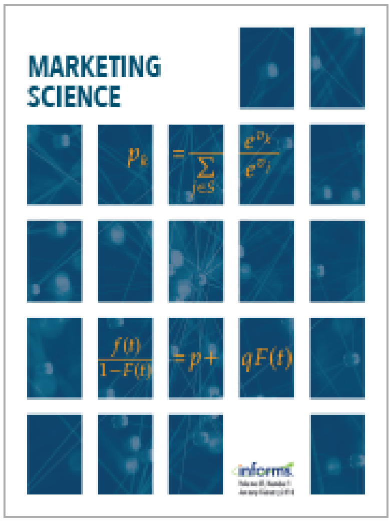

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Self-Control and Optimal Goals: A Theoretical Analysis

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Consumers set goals to achieve a variety of objectives such as losing weight, saving for retirement, and achieving better health. A large body of literature in psychology and consumer behavior shows that goals can help consumers achieve these objectives. However, there is almost no research that examines how we should set optimal goals. The purpose of this paper is to develop a parsimonious framework that examines how goals can help performance and how we should set optimal goals. We use the literature on hyperbolic discounting to model these issues. Our results show that goals can often increase performance but can also sometimes encourage procrastination. We show that some goals are worse than having no goals, even when the goals are achieved and the consumer exerts more effort because of the goal. We also find that the presence of goals can lead to myopic consumers behaving as if they were hyperopic. Our results also show that the most difficult goals should be assigned to consumers with moderate levels of motivation and self-control problems. We also find that it is sometimes optimal to set goals that are never achieved.

Key words: hyperbolic discounting; optimal goal setting; behavioral economics
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1. Introduction

Goals play an important role in consumer decision making (Bagozzi and Dholakia 1999). Consumers often set goals to achieve a variety of objectives such as losing weight, saving money, and improving health. Surveys indicate that at any given time, two thirds of the U.S. population is dieting to lose weight (Cochran and Tessler 1996). Companies that help consumers lose weight or save for retirement by setting appropriate goals are multibillion dollar businesses. For example, the weight loss industry alone is estimated to have yearly sales that exceed $44.6 billion (Thompson 2005). Furthermore, motivational seminars that are offered in-house by top companies to their employees stress the importance of goal setting. Indeed, research has shown that setting goals can sufficiently motivate consumers to achieve their long-term objectives (e.g., Latham and Yukl 1975, Locke et al. 1981).

Researchers in psychology and marketing have studied why goals can improve performance (e.g., Locke and Latham 1990, Heath et al. 1999, Bagozzi and Dholakia 1999). Furthermore, researchers have also found that goal specificity and difficulty of goal affect performance. In particular, research has shown that performance is highest for specific and moderately difficult goals (Locke and Latham 2002). Some researchers also suggest that goals, if unsuccessful, can lead to worse performance than when the consumer does not set any goals (Cochran and Tesser 1996). Furthermore, some studies have found that while goals can lead to higher performance, they can negatively affect satisfaction (e.g., Jackson and Zedeck 1982).

Surprisingly, although there is a large literature on goal setting, there is little research that addresses how we should set optimal goals. Furthermore, most studies have only looked at performance (such as lost weight) but not at the cost of achieving these objectives, something one needs to look at to address the issue of optimal goals. An understanding of optimal goal setting is important for several reasons. First, it can help companies that assist consumers in setting goals develop more effective programs. Second, because goal setting is so pervasive, a study of optimal goal setting can sharpen our understanding of consumer behavior. Finally, goal setting is common in many other contexts such as setting quotas for salespersons. Therefore, a framework that looks at optimal goal setting in the context of consumer behavior can also be adapted to study these firm-related problems. The purpose of this paper is to develop a parsimonious framework to address how consumers should set optimal goals.

To achieve this objective, we develop a utility-based model in which a consumer invests in effort (e.g., diet) to achieve an ultimate objective (e.g., weight loss). We model a situation in which the consumer has self-control problems and uses goals to rectify the situation. We follow the literature in economics that models such self-control problems by assuming that consumers have present-biased preferences (e.g., Laibson 1997, O'Donoghue and Rabin 1999, Carrillo and Mariotti 2000, DellaVigna and Malmendier 2004). In particular, consumers use hyperbolic discounting in which their discount rate changes over time with a higher discount rate between the present and the next period than between any of the subsequent periods. This leads to the situation that a course of action that seems desirable in the distant future often seems undesirable in the near future. Hyperbolic discounting has been used to study procrastination (see, for example, Fischer 2001; O'Donoghue and Rabin 1999, 2001), addiction (Gruber and Koszegi 2001, O'Donoghue and Rabin 2000, Machado and Sinha 2007), strategic ignorance (e.g., Carrillo and Mariotti 2000), and investment behavior (Laibson 1997, 1998).

We develop a two-period model in which the consumer makes a decision to exert effort to achieve an ultimate objective. The consumer, however, suffers from self-control problems and therefore (absent goals) exerts suboptimal effort. We then allow consumers to set goals. Goals in our framework can motivate consumers to exert more effort because unsuccessful goals are assumed to lead to a decrease in utility while achievement of goals enhances utility. This change in utility because of the achievement or nonachievement of a goal could differ across consumers and represents the level of motivation of the consumer. We study how goals affect a consumer's decision to exert effort in each of the two periods and how this in turn affects the final outcome. The effectiveness of the goal depends on the consumer's level of motivation and the severity of his present-biased preference. We study how optimal goals can be designed to counter the negative effect of present-biased preferences on effort. We also examine how optimal goals should change as a function of consumers' level of motivation. Finally, we explore how consumers' biases in estimating their future actions can affect outcomes and optimal goals.

We find several interesting results. First, we show that some goals can be counterproductive even when they are achieved and when these goals lead to higher efforts. This result suggests that goals can lead to reduced satisfaction even when they lead to better outcomes. Our results also show that goals can sometimes exacerbate the problem of procrastination. Furthermore, this problem of procrastination may be higher for consumers who are more motivated. Consequently, sometimes increased motivation can make consumers worse off. The result suggests that programs that attempt to increase the motivation level of consumers can sometimes be counterproductive. Our results show that optimal goals depend on the level of consumer motivation and the intensity of present-biased preferences. We find that individuals with low motivation should be assigned aggressive goals that push them to exert higher effort. In contrast, individuals with higher motivation levels need to be assigned moderate goals. Our results also suggest that it is sometimes optimal for individuals to aim for goals that they never achieve.

The paper makes several contributions to the literature. First, it provides a parsimonious and unifying framework in which we can examine the issue of optimal goals. The results are consistent with several empirical observations found in the behavioral literature. For example, our results show why goals are effective and why goals can sometimes lead to reduced satisfaction. Our results also explain why consumers keep setting the same goals even after repeated failure to achieve the goals. We, however, also provide additional hypotheses for future empirical research. For example, we show how the level of goals depends on the consumer's self-control problem and motivation, and we provide conditions under which setting some goals may be worse than having no goals. We also show how present-biased preferences can lead to a consumer behaving as if he were future biased. The paper also adds to the growing literature that tries to incorporate psychological and sociological realism into economic models (see, for example, Carpenter and Nakamoto 1990; Wernerfelt 1995; Becker and Murphy 2000; Rabin 2002; Wu et al. 2004; Amaldoss and Jain 2005, 2008; Machado and Sinha 2007; Syam et al. 2008; Kuksov and Villas-Boas 2008).

The rest of the paper is organized as follows. In the next section, we review the literature. In §3, we describe the basic model and present the main results. In §4, we will relax some of the assumptions of the basic model to generate additional insights. We conclude the paper with implications and directions for future research in §5.

2. Related Literature

Our work is related to the large literature in psychology that has studied the impact of goal setting on behavior (see Locke and Latham 1990 for a review). There is substantial evidence that having goals improves performance (Latham and Yukl 1975, Locke et al. 1981). Researchers have tried to understand why goals influence behavior. Locke and Latham (2002) argue that there are four distinct mechanisms by which goals can affect performance. First, goals direct attention toward goal-relevant activities. Second, goals can motivate consumers. Third, goals affect persistence. Finally, goals can affect action by leading to the use of appropriate knowledge and strategies.

There are numerous studies that have shown that increasing goal difficulty improves performance up to a point (see, for example, Locke 1966, Garland 1983, Mento et al. 1987). However, very difficult goals can lead to a reduction in performance (Erez and Zidon 1984). Although most psychological research has found that goals improve performance, the presence of goals can sometimes lead to worse performance. Dieters, once they perceive that they will be unable to achieve their goal, often overindulge and eat more than those not on a diet (Polivy and Herman 1985). This is labeled as the "what-the-hell" effect (see also Cochran and Tesser 1996). Soman and Cheema (2004) show that when goals are unsuccessful, goals can be counterproductive and decrease performance. They conclude that consumers should set moderately difficult goals because goals that are too difficult could fail and consequently lead to worse performance.

Our work differs from the psychological research on goals in several significant ways. First, we develop an analytical model that tries to address the impact of goals not only on performance but also on cost and the overall utility achieved by the consumer. Second, we develop a dynamic model that tracks the effect of goals on performance over time. Finally, our model shows that many of the results in previous work can be shown to hold in our simple and parsimonious work. We, however, also find additional results that are counter to previous research. For example, we show that setting goals sometimes can be counterproductive even when the goal is achieved. We also provide a precise answer to the question of what the optimal goal should be.

Our work is also related to the behavioral economics literature that has tried to study why consumers fail to exert the right amount of self-control. Although the effectiveness of goals in improving performance is well-documented, from the perspective of a rational consumer, it is not immediately clear as to why goals should matter. After all, the rational consumer should in any case do what is optimal for the self. There is now a substantial literature in economics that has examined such self-control problems by appealing to the notion that consumers' discount factor decreases over time (for empirical evidence of this phenomenon, see, for example, Thaler 1981, Chapman 1996, Kirby 1997, Benzion et al. 1989).[1] This phenomenon can be represented in an analytically convenient form by assuming that the individual at time zero discounts payoff at time t by $\beta\delta^t$, where $0 < \beta < 1$, and δ is the usual exponential discount factor and β is a factor that represents present-biased preferences. The $\beta\delta^t$ formulation is referred to as quasi-hyperbolic discounting (Laibson 1997).[2] This implies that the per-period discount rate from now and the next period is higher than the discount rate between any two future periods.[3] Such a formulation leads to time inconsistency in which an individual's choices in the future are not the same as his choices in the current period.

Laibson (1997) develops a model of savings over time and incorporates present-biased preferences. He shows that such preferences can lead to consumers choosing illiquid assets to limit overconsumption. O'Donoghue and Rabin (1999) use present-biased preferences to show why consumers procrastinate. Gruber and Koszegi (2001) show how hyperbolic discounting can lead to addiction. Carrillo and Mariotti (2000) examine the implication of hyperbolic discounting on a consumer's decision to acquire information. They find that sometimes consumers may choose not to acquire information even if it is free. Machado and Sinha (2007) examine how time-inconsistent preferences can affect the time when a smoker plans to quit and when he actually does. Their empirical results are consistent with their model. DellaVigna and Malmendier (2004) examine how firms should design pricing contracts when consumers have present-biased preferences. They also find empirical support for the model predictions. Like this stream of research, we use hyperbolic discounting to study a different problem, i.e., the impact of goals on consumer behavior and the design of optimal goals.

Our work is also related to the work by Wu et al. (2004). They use prospect theory to examine how goals affect performance. They show that if goals act as reference points, they can then increase performance. Like them, we incorporate established psychological theories in formal economic models to study impact of goals. However, unlike them, we study a dynamic model and argue that consumers fail to achieve their optimal efforts because of present-biased preferences. Furthermore, unlike Wu et al. (2004), we also examine how consumers should set optimal goals.

[1] There are alternate approaches for modeling self-control problems. See, for example, Thaler and Shefrin (1981), Gul and Pesendorfer (2000), and Fudenberg and Levine (2006). However, the approach using hyperbolic discounting is more prevalent.

[2] We use the terms "present-biased preferences" and quasi-hyperbolic discounting because both have been used previously in the literature.

[3] In particular, the discount rate between now and the next period is $(1-\beta\delta)/(\beta\delta)$, and the discount rate between time period $t-1$ and t is given by $(1-\delta)/\delta$, which is less than $(1-\beta\delta)/(\beta\delta)$ for $0 < \beta < 1$.

3. Model

Consider the case where the consumer has an ultimate objective such as losing weight, improving health, or saving for retirement. To achieve these goals, the consumer needs to exert some effort. For example, the consumer may decide to exercise to ultimately achieve better health. Similarly, the consumer may decide to curb spending to save for the future. In such situations, although the cost of effort is incurred in the current period, benefits are realized in the more distant future. For example, saving for retirement requires one to exert self-control in the present but the benefit of retirement savings is realized only some time in the future. The problem for the consumer is to exert the right amount of self-control (or other effort such as exercising) to maximize his utility over the long term.

We consider a two-period model in which the consumer exerts effort given by x in period 1 and effort y in period 2. Table 1 summarizes the model notation. Efforts such as exercising and exerting self-control are costly (see Thaler and Shefrin 1981, Shefrin and Thaler 1988, and Wu et al. 2004 for a similar assumption). We model this cost by a function $h(\cdot)$, where $h'(\cdot) > 0$ and $h''(\cdot) > 0$ and $h(0) = 0$.[4] The assumption that $h(\cdot)$ is convex reflects the notion that self-control becomes increasingly difficult the more one exerts it (see Baumeister et al. 1998 for empirical support).[5] We are assuming that effort x in period 1 does not affect the cost function in period 2. However, in some cases it may be easier or more difficult to exert effort depending on the level of effort exerted in period 1. We discuss the implications of this in §4.

We assume that effort leads to some delayed benefits $\phi(x) + \phi(y)$, where $\phi'(\cdot) > 0$, $\phi''(\cdot) \leq 0$, and $\phi(0) = 0$ and the benefits are realized in time period 3.[6] In other words, the realized benefits of the effort are increasing and (weakly) concave in effort. The assumption that $\phi''(\cdot) \leq 0$ captures the notion that it is better to spread out effort rather than concentrate effort in one period.[7] Note that to ensure interior solutions, we do need either $h(\cdot)$ to be convex or $\phi(\cdot)$ to be concave. In this paper, we assume that $h(\cdot)$ is strictly convex and $\phi(\cdot)$ is weakly concave. Our results do not require the assumption of strict concavity of the benefit function.

Table 1 Model Notation

Notation	Explanation
x	Effort in period 1.
y	Effort in period 2.
$h(\cdot)$	Cost function for effort.
$\phi(\cdot)$	Benefit function.
$V_0(x, y)$	Long-term utility obtained if the consumer exerts (x, y).
β	Hyperbolic discount factor.
x_β	First-period effort exerted by a present-biased consumer without goals.
y_β	Second-period effort exerted by a present-biased consumer without goals.
x^*	First-period effort exerted by a consumer without goals and with no present bias.
y^*	Second-period effort exerted by a consumer without goals and with no present bias.
s	Increase in utility experienced if the goal is achieved.
l	Loss in utility experienced if the goal is not achieved.
m	Motivational power of goals: $m = l + s$.
G	The assigned goal expressed in terms of cumulative effort $x + y$.
x_G	The effort by first-period consumer assuming that the second-period consumer exerts $G - x_G = y_G$.
$\hat{y}$	The maximum effort the second-period consumer is willing to exert to achieve the goal.
k	Cost parameter when $h(x) = kx^2/2$.

Note that we are assuming that effort is deterministically related to outcomes $\phi(\cdot)$. However, our framework can easily accommodate the situation when effort is only probabilistically related to the outcome. To do this, we can relabel the $\phi(\cdot)$ terms as expected benefits and assume that consumers are risk neutral. As long as the outcome of the stochastic process is realized after the efforts are exerted, the analysis would essentially remain unchanged.

Consumers with time-consistent preferences. Consider the case where the consumer does not have any self-control problems and exerts effort x in the first period and y in the second period. We define the long-run

[4] Our framework can also be modified to allow for the possibility that there is a discontinuity at $x = 0$ and the initial effort requires a fixed setup cost f; i.e.,

$$\lim_{x \downarrow 0} h(x) = f > 0.$$

This reflects the notion that beginning to diet or exercise is often hard. As long as f is not too large and effort is positive, this alternate formulation would not affect the main results. If f is large, then the consumer might find it optimal to exert effort in only one period and therefore incur f only once. This would effectively turn our two-period problem into a single-period one in which the consumer exerts effort in the last period. If we were to consider a model with more than two periods, then this assumption would lead to the consumer exerting effort in only some periods and exerting zero effort in other periods.

[5] An alternative conceptualization of self-control is that it is a skill. This implies that the required effort should decrease as one exerts self-control. However, skill theory predicts such changes in the long run, and therefore, in general, would not affect costs from period one to period 2 (see Baumeister and Vohs 2003). In §4, we consider the implications of a model that allows costs to decline over time.

[6] Alternatively, we could assume that the first-period benefits $\phi(x)$ are realized in period 2 and $\phi(y)$ is realized in period 3. The analysis of this case would essentially be the same, and the results would go through in this alternate formulation.

[7] There is empirical support for this. For example, Thacher (2008) finds that students who concentrate their efforts in preparing for the final exam by pulling one-nighters perform worse than students who do not.

utility that the consumer receives as $V_0(x, y)$, which is given by

$$V_0(x, y) = \delta^2[\phi(x) + \phi(y)] - h(x) - \delta h(y). \quad (1)$$

The consumer with time-consistent preferences will choose optimal efforts (x^*, y^*) to maximize $V_0(x, y)$. Denote the associated utility as $V_0(x^*, y^*)$. The consumer's decision problem in the second period is to choose $y(x^*)$ such that

$$y(x^*) = \arg\max_{y}\left[-h(y) + \delta(\phi(x^*) + \phi(y))\right], \quad (2)$$

where δ is the discount factor. Assuming that there is an interior solution, the relevant first-order condition is

$$\delta\phi'(y^*) - h'(y^*) = 0. \quad (3)$$

Using this, we can find x^*, which is given by the relevant first-order condition:

$$\delta^2\phi'(x^*) - h'(x^*) = 0. \quad (4)$$

We have

$$V_0(x^*, y^*) = \delta^2(\phi(x^*) + \phi(y^*)) - h(x^*) - \delta h(y^*). \quad (5)$$

The consumer ideally wants to achieve $V_0(x^*, y^*)$. Indeed, if the consumer could decide how much effort to exert long before the actual decision time, he will want to exert (x^*, y^*). The fact that individuals do not end up exerting (x^*, y^*) is what is typically used to infer that the consumer has a self-control problem. We will later examine whether goals can help consumers achieve the optimal long-run utility $V_0(x^*, y^*)$.

Consumers with self-control problems. We follow prior literature and assume that the consumer suffers from self-control problems, which are usually modeled using quasi-hyperbolic discounting. In particular, at time t, the consumer discounts the next period with a discount factor $\beta\delta$, where $0 < \beta < 1$. As we discussed before, the presence of β leads to time-inconsistent preferences in which the preferences of the consumer at time period 1 are different from those at time period 2. These are usually modeled by assuming that the consumer at each point in time is a separate agent who chooses current actions to maximize current preferences. However, the consumer at time $t = 1$ can take into account what the consumer at time $t = 2$ will do. Thus, present-biased preferences lead to a game being played between the first-period self and the second-period self, where the first-period self acts as the leader.

Denote the first- and second-period efforts of the consumer as x_β and y_β, respectively. Let us first consider the action of the second-period self. In period 2, he will make the decision to exert an effort $y_\beta(x_\beta)$, which is defined by[8]

$$y_\beta = \arg\max_{y(x_\beta)}\left(-h(y(x_\beta)) + \beta\delta[\phi(x_\beta) + \phi(y(x_\beta))]\right). \quad (6)$$

Now, consider the decision of the consumer in period 1. The consumer needs to take into account his expected behavior in period 2. It is possible that the consumer is completely aware of his self-control problems and makes his decision based on this knowledge. O'Donoghue and Rabin (1999) label such consumers as sophisticates. The assumption that consumers are sophisticated implies that consumers have rational expectations; this is typically assumed in most models that use time-inconsistent preferences (O'Donoghue and Rabin 2000).[9] There is also evidence that consumers exhibit some sophistication (see, for example, Laibson 1997, O'Donoghue and Rabin 2000).

Alternatively, the consumer may underestimate his self-control problem by assuming that in period 2, he will do what is optimal for the long-run self; i.e., $\beta = 1$. These optimistic consumers are labeled as "naïve" (following O'Donoghue and Rabin 2001). We will first analyze the case when the consumers are sophisticated because this is the usual assumption in the literature. In §4, we consider the case when consumers are naïve. In such situations, we find that many of our results under the assumption of sophisticated consumers still hold when consumers are naïve.[10]

The sophisticated consumer in the first period is aware of his self-control problem and will therefore choose x_β such that

$$\begin{aligned} x_\beta = \arg\max_{x}\big(&-h(x) - \beta\delta h(y_\beta(x)) \\ &+ \beta\delta^2[\phi(x) + \phi(y_\beta(x))]\big). \end{aligned} \quad (7)$$

It is important to note the source of time inconsistency. Ideally, the first-period consumer would prefer that the second-period consumer chooses a $\tilde{y}$, which is given by

$$\tilde{y} = \arg\max_{y(x_\beta)}\left(-\beta\delta h(y(x_\beta)) + \beta\delta^2[\phi(x_\beta) + \phi(y(x_\beta))]\right). \quad (8)$$

Comparing Equations (6) and (8), we can see that if $\beta = 1$, then $\tilde{y} = y_\beta$.[11] However, if $\beta < 1$, then $\tilde{y} \neq y_\beta$.

[8] Note that concavity of $\phi_i(\cdot)$ and the convexity of $h(\cdot)$ function ensures that the solution is unique.

[9] Rational expectations are usually assumed in most other analytical models (see, for example, Stokey 1981, Becker 1991, Rajiv et al. 2002).

[10] Our approach of modeling consumers as having rational expectations also enables us to more clearly understand the role of β in optimal goal setting because the only difference between our model in this section and the traditional economic model is the presence of β.

[11] If $\beta = 1$, then the right-hand side of Equation (8) is just δ times the right-hand side of Equation (6). This implies that $y(x_\beta)$, which maximizes both, must be the same.

In other words, the preferences of the first-period agent and the second-period agent are different. Thus, the traditional one-person dynamic optimization method is not appropriate and this individual-level problem is more appropriately modeled as a two-person game. Also, note that the long-run self would like the second-period agent to choose

$$\bar{y}(x) = \arg\max_{y(x)} \left(-\delta h(y(x)) + \delta^2[\phi(x_\beta) + \phi(y(x_\beta))]\right), \quad (9)$$

which implies that $\bar{y}(x) = \tilde{y}$; i.e., the long-run self would like the second-period agent to behave as if it does not have present-biased preferences. This again implies that as long as $\beta < 1$, there is a discrepancy between what the long-run self desires and what actually happens. Because our primary focus is on understanding how β affects decisions, to reduce notational clutter and to simplify the analysis, we will assume that $\delta = 1$ (see O'Donoghue and Rabin 1999 for a similar assumption). In Technical Appendix B (available at http://mktsci.pubs.informs.org), we show that the main results in the paper hold even if $\delta \neq 1$. We first have the following result, which shows that the consumer will not exert optimal effort:

Proposition 1. *A consumer with $\beta < 1$ exerts lower effort in both periods; i.e., $x_\beta < x^*$, $y_\beta < y^*$ as β decreases. Furthermore, the consumer achieves lower benefits and lower overall (long-run) utility as β decreases.*[12]

This benchmark proposition shows that in the framework we have chosen, consumers' long-term objectives and their actions are not properly aligned. For example, consider the case when $\phi(x) = x$, $h(x) = x^2/2$, and $\beta = 0.5$. In this case, the consumer exerts an effort of 0.5 in both periods while the long-run optimal requires him to exert an effort of 1. As a result, the long-run utility $V_0(x, y)$ reduces from 1 to 0.5 because of self-control problems. This result explains why consumers who want to lose weight, quit smoking, save money, or exercise often never do, despite understanding the clear benefits of such actions. For example, a 1993 survey finds that the mean gap between what consumers believe they should save and what they actually do is 11.1% (Bernheim 1995). As we discussed before, there is ample evidence to suggest that goals may be one way to rectify self-control problems. Next, we examine how goals affect performance and how we should set optimal goals.

3.1. Goals

Now, we consider the case when the consumer sets a goal. We focus on specific and measurable goals. For example, the consumer might decide to exercise for two hours a week, eat 2,000 calories in a day, or put in 10 hours for completion of his desired project. The consumer here is specifying his cumulative goals in terms of the process of achieving the outcome. Alternatively, the consumer could specify goals in terms of outcome. For example, he could specify the goal as five pounds in lost weight, better health (say, blood pressure), etc. Because outcomes are distant, it is often the case that goals are specified in terms of effort. In this paper, we will focus on situations in which the consumer is specifying a goal in terms of the effort, i.e., the process required to achieve the ultimate benefit.[13]

We assume that the consumer sets a cumulative goal G of achieving $x + y = G$. Note that we are assuming that goals are set over a longer time period than the actions. This is because while a consumer has many opportunities to exert effort, it may become too cumbersome to specify goals for each time period. For example, consider an individual who is saving for retirement. The individual has several opportunities to spend money and must exert self-control at various points in time. However, it is not possible to specify goals for each unit of time.[14] In our two-period formulation, this is captured by assuming that a cumulative goal is specified over two periods while the consumer must exert effort in each period. It is also possible that in some situations, a consumer may be able to specify short-term recurrent goals for each period of time. In such situations, the consumer can specify goals as (x^*, y^*) and achieve the optimal long-run utility. We will focus on the more difficult problem in which we are unable to specify goals for each period.[15]

Note that we specify goals in terms of the process required to achieve a desired outcome. However, if $\phi(\cdot)$ is linear, then any goals that are specified in terms of effort can also be equivalently specified in terms of outcomes. To see this, note that because of linearity, any effort combination (x, y) would lead to an outcome that can be expressed as $\psi(x + y)$, where $\psi(\cdot)$ is a linear function that is strictly increasing in its arguments. Then, the goal $G = x + y$ is equivalent to specifying an outcome $\psi(G) = \mathcal{G}$. Thus, all the

[12] Proofs are in the Technical Appendix, available at http://mktsci.pubs.informs.org.

[13] There is also research that suggests that the type of goals, the framing of goals, and goal proximity affect the efficacy of goals (see, for example, Gollwitzer 1999). We abstract away from these issues in this paper. Future research can explore how these and other factors can be incorporated in a formal model.

[14] The consumer could also use rules such as how much money to spend on food, entertainment, etc. Although such rules are clearly important, they are not the focus of our paper.

[15] However, under a different set of assumptions, there could be several interesting issues with short-term goals. We leave it for future research to explore the implications of consumers setting short-term goals.

analysis with G in this case can be restated in terms of $\mathscr{G}$. As we discussed earlier, all the results in the paper would hold for the case of linear $\phi(\cdot)$ function, and therefore, our results would hold in those situations even if the goal was specified in terms of outcome.

Finally, we assume that achieving a goal gives the consumer an added benefit $s > 0$, which could be the result of positive emotions experienced because of goal achievement or could be even monetary or some other gain that one might get for achieving the goal. Similarly, if the consumer does not achieve the goal, then he experiences a negative emotion and may also suffer some other negative consequences. We assume that this is represented by a loss $-l$ where $l > 0$. We denote the term $(l + s)$ by m, which represents the motivational level of the consumer. Clearly, m needs to be sufficiently high for the consumer to strive for the goal.[16] We do not place any restrictions on the relative sizes of s and l. Thus, for example, our framework allows for the possibility that $l > s$; i.e., nonachievement of goal hurts more than the achievement of goals. This would be consistent with prospect theory if we assume that successful achievement of a goal is coded as a gain and failure is coded as a loss. In such situations, we would expect losses to loom larger than gains; i.e., $l > s$.

First, consider the consumer's second-period decision. If the consumer is sufficiently motivated, i.e., m is sufficiently large, the consumer's second-period effort is $y_G = G - x$, where x is the effort in the first period. The first-period decision for the consumer is to choose x_G to maximize

$$x_G = \arg\max_x \big(\beta[\phi(x) + \phi(y_G) - h(y_G)] - h(x)\big). \quad (10)$$

If there is an interior solution with $x_G > 0$, we must have

$$\beta\big(\phi'(x_G) - \phi'(y_G)\big) - \big(h'(x_G) - \beta h'(y_G)\big) = 0. \quad (11)$$

The analysis above assumes that the consumer is sufficiently motivated such that $y = y_G$. However, if m is not too large, then it is plausible that the second-period effort may fall below y_G and the goal is not achieved. Therefore, the first-period self needs to determine what maximum effort the second-period self is willing to make. Denote this by $\hat{y}$. If the second-period self exerts an effort that does not achieve the goal, then it is optimal to exert y_β. On the other hand, if an effort $\hat{y}$ is exerted and the goal is achieved, then the additional benefit is given by[17]

$$\mathscr{B}_y(\hat{y}) = m + \beta[\phi(\hat{y}) - \phi(y_\beta)] - [h(\hat{y}) - h(y_\beta)]. \quad (12)$$

By definition of $\hat{y}$ we need

$$\mathscr{B}_y(\hat{y} \mid \hat{y} \geq y_\beta) = 0. \quad (13)$$

In Technical Appendix A (available at http://mktsci.pubs.informs.org), we show that this equation uniquely defines $\hat{y}$. Note that $\hat{y}$ is increasing in m. Now, consider the decision of the first-period self. The consumer in this period needs to decide how much effort to exert to ensure that the goal is achieved. Let $\hat{x}$ be the maximum effort that the consumer is willing to exert in period 1 to achieve the goal if the second-period consumer exerts $\hat{y}$. If $\hat{x} + \hat{y} > G$, then the goal can be achieved. If the consumer finds that the goal cannot be achieved, then he exerts efforts x_β and y_β in periods 1 and 2, respectively. The following lemma characterizes the consumer's efforts in the two periods as a function of the motivational level m. We have

Lemma 1. *For any goal G, there exist an m_1 and m_2 such that*

$$x(G) = \begin{cases} x_\beta & \text{if } m < m_1, \\ G - \hat{y} & \text{if } m \in [m_1, m_2), \\ x_G & \text{otherwise}. \end{cases} \quad (14)$$

$$y(G) = \begin{cases} y_\beta & \text{if } m < m_1, \\ \hat{y} & \text{if } m \in [m_1, m_2), \\ G - x_G & \text{otherwise}. \end{cases} \quad (15)$$

The lemma shows that the second-period effort is weakly increasing as goals become more motivational; i.e., m increases. This is intuitive. Interestingly, however, we find that for $m \in (m_1, m_2)$, first-period effort decreases as goals become more motivational! *In other words, increased motivation can lead to procrastination.*

Now, we address the question as to how goals can improve performance and how we should set goals. As we discussed before, there is substantial evidence to suggest that having goals can be beneficial in terms of the outcome. There is also some research that argues that goals can be counterproductive when goals are not achieved and leads consumers to lose self-control (see, for example, Soman and Cheema 2004). We later examine the case when goals are not achieved, but we first examine the case when goals are actually

[16] Note that we are assuming that a consumer codes a goal to be successful only if he achieves the desired target and codes it as a failure otherwise. Thus, we focus on "all-or-nothing" goals (see Soman and Cheema 2004 for a similar focus). Note, however, that the utility of the consumer is dependent not only on the reward s and loss $-l$ but also on $\phi(\cdot)$. Thus, the overall realized benefit of a consumer who fails the goal and is near the goal is higher than the consumer who is far off from the goal.

[17] Note that we are assuming that m is realized in the second period. Because goal achievement is determined by whether the required effort is exerted and is observed in the second period, this is reasonable. Alternatively, we could assume that m is realized in the next period. This alternate assumption does not change the basic nature of the results.

achieved. Consider, for example, an individual who in general studies for about 30 minutes in a given day. Suppose we set the daily goal to be 35 minutes (which is only slightly higher than 30 minutes). Intuition would suggest that this goal is not too onerous and, if achieved, would clearly improve learning. The next proposition shows that such easy goals, even when successful, can be counterproductive.

Proposition 2. *There exists a goal $G \geq x_\beta + y_\beta$ such that if the consumer achieves the goal, he is (weakly) worse off in terms of realized benefit and effort; i.e.,*

$$\phi(x_G) + \phi(y_G) \leq \phi(x_\beta) + \phi(y_\beta), \tag{16}$$

$$h(x_G) + h(y_G) > h(x_\beta) + h(y_\beta), \tag{17}$$

where the weak inequality in (16) *is replaced with strict inequality when $\phi'' < 0$. Also, for low s, the consumer has a lower overall utility as compared to the no-goal case; i.e., $V_0(x_G, y_G) + s < V_0(x_\beta, y_\beta)$.*

Proposition 2 thus shows that some goals are worse than having no goals, *even when those goals are achieved*. In particular, when the consumer sets easy goals that are just slightly more than what he would normally do, he is worse off than the case when he had no goals. Note that this result is in contrast to claims that having a goal itself may be beneficial. Note also that the goal we set is greater than what the consumer would have done otherwise (i.e., $x_\beta + y_\beta$). For example, consider the case when $h(x) = x^2/2$, $\phi(x) = 2\sqrt{x}$, $\beta = 0.25$, $m = s + l \geq 0.012$. In this case, absent any goal, the consumer will set $x_\beta = y_\beta = 0.396$. This will result in a total benefit of 2.52, effort of 0.157, and $V_0(x_\beta, y_\beta) = 2.36$. The optimal efforts from a long-term perspective (i.e., with $\beta = 1$) are 1.0 in each period and $V_0(x^*, y^*) = 3.0$. Suppose, we set a goal of 0.8, which is strictly greater than what is achieved without the goal. In this case, we find that the goal is achieved and $x = 0.27$ and $y = 0.53$. However, the net benefit is lower at 2.49 and the total costs are higher at 0.176. Furthermore, if $s < 0.05$, then $V_0(x_G, y_G) + s = 2.31 + s < V_0(x_\beta, y_\beta) = 2.36$. Thus, the goal that is achieved makes the consumer worse off on every relevant dimension.

The intuition for this is as follows. Recall that because of hyperbolic discounting, the preferences of the first-period consumer and the second-period consumers are not completely aligned and we model them as two different agents. When goals are sufficiently motivating, the first-period consumer knows that the second-period consumer will exert enough effort so that the goal will be achieved. This gives the first-period consumer the incentive to defer action to the second period. In other words, goals are a commitment mechanism. To see this formally, consider the case when $m > m_2$ and the consumer exerts efforts x_G and y_G. Note that $x_G < y_G$. To see this, suppose it is not true. Then, the first term in (11) is negative by concavity and because convexity ensures that $h'(x_G) > h'(y_G)$, the equality in (11) cannot be satisfied. Therefore, $x_G < y_G$. In other words, *for sufficiently motivated consumers, goals distort incentives and encourage procrastination.* This procrastination effect of goals has empirical support. For example, Asch (1990) observes that Navy recruiters procrastinate early on and increase effort when they are near the month in which the quota-based reward is decided. Similar observation has been made in the context of salesforce by Oyer (1998). Camerer et al. (1997) argue that if cab drivers set a weekly goal, then they are likely to quit early and try to make up the shortfall toward the end of the week.

This shifting of efforts because of goals can hurt the consumer in two ways. First, because the cost functions are convex, shifting effort from first period to the second period will increase costs. Similarly, because $\phi(\cdot)$ is weakly concave, the outcome is weakly less favorable when we shift effort and put more concentrated efforts in the last period. Thus, if the goal is easy and is only a little above what the consumer would normally do, the consumer is worse off in terms of outcomes, effort, and the long-term utility function $V_0(\cdot)$ by having the goal. There is some empirical evidence that suggests that goals can hurt utility even when they increase performance (i.e., outcome). For example, Jackson and Zedeck (1982) in an experimental study find that goals and satisfaction are negatively correlated. Similar results are found by Wotruba (1989) who, in a study of independent salespersons, found that salespersons who set specific goals exerted more effort but were less efficient and less satisfied than those who did not have goals. Our results provide one potential explanation; i.e., although some goals can increase performance, they can also lead to inefficient effort allocation and thereby reduce utility and satisfaction. This result also has implications for companies assigning sales quotas. If absent a quota, the salesperson exerts an effort $x_\beta + y_\beta$. A quota that is only slightly higher can make both the firm and the salesperson worse off.

Proposition 2 shows that goals can distort incentives and sometimes lead to problems. In particular, the result shows that setting any goal that is higher than $x_\beta + y_\beta$ is not a prudent strategy and can backfire. Therefore, we need to examine what the optimal goal should be. The optimal goal could be set by the consumer well before the actual decision so that he does not suffer from present-biased preferences at the time of making the decision. Consequently, the consumer maximizes his long-run utility function $V_0(x, y)$. Alternatively, the decision could be made by an organization (such as weight loss programs) or individuals (personal coaches). Thus, the game can be viewed as a three-person game. The consumer at time zero acts as the principal and sets G^* to maximize $V_0(x, y)$. Given G^*, the first-period and second-period selves act as agents at time periods 1 and 2, respectively. We will first consider the case when m is sufficiently large such that $y_G = G - x_G$. In this case, define

$$G_0 = \arg\max_G \left[\phi(x_G) + \phi(y_G) - h(x_G) - h(y_G)\right]. \quad (18)$$

If the consumer could set a goal G_0, can goals eradicate the problem because of self-control and achieve $V_0(x^*, y^*)$? Proposition 3 considers this issue.

Proposition 3. *If the consumer is sufficiently motivated and $m > m_2$, then*

(a) *The long-run utility using optimal goal is strictly less than that for the consumer with no self-control problems; i.e., $V_0(x_{G_0}, y_{G_0}) < V_0(x^*, y^*)$.*

(b) *The first-period effort under the optimal goal is less than x^* but greater than what the individual would do without the goal. In other words, $x_\beta < x_{G_0} < x^*$.*

(c) *The second-period effort under the optimal goal is greater than y^*; i.e., $y_{G_0} > y^* > y_\beta$.*

(d) *If $\phi'''(\cdot) - h'''(\cdot) = 0$, then the optimal goal is between what the individual would do without the goal and what is optimal from the long-run perspective; i.e., $x_\beta + y_\beta < G_0 < x^* + y^*$.*

The first part of Proposition 3 shows that even when consumers are sufficiently motivated, goals cannot achieve the optimal long-term utility. This is because the optimal goal does not induce the consumer to exert the optimal level of self-control, i.e., (x^*, y^*). The second part of Proposition 3 shows that even with optimal goals, a sufficiently motivated consumer would exert less effort in period 1 than what is optimal; i.e., $x_{G_0} < x^*$. A consequence of this result is that if the consumer were to retrospectively evaluate his actions in time period 2, he will regret having exerted too little self-control. This is consistent with empirical observations that present-biased consumers regret their underinvestment in self-control (see, for example, Baumeister 2002). However, Proposition 3(c) shows that under optimal goals, the consumer would exert more effort in the second period than is optimal from long-run perspective; i.e., $y_{G_0} > y^*$. In fact, we could look at the consumer's second-period choices and infer that he is not present biased but instead is future biased (see, for example, Kivetz and Simonson 2002, Kivetz and Keinan 2006). Although the empirical observation that $y_{G_0} > y^*$ could well arise because of future-biased preferences, our results show that it could also be the outcome of goal setting by a present-biased consumer. In other words, we provide an alternate explanation for hyperopic (i.e., future-biased) behavior. *In particular, we show that a consumer might exert too much self-control not because he is hyperopic but because he is myopic*. Thus, only examining the consumer's actions is not sufficient to infer the presence of future-biased preferences. Furthermore, our result shows that in the presence of a goal, a consumer with present-biased preferences may at the same time regret having exerted too little self-control (in period 1) and too much self-control (in period 2).

Note also that we find $x_{G_0} < y_{G_0}$. Thus, goals do not eradicate the problem of procrastination but only induce consumers to do more in the hope of award s or in fear of a loss l. Proposition 3 also shows that the optimal goal is always higher than what a consumer would normally do, i.e., $(x_\beta + y_\beta)$. This is consistent with Proposition 2. If we assume that $\phi'''(\cdot) - h'''(\cdot) = 0$, then we find that the optimal goal is in between what the consumer normally does, i.e., $x_\beta + y_\beta$, and what is optimal for the consumer without self-control problems, i.e., $x^* + y^*$. The condition that we specify on $\phi''' - h''' = 0$ is satisfied, for example, when $\phi(\cdot)$ is linear and $h(\cdot)$ is quadratic. Note, however, that this is a sufficient and not necessary condition. The result is consistent with the general notion in the goal-setting literature, which suggests that goals should be moderately difficult. However, the argument there is that very difficult goals can discourage consumers from attempting such goals and, therefore, can be ineffective. We consider a scenario where the consumer is sufficiently motivated and even higher goals will be achieved. Even in these situations, we find that consumers should set goals that are only moderately difficult. This is because in our framework, we consider both the outcome and the costs.

Now, we consider the more general case where motivation levels may not be high enough to ensure that the consumer exerts an effort y_G in period 2. The consumer exerts y_G only if

$$\mathcal{B}_y(G - x_G) \geq 0. \quad (19)$$

If (19) is violated, then the first-period self needs to consider the maximum level of effort that can be exerted in the second period (defined earlier as $\hat{y}$). Note that $(G - x_G)$ is increasing in G. Therefore, the assigned goal affects whether the constraint in (19) holds. In particular, as G increases, (19) is less likely to be satisfied. If the first-period self finds it worthwhile to achieve the goal, then he exerts an effort $(G - \hat{y})$. However, when G is very high, the consumer in the first period realizes that the goal cannot be achieved and therefore exerts x_β, and the second-period self therefore exerts an effort y_β. To evaluate the optimal goals, we need to consider how the assigned goals affect the effort and therefore the value function. We first have the following lemma.

Lemma 2. *The long-run utility as a function of the assigned goal G is defined by*

$$V_0^*(G) = \begin{cases} V_0(x_G, G - x_G) + s & \text{if } G \le \gamma_1, \\ V_0(G - \hat{y}, \hat{y}) + s & \text{if } G \in (\gamma_1, \gamma_2], \\ V_0(x_\beta, y_\beta) - l & \text{if } G > \gamma_2. \end{cases} \quad (20)$$

The critical values γ_1 and γ_2 depend on the parameters m, β, and k. Figure 1 plots how the long-run value function varies with the goal G. Note that Lemma 2 points to two types of goal-setting approaches. When the goal is not too difficult, the consumer exerts x_G in period 1 and $y_G < \hat{y}$ in period 2. We label the strategy of setting goals that lie in $(x_\beta + y_\beta, \gamma_1)$ as a "moderate goal" strategy. On the other hand, if the goal is difficult but achievable, then the consumer is forced to do the maximum he is willing to do in the second period, i.e., exert $\hat{y}$. We label this goal-setting approach as "aggressive goal" strategy. The problem, then, for the long-run planner is to first determine what type of goal-setting strategy is optimal.

In Figure 1, note that the value function $V_0^*(G)$ is not continuous throughout and, in particular, is discontinuous at γ_2. At γ_2, the consumer is just indifferent between attempting the goal and not attempting it. However, for a goal that is strictly greater than γ_2, the goal is ineffective and the consumer ignores the goal, which leads to the discontinuity. Furthermore, the function is continuous but nondifferentiable at γ_1 and is also not concave. Thus, it is not straightforward to determine the optimal G^* for the general case. In general, G^* would vary discontinuously with the model parameters. To proceed, we choose specific functional forms for $\phi(\cdot)$ and $h(\cdot)$. In particular, we assume that $\phi(x) = x$ and $h(x) = kx^2/2$, where $k > 0$ is a constant. Define

$$G_1 = \arg\max_G \left[G - \frac{k\hat{y}^2}{2} - \frac{k(G - \hat{y})^2}{2} \right]. \quad (21)$$

Thus, G_1 is the optimal level of goal G under the assumption that the consumer uses the aggressive goal strategy $(G - \hat{y}, \hat{y})$. If $G_1 > \gamma_2$, then G_1 is not feasible. Similarly, if $G_0 > \gamma_1$, then G_0 is not feasible. Thus, to determine the optimal G^*, we may need to evaluate the value function at G_0, G_1, γ_1, and γ_2. Furthermore, we need to check whether the assigned goal can be achieved given m, k, and β. The general problem is difficult to characterize if we allow all the parameters to vary. We first examine how the optimal goal varies with the level of motivation, i.e., m.

Proposition 4. *Suppose $\phi(x) = x$, $h(x) = kx^2/2$, and $\beta = \frac{1}{2}$. The optimal G^* is defined by*

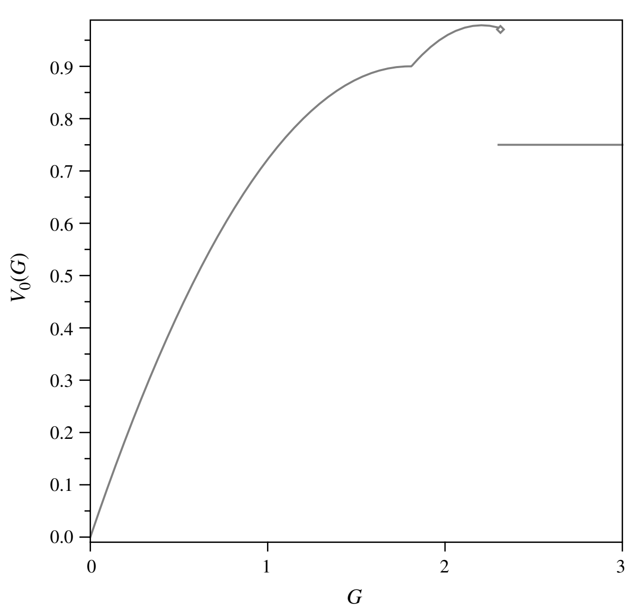
$$G^* = \begin{cases} \dfrac{2 + 2\sqrt{2mk} + \sqrt{2\sqrt{2mk}}}{2k} & \text{if } m \le \dfrac{1}{8k}, \\ \dfrac{3 + 2\sqrt{2mk}}{2k} & \text{if } \dfrac{1}{8k} < m < \dfrac{9 + 4\sqrt{5}}{40k}, \\ \dfrac{9}{5k} & \text{otherwise}. \end{cases} \quad (22)$$

G^* is highest for intermediate values of m. Furthermore, for $1/(8k) < m < (9 + 4\sqrt{5})/(40k)$, the assigned goal is strictly greater than $x^* + y^*$; i.e., $G^* > x^* + y^*$.[18]

Figure 2 plots how G^* varies with motivation m when $k = 1$.[19] Intuition would suggest that as motivation increases, the consumer should be assigned higher goals. The intuition is correct locally in the sense that almost everywhere except at $m = (9 + 4\sqrt{5})/(40k)$, G^* increases in motivation. However, as is easy to see from Figure 2, this intuition is misleading if one were to assume that for any $m_1 < m_2$, $G(m_1) < G(m_2)$. Indeed, this is not true for a large range of m. Note also that although the result here is stated in terms of $\beta = \frac{1}{2}$, similar results are obtained for other β values. Figure 3 plots the case when $\beta = \frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$. We see that the pattern of optimal goals is similar in all cases. Details of these cases are in Technical Appendix C (available at http://mktsci.pubs.informs.org).

To understand the intuition for this result, we need to understand the reason for the discontinuity in the G^* as a function of m. First, note that by

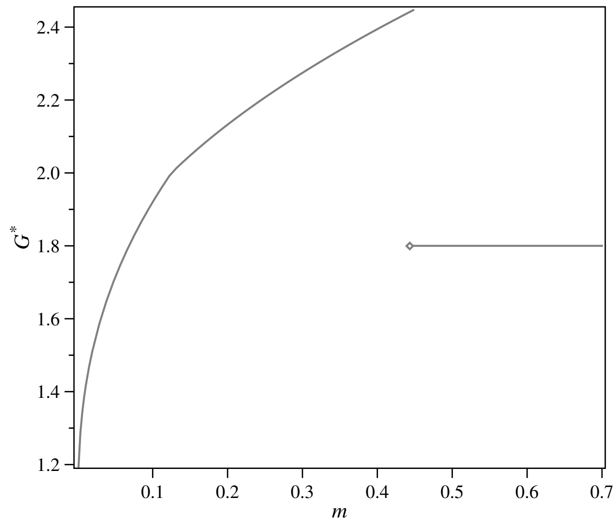
Figure 1 **Long-Run Utility as a Function of Goals**



[18] Although the proof is for a specific value of β because it enables closed-form solutions, the result is more general. We can show that a similar pattern holds for other values of β. Also, the chosen value of $\beta = \frac{1}{2}$ has some empirical basis. For example, Viscusi and Huber (2006) found empirical estimates of β that range from 0.48 to 0.61.

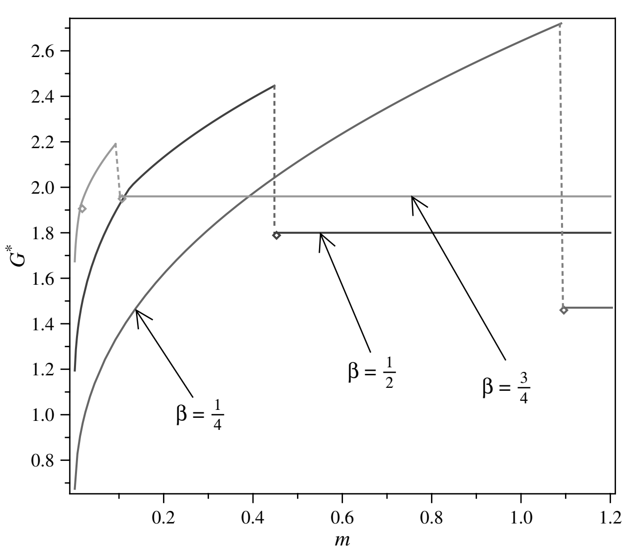
[19] Alternatively, the x-axis can be read as depicting mk.

Figure 2 Optimal Goal as a Function of Motivation ($\beta = \frac{1}{2}$)



selecting G, the consumer is selecting among two potential strategies, i.e., the moderate $(x_G, G - x_G)$ strategy and the aggressive $(G - \hat{y}, \hat{y})$ strategy. When G is low, the consumer may exert an effort x_G in period 1 because the second-period agent is willing to exert $(G - x_G)$. However, for larger values of G, $(G - x_G)$ is not feasible: the second-period constraint binds and the second-period self is willing to exert at most $\hat{y}$. Therefore, if the goal is to succeed, the first-period agent must exert $(G - \hat{y})$. Thus, the strategy of $(x_G, G - x_G)$ requires less aggressive goal setting, and although it achieves lower benefits, it also economizes on costs. On the other hand, the strategy $(G - \hat{y}, \hat{y})$ requires more aggressive goal setting, which leads to higher benefits but also leads to higher costs.

Figure 3 Optimal Goal as a Function of Motivation for Different Values of β



It is important to note how effort varies with motivation under the two strategies. In the moderate goal-setting strategy of $(x_G, G - x_G)$, motivation does not directly affect x_G but only limits the maximum goal that is feasible under this strategy. However, under the aggressive goal-setting strategy of $(G - \hat{y}, \hat{y})$, motivation level directly affects $\hat{y}$. In fact, $\hat{y}$ is given by

$$\hat{y} = \frac{\beta + \sqrt{2mk}}{k}, \tag{23}$$

which is strictly increasing in m. When the consumer has low motivation, it is optimal to "push" the consumer to put in the most effort that his motivation level would allow. In other words, it is beneficial to set more aggressive goals, i.e., use the $(G - \hat{y}, \hat{y})$ strategy. Such a strategy leads to better realized benefits but does come at increased costs. On the other hand, when the consumer has a sufficiently high motivation level, one can more effectively balance the cost and the realized benefits, and the consumer uses a less aggressive strategy of $(x_G, G - x_G)$. The critical point at which it is optimal to switch from the aggressive strategy of $(G - \hat{y}, \hat{y})$ to the more moderate strategy of $(x_G, G - x_G)$ is given by $m = (9 + 4\sqrt{5})/(40k)$ when $\beta = \frac{1}{2}$. Note that Proposition 4 is consistent with the common notion that goals should be used to "push" consumers the best they can do. However, Proposition 4 clarifies that this is true only for consumers with low levels of motivation.

The next part of Proposition 4 shows that sometimes it is optimal to specify goals that are higher than what a consumer with no self-control problems would exert, i.e., $(x^* + y^*)$. Furthermore, because the goal is achieved, this would imply that proper goal setting can lead consumers with low motivation and self-control problems to have higher benefits than those with high motivation and no self-control problems! Thus, for example, a properly assigned goal can make a consumer save more and achieve better health than the "rational" consumer with no self-control problems. Note, however, that this does not imply that the person with self-control problems is better off, because although he does achieve higher benefits, he incurs much higher costs. Thus, although this consumer may be healthier and save more, he will have a lower quality of life doing this than the consumer without self-control problems.

Note that, consistent with Proposition 3, we find that consumers with a moderate level of motivation might regret that they exerted too much self-control (because their effort is higher than $x^* + y^*$). Therefore, the result again shows that in the presence of goals, even present-biased consumers might regret that they have exerted too much self-control. Proposition 4 also highlights why it is important to account for both the benefit and the cost in deciding the optimal goal level.

This is because a decision that is focused only on the benefit would tend to always increase goals as motivation increases. Because most psychological studies have focused only on outcomes, results from these studies to decide on optimal goals could lead to goals that are too demanding in some cases. Although these goals would lead to higher performance, they would lead to lower overall utility. This, in turn, could negatively affect a consumer's desire to stick with such goals in the future. Such a performance focus could be the reason why most consumers who lose weight quickly gain it back and why people often do not continue with their saving goals.

An interesting question that we have not yet addressed is how motivation affects the total long-run utility. Intuitively, we would expect that as m increases, the consumer would always be better off. To address this issue, we need to consider both the components of m separately: the utility from a success s and the loss l that is avoided if the goal is achieved. Note that the analysis so far has been agnostic about these two parameters, and indeed only the combination matters so far. The next proposition examines two polar cases: when motivation is primarily driven by reward s, i.e., $m = s$, and when motivation is primarily driven by fear of failure, i.e., $m = l$. We have the following result:

Proposition 5. *Suppose $\phi(x) = x$, $h(x) = kx^2/2$, and $\beta = \frac{1}{2}$. If the consumer is primarily motivated by fear of loss, i.e., $m = l$, then for $m \in (1/(8k), (9+4\sqrt{5})/(40k))$, the total utility, i.e., $V_0(x, y) + m$, decreases as motivation increases. If $m = s$, then under optimal goal setting the total utility $V_0(x, y) + m$ is always increasing in m.*

This proposition shows that goals that motivate by rewarding success are better than goals that motivate by punishing failure. Also, we find that sometimes increased motivation can actually be harmful. Note that this is true despite the fact that the consumer always achieves the goal and l is never realized. However, an increase in l can still make the consumer worse off.[20]

Figures 4 and 5 plot $V_0(x, y) + m$ under optimal goals for the case when $m = l$ and $m = s$, respectively. We see in Figure 4 that for some range of m, the consumer is strictly worse off as motivation increases. First, note that at $m = 1/(8k)$ the specified goal is equal to $(x^* + y^*)$, and because $\hat{y} = y^*$, the consumer in this case actually achieves the optimal effort levels (x^*, y^*). Thus, it must be the case that the consumer at all other motivation levels must receive lower utility than the consumer at $m = 1/(8k)$. This result is general and can be proved to hold even without making any assumptions about the functional forms. In other words, we can show that regardless of the functional form there would be some $m_1 < m_2$ such that if $s = 0$, then the long-run utility of the consumer with lower motivation is higher.[21]

Figure 4 $V_0^*(m) + m$ **When** $m = l$ **and** $\beta = \frac{1}{2}$

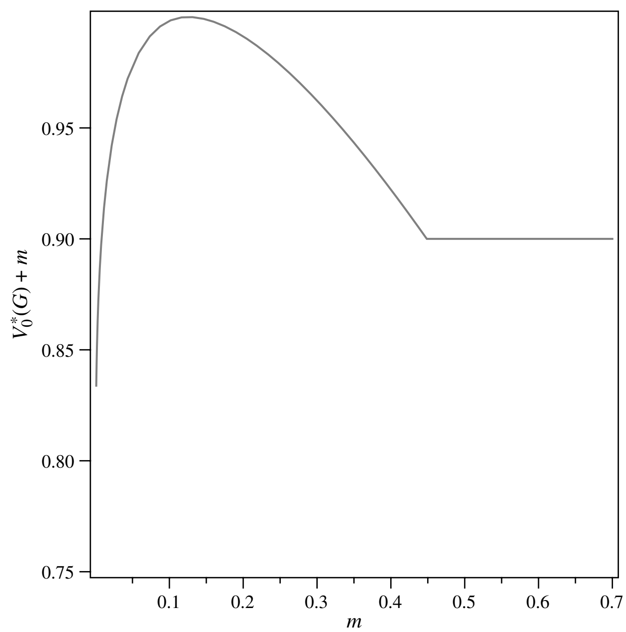
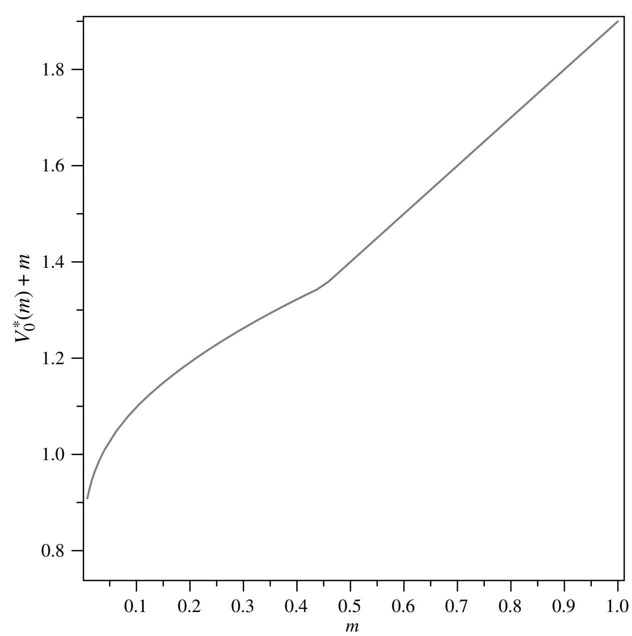


Figure 5 $V_0^*(m) + m$ **When** $m = s$ **and** $\beta = \frac{1}{2}$



[20] Technical Appendix C (available at http://mktsci.pubs.informs.org) details the result when $\beta = \frac{1}{4}$ and $\beta = \frac{3}{4}$. As can be seen there, the results are qualitatively similar to those reported here.

[21] To see this, note that there must exist an m such that $\hat{y} = y^*$ because $\hat{y}$ is monotonically increasing in m. Thus, if we specify a goal $x^* + y^*$, the second-period consumer would exert y^* and the first-period consumer would exert x^*, leading to $V_0(x^*, y^*)$.

At first glance, this seems counterintuitive. After all, why can we not specify the same goal that the consumer at $m = 1/(8k)$ has for the consumer in the region $m \in (1/(8k), (9+4\sqrt{5})/(40k))$? The reason is that motivation has both positive and negative effects on utility. On the positive side, increased motivation allows consumers to exert more effort. However, increased motivation also provides a commitment from the second-period consumer: that he will exert the requisite effort to achieve the goal. This in turn encourages the first-period consumer to procrastinate. Thus, if we were to specify the same goal that the consumer at $m = 1/(8k)$ has, i.e., $(x^* + y^*)$, to the consumer with higher motivation level, this would only lead to a shifting of efforts toward the second period and consequently lead to utility that is strictly lower than $V_0(x^*, y^*)$. Note, however, that if the source of motivation is an award s, the consumer is better off as m increases because $V_0(x, y) + m$ is increasing in m. Thus, our framework argues that motivational goals that are reward-based are better than those that are based on penalty. The result also shows that if the source of motivation is primarily a penalty for nonachievement, then increasing such motivation can sometimes be harmful. This has clear implications for motivational programs that are based on the assumption that one can always improve a consumer's well-being if we can increase his motivation to take desirable actions. Proposition 6 examines how the degree of self-control problems affects the optimal goals.

Proposition 6. *Suppose $\phi(x) = x$, $h(x) = kx^2/2$, and $m = 1/(2k)$. Then, the optimal G^* is defined as*

$$G^* = \begin{cases} \dfrac{1+2\beta+\sqrt{2\beta(1-\beta)}}{k} & \text{if } \beta \in \left[0, \dfrac{1}{3}\right), \\[2ex] \dfrac{2+\beta}{k} & \text{if } \dfrac{1}{3} < \beta < \beta_1, \\[2ex] \dfrac{(\beta+1)^2}{k(\beta^2+1)} & \text{otherwise}, \end{cases} \tag{24}$$

where β_1 is the real root of the equation

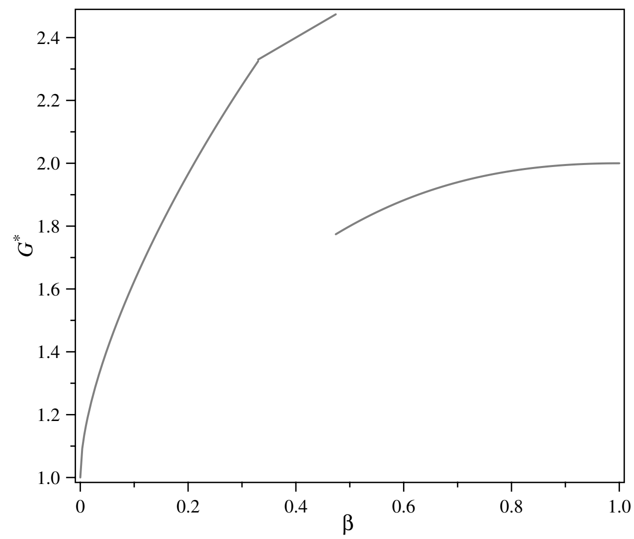
$$2\beta_1 - 1 + \beta_1^4 = 0. \tag{25}$$

This equation has a unique real root and $\beta_1 \approx 0.474$.

Thus, the most difficult goals are assigned for consumers with moderate levels of β. Furthermore, for consumers with $\beta \in (\sqrt{3}(\sqrt{3}-1)/6, \beta_1)$, the assigned goals are strictly greater than $(x^* + y^*)$.[22]

[22] Although we have chosen to restrict m to $1/(2k)$, the result is more general and applicable for a wider set of parameters. For example, we can show that as long as $m \in (1/(4k), 2/k)$, the optimal G^* will achieve its maximum for intermediate values of β. The restriction on m, however, allows us to fully characterize the solution.

Figure 6 **Optimal Goal as a Function of $\beta(mk = \frac{1}{2})$**



Proposition 6 shows that the optimal goal is highest for intermediate values of β. Furthermore, this goal could even be higher than what a consumer without a self-control problems would achieve. Figure 6 plots the optimal goal as a function of β. The intuition for the result is similar to that of Proposition 5. For consumers with low self-control, it is optimal to assign aggressive goals of the type $(G - \hat{y}, \hat{y})$, which pushes them to achieve better outcomes. However, as the consumer has lower self-control problems, i.e., higher β, a more moderate goal strategy is optimal. As before, we observe that for some moderate levels of β, it is optimal to assign goals that are even higher than what a consumer with no self-control problems would achieve.

4. Model Extensions

The base model provides a simple framework in which to examine the issue of goals. In this section, we discuss the implications of relaxing some of the assumptions in the base model. First, we will discuss how consumer's inability to accurately forecast his actions affects goal setting. Next, we examine the situation in which cost of effort in the second period is related to the amount of effort exerted in the first period. Finally, we examine the implications of allowing motivation to depend on the goal and also on β.

4.1. Consumers Are Naïve

In the base model, we assume that consumers are sophisticated in that they have rational expectations and perfectly foresee the actions of their second-period selves. It is plausible that consumers are not aware of their self-control problems and do not take this into account when making the first-period decisions. This approach of modeling self-control problems has been used by others (see, for example, Akerlof 1991). In particular, the first-period consumer incorrectly assumes that the second-period self will exert an effort as if $\beta = 1$. Of course, when the second-period self makes his decision, he uses a $\beta < 1$. Thus, unlike the sophisticated agent, the first-period naïve agent incorrectly forecasts what would happen in the second period. Such an approach is also justified by the large body of literature that shows that consumers often incorrectly predict their future actions (see, for example, Zauberman 2003).

We first consider whether our earlier results would still hold even if consumers were naïve. Let us first consider Propositions 2 and 3. In these cases, the goals are moderately difficult and the consumer is sufficiently motivated to achieve the goal. Consequently, rational expectations do not play any role in the proof of these propositions and the results remain unchanged. For Propositions 4 and 5, however, rational expectations do matter. This is because in these cases, the sophisticated consumer correctly anticipates that the second-period consumer would exert an effort $\hat{y}$. However, the naïve consumer would underestimate the degree of self-control problems. Consequently, the naïve consumer would overestimate the amount of effort that the second-period consumer is willing to exert. This leads to the possibility that the consumer may fail to achieve the goal even though in the first period he believes that the goal would be achieved. Intuition would suggest that naïvete would lead to lower utility. The next proposition examines this intuition.

Proposition 7. *If the consumer has low motivation and $x_G > x_\beta$, the naïve consumer has a weakly higher long-run utility than the sophisticated consumer.*

Proposition 7 thus shows that if the consumer has low motivation, then false optimism about the future can actually be beneficial for the consumer. The intuition for this result is as follows. When motivation is low and the goal cannot be achieved, the sophisticated consumer will correctly anticipate this. Consequently, the consumer will exert efforts x_β and y_β in periods 1 and 2, respectively. However, a naïve consumer assumes that the second-period self is going to exert a higher effort. For certain range of motivation levels, this consumer will then assume that the goal will be achieved. Therefore, he would exert an effort $x > x_\beta$, which will increase overall utility. Thus, in this case, where both the naïve and sophisticated consumers fail to achieve the goal, the naïve consumer would be better off because of his (false) optimism. On the other hand, if the goal is achievable, then overoptimism by the naïve consumer could lead him to exert less effort in the first period, and consequently the goal is not achieved, leading to lower overall utility. In this situation, the naïve consumer is worse off as compared to the sophisticated consumer. Finally, for a sufficiently large level of motivation, both the sophisticated and naïve consumer would assume that the second-period agent would exert $(G - x_G)$, which is correct for a large level of motivation. In this case, the goal would be achieved and naïvete does not affect overall utility.

Proposition 8 examines how naïvete affects optimal goal. As in Propositions 4–6 we assume a specific functional form; i.e., $\phi(x) = x$ and $h(x) = kx^2/2$.

Proposition 8. *Suppose $\phi(x) = x$ and $h(x) = kx^2/2$. For sufficiently small m, the naïve consumer should be assigned goals that he will never achieve.*

To understand Proposition 8, first note that the aggressive strategy of $(G - \hat{y}, \hat{y})$ is not possible any more. This is because the naïve consumer would assume that the second-period consumer is willing to exert an effort $\tilde{y} > \hat{y}$. Consequently, the consumer would not achieve the goal. However, although the aggressive strategy $(G - \hat{y}, \hat{y})$ is not feasible, an alternate strategy that was not available to the sophisticated consumer becomes available. In particular, we could specify a goal G, which the naïve consumer (incorrectly) assumes is achievable. Thus, the consumer exerts an effort $G - \tilde{y}$ in the first period. In the second period, however, the consumer realizes that the goal is not achievable and exerts y_β. The sophisticated consumer, on the other hand, would see in the very first period that the goal is not achievable and, therefore, exerts $x_\beta < G - \tilde{y}$ in the first period. Thus, the long-range planner can use the naïve consumer's incorrect forecasts to motivate him to do more in the first period. Intuitively, this strategy is more advantageous for low levels of motivation.

Proposition 8 clarifies that one might observe consumers with low levels of motivation setting goals that they do not achieve. For example, Norcross et al. (1989) found that most consumers fail to achieve their New Year's resolutions and, in fact, on average make the same New Year's resolution 9.9 times. Furthermore, unsuccessful attempts did not affect the consumer's intention to make such resolutions again. Why do people not learn from these repeated failures and set lower goals? Polivy and Herman (2002) argue that consumers incorrectly interpret failures in such a way that it leads them to set the same goal again despite repeated failures. Although one could ascribe such goal-setting behavior to misattribution or irrationality, our result clarifies that given self-control problems and overoptimism, it can be optimal to set such unachievable goals. Note, however, that repeated failure to achieve goals could adversely affect a consumer's level of self-confidence and self-esteem (Norcross et al. 1989). This, in turn, could make setting such goals less attractive.[23] Our model does not include these dynamic effects. Nevertheless, the results suggest that when such dynamic effects are not too large, setting unachievable goals could be optimal.

Proposition 8 also suggests that the discontinuity in m that we observe in Proposition 4 will also happen in the case of naïve consumers. In particular, as in Proposition 4, we will observe that for low levels of motivation, a consumer might be better off with more demanding (and unachievable) goals. However, for higher levels of motivation, it is optimal to assign easier and achievable goals. Consequently, there would be a region such that consumers with higher levels of motivation will be assigned lower goals. Thus, the main result in Proposition 4 would also hold in the case of naïve consumers.

4.2. Efforts Are Interrelated

In the base model, we assumed that the second-period effort is given by the function $h(y)$. A more general model would allow for the possibility that second-period effort would depend on the self-control exerted in the first period. For example, consumers who have been on a diet find it increasingly difficult to continue (Polivy and Herman 2002). This is because the amount of effort required to diet the next day when one has dieted the previous day is higher than when one is starting the diet. Alternatively, effort made in the first period could make it easier to exert effort in the second period. This could happen if actions in the first period lead to habit formation (e.g., Verplanken and Wood 2006). One way to represent both of these cases is to assume that the cost function for the second period is given by $h(\lambda x + y)$ where λ is a constant. In the base model, we assumed that $\lambda = 0$.

Second-period effort is more costly. First, consider the case when effort in the first period makes it more difficult to exert effort in the second period. This can be represented by assuming that $0 < \lambda < 1$. Note that, in general, we would expect λ to be higher when the time interval between the decision period is relatively small. In other words, if the time period between the two decision points is small, the consumer does not have the time to rejuvenate and "reset" the cost function to $h(y)$ for the next period.

The analysis of this case is similar to that of the base model. In general, the parameter λ would lead to lower efforts in the second period. However, when the consumer is naïve, the presence of λ can lead to the situations in which the consumers perform worse when they break a goal. This is known as the what-the-hell effect (e.g., Cochran and Tesser 1996). To see this, suppose for a given G the consumer exerts $x_1 > x_\beta$ in period 1. However, the goal fails in period 2. In the second period, the consumer realizes that the goal cannot be achieved and therefore exerts an effort y_2, which is given by

$$y_2 = \arg\max_y \big(\beta\phi(y) - h(\lambda x_1 + y)\big). \tag{26}$$

It is easy to see that y_2 is decreasing in x. Because $x_1 > x_\beta$, it follows that $y_2 < y_\beta$. Note that this result would not be obtained if the consumer was sophisticated. This is because the sophisticated consumer would correctly anticipate that the goal would fail and would therefore exert an effort x_β in the first period. Also, note that our results suggest that this effect is likely to be stronger when λ is larger. Because λ is likely to be larger when decision periods are closer together, our results suggest that this effect is likely to be stronger in such cases. Finally, note that although the what-the-hell effect could lead to consumers performing worse in the second period, it may still be optimal to specify goals where we would observe such effects.

Second-period effort is less costly. Now, consider the case when effort in the first period can lead to habit formation and reduce the cost of effort in the second period. This could be modeled by assuming that $-1 < \lambda < 0$. The analysis again is similar. However, in this case, the consumer has more reason to exert effort in the first period because it reduces costs in the second period. Note, however, that in the presence of naïve consumers, when $\lambda < 0$ we will observe a result that is opposite from the what-the-hell effect. In particular, from (26), it follows that if $\lambda < 0$, then the consumer would exert more effort with a goal even when the goal fails. Thus, in this situation, goals can benefit the naïve consumer not only in the first period but also in the second period. Consequently, it is likely that in situations where habit formation is important, assigning goals can be beneficial even when these goals are unachievable. In other words, Proposition 8 is likely to be stronger in such scenarios.

4.3. Motivation Depends on β

Consider the case when the level of motivation depends on β. It is plausible that consumers who have a high degree of self-control problems also have a lower level of motivation to achieve their goals. In other words, m and β are positively correlated. Much of our analysis would remain unchanged under this scenario. However, this additional assumption could enable us to make sharper predictions about optimal goals. For example, consider Proposition 4 in which we discuss how different levels of motivation affect the optimal goals for $\beta = \frac{1}{2}$. Figure 3 plots the optimal goals as a function of motivation for different β

[23] Norcross et al. (1989), however, found that there is no relationship between this decrease in self-esteem and future self-change plans.

values. We see that consumers with lower β values, i.e., higher self-control problems, are assigned aggressive goals for a larger set of parameters. If we make the assumption that m and β are positively correlated, the analysis suggests that consumers with high β should be assigned moderate goals and consumers with low β should be assigned more aggressive goals. Furthermore, consumers with a high level of self-control problems are likely to be assigned goals that are tougher than those for consumers with low self-control problems.[24]

4.4. Motivation Depends on Goals

In the main body of the paper, we assumed that goals do not affect the level of motivation. However, it is possible that a consumer who achieves tough goals receives a higher psychological reward than the consumer who achieves an easier goal. To model this aspect, we can assume that $m(G) = \eta + \zeta(G)$, where $\zeta(\cdot)$ is an increasing function. In the base model, we have assumed that $\zeta(\cdot) = 0$. First, consider the case when the optimal goal under the case $\zeta(\cdot) = 0$ is a moderate goal and the consumer uses a strategy $(x_G, G - x_G)$. If we retain the assumption that $s(G) = 0$, $\forall G$, then the analysis essentially remains unchanged. However, if we assume that achieving higher goals lead to higher levels of psychological reward, i.e., $s(G)$ is increasing in G, then it would be optimal to increase the goal to higher levels. To see this, consider the case when

$$G^* = \arg\max_G V_0(x_G, G - x_G). \tag{27}$$

If $s(G)$ is increasing in G, then we need to choose a G^{**} such that

$$G^{**} = \arg\max_G V_0(x_G, G - x_G) + s(G). \tag{28}$$

Because the $V_0(x_G, G - x_G)$ function is concave, then if $s''(G) \le 0$, it immediately follows from Equations (27) and (28) that $G^{**} > G^*$.

When the optimal goal is of the aggressive type such that the consumer is exerting $\hat{y}$ in the second period, once we consider $\zeta(G)$, two things can happen. It is possible that the optimal goal would be such that the second-period constraint does not apply and the consumer can be assigned moderate goals, or alternatively, we could specify more aggressive goals. In either case, however, the consumer will be assigned more difficult goals with the presence of $\zeta(G)$. Overall, we see that if we allow motivation to depend on G, then the consumer will be assigned more difficult goals.

[24] We can make similar predictions if we examine Figures 2 and 6.

5. Conclusion

The purpose of this paper was to develop a parsimonious framework to examine how goals impact performance and overall utility. We use the literature on hyperbolic discounting to study these issues. Our analysis provides several insights into goal-setting behavior.

Is it always better to set some goals rather than have no goals? Our results indicate that we should avoid setting goals that are easy because they can be worse than not setting goals. We find that goals have a positive influence by encouraging the consumers to exert more effort. However, goals can also exacerbate procrastination. For easy goals, the procrastination effect dominates, and having goals can make the individual worse off than having no goals. This result is consistent with the empirical work of Asch (1990) and Oyer (1998), who show the presence of the procrastination effect. Empirical work by Jackson and Zedeck (1982) and Wotruba (1989), which shows that goals can lead to reduced satisfaction, is also consistent with our results. The results have implications for firms that set quotas for salespersons. The results suggest that sales quotas that are easy and only slightly higher than what the salesperson would achieve absent quotas can backfire. In particular, such quotas can lead to lower firm profits and lower salesperson satisfaction.

How should we determine the optimal level of goals? Our results indicate that the optimal level of goals depend on individual characteristics such as motivation level and intensity of present-biased preferences. We should set goals that are moderately difficult for individuals who are highly motivated. In contrast, for low-motivation individuals, we should set aggressive goals. Furthermore, for some individuals, it may be optimal to assign goals that are so difficult that the individual never achieves the goal. This result has important implications for companies that help consumers achieve their weight or retirement goals. In particular, our results suggests that to develop more effective programs, companies must assess the consumer's degree of motivation and the level of self-control problems, and customize goals accordingly. Such a strategy versus the commonly used "one-size-fits-all" approach that is often used can lead to greater customer satisfaction.

Can we improve utility by increasing motivation? Our results indicate that self-help programs that aim to increase motivation can sometimes lead to decreased overall utility. This is particularly true for programs that stress the negative effect of not achieving the goal. Our results also show that programs that stress the positive benefits of achieving goals are likely to be more successful and lead to greater customer satisfaction than those that stress the negative effect of not achieving the goal.

Our analysis also has important implications for behavioral research in goal setting. First, we provide a simple framework that can explain many of the empirical observations made in the behavioral literature. For example, we show how goals can improve performance but also caution that only focusing on outcomes can lead to counterproductive goals. Previous research has shown that when goals fail, they can decrease future performance (Soman and Cheema 2004). We extend this work and show that even successful goals can sometimes lead to poor performance. Our results provide a simple explanation for the presence of the what-the-hell effect. We also show that such an effect might be observed even when consumers set optimal goals. Our results also provide one potential explanation as to why consumers repeatedly set goals that they never achieve. Finally, our research shows that only looking at consumers' actions and ex post feelings of regret are not enough to judge whether consumers are present biased or hyperopic. Indeed, we find that the presence of goals can lead to present-biased consumers behaving as if they were hyperopic.

To develop a parsimonious framework, we have made several simplifying assumptions. We considered a situation in which the effort function is deterministic, and therefore, a sophisticated consumer could predict what will happen in the next period. There are two ways to relax this assumption. First, we could assume that the outcome $\phi(\cdot)$ is not a deterministic function. In this case, our results would continue to hold as long as the expected value of $\phi(x)$ is increasing in x and the consumer is risk neutral. If, however, the consumer is risk averse, then it is likely that this would lead to the consumer exerting less effort to achieve the uncertain benefits. An alternate source of uncertainty could be uncertainty in the cost function. For example, a dieter may unexpectedly come across a tempting dish that he finds difficult to resist. Also, a consumer's mood at a particular time may make it easier or more difficult to follow a goal. This implies that the cost function for the next period may be stochastic. In such situations, it is possible that if the goal is sufficiently motivating, i.e., m is high, then a high level of cost uncertainty in the second period can encourage the consumer to exert higher levels of effort in the first period to ensure that the goal is achieved. On the other hand, a high cost realization in the first period could lead to the consumer abandoning the goal altogether. Future research can explore how such cost uncertainties can affect optimal goals.

To model self-control problems, we used a hyperbolic discounting parameter β that is exogenously specified. Future research can explore how present-biased preferences can be generated using first principles. We also assumed that the achievement of goals can enhance utility and that nonachievement can lead to decreased utility. In our framework, this motivational aspect of goals is exogenous. It would be useful to generate a model in which these effects arise endogenously. One possibility is to use the prospect theory framework proposed by Wu et al. (2004). They assume that goals act as reference points and achievement of goals is coded as a gain while a failure to achieve goals is coded as a loss. Goals in their framework lead to more effort. In their setup, however, it is not immediately clear what is meant by optimal goals. This is because the consumer in their model does not suffer from any self-control problems, and absent goals would still maximize his utility. Future research can explore how a dynamic model such as ours can incorporate the notion that goals can act as reference points to examine how one should set optimal goals.

We also restricted our analysis to the case of two periods. In a multiple-period setting in which consumers may form goals on multiple occasions, there is opportunity for the consumer to learn about their present-biased preferences. They can therefore try to rectify the underlying problem by increasing β. There is, however, little empirical evidence that suggests that a consumer's β changes over time. Nevertheless, it is important to examine how a consumer's present-biased preferences change over time. Furthermore, from a public policy perspective, it would be useful to examine mechanisms that can lead to a reduction in present-biased preferences. Another avenue for future research is to examine how we should set multiple goals, e.g., losing weight and saving money for the future. Although these goals are ostensibly different, both require self-control. Consequently, a challenging goal for weight loss should indeed have an impact on a consumer's ability to save for retirement.[25] Finally, our research provides several hypotheses that can be empirically tested.

The framework presented in this paper to study optimal goals can also be used in other settings. For example, in the salesforce literature, setting a sales quota is common. Raju and Srinivasan (1996) show that quotas can approximate the optimal compensation structure of salary plus commission. Oyer (2000) shows that setting quotas can be optimal when a salesperson's participation constraint does not bind. Our framework can be used to examine how quotas should be designed when salespersons have self-control problems and quotas have a motivational role.[26] This could

[25] This is consistent with the research of Brendl et al. (2003). They show that an object capable of satisfying a need is perceived as more valuable while an object that is unrelated to the need is devalued. They call this the "devaluation" effect.

[26] To achieve this, we would need to appropriately modify the objective function because, the firm, and the salespersons' objectives do not coincide. However, the salespersons' utility is still relevant because it enters the participation constraint.

potentially help managers develop better compensation plans that take into account salespersons' present-biased preferences.

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