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# Reactions to Compensation to Inequity Perceptions: A Theoretical Model

Gil S. Epstein, Aharon Tziner

## Abstract

This paper investigates the effects of the perception of being under- or over-rewarded on employees' level of investment in work and non-work related activities. We examine the relationship between the effort invested by an employee in the workplace, in both work and non-work related activities, and the difference between what the employee believes he/she should receive (preferred reward) and the actual compensation received (actual reward).

## 1. Introduction

This paper investigates the effects of the perception of being under- or over-rewarded on employees' level of investment in work and non-work related activities. As many firms have difficulty in assessing their workers' contribution to total output and profits (Radner, 1993), employees may receive less or more than they think they deserve. We therefore sought to examine the relationship between the effort invested by an employee in the workplace, in both work and non-work related activities, and the difference between what the employee believes he/she should receive (preferred reward) and the actual compensation received (actual reward).

The literature to date contains a number of discussions that relate to employees' attempts to influence their employers' decisions. Milgrom and Robert (1992) define such activities as "influence costs," where through rent-seeking activity individuals earn rents in the form of promotion. Epstein and Spiegel (2001) take a different approach, considering the effect of the difference between perceived and actual *income* on influence costs and thereby explaining why the effect of *income* inequality on productivity and growth is ambiguous. In another line of research, Lazear and Rosen (1981) investigated the incentive of prizes that enhance survival in sequential elimination events, i.e., when the most highly qualified contestant is determined by a tournament. As success is based on "survival of the fittest," the "quality of play" is sustained as the game progresses. Their models identify the unique role of top-ranking prizes in maintaining performance incentives in career and other survival games: the equilibrium reward structure favors top-ranking prizes, encouraging competitors to aspire to further heights, regardless of past achievements. However, in the present model, the employees' productivity cannot be fully observed by the employer and the outcome of increased work effort might not ensure efficiency. We therefore take a different approach and investigate the effect of the difference between preferred and actual *rewards* on the level of effort invested by the employee in both work and non-work related activities.

A theoretical framework was developed to analyse this relationship. A two-period model was devised whereby in the first period an employee determines how much effort to invest in work and non-work related activities, and in the second period either does or does not receive an increase in rewards. The probability of receiving an increase in period 2 is a function (linear or otherwise) of the effort invested in period 1. Furthermore, when making decisions regarding the level of effort to invest, employees take into account the difference between their actual reward at the time and what they believe they deserve, i.e., their preferred reward.

It is clear that the reward an employee receives is a composite of different types of rewards. An increase in one, such as a promotion, may be accompanied by a decrease in another. We therefore define reward as the weighted average of all rewards received, and refer to an increase only when this weighted average increases.

As stated above, employees compare the rewards they receive, the actual reward, to what they believe they should be receiving, the preferred reward, and the difference between them de-

termines the level of effort they decide to invest in work and non-work related activities. When the actual reward is lower than the preferred reward, then the total amount of input invested in work related activities is relatively higher than the benefits obtained from that input. In other words, a decrease in the difference between actual and preferred rewards means that the ratio of input to benefits has increased.

The difference between actual and preferred rewards can be interpreted in terms of Adams' (1963; 1965) equity theory. The central tenet of Adams' theory is that individuals constantly compare the ratio of the inputs (e.g., efforts, competence) they provide the firm to the perceived rewards (e.g., promotions, pay) they get in return, to the ratio they perceive comparable employees (e.g., referents) receive. Adams posited that when these ratios are judged to be relatively equal, the individual perceives the situation ("the exchange" with the company) to be fair, resulting in positive work attitudes (e.g., Lee, 1995) and high performance. Conversely, when these ratios are perceived to be unequal (either over- or under-payment), the individual experiences a sense of inequity, leading to a state of attention and attempts to alter the situation by reducing inputs or exerting pressure to increase rewards (Donovan, 2001).

This paper considers how changes in the difference between actual and preferred rewards may effect the amount of effort invested in work and non-work related activities. The analysis may be relevant to a variety of situations, for example:

1. The fact that all employees do not invest the same level of effort in their work may be related to perceived differences between preferred and actual rewards.
2. Whenever a new employee joins a firm or work team, each employee reevaluates his/her contribution to the firm's (or team's) profits and production. Any change in this evaluation may change the difference between actual and preferred rewards, and thus the level of effort invested in work related activities.
3. New information regarding the productivity of the firm or the rewards received by other employees in the firm or employees in other firms may cause the individual to reevaluate his/her preferred rewards.
4. Changes in the environment of the firm may cause the employee to reevaluate his/her contribution.

This paper, then, suggests a model for analyzing the effect of changes in the difference between actual and preferred rewards on the effort invested in work related activities, and the conditions under which an increase or decrease in this difference will result in an increase in the level of effort invested by the employee in work related activities.

## 2. The Model

Each employee invests a certain level of effort in the workplace. Employees can withhold work efforts and invest time in non-related activities such as talking on the phone, taking long coffee breaks, surfing the web, and so on (Birati & Tziner, 1996; Sagie, Birati & Tziner, 2002). Such withdrawal behavior obviously decreases the level of effort invested in work related activities and consequently the employee's contribution to the firm's productivity and profits. In our analysis, the employee makes strategic decisions as to how much time to invest in work related and non-work related activities, a course of action that may be accounted for by motivation, as in the Expectancy Theory (Fishbein & Azjen, 1975; Porter & Lowten, 1968; Vroom, 1964) or the Goal-Setting theory (Locke, 1968; Locke & Latham, 1990). We assume that an employee obtains instrumental utility benefits from both work and non-work related activities carried out in the workplace, and that they have differential effects on motivation (Stajkovic & Luthans, 2001).

Each employee has one unit of time (an hour, a day, a week, etc.) to divide optimally between work (denoted  $e$ ) and non-work (denoted  $L$ ) related activities. Thus the total amount of effort invested by the employee in both types of activity equals one unit of time:  $L + e = 1$ .

In our two-period model, the employee receives a reward of  $I_1$  in period 1, and must determine how much effort to invest in productive, work related activities and in non-work related activities ( $e$  and  $L$  respectively). He/she is aware that as a result of this decision there is a probability of obtaining increased reward in period 2. This might take the form of a raise in wages, a

promotion with or without an increase in wages, greater authority in the firm, or other financial and non-financial benefits, such as a better office, a grant to study for a certain period of time outside the workplace, etc. The possibility of receiving an increased reward in period 2 thus affects the amount of effort invested by the employee in work and non-work related activities in period 1.

As stated above, we define the reward level as the weighted average of all the rewards received by a given employee and do not consider each of the rewards separately. If we denote by  $r_i$  the reward of type  $i$  and by  $w_i$  the weight assigned to that reward by the employee, then an individual's total "reward" in period 1 equals:  $I_1 = \sum w_i r_i$ . Thus, while some  $r_i$  may increase and

others may decrease, we relate only to changes in the weighted average of all rewards.

In order to focus our analysis, we concentrate first on the case in which the preferred reward is greater than the actual reward. Later we will derive the results from the opposite situation.

Using probability  $P$ , the employee will receive an increase in rewards in the second period of time. Thus the total reward in period 2,  $I_2$ , is by definition greater than the reward in period 1:  $I_2 > I_1$ . Using the complementary probability,  $1-P$ , the employee does not receive an increase in rewards in period 2, but retains the same level of reward as in period 1. (This is obviously a simplification. It could easily be generalized to the assumption of some increase in the second period that is either large or small. For the purposes of our model, we have normalized a small increase to zero.) It is important to note that we confine our analysis to cases in which the probability that the employee will receive a higher reward in period 2 is a function of the effort invested in work related activities in the workplace in period 1:  $P(e)$ . Moreover, probability  $P(e)$  is assumed to relate monotonously (and not linearly) to the work effort, such that  $\frac{\partial P}{\partial e} \geq 0$ , i.e., as effort in work

related activities increases, the probability of receiving additional rewards in the period 2 is non-decreasing. Conversely, as the level of effort invested in non-related work activities,  $L = 1 - e$ , increases, the amount of effort in work related activities decreases, thereby reducing the probability of receiving increased rewards in period 2. Nevertheless, employees continue to invest time in non-work related activities as they obtain instrumental utility from doing so. Let us consider the personal instrumental utility to be gained from work and non-work related activities.

The personal instrumental utility of a given employee,  $u$ , is a function of a number of parameters that can be affected directly by the individual's choices regarding the level of effort to invest in work and non-work related activities. For one thing, it may be positively related to the efforts invested in non-work related activities in the workplace, as it may increase satisfaction at work, provide more free time for other activities after work, etc. Secondly, instrumental utility may be positively related to the employee's actual rewards, since as rewards increase, the individual's "benefit" from them, in terms of satisfaction or monetary benefits, increases. Finally, instrumental utility may be negatively related to the difference between the rewards an employee thinks he/she should earn,  $I^e$ , that is the preferred reward, and the actual reward received, i.e.,  $A = I^e - I$ . According to Adams' (1963, 1965) equity theory, a decrease in the difference between actual and preferred rewards means that the inputs relative to the benefits have increased.

The employee's personal instrumental utility in period 1 can therefore be formulated as follows:

$$u_1 = u_1(L_1, I_1, A_1). \quad (1)$$

The personal instrumental utility in period 2 can not be known with certainty, as the employee can not be sure that he/she will receive an additional reward at that time. However, the employee does know that the probability of receiving an additional reward in period 2 is positively related to the effort he/she invests in period 1. Thus in period 2, the difference between the reward that the employee thinks he/she deserves and the actual reward received will be a function of the level of effort invested in work related activities in period 1, i.e.,  $A(e)$ . If the employee invests a lot

of effort in work related activities and receives an increase in rewards, then the difference between the actual and preferred rewards will decrease. However, if the employee does not receive an additional reward despite an increased effort in work related activities, this difference will increase.

With probability  $P(e)$ , the employee will receive an increase in rewards in period 2 of  $I_2(e)$ . (While the level of the rewards in the second period may be a function of the level of effort invested in the first period, it may also be independent of it, for example, a fixed amount for all employees. We will elaborate on this below.) The employee will then invest  $L_2$  units of effort in non-work related activities in period 2, and the difference between perceived and actual rewards will be  $A_2(e)$ . We conclude, therefore, that with probability  $P(e)$ , the personal instrumental utility in the period 2 will be  $u_2(L_2, I_2(e), A_2(e))$ .

With probability  $1 - P(e)$  the employee will not receive an increase in rewards in period 2 and thus will continue to receive a reward of  $I_1$ , the same level of reward he/she received in period 1. However, the difference between actual and perceived rewards, now represented by  $A_3(e)$ , will change.  $A_3(e)$  is, of course, a positive function of the level of effort invested in work related activities in period 1. As the worker invested more effort in work related activities in period 1, the difference between actual and perceived rewards will increase since he/she did not receive the expected increase in rewards. (As the model we present a two-period model, the level of effort invested in work and non-work related activities in the second period is independent of whether or not the worker received an increase in the level of rewards at this time, since the level of effort only affects rewards in the following period. This assumption is employed for reasons of simplification; however, relaxing it would not alter the results.) Thus, with probability  $1 - P(e)$ , the employee's instrumental utility in period 2 is  $u_3(L_2, I_1, A_3(e))$ . To sum up, a representative employee's personal expected instrumental utility in period 2,  $E[U_2]$ , can be formulated as follows:

$$E[U_2] = P(e)u_2(L_2, I_2(e), A_2(e)) + (1 - P(e))u_3(L_2, I_1, A_3(e)) \quad (2)$$

such that,

1. as the level of non-work related activities increases, the instrumental utility of the employee increases,  $\frac{\partial u_i(\cdot)}{\partial L_i} > 0$ ,
2. as the reward level increases, the employee's instrumental utility increases,  $\frac{\partial u_i(\cdot)}{\partial I_i} > 0$ ,
3. as the difference between the rewards an employee receives and the rewards he/she thinks he/she should receive increases, the employee's instrumental utility decreases,  $\frac{\partial u_i(L_i, I_i, A_i)}{\partial A_i} < 0$ .

We assume above that the level of effort invested in work-related activities in period 1 affects the total rewards received in period 2. In period 1, an employee takes as given his/her reward level at that time,  $I_1$ , and also takes as given the difference between perceived rewards and actual rewards,  $A_1$ . What this means is that the employee cannot affect his/her level of rewards in the first period, but only those in the next period. An employee therefore determines the level of effort in productive work related activities in period 1 that is likely to result in an increase in rewards in period 2, and consequently a new difference between actual and preferred rewards,  $A_2$ . If the employee does not receive the expected increase in rewards in period 2 despite the increase in level of effort, his/her actual reward will remain  $I_1$ , while his/her preferred reward will have risen.

Thus, under these circumstances, the difference between actual and preferred rewards will increase in period 2:  $A_3 > A_1$ . It is clear therefore that  $A_2$  and  $A_3$  are a function of the effort invested in period 1.

There might be a situation in which the increase in rewards in period 2 is fixed, i.e., when the supervisor decides to grant an increase in rewards, the level of the increase is fixed regardless of the level of effort invested in work related activities. Our assumption, however, is more general. We assume here that if the employee receives an increase in period 2, it will be a positive function of the amount of effort he/she invested in period 1. This is not to say that there is a linear relationship between effort and increase in rewards. Rather, we assume a monotonous relationship between the two. Later we will also analyze the situation in which the level of increase in rewards is independent of the level of effort invested in work related activities.

The employee's personal expected instrumental utility in both periods together is represented by:

$$E[U] = u_1(L_1, I_1, A_1) + P(e)u_2(L_2, I_2(e), A_2(e)) + (1-P(e))u_3(L_2, I_1, A_3(e)) \quad (3)$$

s.t.

$$L + e = 1.$$

Note the constraint that the sum of effort invested in work related activities,  $e$ , and non-related work activities,  $L$ , is normalized to unity.

The employee's objective is to maximize his/her personal expected instrumental utility over both periods (to simplify matters we assume a discount rate of 1<sup>1</sup>) by determining the level of effort to invest in work related and non-work related activities. As the sum of these two types of activities equals one unit of time or effort, when the employee decides on the optimal level of effort for one, the complimentary optimal level of effort for the other is also determined. Thus, the problem faced by the employee can be represented by:

$$\text{Max}_{L,e} \{E[U] = u_1(L_1, I_1, A_1) + P(e)u_2(L_2, I_2(e), A_2(e)) + (1-P(e))u_3(L_2, I_1, A_3(e))\} \quad (3')$$

s.t.

$$L + e = 1.$$

In order to find the optimal level of effort to invest in work related activities,  $e$  ( $e = 1-L$ ), we must take the derivative of (3) and determine the level that satisfies the first derivative when level of effort equals zero. The first order conditions are given by <sup>2, 3</sup>

$$\begin{aligned} \frac{\partial E[U]}{\partial e} &= \\ &= -\frac{\partial u_1}{\partial L_1} + \frac{\partial P(e)}{\partial e}(u_2(\cdot) - u_3(\cdot)) + \\ &\quad + P(e) \left( \frac{\partial u_2}{\partial I_2} \frac{\partial I_2}{\partial e} + \frac{\partial u_2}{\partial A_2} \frac{\partial A_2}{\partial e} - \frac{\partial u_3}{\partial A_3} \frac{\partial A_3}{\partial e} \right) + \frac{\partial u_3}{\partial A_3} \frac{\partial A_3}{\partial e} = 0. \end{aligned} \quad (4)$$

<sup>1</sup> Adding a discount rate lower than 1 would not change the thrust of the results.

<sup>2</sup> Note that as the sum of both types of activities, work and non-work related, equals one unit, the derivative of the level of effort invested in non-work related activities with respect to the level of effort invested in related work activities,  $\frac{\partial L}{\partial e}$ , equals  $\frac{\partial(1-e)}{\partial e}$  (as  $e + L = 1$ ). Therefore, increasing  $L$  by "1 unit" will decrease  $e$  by "1 unit," and so  $\frac{\partial L}{\partial e} = -1$ . Moreover it thus holds that  $\frac{\partial U(L)}{\partial e} = -\frac{\partial U(L)}{\partial L}$ .

<sup>3</sup> Assuming that the second order condition holds that  $\frac{\partial^2 E[U]}{\partial e^2} < 0$ , then the second order condition for maximization ensures that the second derivative with respect to the level of effort invested in work related activities,  $\frac{\partial^2 E[U]}{\partial e^2} < 0$ , will be negative.

Formulating (4) in a different way, we obtain:

$$\begin{aligned} \frac{\partial u_1}{\partial L_1} &= \frac{\partial P(e)}{\partial e} (u_2(\cdot) - u_3(\cdot)) + \\ &+ P(e) \left( \frac{\partial u_2}{\partial I_2} \frac{\partial I_2}{\partial e} + \frac{\partial u_2}{\partial A_2} \frac{\partial A_2}{\partial e} - \frac{\partial u_3}{\partial A_3} \frac{\partial A_3}{\partial e} \right) + \frac{\partial u_3}{\partial A_3} \frac{\partial A_3}{\partial e}. \end{aligned} \quad (5)$$

The left hand side of (5),  $\frac{\partial u_1}{\partial L_1}$ , represents the marginal “cost” of the investment in

terms of the instrumental utility of the worker, i.e., the decrease in instrumental utility resulting from the decrease in non-work related activities deriving from an increase in effort invested in work related activities. The right hand side of (5) consists of three components,

$\frac{\partial P(e)}{\partial e} (u_2(\cdot) - u_3(\cdot)) + P(e) \left( \frac{\partial u_2}{\partial I_2} \frac{\partial I_2}{\partial e} + \frac{\partial u_2}{\partial A_2} \frac{\partial A_2}{\partial e} - \frac{\partial u_3}{\partial A_3} \frac{\partial A_3}{\partial e} \right) + \frac{\partial u_3}{\partial A_3} \frac{\partial A_3}{\partial e}$ , which represent the marginal “benefit” of investing in work related activities. The first component,  $\frac{\partial P(e)}{\partial e} (u_2(\cdot) - u_3(\cdot))$ , the marginal probability of an increase in work related activities times the

increase in instrumental utility, represents the expected increase in instrumental utility as a result of an increase in the probability of receiving a higher reward in period 2 because of the greater effort invested in work related activities in period 1. The second component,

$P(e) \left( \frac{\partial u_2}{\partial I_2} \frac{\partial I_2}{\partial e} + \frac{\partial u_2}{\partial A_2} \frac{\partial A_2}{\partial e} - \frac{\partial u_3}{\partial A_3} \frac{\partial A_3}{\partial e} \right)$ , the marginal increase in instrumental utility from the

increased effort in work related activities multiplied by the probability of receiving increased rewards, represents the effect of a change in instrumental utility as a result of increasing the level of effort invested in work related activities, disregarding the effect of the change in the probability of obtaining an increase in the level of rewards. The third component,  $\frac{\partial u_2}{\partial I_2} \frac{\partial I_2}{\partial e}$ , represents the

marginal effect of an increase in effort on the employee’s instrumental utility through additional rewards obtained as a result of the increase in the effort in work related activities. Finally,

$\frac{\partial u_2}{\partial A_2} \frac{\partial A_2}{\partial e} - \frac{\partial u_3}{\partial A_3} \frac{\partial A_3}{\partial e}$  represents the marginal effect of an increase in the level of effort in-

vested in work related activities on instrumental utility via the difference between preferred reward and actual reward. It is natural to assume that as the level of effort increases, and the employee receives an increase in rewards in period 2, the difference between preferred and actual rewards will decrease. On the other hand, if the employee increases his/her efforts in work related activities in period 1 and does not receive an increase in rewards in period 2, the difference between actual and preferred rewards will increase. We thus obtain  $\frac{\partial A_2}{\partial e} < 0$  and  $\frac{\partial A_3}{\partial e} > 0$  respectively. In

other words, increasing effort in work related activities will decrease  $A$  (the difference between preferred and actual rewards) if an employee obtains an increase in rewards, and will increase  $A$  if an employee does not obtain the increase<sup>1</sup>. It follows, therefore, that the term

$\frac{\partial u_2}{\partial A_2} \frac{\partial A_2}{\partial e} - \frac{\partial u_3}{\partial A_3} \frac{\partial A_3}{\partial e}$  will always be positive:  $\frac{\partial u_2}{\partial A_2} \frac{\partial A_2}{\partial e} > \frac{\partial u_3}{\partial A_3} \frac{\partial A_3}{\partial e}$ . (Note that the term

<sup>1</sup> It could be argued that  $A_2$  may increase even if the worker receives an increase in rewards as both the preferred and the actual reward will increase. We simplify our calculations by assuming that this does not happen. In general our results will still hold if we relax this assumption.

$\frac{\partial u_3}{\partial A_3} \frac{\partial A_3}{\partial e}$  represents the marginal effect of increasing effort in work related activities on instrumental utility when no increase in rewards is received.)

The level of effort that satisfies (5), that is, the optimal level of effort invested by the employee in work related activities that maximizes his/her expected instrumental utility over the two periods, is denoted by  $e^*$ . We are now interested in investigating the effect of a change in  $A_1$  on individual productivity, or in other words, how does a change in the difference between actual and preferred rewards affect the level of effort invested by a given employee in work related activities.

We must therefore calculate the expression:  $\frac{\partial e^*}{\partial A_1}$ . It can be verified that  $\frac{\partial e^*}{\partial A_1} = - \frac{\frac{\partial^2 E[U]}{\partial e \partial A_1}}{\frac{\partial^2 E[U]}{\partial e^2}}$ ,

i.e., the effect of a change in the difference between actual and preferred rewards on the optimal level of effort invested in work related activities equals the ratio between the two components:

$\frac{\partial^2 E[U]}{\partial e \partial A_1}$  and  $-\frac{\partial^2 E[U]}{\partial e^2}$ . The component  $\frac{\partial^2 E[U]}{\partial e^2}$  represents the second order condition which

ensures that the level of effort invested in work related activities, as found in  $e^*$ , is in fact the level of effort that maximizes (rather than minimizes) the expected instrumental utility over both periods. The second order condition for maximization ensures that the second derivative with respect to the level of effort invested in work related activities,  $\frac{\partial^2 E[U]}{\partial e^2} < 0$ , is negative. Given that we

know that the denominator in the expression  $\left( - \frac{\frac{\partial^2 E[U]}{\partial e \partial A_1}}{\frac{\partial^2 E[U]}{\partial e^2}} \right)$  is negative, it is clear that the sign of

$\frac{\partial e^*}{\partial A_1}$  will be the same as the sign of the numerator in  $\left( - \frac{\frac{\partial^2 E[U]}{\partial e \partial A_1}}{\frac{\partial^2 E[U]}{\partial e^2}} \right)$ , that is  $Sign\left(\frac{\partial e^*}{\partial A_1}\right) =$

$Sign\left(\frac{\partial^2 E[U]}{\partial e \partial A_1}\right)$ . We must therefore calculate the term:  $\frac{\partial^2 E[U]}{\partial e \partial A_1}$ . This will show us how the

marginal expected instrumental utility,  $\frac{\partial E[U]}{\partial e}$ , changes with a change in the difference between

actual and preferred rewards in period 1,  $A_1$ , namely:  $\frac{\partial\left(\frac{\partial E[U]}{\partial e}\right)}{\partial A_1} = \frac{\partial^2 E[U]}{\partial e \partial A_1}$ . Remember that the

level of effort invested in work related activities in period 1 affects the probability of receiving an increase in rewards in period 2. Thus a change in the difference between actual and preferred rewards in period 1 will have an effect on the level of effort invested in work related activities in that period.

The term  $\frac{\partial^2 E[U]}{\partial e \partial A_1}$  can be calculated in the following way:



$$\begin{aligned} \frac{\partial^2 E[U]}{\partial e \partial A_1} = & -\frac{\partial^2 u_1}{\partial L_1 \partial A_1} + \frac{\partial P(e) \partial (u_2(\cdot) - u_3(\cdot))}{\partial e \partial A_1} + \\ & + P(e) \left( \frac{\partial^2 u_2}{\partial I_2 \partial A_1} \frac{\partial I_2}{\partial e} + \frac{\partial^2 u_2}{\partial A_2 \partial A_1} \frac{\partial A_2}{\partial e} - \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e} \right) + \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e}. \end{aligned} \quad (6)$$

It is assumed that  $u_i$  exhibits decreasing returns on the various variables, thus:

1. increasing the level of non-work related activities will increase the employee's instrumental utility,  $\frac{\partial u_1}{\partial L_1} > 0$ ; however the increase in effort will have a decreasing

$$\text{marginal effect: } \frac{\partial^2 u_1}{\partial L_1^2} < 0;$$

2. an increase in the difference between preferred and actual rewards,  $A$ , will decrease the employee's instrumental utility,  $\frac{\partial u_i(\cdot)}{\partial A_1} < 0$ ; however the effect of the decrease

in instrumental utility decreases with the increase in  $A$ ,  $\frac{\partial^2 u_i(\cdot)}{\partial A_1^2} < 0$  (the larger  $A$

is, the smaller the effect of the change on the level of instrumental utility appears to be);

3. as the level of rewards increases in period 2,  $I_2$ , the employee's instrumental utility will increase,  $\frac{\partial u_i}{\partial I_2} > 0$ ; however the increase in instrumental utility decreases as

the level of  $I$  increases,  $\frac{\partial^2 u_i}{\partial I_2^2} < 0$  (a change in  $I$  has a greater effect on instrumental

utility when the reward level is low rather than high).

We can also make a number of assumptions regarding the cross derivatives:

1. An increase in the difference between actual and preferred rewards increases the effect of the marginal level of effort invested in non-work related activities on instru-

mental utility:  $\frac{\partial \left( \frac{\partial u_1}{\partial L_1} \right)}{\partial A_1} = \frac{\partial^2 u_1}{\partial L_1 \partial A_1} > 0$ . Thus, as the difference between actual and

preferred rewards increases (i.e., the level of  $A$  increases), the effect of a change in non-work related activities on instrumental utility increases;

2. An increase in the difference between actual and preferred rewards has a positive effect on the marginal instrumental utility of an increase in the level of rewards in pe-

riod 2:  $\frac{\partial \left( \frac{\partial u_2}{\partial I_2} \right)}{\partial A_1} = \frac{\partial^2 u_2}{\partial I_2 \partial A_1} > 0$ . Thus, as  $A$  increases, the effect of a change in re-

wards on instrumental utility also increases;

3. An increase in the difference between actual and preferred rewards in period 1,  $A_1$ , has a decreasing effect on the marginal instrumental utility of the increase in rewards

in period 2:  $\frac{\partial \left( \frac{\partial^2 u_2}{\partial A_2} \right)}{\partial A_1} = \frac{\partial^2 u_2}{\partial A_2 \partial A_1} < 0$ . Thus as  $A_1$  increases, a change in rewards

in period 2 will have a smaller effect on the marginal instrumental utility of this difference;

4. A parallel assumption can be made regarding the case in which the employee does

$$\text{not receive an increase in rewards in period 2, } A_3: \frac{\partial \left( \frac{\partial u_3}{\partial A_3} \right)}{\partial A_1} = \frac{\partial^2 u_3}{\partial A_3 \partial A_1} < 0 .$$

Equation (6) can be divided into two parts, with the first being the “cost” of investing effort in work related activities:  $-\frac{\partial^2 u_1}{\partial L_1 \partial A_1} + \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e}$ . The first component of this “cost” is

a direct effect of increasing the level of effort in work related activities. An increase in work related activities brings with it a decrease in non-work related activities, and thus decreases the em-

ployee’s instrumental utility:  $\frac{\partial^2 u_1}{\partial L_1 \partial A_1}$ . The second component of the “cost”,  $\frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e}$ , is

the effect on instrumental utility of not receiving an increase in rewards despite a change in the difference between preferred and actual rewards. This occurs with probability  $1 - P(e)$ . The second part of (6) takes into account the effect of receiving an increase in rewards in period 2, i.e., the “benefit” of increasing the effort invested in non-work related activities:

$$\frac{\partial P(e)}{\partial e} \frac{\partial (u_2(\cdot) - u_3(\cdot))}{\partial A_1} + P(e) \left( \frac{\partial^2 u_2}{\partial I_2 \partial A_1} \frac{\partial I_2}{\partial e} + \frac{\partial^2 u_2}{\partial A_2 \partial A_1} \frac{\partial A_2}{\partial e} - \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e} \right). \quad (6)$$

Applying the assumptions above, let us first consider the “cost” of investing effort in work related activities, i.e., the situation in which there is an increase in the level of effort invested in productive work related activities when the possibility of not receiving an increase in

rewards in period 2 is taken into consideration:  $-\frac{\partial^2 u_1}{\partial L_1 \partial A_1} + \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e}$ . Here, a change in

the level of  $A$  has an effect on the relationship between non-work related activities and instrumental utility which, according to the above assumptions, is negative  $\left( -\frac{\partial^2 u_1}{\partial L_1 \partial A_1} < 0 \right)$ . Moreover, the

effect of the difference between preferred and actual rewards also has a negative effect on the marginal utilities  $\frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e} < 0 \left( \frac{\partial^2 u_3}{\partial A_3 \partial A_1} < 0 \text{ and } \frac{\partial A_3}{\partial e} > 0 \right)$ . We can see that both ele-

ments of the “cost” of increasing the level of effort in work related activities are negative. Thus ***the effect of an increase in the difference between preferred and actual rewards on the impact of effort invested in work related activities on instrumental utility is negative.*** These two components represent the negative effect of increasing the level of effort in related work activities: the first is the effect of a decrease in instrumental utility via the decrease in non-work related activities, and the second is the decrease in instrumental utility if the employee does not receive an increase in rewards after investing greater effort in work related activities. Note that this result is not trivial. It is not obvious that an increase in the difference between preferred and actual rewards will either increase or decrease the “cost” of investing in work related activities.

Let us now consider the case in which the employee does receive an increase in rewards in period 2. If in the “cost” component we take into consideration the “cost” of the decrease in the instrumental utility of non-work related activities, *and* the chance of not receiving an increase in the rewards, we now have to add a further element, that of (6): the effect on future instrumental utility of receiving an increase in rewards in period 2:

$$\frac{\partial P(e)}{\partial e} \frac{\partial (u_2(\cdot) - u_3(\cdot))}{\partial A_1} + P(e) \left( \frac{\partial^2 u_2}{\partial I_2 \partial A_1} \frac{\partial I_2}{\partial e} + \frac{\partial^2 u_2}{\partial A_2 \partial A_1} \frac{\partial A_2}{\partial e} - \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e} \right). \quad (7)$$

Note that we have assumed that as the worker increases the level of effort invested in work related activities, the probability of receiving a higher level of reward in the next period increases,  $\frac{\partial P(e)}{\partial e} > 0$ , and at the same time, the level of reward increases, and also increases subse-

quent work related activities,  $\frac{\partial I_2}{\partial e} > 0$ . Given the assumptions above, it therefore holds that

$\frac{\partial^2 u_2}{\partial A_2 \partial A_1} \frac{\partial A_2}{\partial e} - \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e} > 0$ . The sign of the term  $\frac{\partial(u_2(\cdot) - u_3(\cdot))}{\partial A_1}$  is thus positive. Since

the effect of a change in the difference between preferred and actual rewards should be smaller when an employee receives an increase in rewards in period 2 than when the increase is not received (remember that instrumental utility is greater when an employee receives an increase in rewards than when he/she does not,  $u_2(\cdot) - u_3(\cdot) > 0$ , and that instrumental utility has a decreasing marginal effect with an increase in the difference between preferred and actual rewards). We have therefore added three new components, all of which are positive. Thus, increasing the difference between actual and preferred rewards has two contradictory effects that may be termed “cost” and “benefit.”

In terms of “cost,” increasing the difference between preferred and actual rewards tends to decrease effort, as it is likely to increase the subsequent difference between perceived and actual reward if the employee does not receive an increase in rewards in period 2. Moreover, the employee incurs the direct “cost” of a decrease in the level of non-work related activities from which he/she could benefit. In terms of “benefit,” a change in the difference between preferred and actual rewards may increase effort if the probability of receiving a consequent increase in rewards is sufficiently high. In this case, the employee may wish to prove that he/she is worthy of the increase of which he/she was “deprived.” On the other hand, a considerable difference between actual and preferred rewards may result in reduced motivation to invest in work related activities, and thus decreased effort, because of the employee’s sense of having been treated unfairly.

If the effect of an increase in the difference between actual and preferred rewards is to make “cost” greater than “benefit,” i.e.,

$$\begin{aligned} & \frac{\partial^2 u_1}{\partial L_1 \partial A_1} - \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e} \\ & > \frac{\partial P(e)}{\partial e} \frac{\partial(u_2(\cdot) - u_3(\cdot))}{\partial A_1} + P(e) \left( \frac{\partial^2 u_2}{\partial I_2 \partial A_1} \frac{\partial I_2}{\partial e} + \frac{\partial^2 u_2}{\partial A_2 \partial A_1} \frac{\partial A_2}{\partial e} - \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e} \right) \end{aligned} \quad (8)$$

then the employee will decrease his/her effort in work related activities the larger the difference between preferred and actual rewards. In other words, if (8) holds, then as the difference between actual and preferred rewards increases, the employee will decide to invest less effort in work related activities. Here, the “cost” of increasing effort and thus decreasing non-productive activities, together with the possibility of not receiving an increase in rewards in period 2, is stronger than the “benefit” to be derived from the combination of increased effort, the chances of receiving an increase in rewards in period 2, and the level of this increase.

On the other hand, if as a result of an increase in the difference between actual and preferred rewards, the “cost” effect is weaker than the “benefit” effect, i.e.,

$$\begin{aligned} & \frac{\partial^2 u_1}{\partial L_1 \partial A_1} - \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e} \\ & < \frac{\partial P(e)}{\partial e} \frac{\partial(u_2(\cdot) - u_3(\cdot))}{\partial A_1} + P(e) \left( \frac{\partial^2 u_2}{\partial I_2 \partial A_1} \frac{\partial I_2}{\partial e} + \frac{\partial^2 u_2}{\partial A_2 \partial A_1} \frac{\partial A_2}{\partial e} - \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e} \right) \end{aligned} \quad (9)$$

then the employee will increase his/her effort in work related activities in the workplace.

In order to fully understand this result, let us consider the case in which the level of effort invested in work related activities does not directly affect the level of rewards subsequently received. In other words, the supervisor merely decides whether or not to grant an increase, but the level of the increase involved is fixed. As it is independent of the level of effort in the work related activities, then  $\frac{\partial I_2}{\partial e} = 0$ . We can therefore reformulate (9) to obtain:

$$\frac{1}{P(e)} \frac{\partial^2 u_1}{\partial L_1 \partial A_1} - \frac{(1-P(e))}{P(e)} \frac{\partial^2 u_3}{\partial A_3 \partial A_1} \frac{\partial A_3}{\partial e} \quad (10)$$

$$< \quad e \frac{\partial P(e)}{\partial e} \frac{e}{P(e)} \frac{\partial (u_2(\cdot) - u_3(\cdot))}{\partial A_1} + \frac{\partial^2 u_2}{\partial A_2 \partial A_1} \frac{\partial A_2}{\partial e},$$

where  $\frac{(1-P(e))}{P(e)}$  denotes the odds ratio of not receiving an increase in rewards in period 2, and  $\frac{\partial P(e)}{\partial e} \frac{e}{P(e)}$  represents the elasticity of the probability of receiving an increase in rewards in

period 2 as a result of a change in the level of effort invested in work related activities. We can see here that as the odds ratio of not receiving an increase in rewards in period 2 increases, the probability of increasing effort in work related activities decreases and consequently the probability of increasing effort in non-work related activities increases. On the other hand, the higher the elasticity of the probability of receiving an increase as a result of effort invested in work related activities, i.e., the greater the sensitivity of the probability of receiving an increase in rewards due to changes in effort invested in work related activities, the higher the probability that an employee with a larger difference between preferred and actual rewards in period 1 will increase efforts invested in work related activities and consequently decrease the effort invested in non-work related activities in the workplace.

We have focused here on positive values of  $A$ , the difference between preferred and actual rewards. However, the opposite situation may also exist, whereby actual reward is higher than preferred reward. Our analysis can also be applied to these conditions, to wit, if  $\frac{\partial u(A)}{\partial A} > \frac{\partial v(A)}{\partial A}$

then  $\frac{\partial u(-A)}{\partial A} < \frac{\partial v(-A)}{\partial A}$ . Therefore, for negative values of  $A$  we will obtain the opposite results,

i.e., inequalities (8) – (10) will change sign. For example, if an employee receiving an actual reward that is lower than his/her preferred reward will decrease the effort invested in work related activities, then an employee receiving an actual reward that is higher than his/her preferred reward will invest more effort in work related activities. This is consistent with the findings of Moreday (1991) that individuals are likely to be more tolerant of overpayment than underpayment, and are less likely to take steps to reduce over-reward inequity.

### 3. Conclusions

In sum, our theoretical analysis suggests the following propositions:

A. An employee who believes that he/she is receiving a reward that is less (more) than he/she deserves, may either: (1) increase effort in work related activities in order to prove he/she is worthy of an increase in rewards; or (2) decrease effort in work related activities as a result of insufficient pecuniary reward.

B. If an employee who believes that he/she is receiving a reward that is less (more) than he/she deserves and as a result decreases (increases) the effort in work related activities and consequently believes that he/she is now receiving a reward that is more (less) than he/she deserves, then he/she will increase (decrease) the effort invested in work related activities.

An empirical investigation of these propositions and the model from which they derive is warranted. Moreover, future research would do well to examine whether individual difference variables or situational factors affect the generalizability of the predictions of our theoretical model.

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