, self-rewards, goals

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\*This paper combines and extends two previous, independent papers entitled “Commitment to Self-Rewards” (by Koch and Nafziger) and “Goal Setting as a Self-Regulation Mechanism” (by Suvorov and van de Ven).

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*“Self-gifts can act as self-contracts in which the reciprocity for the gift is also personal effort and achievement.”* (Mick and DeMoss 1990, p.326)

## 1 Introduction

The pleasure of the moment often seduces people to act against their own long run interests. Many individuals are tempted to shirk on unpleasant tasks – such as studying for an exam, writing a report, dieting, or saving money. If a person with such a present-bias anticipates the intrapersonal conflict, this gives scope for self-regulation (e.g., Laibson 1997, O’Donoghue and Rabin 1999). One form of self-regulation is the use of self-rewards or self-punishments. To help reach their goals, people frequently promise themselves a reward if they persist and accomplish a particular task. Consumer researchers have documented a wide-spread use of such “self-gifts” as incentives for personal accomplishments (e.g., Mick and DeMoss 1990, Mick and Faure 1998). Self-rewards are also recommended in self-help guides and figure prominently in the professional treatment of problem behaviors (e.g., Bandura 1971, Febbraro and Clum 1998, Faber and Vohs 2004, Clum and Watkins 2007). Even firms invest into self-leadership training programs, to teach their employees how to increase their motivation with self-rewards (e.g., Vancouver and Day 2005).

But how can self-rewards work? A self-administered reward can only truly work if the person only takes it after reaching the goal. It has to be credible that the person does not take the self-reward after failing to reach the goal, or forgo to take it even after reaching the goal. And why do people sometimes succeed with quite mundane self-rewards (such as a cup of coffee or a game of pinball) but on other occasions treat themselves to a luxury good they would normally consider too extravagant (such as an expensive pair of shoes or an exclusive bottle of wine)?

We analyze the use and limits of self-rewards by developing a model of self-regulation through goal setting and self-rewards. We show that a self-reward makes an individual pursue more challenging goals. And we analyze how and when different kinds of rewards help the individual overcome a self-control problem. A crucial element of the model is that the promise of a self-reward shapes expectations. Given a promise of a self-reward conditional on meeting a goal, buying the good after meeting the goal is something the individual expected to happen; whereas buying it after having missed the goal goes against what she expected. And whether expectations are met or not matters. According to Köszegi and Rabin (2006), past expectations become reference points against which people evaluate outcomes, such as the benefit of a good and the price to be paid for it. In these evaluations, people often display loss-aversion in the sense of Kahneman and Tversky (1979). What reference points an individual forms, however, is not arbitrary. For an individual who is rational and forward-looking, in equilibrium, it must indeed be optimal (not) to buy the good if she expected (not) to buy

it.

To illustrate the consequences of these ideas for self-regulation, consider a self-reward strategy of the form “If I achieve a specific goal, I’ll buy a certain good; but if I do not stick to my goal, I will deny myself this good.” If the price of the good is very low, the individual will always buy it – no matter what her past expectations were. Hence, the part of the self-promise “. . . if I do not stick to my goal I will deny myself the good” is not credible. So the individual rationally expects that she will buy the good, irrespective of the task outcome and the self-reward strategy unravels. Conversely, if the price of the good is very high, she knows that she will never buy it – so the part of the self-promise “If I achieve my goal, I’ll buy that good . . .” is not credible. So again the self-reward strategy unravels. For an intermediate price range, buying as well as not buying can be a self-sustaining self-reward strategy. If the individual expects to buy the good she will buy it; if she expects not to buy the good she will not buy it. Thus, the promise that she will reward herself upon meeting her goal, but would deny herself the reward if she failed the goal is credible.

To help overcome the self-control problem, the self-reward strategy not only must be credible but also provide appropriate incentives. Sticking to the goal and taking the reward must increase the continuation utility enough to offset the temptation to deviate from the goal and not take the reward. The more difficult the task is, or the more severe the present bias is, the stronger the incentives must be (i.e., the lower the price of the good must be). Otherwise, the reward is not attractive enough to overcome the self-control problem.

Our analysis helps understand the nature of self-reward goods. Vice goods (goods that tempt a present-biased individual because they confer immediate benefits but costs are delayed) motivate the individual the most, followed by neutral goods (goods where benefits and costs arise at the same time) and virtue goods (goods with delayed benefits and immediate costs). Intuitively, for someone struggling with self-control, the prospect of a tasty chocolate cake can be more motivating than doing some exercise or than having a 5 minute break in the park after finishing a report, depending on the relative prices of these options.

However, self-denial after failure to meet the goal is most difficult to achieve with vice goods. Our results show that a vice good has to be costly from an ex-ante perspective so that self-denial is credible. Intuitively, self-denial does not work if the reward is a (relatively cheap) chocolate cake – the individual will consume this cake even if she did not stick to her goal. It needs to be the expensive bottle of St. Emilion wine – a bottle that the individual normally considers as too extravagant.

Neutral or even virtue goods avoid indulgence in excessively costly consumption after goal completion and therefore often work better as a self-reward than vice goods. Specifically, we argue that for mild self-control problems virtue or neutral often suffice. But, as we show, vice goods can be optimal to tackle more severe self-control problems. Their greater motivational force leads to extra effort that compensates for the fact that the reward is costly from an ex

ante perspective.

The paper is organized as follows. After discussing the related literature we introduce the model in section 2. Our main analysis and results are in section 3. In section 4, we analyze the different kinds of self-reward goods. Section 5 discusses robustness of our model to alternative assumptions. Section 6 concludes the paper.

**Related literature** Our main contribution is to the literature that deals with the question of how present-biased individuals cope with self-control problems (for an overview see, e.g., Brocas, Carrillo, and Dewatripont 2004). A large body of work focuses on the role of external commitment technologies. It explains why people incur costs – for example by investing in illiquid assets, signing binding contracts, or making binding promises to other parties – in order to overcome self-control problems in savings and consumption decisions (e.g., Laibson 1997), or to overcome low effort provision and procrastination (e.g., DellaVigna and Malmendier 2004, Carrillo and Dewatripont 2008).

While most instances of self control in everyday life seem to occur without any extrinsic commitment at all (cf. Rachlin 1995), only a few papers deal with intrapersonal strategies – as we do here. Benhabib and Bisin (2005) model the use of neural control processes, Bisin and Hyndman (2009) consider deadlines, Koch and Nafziger (2011b) and Hsiaw (2010) model goal setting, and Koch and Nafziger (2011a) consider multiple goals and mental accounting. Our paper builds upon the goal setting models and shows how an individual can further alleviate her self-control problem by specifying not only goals, but also self-rewards.

Bénabou and Tirole (2004) ask why personal rules can actually work. In their model, individuals have imperfect recall about past motives, and hence draw inference about these motives based on their past actions (like living up to a personal rule in a situation that puts their willpower to a test). Carrillo and Mariotti (2000) and Bénabou and Tirole (2002) model how the manipulation of self-confidence and self-esteem can serve as a self-regulation strategy. Self-rewards differ from these mechanisms because they do not rely on reputation building. Asheim (1997) considers a different notion of self-reward. He notes that multiple subgame perfect equilibria may exist if a present-biased individual faces an infinite horizon decision problem, or if there are indifferences. He proposes a refinement and provides examples of decision rules that can be interpreted as incorporating self-reward or self-punishment.

## 2 The model

**The task.** There is a single agent that faces a task at date 1. The task requires effort,  $e \in \mathbb{R}_0^+$ . Providing effort  $e$  yields an immediate disutility of  $c(e)$  and a delayed benefit of  $f(e)$ , which is felt at date 2. We assume that  $f(0) = c(0) = 0$ ,  $f'(e) > 0$ ,  $c'(e) > 0$ ,  $c''(e) > 0$ ,  $f''(e) \leq 0$  and  $f'(0) > c'(0)$ .

**The self-reward opportunity.** There is an opportunity to buy one unit of an indivisible good, after the effort decision. At date 0, the individual can make a promise to herself of a consumption plan that conditions on the date-1 effort decision (*self-reward*). More precisely, self 0 (the date-0 incarnation of the individual) sets a goal for effort denoted by  $\hat{e}$ . The state-contingent consumption plan takes the form: “reward yourself and buy the good if effort meets the goal, i.e., if  $e \geq \hat{e}$ ” and “don’t buy the good otherwise”.<sup>1</sup> The individual values the good at  $b$  and incurs cost  $\gamma b$  for it, where  $\gamma$  is a relative price parameter. The only choice is between buying the good or not. Throughout this section we assume that the costs and benefits of the self-reward accrue at date 1, while various other cases are analyzed in the next section.

**Preferences.** When making her effort decision in period 1, the individual overemphasizes the immediate cost relative to the more distant benefit of a completed task. Specifically, the individual has present-biased preferences, which we model with a quasi-hyperbolic utility function of the  $(\beta, \delta)$ -form (e.g., Laibson 1997, O’Donoghue and Rabin 1999). The first parameter,  $\delta$ , corresponds to the standard exponential discount factor. For simplicity we set  $\delta = 1$ . The second parameter,  $\beta \in [0, 1)$ , captures the extent of the present bias, and is the parameter of interest in our model. The utility of the individual in period  $t \in \{0, 1, 2\}$  is given by:

$$U_t = u_t + \beta \left[ \sum_{\tau > t} u_\tau \right],$$

where  $u_t$  is the *instantaneous utility* in period  $t$  (to be specified below). For instance, the period-0 incarnation of the individual (*self 0*) weighs future utilities  $u_1$  and  $u_2$  equally; but the period-1 incarnation of the individual (*self 1*) puts a larger relative weight on  $u_1$  by discounting  $u_2$  with  $\beta < 1$ , reflecting her present bias. Given that we are modeling deliberate self-regulation, it is natural to assume that self 0 knows about the present-biased preferences of her future selves. That is, the individual is *sophisticated* in the sense of O’Donoghue and Rabin (1999).

The instantaneous utility in each period has the properties of Kőszegi and Rabin’s (2006) reference-dependent utility. It is composed of two components. The first component,  $m_t$ , is consumption utility derived from the payoffs received at time  $t$ , such as the disutility of effort, the benefit from completing the task, or the costs and benefits of the good. The second component is reference dependent gain-loss utility. It consists of the received payoff  $m_t$  as

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<sup>1</sup>While we speak for concreteness of a consumption good and a self-reward, other interpretations are possible. For example, a state-contingent plan can be phrased in terms of *self-punishment*. If the individual did not meet the goal, she punishes herself by not buying a good that she would normally buy. The reward (or punishment) need not be a consumption good but can also be some activity that brings pleasure  $b$  and causes pain or has some opportunity cost  $\gamma b$ .

compared to the reference point  $\hat{m}_t$  for that outcome. The reference point is determined by the individual's past expectations (see below). For example, the goal  $\hat{e}$  induces the reference point  $\hat{m}_1 = -c(\hat{e})$  in the cost dimension and  $\hat{m}_2 = f(\hat{e})$  in the benefit dimension. The individual experiences a gain if an outcome exceeds the goal-induced reference point and a loss if it falls short of the reference point. Gain-loss utility takes the form of Kahneman and Tversky's (1979) value function. Losses loom larger than gains. For tractability we assume a piecewise linear value function with a kink around the reference point, as is common in applications (Tversky and Kahneman 1991; see DellaVigna 2009 for applications). That is, we assume that  $u_t$  takes the following form:

$$u_t = m_t + \mu(m_t - \hat{m}_t), \quad (1)$$

where :

$$\mu(x) = \begin{cases} \eta x & \text{if } x > 0, \\ \eta \lambda x & \text{if } x \leq 0 \end{cases} \quad (2)$$

is the component of the utility function reflecting its reference-dependent nature. The parameter  $\eta \geq 0$  reflects the weight attached to the reference-dependent component, and  $\lambda \geq 1$  reflects the degree of loss aversion. As Kőszegi and Rabin (2006), we assume that gain-loss utility is separable across the different outcome dimensions.

**Timing.** At date 0, the individual sets a self-reward strategy in conjunction with effort goal  $\hat{e}$ ; but no payoff-relevant outcomes occur, and thus  $u_0 = 0$ . At date 1, the individual makes her effort choice and incurs the cost of effort, which result in a consumption utility of  $-c(e)$  and a gain-loss utility of  $\mu(c(\hat{e}) - c(e))$ . Subsequently, she has the opportunity to purchase one unit of the good. Normalizing good and money endowments to (0,0), she derives utility  $bs$  from  $s \in \{0, 1\}$  units of the good and disutility  $b\gamma s$  from spending money. Her gain-loss utility from this decision is  $\mu(bs - b\hat{s}) + \mu(b\gamma\hat{s} - b\gamma s)$ , where  $\hat{s}$  are her expectations regarding the consumption decision of the self-reward. At date 2, the benefits from the task realize and the individual's instantaneous utility is  $f(e) + \mu(f(e) - f(\hat{e}))$ .

**Equilibrium concept.** To close the model we need to make some additional assumptions on how reference points are formed. In doing so, we build upon the ideas of Kőszegi and Rabin (2006). The reference point regarding the outcomes for periods  $t > 0$  is determined by the effort goal and consumption plan the individual forms in period 0. In equilibrium, these plans have to be rational. That is, in each continuation game behavior given the plan must be consistent with this plan. If, for example, self 0 expects to buy the good at date 1, then the reference point in the good dimension is  $b$  and in the money dimension it is  $-b\gamma$ . It then must indeed be optimal for the individual to buy the good given this reference point. We call a goal that is consistent with actual effort a *self-sustaining goal*. Similarly, we call a consumption plan that is consistent with the actual purchase decision for the good a *self-*

*sustaining plan.* Note that a consumption plan can include state-contingent decisions, such as purchasing the good only after meeting the goal. Such a plan translates into corresponding effort-contingent expectations. We also assume that, in case multiple self-sustaining goals and plans exist, self 0 chooses the goal and plan that maximize her utility.

**Assumption 1** *Self 0 implements a self-sustaining goal and plan, and in case multiple self-sustaining goals and plans exist, selects the self-sustaining goal and plan that maximize her utility.*

It is worthwhile to stress that the way in which we model self rewards deviates from Köszegi and Rabin’s (2006) framework. In particular, we introduce state contingent expectations. The individual not only resolves to take the self reward after meeting the effort goal, but also only *expects* the self reward after meeting the effort goal. This requires that the individual can switch her expectations about taking the self reward after the effort decision at date one. Throughout most of the paper we assume that these expectations are completely flexible, but this is not crucial and we will relax this assumption in an extension of the main model. Note also that this can be given a different interpretation in terms of an entitlement effect. A person may feel that she only deserves the self reward after exerting sufficient effort. Then, taking the self reward after meeting the effort goal feels good, but taking it after failing to meet the effort goal feels bad. This can be modeled in exactly the same way as contingent expectations through the reference dependent part: the reference point with respect to the self rewards is then determined by whether or not the person feels she deserved it, and this depends on the effort level.

## 3 Analysis

### 3.1 Benchmark: The effort decision in the absence of self-rewards

We first consider as a benchmark the case where no self-reward opportunity exist and self 0 can attempt to motivate self 1 solely by setting goals.<sup>2</sup> From the perspective of self 0, the optimal effort level  $e_0^*$  equates marginal benefits to marginal costs, i.e., it is determined by

$$f'(e_0^*) = c'(e_0^*).$$

Can self 0 achieve this effort level by setting an appropriate goal? To determine the set of self-sustaining goals, we ask when self 1 has no incentive to deviate from a given goal  $\hat{e}$ . If self 1 sticks to the goal, she meets expectations. So there will be no gain or loss once outcomes are evaluated and the utility for self 1 is  $\beta f(\hat{e}) - c(\hat{e})$ . If self 1 falls short of the

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<sup>2</sup>Our analysis of goal setting with continuous effort in the absence of self-rewards follows Koch and Nafziger (2011a). Suvorov and van de Ven (2008) consider a discrete effort model.



goal, this creates a gain because costs are lower than expected. But it also leads to a loss from not achieving the expected benefits. Specifically, the utility for self 1 if she deviates to some  $e < \hat{e}$  is:

$$\beta f(e) - c(e) + \eta(c(\hat{e}) - c(e)) - \eta\beta\lambda(f(\hat{e}) - f(e)).$$

For goal  $\hat{e}$  to be self-sustaining, self 1 should have no incentive to lower her effort, i.e., the utility from sticking to the goal has to exceed the utility from falling short of it. This is the case if the goal is not “too high”:  $\hat{e} \leq \bar{e}_N$ , where  $\bar{e}_N$  (**N**o self-reward) is defined by

$$\beta(1 + \eta\lambda)f'(\bar{e}_N) = (1 + \eta)c'(\bar{e}_N). \quad (3)$$

Similarly, self 1 has no incentive to deviate and surpass the goal if it is not “too low”:  $\hat{e} \geq \underline{e}_N$ , where  $\underline{e}_N$  is defined by

$$\beta(1 + \eta)f'(\underline{e}_N) = (1 + \eta\lambda)c'(\underline{e}_N). \quad (4)$$

It is easy to see that  $\bar{e}_N > \underline{e}_N$  for  $\lambda > 1$ . Hence, there is a continuum of self-sustaining goals  $[\underline{e}_N, \bar{e}_N]$ . From the continuum self 0 picks as her goal the one that maximizes her utility. Whenever  $e_0^* \in [\underline{e}_N, \bar{e}_N]$ , self 0 can implement the effort level that she considers to be optimal. When is this the case? Note that  $\underline{e}_N < e_0^*$  always holds. Thus, self 0 can fully overcome her self-control problem whenever  $e_0^* \leq \bar{e}_N$ , which arises whenever  $\beta \geq \bar{\beta} \equiv \frac{1+\eta}{1+\eta\lambda}$ , i.e., whenever the agent is sufficiently patient. Intuitively, the larger  $\beta$ , the more the selves agree on perceived costs and benefits. Self-regulation however is constrained if the individual faces a more severe self-control problem such that  $\bar{e}_N < e_0^*$ . In the absence of self-rewards, the best self 0 can do in such a case is to set goal  $\bar{e}_N$ . To study the use of self-rewards, our focus will be on just these cases, where a conflict of interest arises between self 0 and self 1:

**Condition 1** *Without self-rewards the optimal effort level from the perspective of self 0,  $e_0^*$ , is not implementable as a self-sustaining goal:  $\beta < \bar{\beta} \equiv \frac{1+\eta}{1+\eta\lambda}$ .*

### 3.2 The effort decision with self-rewards

In an attempt to resolve the intra-personal conflict of interest, self 0 can make use of an effort-contingent consumption plan such as “buy the good if you reached the goal, do not buy it otherwise.” We start by asking which goals are self-sustaining in the presence of such a self-reward – supposing that the self-reward is self-sustaining. In the next step, we derive the conditions that ensure that the self-reward plan indeed is self-sustaining.

Suppose self 0 sets a goal  $\hat{e}$  above the maximal self-sustainable goal without self-rewards,  $\bar{e}_N$ . Excluding any benefits and costs of self-rewards, such a goal induces a lower utility for self 1 than she would experience when providing  $\bar{e}_N < \hat{e}$ . Hence, self 1 had an incentive to deviate from the goal. To capture this incentive, define the function  $\Phi(\hat{e})$  as the utility gain (net of a possible self-reward) that self 1 experiences if she deviates from a goal  $\hat{e} > \bar{e}_N$  to

the most attractive alternative effort  $\bar{e}_N$ :

$$\Phi(\hat{e}) = - \int_{\bar{e}_N}^{\hat{e}} [\beta f'(e) - c'(e) + \beta \eta \lambda f'(e) - \eta c'(e)] de. \quad (5)$$

When deciding whether to stick to a goal  $\hat{e} > \bar{e}_N$  or to decrease her effort to  $\bar{e}_N$ , self 1 weighs the utility gain  $\Phi(\hat{e})$  against the loss from not consuming the reward good,  $b(1 - \gamma)$ . Thus, the maximal self-sustainable goal,  $\bar{e}_R$  (with self-**R**ewards), is determined by:

$$\Phi(\bar{e}_R) = b(1 - \gamma). \quad (6)$$

For  $\gamma < 1$ , the right-hand-side is positive and constant in  $\bar{e}_R$ .<sup>3</sup> The left-hand side is increasing and convex in  $\bar{e}_R$ . Hence, there exists a unique  $\bar{e}_R > \bar{e}_N$  satisfying (6). That is, the maximal self-sustainable goal is higher with a (self-sustaining) self-reward than without, thereby alleviating the individual's self-control problem. Whether or not a self-reward allows the individual to fully overcome her self-control problem depends on how attractive the good is.

**Lemma 1** *Suppose a self-sustaining self-reward opportunity with relative price  $\gamma < 1$  exists. Self-reward plans expand the set of self-sustaining goals:  $\bar{e}_R > \bar{e}_N$ . If  $\gamma \leq \gamma^*$ , defined by*

$$\Phi(e_0^*) = b(1 - \gamma^*), \quad (7)$$

*the self-reward provides sufficient motivation to fully overcome the individual's self-control problem. Otherwise it only alleviates the problem, and the best self 0 can do is to set as goal  $\bar{e}_R$  defined by equation (5), where  $e_0^* > \bar{e}_R$ .*

The result directly implies the following comparative statics. The more difficult the task is (i.e., the higher marginal costs relative to marginal benefits), or the more severe the present bias is (i.e., the lower  $\beta$ ), the stronger the incentives must be (i.e., the lower the price ceiling  $\gamma^*$ ) for the good to be attractive enough to help overcome the self-control problem.

### 3.3 Self-sustaining self-reward plans

It is not enough that a self-reward provides the desired incentives. It must also be a self-sustaining plan to (not) consume the good whenever the individual promised to herself (not) to consume it after a given effort level. To derive the relevant conditions for a plan to be self-sustaining, we follow Kőszegi and Rabin (2006). We need to distinguish two cases. Did the individual expect to buy the good, or not (in a given state of the world)?

Suppose first she did, and her reference points regarding the good and money dimensions thus are  $b$  and  $-\gamma b$ , respectively. Following through with this expectation provides the individual

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<sup>3</sup>If  $\gamma > 1$ , the individual could threaten to punish herself and consume the good whenever she does not provide the desired effort. Because self-punishment occurs off the equilibrium path, such a plan does not harm self 0. The analysis is analogous to the one above.

with consumption utility  $b(1 - \gamma)$  from purchasing the good. As her reference points for each outcome dimension are met, she perceives no gain or loss. If, instead, she abstains from buying the good, her consumption utility is 0. So she perceives a loss in the goods dimension and a gain in the money dimension. This results in gain-loss utility  $-\lambda b + \gamma b$ . Hence, it is indeed optimal for the individual to buy the good if  $b - \gamma b \geq -\lambda b + \gamma b$ , i.e., if

$$\gamma \leq \frac{(1 + \lambda \eta)}{1 + \eta} \equiv \bar{\gamma}. \quad (8)$$

Should the price exceed  $\bar{\gamma}$ , then the individual will never consume the good – no matter what expectations the individual held in the past. This means that the part of the self-promise “If I stick to my goal I will reward myself and buy the good . . .” is not credible. In equilibrium, self 0 hence expects not to buy the good, and the individual later on will indeed not buy it. Suppose next that the individual did not expect to buy the good, i.e., the reference points regarding the good and money dimensions both are 0. In similar fashion as above, one can derive a bound  $\underline{\gamma}$ , such that it indeed is optimal not to purchase the good if

$$\gamma \geq \frac{(1 + \eta)}{1 + \lambda \eta} \equiv \underline{\gamma}. \quad (9)$$

Should the price be less than  $\underline{\gamma}$ , then the individual will always consume the good – no matter what expectations the individual held in the past. Thus, the part of the self-promise “. . . if I deviated from my goal I will deny myself the good” is not credible. In equilibrium, self 0 expects her future self to consume the good, and the individual later will indeed do so. Note that  $\underline{\gamma} < 1$ , so self-denial of the good and the condition  $\gamma < 1$  from lemma 1 do not contradict each other.

To summarize, if either the price is too high ( $\gamma > \bar{\gamma}$ ) or too low ( $\gamma < \underline{\gamma}$ ), the promise of a self-administered reward is not self-sustaining. Hence, a self-reward cannot provide the necessary incentives. In the intermediate price range,  $\gamma \in [\underline{\gamma}, \bar{\gamma}]$ , two possibilities arise. If the individual earlier formed the expectation of buying the good, she will buy the good; and if she earlier formed the expectation of not buying the good, she will not buy the good. This provides self 0 with scope to motivate her future self with a self-sustaining reward plan of the form “If I stick to my goal I will reward myself and buy the good, if I shirk I will deny myself the good.” Stated differently, the noncommittal promise becomes a self-sustaining plan. Given expectations, it is optimal for the individual to buy the good if she kept to her goal and not to buy it otherwise.

**Proposition 1** *Suppose condition (1) holds, i.e., there is a conflict of interest between self 0 and self 1 that cannot be solved in the absence of self-rewards.*

1. *If  $\gamma < \underline{\gamma}$  or  $\gamma > \bar{\gamma}$ , the self-reward is not self-sustaining. The individual either never ( $\gamma < \underline{\gamma}$ ) or always ( $\gamma > \bar{\gamma}$ ) consumes the good. In this case, Self 0 implements the maximal self-sustaining goal that can be achieved without self-rewards ( $\bar{e}_N$ ).*

2. If  $\bar{\gamma} \geq \gamma \geq \underline{\gamma}$ , the self-reward is self-sustaining.

(a) If, in addition,  $1 > \gamma^* \geq \gamma$  then the self-reward allows the individual to fully overcome her self-control problem, i.e.,  $e_0^* < \bar{e}_R$ . Self 0 implements the from her perspective optimal effort level  $e_0^*$ .

(b) If, in addition,  $\gamma^* < \gamma < 1$  then the self-reward alleviates the self-control problem, i.e.,  $e_0^* > \bar{e}_R > \bar{e}_N$ . In that case, Self 0 implements the maximal self-sustaining goal that can be achieved with self-rewards,  $\bar{e}_R$ .

Proposition 1 shows that, under certain conditions, a rational, forward-looking individual can overcome a self-control problem with the promise to administer a reward after fulfilling a specific target, and the threat to deny herself the reward otherwise. Two forces may however constrain self-regulation, depending on the characteristics of the available reward good. First, the good must be neither something that the individual will consume anyway – no matter what her expectations and reference point are (e.g., because it is a necessity or a bargain) – nor so extravagant or expensive that she will never consume it, i.e.,  $\gamma \in [\underline{\gamma}, \bar{\gamma}]$ . Second, the conditions on  $\gamma$  for self-denial and motivational force may be in conflict with each other. In order for the good to be a powerful incentive tool it must come at a low enough price; but then the opportunity to purchase the good may be so attractive that the individual will always end up consuming the good. While our analysis shows that  $\underline{\gamma} < 1$  always holds,  $\gamma^* < \underline{\gamma}$  can arise. That is, a self-sustaining reward might not be powerful enough to fully overcome the conflict of interest between self 0 and self 1, but may nevertheless alleviate the self-control problem.

## 4 Other types of self-rewards

So far we assumed that the benefits from consuming the reward good and its costs are both immediate. This captures *neutral* self-reward goods, i.e., goods for which self 0 and self 1 agree about the optimal consumption and no intra-personal conflict of interest arises. Examples are having dinner with friends after finishing a paper, playing some game after doing homework, or having a walk in the park after writing a report.

More generally, the costs and benefits of rewards can arise in different periods. To consider the additional cases, we write  $\hat{e}_R(t, \tau)$  for a goal with the option of taking a self-reward that provides benefits in period  $t \in \{1, 2\}$  and for which costs accrue in period  $\tau \in \{1, 2\}$ . For example,  $\bar{e}_R$  defined in equation (6) corresponds to  $\bar{e}_R(1, 1)$ . Similarly, we define  $\underline{\gamma}(t, \tau)$  and  $\bar{\gamma}(t, \tau)$ .

## Vice goods: Immediate consumption benefits and delayed costs

Suppose the reward good provides immediate consumption benefits to self 1, but the individual only bears the costs in period 2. Because a present-biased individual focuses excessively on the short-term benefits and neglects future costs, such goods are often called *vice* or leisure goods. Examples are rewarding yourself with a cigarette or calorie-laden snacks. They are enjoyable when consumed but have adverse health effects in the long run. Some luxury goods also have the character of vice goods. They are too extravagant from the perspective of self 0, because the individual has to excessively reduce future consumption in order to afford them now. But they appeal to self 1 because she puts too much weight on her current consumption.

Applying similar arguments as the ones outlined in section 3.3 yields the following bounds on the relative price for a self-sustaining reward:

$$\underline{\gamma}(1, 2) \equiv \frac{1 + \eta}{\beta(1 + \eta\lambda)} \quad \text{and} \quad \bar{\gamma}(1, 2) \equiv \frac{1 + \eta\lambda}{\beta(1 + \eta)}. \quad (10)$$

Note that condition 1 implies that the lower bound on the relative price  $\underline{\gamma}(1, 2) > 1$ . The intuition is simple. A vice good is so attractive for self 1 that it must come at a very high price – otherwise self 1 would always consume it and the promise of self-denial after not meeting the goal would not be self-sustaining. In other words, self-denial does not work if the reward is a chocolate cake that is relatively cheap. It needs to be the expensive bottle of St. Emilion wine – a bottle that would otherwise be considered as too extravagant. That is, because  $b[1 - \gamma] < 0$ , the self-reward is costly from the perspective of self 0. But while costly for self 0, the promise of indulgence can provide the desired incentives for self 1. The reason is that self 0 and self 1 perceive the costs and benefits of the vice good differently because of the present bias. Specifically, we have  $\beta\underline{\gamma}(1, 2) < 1$  and the maximal self-sustainable goal with self-rewards,  $\bar{e}_R(1, 2)$ , is determined by:

$$\Phi(\bar{e}_R(1, 2)) = b[1 - \beta\gamma]. \quad (11)$$

A vice good is, *ceteris paribus*, more motivating for self 1 than a good with immediate benefits and costs (compare equations 6 and 11). Intuitively, the individual is willing to work harder for the chance to indulge in a bit of luxury than she would for the chance of “mundane” consumption. Of course, this comparison assumes that the value of  $\gamma$  falls within the range of self-sustaining rewards in both cases (vice and neutral), but this is not necessarily the case since the intervals  $[\underline{\gamma}(1, 1), \bar{\gamma}(1, 1)]$  and  $[\underline{\gamma}(1, 2), \bar{\gamma}(1, 2)]$  do not completely overlap.

Self 0 will specify a costly self-reward good whenever its benefits outweigh its costs, i.e., whenever

$$\int_{\bar{e}_N}^{\bar{e}_R(1, 2)} [f'(e) - c'(e)] de \geq -b(1 - \gamma).$$

In such a case self-rewards lead to indulgent behavior: self 0 tackles one self-control problem by giving in to another self-control problem.

### **Virtue goods: Delayed consumption benefits and immediate costs**

Next we consider goods with delayed consumption benefits and immediate costs which are often referred to as *virtue* or investment goods. Examples are doing sports after finishing work, or booking a holiday for a future date after successfully completing a project.

For a virtue good the bounds on the relative price for a self-sustaining reward are:

$$\underline{\gamma}(2, 1) \equiv \beta \frac{1 + \eta}{1 + \eta\lambda} \quad \text{and} \quad \bar{\gamma}(2, 1) \equiv \beta \frac{1 + \eta\lambda}{1 + \eta}. \quad (12)$$

And the maximal self-sustainable goal with self-rewards,  $\bar{e}_R(2, 1)$ , is determined by:

$$\Phi(\bar{e}_R(2, 1)) = b [\beta - \gamma]. \quad (13)$$

A virtue good is, *ceteris paribus*, less motivating from the perspective of self 1 than a vice or a neutral good. Rewarding oneself with a gym visit after finishing homework has only a limited motivational force. Similarly, the prospect of consuming an expensive bottle of wine right now is more promising than spending hours online to book a vacation one will only take in several weeks.

Nevertheless virtue rewards might be attractive from the perspective of self 0 because they make it cheap to achieve self-denial. Even if the good comes at a very low price, self 1 would not always buy it. Specifically,  $\underline{\gamma}(2, 1)$  is lower than  $\underline{\gamma}(1, 1)$  or  $\underline{\gamma}(1, 2)$ . So while a gym visit is not the most motivating reward, it spares self 0 the cost of allowing her future self to indulge in the expensive bottle of wine.

### **Delayed consumption benefits and delayed costs**

Instead of buying and consuming a neutral good right now, the individual could delay it to tomorrow. For example, the individual could promise to herself to have a game of pinball tomorrow (rather than today). In this case, the bounds on the relative price are given by:

$$\underline{\gamma}(2, 2) \equiv \frac{1 + \eta}{1 + \eta\lambda} \quad \text{and} \quad \bar{\gamma}(2, 2) \equiv \frac{1 + \eta\lambda}{1 + \eta}. \quad (14)$$

And the maximal self-sustainable goal with self-rewards,  $\bar{e}_R(2, 2)$ , is determined by:

$$\Phi(\bar{e}_R(2, 2)) = b\beta [1 - \gamma]. \quad (15)$$

Note that the bounds on the relative price coincide with those for the case of immediate benefits and costs:  $\underline{\gamma}(1, 1) = \underline{\gamma}(2, 2)$  and  $\bar{\gamma}(1, 1) = \bar{\gamma}(2, 2)$ . As with immediate benefits and rewards, the good is both motivating for self 1 and desirable for self 0 whenever  $\gamma < 1$ . However, incentives are, *ceteris paribus*, stronger if the individual rewards herself with a neutral good today (compare equations 6 and 15). Intuitively, the reward of consuming an *ex ante* desirable good is stronger if experienced now than if experienced in the future.

**Proposition 2** *Suppose condition 1 holds.*

1. *Provided that  $\gamma$  is such that the different types of self-rewards are self-sustaining, vice goods motivate self 1 the most and virtue goods the least; ceteris paribus: holding  $b$  and  $\gamma$  fixed,  $\bar{e}_R(1, 2) > \bar{e}_R(1, 1) > \bar{e}_R(2, 2) > \bar{e}_R(2, 1)$ .*
2. *Achieving self-denial is most difficult with vice goods and least difficult with virtue goods:  $\underline{\gamma}(1, 2) > 1 > \underline{\gamma}(1, 1) = \underline{\gamma}(2, 2) > \beta > \underline{\gamma}(2, 1)$ . That is, rewarding oneself with a vice good is always costly from the perspective of self 0.*

To illustrate the consequences of the proposition, compare the utility of self 0 for two alternative self-reward plans: one based on a vice good and one based on a neutral good with immediate benefits and costs. (The other comparisons are analogous.) While a vice good may motivate a higher effort level than a neutral good, the former type of reward is always more expensive. Indeed, it is even painful from the perspective of self 0 because  $\gamma \geq \underline{\gamma}(1, 2) > 1$ . So, overall, a self-reward plan based on a vice good only yields higher utility for self 0 if the increase in utility from the higher effort compensates for the higher expenditures or, more formally, if

$$\int_{\bar{e}_R(1,1)}^{\bar{e}_R(1,2)} [f'(e) - c'(e)] de \geq b[\gamma(1, 2) - \gamma(1, 1)],$$

where  $\gamma(1, 1)$  denotes the price of the neutral good,  $\gamma(1, 2)$  the one of the vice good; and  $\bar{e}_R(1, 2)$  is evaluated at  $\gamma(1, 2)$  and  $\bar{e}_R(1, 1)$  is evaluated at  $\gamma(1, 1)$ .

If the individual has a mild self-control problem or faces an easy task, the neutral good might already suffice to fully overcome the self-control problem, i.e.,  $\bar{e}_R(1, 1) > e_0^*$  holds. In this case, there is no need to increase motivation further with an expensive luxury good. If, however, the individual has a more severe self-control problem or faces a more difficult task, the neutral good may not be motivating enough. In this case, it depends on the relative prices  $\gamma(1, 1)$  and  $\gamma(1, 2)$  whether using a vice good as self-reward can yield a strictly higher utility for self 0 than a neutral good.

If, for example, the individual had access to reward goods with a price just equal to the respective lower price bound  $\underline{\gamma}(1, 1)$  and  $\underline{\gamma}(1, 2)$ , any self-reward plan based on a vice good would be dominated. Specifically, evaluating the incentive constraints (6) and (11) at  $\underline{\gamma}(1, 1)$  and  $\underline{\gamma}(1, 2)$ , respectively, shows that both goods provide the same incentives. But the neutral reward good avoids the indulgence that is costly from self 0's perspective. However, for the generic case where a neutral good is available at a price above  $\underline{\gamma}(1, 1)$ , a vice reward good might yield a strictly higher utility for self 0 than using a neutral good.

A parametric example helps to illustrate this. Suppose  $f(e) = ve$  and  $c(e) = \frac{1}{2}ce^2$ . Let  $\eta = 1$ ,  $\lambda = 2.5$ ,  $v = 10$ ,  $c = 1$ , and  $b = 1$ . Figure 1 holds fixed the severity of the self-

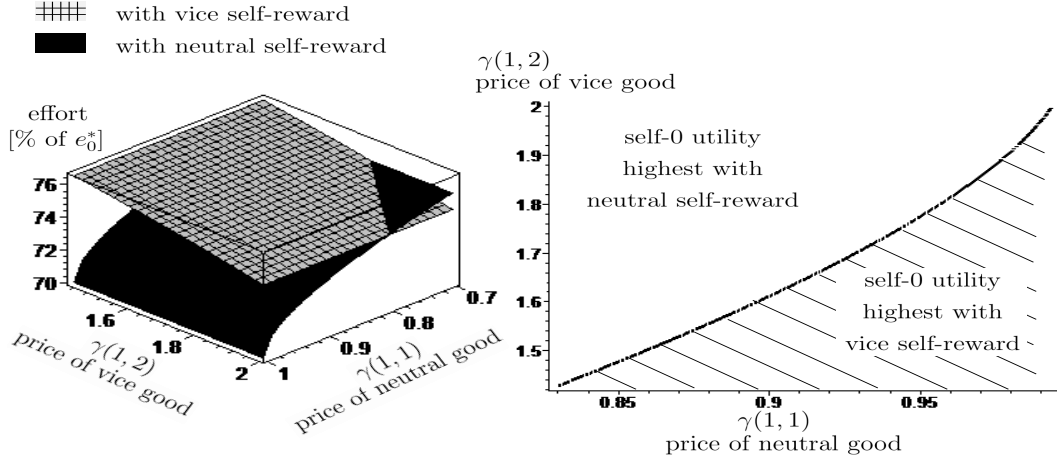


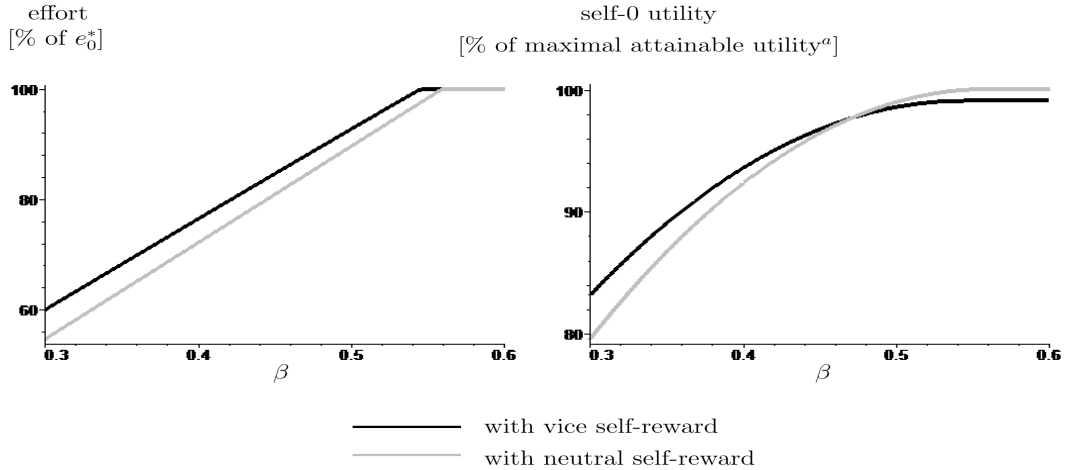
Figure 1: Effort of self 1 and utility of self 0 dependent on  $\gamma(1,1)$  and  $\gamma(1,2)$

control problem ( $\beta = 0.4$ ).<sup>4</sup> The left picture shows how the effort of self 1 in percentage of  $e_0^*$  varies with the price of the respective self-reward good. It illustrates that a vice good motivates higher effort than a neutral good – except when the price of the neutral good is very much lower and than the one of the vice good. The right picture shows how, depending on  $\gamma(1,1) > \underline{\gamma}(1,1)$  and  $\gamma(1,2) > \underline{\gamma}(1,2)$ , a self-reward plan based on a vice good can yield strictly higher utility to self 0 than a self-reward plan based on a neutral good – even though the vice good is a luxury that comes at an excessively high price from the perspective of self 0.

Figure 2 illustrates how the severity of the self-control problem impacts the effort of self 1 and the utility of self 0. It holds fixed the prices of the reward goods ( $\gamma(1,1) = 0.95$  and  $\gamma(1,2) = \underline{\gamma}(1,2) = 1.43$ ). The left picture shows how effort increases with  $\beta$  for both self-reward plans, up to the point where  $e_0^*$  can be sustained. The right picture shows that for severe self-control problems (low  $\beta$ ) the vice reward good yields higher utility for self 0, because the increase in effort compensates for the fact that the vice good is ex ante costly. For a mild self-control problem (high  $\beta$ ) the neutral reward good is optimal because it is sufficiently motivating.

<sup>4</sup>With these parameters, condition (1) becomes  $\beta < \bar{\beta} = 2/3$ . The optimal effort from the perspective of self 0 is  $e_0^* = 10$ , whereas in the absence of a self-reward only the goal of  $\bar{e}_N = 7$  can be sustained. Neutral good:  $\underline{\gamma}(1,1) = 0.57$ ,  $\bar{\gamma}(1,1) = 1.75$ ,  $\bar{e}_R(1,1) = 7 + \sqrt{1 - \gamma(1,1)}$ . Vice good:  $\underline{\gamma}(1,2) = 1.43$ ,  $\bar{\gamma}(1,2) = 4.38$ ,  $\bar{e}_R(1,2) = 7 + \sqrt{1 - 0.4\gamma(1,2)}$ . Virtue good:  $\underline{\gamma}(2,1) = 0.23$ ,  $\bar{\gamma}(2,1) = 0.7$ ,  $\bar{e}_R(1,2) = 6 + \sqrt{0.4 - \gamma(2,1)}$ .





<sup>a</sup> Utility if self 0 could commit future self to optimal effort  $e_0^*$ .

Figure 2: Effort of self 1 and utility of self 0 dependent on  $\beta$

## 5 Discussion

### 5.1 Change of mind

We assumed that the individual forms a self-reward plan in period 0 that determines the reference point to which she later compares outcomes. The model hence captures settings where a change of mind in period 1 is without consequences. Self 1 may well think of a new effort-contingent consumption plan (like “I consume the good even though I did not meet my goal”), but the reference point does not adjust quickly enough for this to affect the consumption decision.

Empirical evidence suggests that reference points do adjust to new information, but not immediately. Bettors who accumulate losses tend to make riskier bets at the end of the day to erase these losses, suggesting that their reference points do not adapt to losses from previous bets (cf. Camerer 2003, p.296). Similarly, Card and Dahl (2011) show that football fans’ emotional reactions to game outcomes appear to be driven by the final outcome relative to expectations at the start of the game, with little or no updating using half-time scores. With sufficient time lag, reference states do seem to adjust, as reflected by the phenomenon of *hedonic adaptation* (see Frederick and Loewenstein 2003).<sup>5</sup>

Thus, our assumption that a change of mind does not affect reference points seems plausible if the reward opportunity is immediate. However, the assumption is less plausible if the reward is delayed. Here, the reference point has more time to adjust to a possible change

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<sup>5</sup>Experimental evidence on short-term responses is less conclusive though. Matthey and Dwenger’s (2008) findings suggest no short-term adjustment of reference states, while Gill and Prowse’s (2011) findings suggest quick adjustment.

of mind. This suggests that self-rewards work best if they occur promptly after the effort choice is made – something also emphasized in self-help guides (e.g., the University of Victoria Counselling Services 2004) and studies on self-reinforcement (e.g., Grady *et al.* 1988).

## 5.2 Partial switching of the reference point after a deviation

We assumed that the individual can form effort-contingent consumption plans and that these induce corresponding effort-contingent expectations. This implies that off the equilibrium path, if the individual falls short of the effort goal, the reference point switches from “buying the good” to “not buying the good”. A plausible alternative is that the individual got used to the idea of buying the good and after a deviation from the goal still puts some weight  $\rho \in [0, 1]$  on the reference point that is induced by the expectation to buy the good. In the following, we show that our results are robust to such a modification of the model.

In this case, self-denial is more difficult to achieve because not buying the good feels more painful. To see this formally, note that the lower bound on the price for a neutral good becomes

$$\underline{\gamma}_S(1, 1) \equiv \frac{1 + \eta + \rho\eta(\lambda - 1)}{1 + \eta\lambda - \rho\eta(\lambda - 1)}. \quad (16)$$

For  $\rho > 0$  we hence have  $\underline{\gamma}_S(1, 1) > \underline{\gamma}(1, 1)$ . Furthermore, the larger  $\rho$ , the larger  $\underline{\gamma}_S(1, 1)$ , i.e., the more costly the good needs to be for self-denial to be sustainable.

What is the impact on the individual’s incentives? Deviating to  $e < \hat{e}$  now does not only produce a loss in the benefit dimension and a gain in the cost dimension but, in addition, decreases utility by  $\rho(\eta\gamma b - \eta\lambda b)$ . This third effect arises because the individual also compares the outcome “do not buy the good” to the reference point that is induced by the expectations of buying the good, to which she still attaches weight  $\rho$ . Thus, the maximal self-sustaining goal,  $\bar{e}_S(1, 1)$ , is implicitly defined by

$$\Phi(\bar{e}_S(1, 1)) = b[(1 - \gamma) + \rho\eta(\lambda - \gamma)], \quad (17)$$

Note that the individual is more motivated to stick to a challenging goal if she still puts some weight on the reference point to buy the good even though she deviated. That is, for  $\rho > 0$  we have  $\bar{e}_S(1, 1) > \bar{e}_R(1, 1)$ . Intuitively, the reference point induced by the expectation to buy the good creates an additional feeling of a loss if the individual does not buy the good. Trying to avoid this loss, the individual is more willing to stick to a challenging goal.

Overall, if the reference point fully switches ( $\rho = 0$ ) the conditions for the self-sustaining goal and the self-sustaining self-reward strategy simply reduce to what we had in section 3.2. If the reference point does not switch at all ( $\rho = 1$ ) then self-rewards are ineffective. Specifically, evaluated at the lower bound for the relative price,  $\underline{\gamma}_S(1, 1)$ , the right-hand side of the incentive constraint (17) is zero for  $\rho = 1$ . Hence, it is less than zero for all higher prices. If, however,  $\rho$  is not too large and  $\gamma < 1$ , the right-hand side of the incentive constraint is strictly positive. Thus, if the individual only partially switches the reference

point this dampens the power of self-rewards. But they can still help the individual to motivate herself.

## 6 Conclusion

Personal accomplishments and achieved goals are important reasons why people reward themselves, according to survey evidence by Mick and DeMoss (1990). Some examples of self-rewards they find are mundane consumption, like watching TV or having lunch with a friend. For instance, one woman motivates herself to do unpleasant household chores with a “promise [to] myself that if I get three rooms cleaned without a break, then I can put my feet up and watch a game show on television” (p.326). Other examples they list have an indulgent character, like buying a whirlpool bath as reward for running a marathon. Such a motivation to consume luxury is also reflected in a KPMG survey in China, where over 60 percent of the respondents bought luxury goods as a way to reward themselves for their hard work and success (Debnam and Svinos 2006).

Our analysis sheds light on the power and limits of different types of self-reward goods. It shows why quite mundane goods often work well as self-rewards. Along these lines, self-help guides typically recommend how to start with thinking about suitable contingent rewards. You should use “small rewards” that are sufficiently enticing to help motivate yourself, but that are not so important to you that you would go ahead and get them even if you failed to achieve the prescribed targets. Examples would be “play a game of pinball” after finishing your homework or “have a nice dinner with your friends” after writing up a report.<sup>6</sup>

Yet our analysis also shows that a self-reward sometimes needs to have an indulgent character to be a sufficiently powerful motivator. Specifically, the model predicts that people may consume vice goods (as a self-reward) after being virtuous in a task. A common interpretation for such behavior is that the exertion of self-control in a task depletes self-control resources and that the individual therefore succumbs to temptation afterwards (cf. Muraven and Baumeister 2000). Our results show that there is a second interpretation for such behavior. It might not mirror self-regulation failure, but it might be the expression of a successful self-regulation strategy.

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<sup>6</sup>In a similar vein, such activities can be employed in a state-contingent plan that uses a self-punishment. Suppose, for example, an individual usually plays pinball after work or enjoys the daily lunch with her colleagues. Then threatening herself not to play pinball or to skip the usual lunch with colleagues, unless she achieves her daily goal, provides incentives to meet the goal.

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