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The utility of pay raises/cuts: A simulation experimental study

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ABSTRACT

Theories from the fields of psychophysics, economics, and organizational behavior are integrated to develop insights about people's attitudinal reactions to (i.e., the utility and disutility of) pay raises and pay cuts of different sizes. Linear, logarithmic, power, and quadratic functions are developed from this integration. Techniques for evaluating the empirical applicability of these utility/disutility relationships are illustrated among a sample of 192 student "employees" in an experimental simulation. The results provide a partial test of the integrated framework. The results indicate a quadratic relationship for pay raises and a linear relationship for pay cuts. Implications of these findings are discussed.

1. Introduction

Merit pay is arguably the most popular incentive system used in business today, although its effectiveness continues to be debated in the academic and practitioner-oriented literature (Heneman, 1992; Pfeffer & Sutton, 2006; Shaw & Gupta, in press). On the one hand, Gerhart and Rynes (2003) concluded that the sparse existing evidence on merit pay is mostly positive including links to job satisfaction, motivation, and performance. On the other hand, few organizations describe their merit pay programs as "very effective" (e.g., see Wells, 2005), a large majority of employees believe they are underpaid

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(*by an average of 19 percent*) (Heneman & Judge, 2000), and average pay raise levels fall short of, or barely exceed, inflation. Against this backdrop, it is particularly problematic that although we "talk, think, argue, and dream about it..." "... money as a central research topic has not been given much attention by management research" (Mitchell & Mickel, 1999: 568).

One of the problematic issues is that merit pay research tends to be conducted in several parallel paradigms, each with its own set of assumptions. Management and applied psychology researchers tend to adopt a linear approach and assume that higher raises are incrementally more valuable (e.g., Schaubroeck, Shaw, Duffy, & Mitra, 2008; Shaw, Duffy, Mitra, Lockhart, & Bowler, 2003). Some researchers adopt a non-linear, psychophysics approach and assume that pay raises below a certain threshold may go completely unnoticed (e.g., Mitra, Gupta, & Jenkins, 1997; Mitra, Tenhiälä, & Shaw, in press). Other researchers, based on economic theory, suggest that money has diminishing marginal utility, but debate persists about the form of the function (Giles & Barrett, 1971; Heneman, Porter, Greenberger, & Strasser, 1997; Jevons, 1871). Indeed, although management, economics, psychophysics, and other approaches offer interesting insights into merit pay dynamics, these fields usually proceed independently and sometimes conflictingly (Rabin, 1998). Our understanding could be improved substantially if research from these perspectives were integrated to answer questions such as: Does a pay raise of, say $5000, evoke twice as strong a positive reaction as a pay raise of $2500?

The existing literature provides little insight and/or empirical evidence related to individual reactions to pay *cuts*. Unanswered in the literature are questions such as: Does a pay cut of $5000 evoke equally as negative a reaction as the positive reaction evoked by a pay increase of $5000? This is a timely question for several reasons. First, with the recent deep recession, many companies have implemented pay cuts instead of opting for lay-offs. Second, with the increasing volatility in stock option value (often implying pay cuts), many managers are experiencing significant reduction in their overall pay. Third, the growing popularity of pay-at-risk programs (e.g., Begley & Lee, 2005) provides impetus to investigate employees' reaction to both positive and negative changes in pay.

We address these issues here. Based on the premises that the value or utility of pay is a non-linear function of the absolute amount, and that the function for losses is steeper than the function for gains (e.g., Galanter, 1962, 1986, 1990; Holmes et al., 2011; Kahneman & Tversky, 1979, 1984), we attempt to move the information base forward by (a) offering an interdisciplinary theoretical exposition of the utility and disutility of pay raises and pay cuts; (b) testing a subset of the resulting predictions empirically; and (c) offering a refined functional form for utility/disutility based on the theoretical and empirical work. We seek to make several unique contributions. First, we integrate theoretical concepts from psychophysics, economics, and psychology to suggest a modified utility function. Second, we empirically test both the utility and the disutility of pay raises and pay cuts. That is, we specifically test the functional form of utility for pay raises (i.e., positive limb) and the functional form of disutility for pay cuts (i.e., negative limb). Third, we discuss and test disutility of small pay raises. Fourth, we use Box–Cox tests for statistical comparisons and assessment of the relative efficacy of linear, quadratic, and log-linear utility functions.

2. Theoretical review

2.1. The inherent utility or value of money

The issue of the utility of money has a rich history (Stigler, 1950), and an understanding of the utility of money in general and pay raises in particular is critical in explaining employee motivation, attitudes, and behaviors. According to Adam Smith, the term "value" can have two different meanings: the inherent utility of an object (value in use), and the power of purchasing other goods that the possession of the object conveys (value in exchange). Things with the greatest value in use (e.g., water) often have little value in exchange and vice versa (e.g., diamonds) (Smith, 1937). An object acquires utility either due to some intrinsic property that directly satisfies human needs or due to its ability to acquire other objects that can satisfy human needs. This analysis imputes an objective as well as a subjective connotation to the term *utility*. That is, the underlying mechanisms for evaluating the utility of any object, including money, have both a cognitive and an affective component. Unlike many objects, money has little inherent value, instead deriving its utility from its instrumentality in acquiring other useful objects (e.g., Black, 1990; Lawler, 1971).

2.2. Concept of utility within the context of employment

Kahneman, Wakker, and Sarin (1997) provide a detailed and convincing exposition of different conceptualizations of the notion of utility. Specifically, they assert that the modern notion of utility, labeled as "*decision utility*," is different from "*experienced utility*." Whereas observed "choices" offer indirect assessment of "decision utility," instant or temporal hedonic experiences form the foundation of "experienced utility" (Kahneman et al., 1997). Instant hedonic experience is referred to as "*instant utility*" and temporal hedonic experiences are captured by "*remembered utility*" as well as "*total utility*" (Kahneman et al., 1997). Kahneman et al. (1997) suggest a relationship between decision utility and experienced utility such that decision utility is jointly influenced by *predicted utility* (i.e., forecast of instant utility of outcomes) and remembered utility.

Within the context of work environment, decision utility is more applicable to individual employees' choices about effort to achieve performance goals. Organizational psychologists propose that employees' choices about the amount, intensity, and direction of effort are based on *predicted utility* of outcomes resulting from successful achievement of desired performance goals (Kahneman et al., 1997; Lawler, 1973; Pinder, 1998). Thus, experienced utility concepts,[4] and not decision utility concepts, are more relevant to understand the utility of *allocated* pay raises/cuts. The process of allocation of changes in pay levels (i.e., pay raises/cuts) involves temporal element and logically relates to remembered utility as well as total utility. Moreover, the intended purpose of a pay raise is to reward an employee's past performance. Employees' reactions to reward signals inform us about instant utility. In the following paragraphs, we summarize three streams of research to develop a conceptual approach for examining the experienced utility of pay raises and pay cuts. Researchers sometimes prefer the use of *value function* to refer to riskless outcomes and *utility function* to refer to outcomes associated with risk (e.g., Birnbaum, 1992; Shanteau & Troutman, 1992; Yates, 1990). Consistent with this, since pay raises and pay cuts are typically associated with risk, we use the term *utility function* throughout the paper.

2.2.1. Psychophysical view of meaning of pay raises or pay cuts

Psychophysical theories focus on judgment processes in evaluating changes in stimulus intensities. These judgment processes are essentially input–output functions between stimulus intensities (Φ) and corresponding sensations (Ψ). Objects susceptible to measurement in terms of "how much" (such as money) are particularly suited for *scaling* tasks and the development of ratio scales (Upshaw, 1984). Assessing the utility of money is thus a "scaling task" (as compared to a "discrimination task") of establishing the functional relationship between money (i.e., pay raises or pay cuts or Φ) and people's subjective reactions (e.g., happiness or unhappiness or Ψ).

Fechner was among the first scientists to relate stimulus continua with people's perceptions and reactions (Gescheider, 1976; Upshaw, 1969, 1984). Based on the work of Weber, Fechner argued that the Just Noticeable Difference (JND) on a psychological scale corresponds to the size of the JND on the physical (or stimulus) scale, and that sensation magnitude is a linear function of the *logarithm* of the stimulus intensity. A sound 100 times greater than the standard would thus be judged twice as loud as a sound ten times greater than the standard, a theoretical premise with mixed empirical support (Gescheider, 1976; McKenna, 1985). The validity of a logarithmic function was questioned by Stevens (1975), who argued (and provided a large amount of supportive data) that the relationship between stimulus magnitude and sensation can be directly assessed and the input–output function conformed a *power* function and was generally greater for unpleasant stimuli and smaller for pleasant stimuli (Stevens, 1975). These approaches (i.e., logarithmic and a power functions) suggest a non-linear function for the utility of money as well, although this issue is explored only rarely, and primarily by Galanter and his colleagues (e.g., Galanter, 1962, 1986, 1990; Galanter & Pliner, 1974; Hamblin, 1971; Parker & Schneider, 1988), and are generally supportive of Stevens' (1975) power function (see Brandstätter & Brandstätter, 1996 for an exception). Across 15 experiments, the exponent value for the positive limb of the utility/disutility curve varied between .43 and .88 (mean = .59), for the negative limb it varied between .54 and 2.6 (mean = .91) across nine experiments.

The notion of JND suggests that a person's ability to discern a change in stimulus intensity depends upon his or her experience of current stimulus intensity. That is, perception of change in the sweetness of sugar in one's coffee (or loudness of music) depends upon a user's current experience of sugar in coffee. Incidentally, two aspects of the assessment of the psychophysical input–output function relate directly to two economic concepts. First, the use of current level of stimulus intensity to assess the perception of JND is akin to the reference point in prospect theory. Second, the notion of decreasing ability of humans to discern same absolute size of a change at a higher level of stimulus intensity is similar to the concept of deceasing marginal utility in economics (Gescheider, 1976; Kahneman & Tversky, 1979; Kahneman et al., 1997).

2.2.2. Economic view of the utility of pay raises/pay cuts

Utility is a central concept in economics (Bernoulli, 1964; Black, 1990). Bentham is credited with highlighting this centrality with his argument that pleasure and pain form the basis of all human behavior (Mitchell, 1918). Broadly two types of utility have been suggested in the economic literature: ordinal and cardinal. For deriving general properties of market demand curves, economists typically use *ordinal* rather than *cardinal* utility theory. Ordinal utility theory (also referred to as dimensionless utility) uses ordinal-level data in analyzing consumer preferences, whereas cardinal utility theory (also referred to as measurable or dimensional utility) requires ratio-level data, as is used to analyze human behavior under conditions of uncertainty (Samuelson & Nordhaus, 1992). Cardinal utility theory assesses cumulative wealth as shown in Fig. 1.

Pay raises or pay cuts reflect changes in the current pay level. Utility assessment of changes in pay levels are not bundled in the form of affective assessment of wealth (Lawler, 1971). Prospect theory offers a superior framework to study utility of pay raises or pay cuts. In proposing prospect theory, Kahneman and Tversky (1979) argued that "utility theory, as it is commonly interpreted and applied, is not an adequate descriptive model" (p. 263). Their utility function was adopted from cardinal utility theory (Larrick, 1993).

In part to integrate utilitarian and psychophysical perspectives, Kahneman and Tversky's (1979; see also Tversky & Kahneman, 1992) *prospect theory* presents several modifications and extensions of cardinal utility theory. Three mechanisms of prospect theory are particularly relevant to the study of the utility of changes in pay.[5] First, the theory suggests the use of

[4] We thank a reviewer for suggesting that we frame this manuscript based on concepts pertaining to experienced utility.

[5] A change in pay or a pay raise/cut implies a discrimination psychophysical task, as is also implied by the gain/loss graphed on the y-axis in Fig. 2a. In a typical *scaling* psychophysical experiment, however, subjects are given a reference stimulus (i.e., base pay) and are asked to scale several comparison stimulus intensities (i.e., new pay levels). Differences between comparison stimulus intensities and the reference stimulus intensity can then be mathematically computed to test prospect theory proposition.

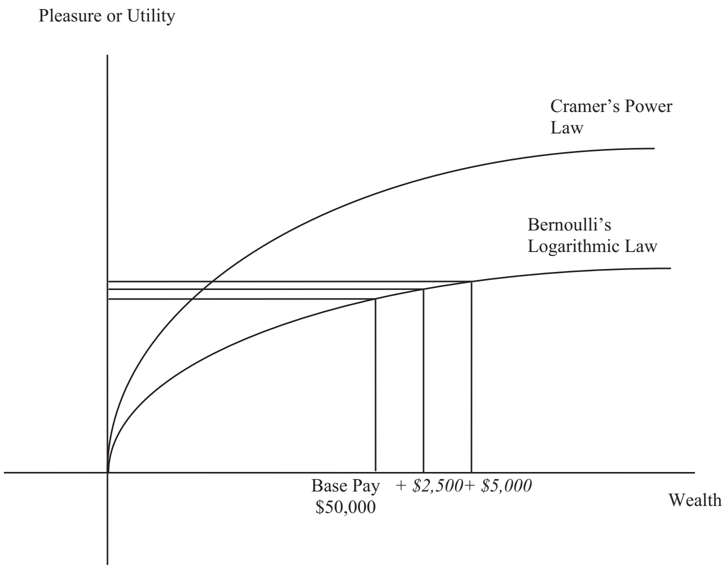

Fig. 1. Predictions from cardinal utility theory: Cramer's power law and Bernoulli's logarithmic law.

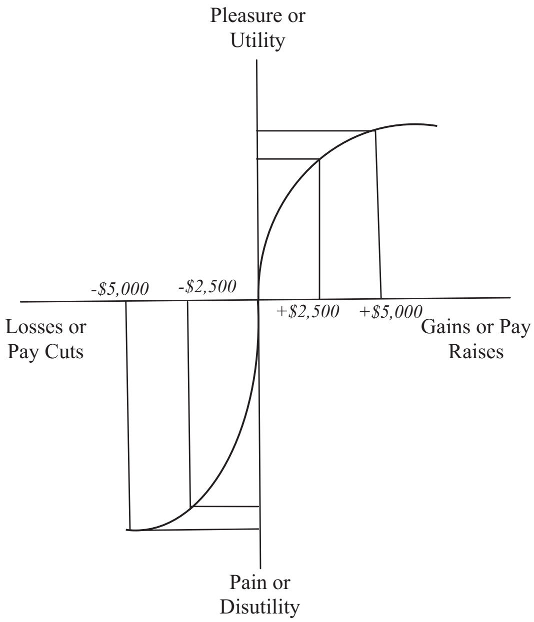

Fig. 2a. Utility predictions from prospect theory.

reference point to assess gains (pay raises) or losses (pay cuts). That is, the utility function should focus on changes in, rather than absolute cumulative amounts of, the stimulus level (the current stimulus level forms the reference point in prospect theory): "Our perceptual apparatus is attuned to the evaluation of changes or differences rather than to the evaluation of absolute magnitude" (Kahneman & Tversky, 1979: 277). In other words, an employee's current salary could act as the standard against which the utility of a pay raise is assessed. This implies (and supports the intuitive notion) that a pay raise of $5000 would be evaluated differently by someone with a current salary of $50,000 than by someone with a current salary of $500,000.

Second, the authors argued that the utility function should be concave for gains and convex for losses, and that it should be steeper for losses than for gains (i.e., losses loom larger than gains). This argument extended the utility function to apply to *disutility* as well as to utility. The utility function described by prospect theory is depicted graphically in Fig. 2a. Gains are shown in the *positive limb*, and losses in the *negative limb*. The utility function for losses, i.e., the negative limb, is steeper than for the positive limb (Galanter, 1990; Kahneman & Tversky, 1979). A pay cut of $2500 should incur a more negative reaction than the counterpart positive reaction incurred by a pay raise of $2500. When related to the analysis of risky outcomes, this also suggests that employees will be risk averse when dealing with pay raises but will seek risk when facing pay cuts. This change in preference is called the *reflection effect* (Kahneman & Tversky, 1979). Third, prospect theory asserts that people are loss averse, i.e., they prefer certain outcomes over risky outcomes.

Please note that we are using the terms ''positive limb'' to refer to the utility function associated with *positive* changes in pay levels (gains) and ''negative limb'' to refer to the utility function associated *negative* changes in pay levels (losses). The vertical axis in Fig. 2a involves assessment of utility or disutility of gains and losses, respectively. Over the last two decades, an impressive body of work by Kahneman and his colleagues has sparked a renewed interest in Bentham's notion of experienced utility (Carter & McBride, 2013; Kahneman, 2000; Kahneman & Thaler, 2006; Kahneman et al., 1997; Reed, 2007). For Kahneman et al. (1997), experienced utility can take many forms. They argue that, ''The basic building block of experienced utility in our analysis is *instant utility*, a measure of hedonic and affective experience, which can be derived from immediate reports of current subjective experience or from psychological indices'' (Kahneman et al., 1997: 376, italics original). Furthermore, temporally experienced utility can be either remembered utility or total utility. Remembered utility is a retrospective measure of pleasure or displeasure of outcomes over a period of time. Total utility is a normative temporal profile of instant and remembered utilities.

Work in the area of prospect theory and experienced utility offers several implications for investigating utility of pay raises or pay cuts. First, pay raises and pay cuts are analogous to gains and losses in prospect theory. Second, utility of pay raises and pay cuts must be assessed based on a reference point (e.g., such as the current pay level). Third, the relationship between utility and the size of pay raises (or disutility and pay cuts) will be nonlinear and will have decreasing marginal returns. Fourth, the slope of the relation between pay raises and utility will be less steep than the slope of the relationship disutility and pay cuts. Fifth, experienced utility of pay raises (or disutility of pay cuts) can be measured subjectively instantly. Sixth, temporal and episodic aspect of remembered utility is impacted by peak-end evaluation, duration neglect, and violations of temporal monotonicity (Kahneman, 2000; Kahneman et al., 1997). For example, the logic of duration neglect would suggest that the utility of a pay raise or pay cut is not impacted by the duration of employment. Instead, the experienced utility of a pay raise or pay cut is largely determined by the highest pay raise/cut (i.e., due to the peak evaluation rule) during the duration of employment as well as the most recent pay raise or pay cut (i.e., due to the end evaluation rule). Also, an employer can minimize disutility effects of pay cuts by ''...adding an extra period of discomfort that reduces the Peak-End average'' (Kahneman et al., 1997: 381). A related concept, adaptation mechanism, i.e., the tendency to adapt to a change and perceive the new level as neutral/normal, has been claimed to imply that utility of stream of income can never last as, ''...people are doomed to march forever on a hedonic treadmill'' (Kahneman & Thaler, 1991: 342). Kahneman and Thaler (1991), based on a theoretical analysis of cognitive processes associated with experienced utility, offer several implications for organizations to manage pay raises and bonuses with the goal to maximize utility.

2.2.3. Psychological mechanisms that alter the utility function for pay raises and pay cuts

Despite garnering significant empirical support, utility theory is ''short on psychological explanations for why people would hold specific attitudes about risk or why there would be differences between people'' (Abdellaoui, Barrios, & Wakker, 2007; Larrick, 1993: 443). Two social psychological theoretical frameworks – expectancy theory and reactance theory – offer additional insights about people's assessment of the utility of money or pay raises/cuts. Factors suggested by these social psychological theories can be fruitfully employed to refine and enhance the utility function suggested by prospect theory.

3. Refinement of the utility function

3.1. Reference point and employment relationships: expectations and reactance

Much research on the utility/disutility of monetary gains and losses, as shown in Fig. 2a, was conducted in the gambling context which is different in several key ways from work contexts. Refinements offered by the prospect theory are no doubt valuable, but they must be supplemented with systematic identification of psychological factors that affect the utility of money in the employment context. Expectancy theory and reactance theory highlight several mechanisms that affect the shape of the utility/disutility function shown in Fig. 2a.

Kahneman (1992) argued that, in most negotiations, many reference points are likely to be used in evaluating the desirability (gains) or undesirability (losses) of a final outcome. An individual's attitudinal reactions to a pay change can be similarly affected by multiple psychological dynamics.

According to expectancy theory (and its variant *value-percept theory* to study pay/job satisfaction), an employee's reaction to a pay raise is affected, not just by the magnitude of the pay raise itself, but also by the employee's expectations about the raise (Judge & Church, 2000; Lawler, 1971; Lawler & Jenkins, 1992). Objective information of historical pay raises and *a priori* agreed upon performance appraisal standards help an employee define expectations for a pay raise. A good performer, expecting a reasonable merit pay raise would not necessarily have positive experienced utility or pay raise satisfaction with *any* raise. Rather, due to pay raise expectations, a smaller-than-expected raise could produce experienced disutility or negative affective reaction. Furthermore, a pay raise is a feedback mechanism as well as an outcome. A low raise signals below-par performance and is potentially physiologically and psychologically distressing (implying disutility). Thus, expectancy theory logic suggests that "actual pay raises" that are less than "expected pay raises" could evoke disutility or negative reactions. Recent work on experienced utility seems to acknowledge the need for this refinement. According to Carter and McBride (2013), at least three factors influence an individual's reference point: past outcomes, expected outcomes, and outcomes received by the peer-group (please see also Huber et al., 1997). Considerable body of research on pay-for-performance systems suggests that pay expectations are impacted by past outcomes as well as the social comparison process (Elster, 1989; Milkovich, Newman, & Gerhart, 2011). Schaubroeck et al.'s (2008) development and extension of the under-met expectation model offers particularly promising support for the disutility of small pay increases. Their work builds on Locke's (1976) under-met expectation model as summarized below:

> "When a person expects a pleasant event to occur, he often begins to anticipate the actual event and the pleasure it will bring, for example, by fantasizing or contemplating its consequences or by telling others about it. If the event then fails to come about, it may be more disvalued than if it had not been expected in the first place, perhaps due to the heightened contrast between the anticipated success and the failure that results. On the other hand, a person who expects failure in attaining some value may have time to erect some defenses against it or to activate coping mechanisms that will lessen the disappointment" (p. 1303).

Schaubroeck et al. (2008) assert that employees react very negatively to under-met expectations, specifically when they believe that they control their outcomes. In other words, a pay raise that is less than expected should evoke disutility for employees who believe that they control the level of their job performance. The results of their longitudinal study among hospital employees offer strong support for the purported extension of the under-met expectation model. To summarize, pay raise expectations play a critical role in determining the affective reactions of pay raises and small pay raises may evoke negative affective reactions.

Reactance theory concerns people's reactions to the loss of behavioral freedom or to the threat of such loss (Brehm, 1966). According to Brehm, for a given set of free behaviors, an employee will experience reactance when "...any of those behaviors are eliminated or threatened" (1966: 4), and that "(t)he magnitude of reactance is a direct function of (1) the importance of the free behaviors which are eliminated or threatened, (2) the proportion of free behaviors eliminated or threatened, and (3) where there is only a threat of elimination of free behaviors, the magnitude of that threat" (1966: 4). Some labor economics theories imply similar mechanisms – very large pay raises reduce an employee's choices about the use of his/her free time for non-work activities (Ehrenber & Smith, 1982). These perspectives suggest that extremely large raises may be perceived as threats to freedom and evoke feelings of reactance (Brehm, 1966; Korman, Glickman, & Frey, 1981). This results in a negative gradient in decreasing marginal utility. Assuming the simultaneous operation of all cognitive and affective (e.g., decreasing marginal utility, valence, reference points, expectations, and reactance) mechanisms, the theoretical predictions shown in Fig. 2a can be modified as applied to pay raises or pay cuts is shown in Fig. 2b.

Note that the positive limb of the curve is pulled down to account for the unmet expectations effects of smaller pay raises; this implies disutility of small positive pay raises as a result of under-met expectations. The high end of this limb is also pulled down to account for the reactance effects of raises that are too large. For the positive limb, an integration of the combined effects of under-met expectations and reactance results in a *quadratic* relationship between pay changes and subjective assessments.

For the negative limb, it is asserted that any pay cut, irrespective of the size of pay cut, results in strong negative reaction. This assertion assumes that an employee will show very negative reaction to a small pay raise due to the under-met expectation. Thus, experienced disutility of a small pay cut is in part impacted by under-met expectation of pay raise. Furthermore, it is well-established that losses loom larger than gains (Kahneman & Tversky, 1979, 1984). Thus, a pay cut should evoke stronger disutility. From psychological point of view, Mitra et al. (in press), argue that, "..., individuals do not react to negative events and interactions symmetrically; negative events carry more evaluative impact and create more cognitive rumination—a process known as *mobilization* (Duffy, Ganster, & Pagon, 2002; Taylor, 1991). Heightened reactions to negative events occur partly because (1) they evoke stronger physiological responses, (2) they focus attention on dealing with immediate dangers/toxicities, (3) they are rarer and are frequently unexpected, and (4) they involve more cognitive effort (Duffy et al., 2002; Taylor, 1991)" (p. 6). Thus, an integration of the impact of under-met expectations and mobilization effects suggests a linear relationship between negative pay changes and subjective assessment.

3.2. Developing functional forms of the utility/disutility of pay raises/cuts

3.2.1. Functional form suggested in psychology literature

Traditionally, research on pay raises assumes a linear relationship between pay increase and pay satisfaction. This can be expressed mathematically as follows:

$$\textit{Linear} \quad Y = b_0 + b_1 \cdot X \tag{1}$$

where X and Y represent changes in pay levels and the utility of money respectively. The theoretical approaches discussed above suggest a more complex relationship.

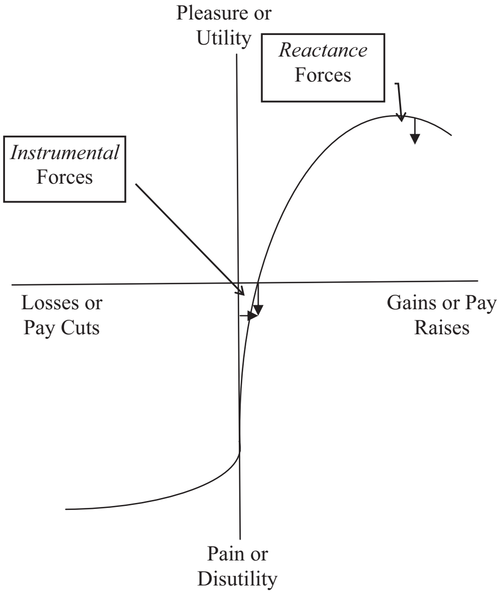

Fig. 2b. Integrated framework for the utility/disutility of pay changes (revised).

3.2.2. Functional forms suggested in economics literature

Traditional utility theory (Fig. 2a) proposes instead a non-linear relationship between changes in pay and the utility/disutility of money. This non-linear relationship could take one of two forms – logarithmic and power – as indicated in Eqs. (2)–(4) below:

$$\textit{Logarithmic} \quad Y = b_0 + b_1 \cdot \mathrm{Log}(X) \tag{2}$$

$$\textit{Power (Log linear)} \quad \mathrm{Log}(Y) = b_0 + b_1 \cdot \mathrm{Log}(X) \tag{3}$$

The non-linear form of the power function can also be expressed as follows:

$$\textit{Power (Non-linear)} \quad Y = b_0 \cdot X^{b1} \tag{4}$$

It may be noted that generalized non-linear power function given in Eq. (4) is known as constant relative risk aversion (CRRA) utility in economics and the log linear function in Eq. (3) is simply its special case.

3.2.3. Proposed functional form of utility for pay raises

A modified functional form shown in Fig. 2b acknowledging the presence of psychological factors, such as effects of expectations and reactance, suggests a quadratic relationship the positive limb that can be represented as follows:

$$\textit{Quadratic} \quad Y' = b_0 + b_1 \cdot X + b_2 \cdot X^2 \tag{5}$$

where Y' is the utility function for the positive gains after adjusting for disutility resulting from the unmet expectations $(-Y_E)$ (i.e., $Y' = Y - Y_E - Y_R$) for small pay raises as well as reflecting disutility effects of reactance $(-Y_R)$ for extremely large raises. The proposed quadratic functional form (inverted-U) results from disutility effects of unmet expectations and reactance.

3.2.4. Proposed functional form of disutility for pay cuts

As shown in Fig. 2b, within an employment context, due to negative effects of unmet pay raise expectations, any pay cut is expected to have a high negative disutility. In essence, the relationship between disutility and pay cuts is proposed to be linear as follows:

$$\textit{Linear} \quad Y = b_0 + b_1 \cdot X \tag{6}$$

The three proposed functions – logarithmic, power, and quadratic – were specifically investigated in at least five studies, with support for a power function in Giles and Barrett (1971) and Schuster, Colletti, and Knowles' (1973) and support for a quadratic or inverted-U function in four studies (Heneman et al., 1997; Porter, Greenberger, & Heneman, 1990; Schuster et al., 1973; Worley, Bowen, & Lawler, 1992). Overall, empirical evidence about the specific relationship is scanty and mixed, but leans toward supporting a quadratic relationship between pay changes and employee reactions. It should be noted, however, that none of the previous studies considered the disutility of small positive raises. All previous studies on monetary gains, including gains from work or non-work settings, assumed that positive gains will always have utility. Based on our refinement of the utility function indicated by Eq. (5), we assert that small gains can have disutility. Moreover, as shown in Fig. 2b, due to pay raise expectations, we argue that even small pay cuts can lead to heightened perceptions of disutility (Eq. (6)). Accordingly, we advance previous work on the utility theory by proposing and testing the following predictions or propositions (please refer to Fig. 2b):

- the utility function is quadratic (i.e., inverted U shape) for the positive limb (i.e., positive pay changes);
- due to under-met expectations, very small pay raises have disutility;
- due to reactance, very large pay raises, as compared to large pay raises, have less utility;
- current pay levels, pay raise expectations, and reactance to very large pay raises, provide referents for evaluating pay raises;
- current pay level, pay raise expectations, and cognitive mobilization act as referents for pay cuts; and
- the utility function is linear for the negative limb (i.e., negative pay changes). The prediction for linear functional form for pay cuts results from the fact that employees react equally negatively to any pay cut irrespective of the size of pay cut. In other words, we predict that any pay cut results in extreme negative reaction from employees (please refer to Fig. 2b).

While we offer several refinements of the traditional utility function, we acknowledge the fact that several additional factors may also impact utility function. Noteworthy among these are *equity and normative* considerations for pay raises and pay cuts. Due to data limitations, we *did not directly* address equity and normative considerations in the empirical analyses. Instead, our design ensures *invariance* in context. We discuss these issues in Section 6.

4. Method

4.1. Participants and procedure

Participants were 192 student "employees" with diverse educational backgrounds at a large southern university. The data reported here were collected as part of a larger study examining the psychophysical dynamics of pay. The larger experimental simulation involved: (a) hiring student "employees" to perform a coding task at one of two base pay rates, (b) giving employees performance feedback ("satisfactory" for all subjects to hold this issue constant), (c) giving employees pay raises of different amounts after the job had been done for a period of time (6 different randomly-assigned positive raise levels for each base pay condition, including one with "no" pay raise), and (d) assessing various psychophysical, psychological, motivational, and behavioral dynamics throughout. The experimental procedures were repeated for two separate coding sessions, after which subjects were debriefed and paid. Data for this manuscript are based on responses subjects provided after the completion of the second coding session. We provide specific details about this data collection phase below as well as in Appendix A.

4.2. Measuring reactions to pay raises through a scaling task

Before providing details of the scaling task, it is important to identify two critical issues that dictated the selection and design of our approach. The first issue is the specific scaling technique to be used. A common method for developing ratio scales from scaling tasks is magnitude estimation, requiring subjects to make direct numerical estimations of their reactions to stimuli of varying intensities (Gescheider, 1976, 1988; Jones, 1974). Pay raises are typically presented numerically, and if utility is also measured numerically, the resulting design is subject to consistency bias. It is reasonable for subjects to attempt to maintain consistency between the first and second set of numbers, i.e., the pay raise and the direct magnitude-based utility scale (Galanter, 1990; Galanter & Pliner, 1974; Worley et al., 1992). The direct cross-modality matching technique, requiring subjects to provide utility estimates along a length of line, addresses this issue (Stevens, 1958, 1974; see also Cross, 1982; Giles & Barrett, 1971), and was therefore appropriate for our study. This traditional psychophysical method is psychometrically different from Likert-type pay satisfaction measures, and is specifically tied to specific stimulus intensities to generate ratio scales. Furthermore, each new pay rate was randomly provided on a new page to preclude cognitively consistent, but not necessarily *true*, responses (Galanter, 1990; Worley et al., 1992).

A second concern focused on replication of judgments (Cross, 1982). Repeated judgments about each stimulus intensity (i.e., a pay change) can be obtained by presenting the same stimulus to the same subject repeatedly (within-subjects replication) or by presenting the same stimulus to a variety of subjects (between-subjects replication) (Torgerson, 1958). Within-subjects replication can be used for scaling of such sensations as taste or heaviness, but its use for scaling changes in monetary levels is logically impractical (Galanter, 1990; Worley et al., 1992). Between-subjects replications for the *same* stimulus intensity and within-subjects replications for *different* stimulus intensities are generally recommended for more generalizable results (Gescheider, 1976). We adopted this approach in our study.

During the break after the second coding session, subjects completed a question booklet to measure *affect* (happiness) by using a 64-mm continuous dependent-response rating line. Subjects provided reactions to 15 pay gains and 9 pay losses. Pay gains varied between 4¢ and 300¢, and pay losses varied between 6¢ and 100¢. These ranges for gains and losses were used because: (a) realistically, employees are more likely to get pay raises than pay cuts; (b) employees are more likely to experience *larger* pay raises and *smaller* pay cuts (thus affecting the realistic range); and (c) they mirrored those used in previous research (e.g., Giles & Barrett, 1971; Worley et al., 1992). Subjects compared each gain/loss to their old pay level (i.e., the starting pay level) and recorded responses with an ''X'' on a line from ''very unhappy'' to ''no change'' to ''very happy.'' Specific details about the experimental design and instructions for the scaling task are provided in Appendix A.

These anchors capture pay reactions reliably (Shaw et al., 2003) and Russell and Bobko (1992) demonstrate that continuous dependent-response rating forms are superior to coarser Likert-type rating formats when investigating complex relationships.

4.3. Analysis strategy

4.3.1. Functional relationships of interest

The data for this study were the 192 subjects' responses to 24 pay changes on the affect dimension. The responses were analyzed to assess the relative validity of the linear, power, logarithmic, and quadratic utility functions through regression techniques. Thus, the four models,[6] given in Eqs. (1)–(3), (5) and (6), were assessed.

Although the functional form indicated in Fig. 2b can be analyzed as one function (i.e., the S-form), data analysis concerns pertaining to the logarithm of negative values have prompted researchers to analyze the positive and negative limbs separately (Galanter, 1990; Giles & Barrett, 1971). Since a separate analysis of the two limbs does not affect the theoretical propositions suggested in Fig. 2b, we treated the positive and negative limbs separately. The data were analyzed through hierarchical OLS regressions (Cohen, Cohen, West, & Aiken, 2003) and the Box–Cox transformation method.

4.3.2. Hierarchical regression

Traditionally, hierarchical regression analysis is used to assess statistical superiority of different theoretical models that involve incremental addition of independent variables and interactive terms (Cohen et al., 2003). The process comprises of testing statistical significance of unique variance associated with incremental addition of a block of variables and, typically, the block of variables that a researcher wishes to control are added first. This ensures that the unique variance associated with the variable of interest can be clearly identified (Cohen et al., 2003). Thus, as a first step of the hierarchical regressions we added base pay as the independent variable (Cohen et al., 2003). Recall that subjects had actually experienced a pay change prior to performing the scaling task for pay increases and/or pay cuts, and it is possible that their perceptions were sensitized to the new pay level or actual pay change. Accordingly, the new pay level (i.e., actual pay change) was added in the second step to control for its effects. In order to control for unknown between subjects' heterogeneity, in the third step, $N-1$ dummy variables (for subjects) were added to the equation. In the last step, the utility function indicated in each equation was added. F-statistics were then used to identify the additional variance explained in each step. Customarily, statistical program SPSS uses change in R^2, rather than change in adjusted R^2, to report F-statistics for additional variance explained in the each step, a practice well accepted in the statistical literature (Cohen et al., 2003). Thus, using hierarchical OLS regressions, it is possible to statistically test superiority of a quadratic functional form compared to a linear functional form (i.e., Eq. (5) vs. Eq. (1)).

4.3.3. Box Cox transformation

Use of hierarchical regressions enables statistical comparison of the linear and quadratic functions in terms of the amount of variance explained by each model. But the focal equations also include logarithmic and power functions. Log linear terms cannot be added incrementally in a hierarchical regression, precluding significance tests of increases in explained variance. Comparison of the proportion of variance explained by linear, log-linear, and quadratic functions is also inappropriate because ''... R^2 is the ratio of explained variance to the total variance and the variances of y and $\log y$ are different'' (Maddala, 1992: 220). Definition of a general function, of which both linear and log linear functions are special cases, is one approach to addressing this issue. The Box–Cox transformation provides such a general function (Kmenta, 1986) and was used to assess efficacy of utility functions given in Eqs. (1)–(5). We performed the Box–Cox analyses as a separate test to complement hierarchical regression analyses. Specific details about the Box–Cox transformation are provided in Appendix B.

4.3.4. Treatment of data heterogeneity

Experimental simulation data based on a between-subjects design necessarily generates heterogeneous reactive responses to same pay raises or pay cuts. Thus, two data combination methods, similar to those used in the literature (Cross, 1982; Galanter, 1990; Giles & Barrett, 1971), were used for data analysis. The first combination technique is referred to here as the *pooled* approach. In this approach, all responses to the 24 pay changes were treated as independent observations, such that there were 192 responses to a 4¢ raise, 192 responses to a 10¢ raise, etc. This resulted in a maximum of 2880 observations for pay raises and a maximum of 1728 observations for pay cuts. The hierarchical regression models were then tested among this pooled data set. This approach allowed us to examine the impact of different frames of reference (two base pay levels) on subjective reactions (Cohen et al., 2003; Kahneman & Tversky, 1979). It also enabled us to control between-subjects differences that may affect reactions to pay changes (Lawler, 1971) by adding subjects as dummy variables.

[6] Following Worley et al. (1992), we also analyzed the positive limb for a cubic function (i.e., $Y = b_0 + b_1X + b_2X^2 + b_3X^3$). The addition of the cubic term *did not* result in the explanation of significant additional variance, a finding consistent with Worley et al. (1992).

For the second combination approach, data were averaged across the 96 subjects in each base pay group for the affect and behavioral intent dimensions. The regression models were tested using these averaged responses to the 15 pay raises and nine pay cuts (this is referred to throughout as the *averaged* approach). Scaling judgments for the 24 pay changes were replicated across 192 subjects, and these averaged responses were used to test the utility functions (Cross, 1982). The averaged approach yields more generalizable results (Gescheider, 1976) by eliminating inconsistencies across subjects.

It should be noted that the two approaches to address data heterogeneity were chosen based on the objectives of the study to assess refinement of the utility functional form within the context of simulated employment setting. However, a growing body of literature in economics points to the usefulness of modeling of subjects' response heterogeneity to fit different utility functional forms. This stream of work involves estimating individual utility functions (Fisman, Kariv, & Markovits, 2007) or mixtures of different utility functions (e.g., Cappelen, Hole, Sørensen, & Tungodden, 2007; Conte, Hey, & Moffatt, 2011; Harrison & Rutström, 2009). Since our research objectives did not seek to assess which functional forms are more likely to fit subjects' individual utility, we do not report results of such analyses.[7]

4.3.5. Data analysis concerns

It is assumed traditionally that people have positive reactions to monetary gains and negative reactions to monetary losses (Galanter, 1990). Our predictions, shown in Fig. 2b, however, suggest that small gains (e.g., a 1% raise) may evoke negative reactions. Eqs. (2)–(4) above require either logarithmic transformations of the variables or derivatives. Neither of these is possible for negative numbers. To address this issue, the data were adjusted for the lowest value of the negative reaction to a raise.[8] In other words, for each subject, the x-axis was moved down by adding the lowest value of the negative reaction to all utilities in the positive limb for that particular base pay. In this way, all values of the positive limb fell in the same quadrant, there were no negative numbers, and logarithmic values could be obtained. For the hourly minimum wage group, the average lowest affective reaction for a 4¢ raise was −40.62 and the counterpart affective value for the second base wage group was −33.

5. Results

Table 1 shows the results of the regression analyses using the *pooled* approach for affective reactions. The cumulative R^2, adjusted R^2, the change in R^2, and the F-statistic are reported for each step. The results using the *averaged* approach are shown in Table 2. This approach treated the two base pay conditions separately, and results are reported separately for each. The results of the Box–Cox test, showing simultaneous assessment of the predictive power of the linear, logarithmic, and power functions, are reported in Table 3. These tests were conducted using *pooled* and *averaged* approaches. The Box–Cox transformation does not allow a direct comparative test of the quadratic function with reference to the linear and log-linear models. Nonetheless, we analyzed the data by adding a quadratic term to the linear function (i.e., the Box–Cox transformation with $\mu = \lambda = 1$).

5.1. Utility function for pay raises (positive limb, Fig. 2b)

It was proposed that, after mathematically adjusting for disutility of small pay raises, the quadratic form will best fit the data. Table 1, based upon the pooled approach, indicates that the quadratic function has the highest R^2 as well as the adjusted R^2, though the logarithmic model offers a close fit too. The results shown in Table 2, using the averaged approach, offer similar pattern with highest value of R^2 found for the quadratic function. For both pooled as well as averaged approach, the results of hierarchical regression suggests that the addition of the quadratic term significantly explains an additional unique variance over and above the variance explained by the linear function. It should be noted that the results of the averaged approach provided a better fit than the pooled approach. This was expected because the averaged approach employs averaged responses across-subjects and, therefore, is less influenced by individual and contextual effects (Cross, 1982; Galanter, 1990; Gescheider, 1976). Finally, the Box–Cox analyses results suggest that the linear function is superior to the power function and the quadratic function offers a superior fit than the linear function. Thus, the Box–Cox analyses shown in Table 3 suggest that the quadratic function provides the higher explanatory power than the linear function or the power function for the positive limbs. Taken together, after adjusting for the disutility of small pay raises and various approaches to analyzing data, our results broadly provide a significant support for the quadratic functional form for the utility of pay raises.[9]

[7] We thank a reviewer for this insight.

[8] Please note that we did not model impact of pay raise expectations on actual pay raises, i.e., we did not make adjustments to variable X in our equations. An adjustment to variable "X" will, in effect, minimizes the finding that there is disutility for small pay raises. It is asserted that pay raise expectations cause negative reaction to small positive gains. Thus, in order to correctly test the nature of the relationship between pay raises and associated utility, the statistical test of the functional form of the utility would require adjustments to the variable "Y" or affective reactions.

[9] Please note that our results, however, do not provide unambiguous support to claim that the quadratic function offers statistically superior fit than the logarithmic function.

Table 1
Hierarchical regression results for the *pooled* approach – affective reactions to pay raises/cuts.

	Positive limb				Negative limb			
	R^2	Adj R^2	ΔR^2	$F_{\Delta R^2}$	R^2	Adj R^2	ΔR^2	$F_{\Delta R^2}$
Base pay	.004	.004		12.6***	.003	.003		5.5*
Reference-raise	.013	.012	.008	24.7***	.005	.004	.002	3.8?
Subjects	.222	.166	.209	3.8**	.583	.531	.577	11.3**
Pay raise (**linear**)	.731	.712	.509	5083.5***	.629	.582	.046	189.4***
Unstandardized utility parameters: $b_0 = 55.29$, $b_1 = 0.27$)								
(Pay raise)^2 (**quadratic**)	.771	.751	.040	472.3***	.634	.588	.006	23.3**
Unstandardized utility parameters: $b_0 = 45.80$, $b_1 = 0.52$, $b_2 = -0.001$)								
Logarithmic model								
Base pay	.004	.004		12.6***	.003	.003		5.5*
Reference-raise	.013	.012	.0084	24.7***	.005	.004	.002	3.8?
Subjects	.222	.166	.2090	3.8**	.583	.531	.577	11.3**
Log (pay raise) (logarithmic)	.762	.745	.5420	6091***	.627	.580	.044	181.1***
Power (log linear) model[a]								
Base pay	.002	.002		6.1*	.003	.003		5.5*
Reference-raise	.009	.009	.0073	21.1***	.005	.004	.002	3.9*
Subjects	.257	.204	.2479	4.7**	.538	.480	.532	9.3**
Log (pay raise)	.605	.577	.3476	2361.9***	.575	.521	.037	131.9***

[a] The numbers for the first three steps for the relationship differ because of the log–log relationship between dependent and independent variables.
* $p < .05$.
** $p < .001$.
*** $p < .0001$.
? $p < .1$.

Table 2
Hierarchical regression results for the *averaged* approach – affective reactions to pay raises/cuts.

	Base pay level 1					
	Positive limb			Negative limb		
	R^2	ΔR^2	$F_{\Delta R^2}$	R^2	ΔR^2	$F_{\Delta R^2}$
Pay raise (**linear**)	.8807	.8807	96.0***	.4330	.4330	5.4?
(Pay raise, pay raise)^2 (**quadratic**[a])	.9471	.064	15.1**	.4810	.0480	.6
Log (pay raise) (**logarithmic**)	.9248	.9248	160.0***	.4096	.4096	4.7?
Log (pay raise) (**log linear: power**)	.7319	.7319	35.5***	.4073	.4073	4.9?
	Base pay level 2 (150% of base pay level 1)					
	Positive limb			Negative limb		
	R^2	ΔR^2	$F_{\Delta R^2}$	R^2	ΔR^2	$F_{\Delta R^2}$
Pay raise (**linear**)	.8739	.8739	90.1***	.6608	.6608	13.6**
(Pay raise)^2 (**quadratic**[a])	.9466	.0727	15.06**	.7121	.0513	1.1
Log (pay raise) (**logarithmic**)	.9248	.9294	171.1***	.6092	.6092	10.9*
Log (pay raise) (**log linear: power**)	.8335	.8335	65.2***	.5905	.5905	10.1*

[a] The "quadratic function" is shown immediately after "linear function" for ease of comparison of incremental predictive power through the addition of the squared pay raise/pay cut term.
* $p < .05$.
** $p < .001$.
*** $p < .0001$.
? $p < .1$.

A few additional results can also be pointed from Tables 1 and 2. First, in case of pooled approach to data analysis, we controlled for subjects base pay, their sensitization of actual pay raise, and subjects heterogeneity (dummy variable for 192 subjects) by adding them as a block of variables in the hierarchical regression analyses. Results for the change in R^2 for these control variables, however, also indicate that these factors do affect subjects' utility of pay raises. Second, after controlling for subjects, base pay, and actual pay raises, Table 1 displays the unstandardized estimated utility parameters for Eqs. (1) and (5). For example, for the quadratic functional form, the estimated unstandardized parameters were $b_0 = 45.80$, $b_1 = 0.52$, and $b_2 = -.001$. It should be noted that all estimated parameters were statistically significant. Moreover, the positive value of b_0 does not reflect data adjustments we had to make for the disutility of small pay raises (see our discussion above in Section 4.3.5). Nonetheless, these estimates do show a small parameter estimate for the quadratic term.[10]

[10] We thank a reviewer for making suggestion to include estimated utility parameters.

Table 3
Results of the Box–cox test – affective reactions to pay raises/cuts.

Model/equation	R^2	
	Positive limb	Negative limb
Pooled approach		
Eq. (1): Linear ($\lambda = \mu = 1$)	.714	.214
Eq. (2): Logarithmic ($\lambda = 1;\ \mu = 0$)	.735	.209
Eq. (3): Power ($\lambda = \mu = 0$)	.590	.191
Eq. (4): Quadratic[a]	.741***[b]	.227**
Averaged approach: base pay level 1		
Eq. (1): Linear ($\lambda = \mu = 1$)	.938	.658
Eq. (2): Logarithmic ($\lambda = 1;\ \mu = 0$)	.962	.640
Eq. (3): Power ($\lambda = \mu = 0$)	.855	.638
Eq. (4): Quadratic	.973**	.693
Averaged approach: base pay level 2 (150% of level 1)		
Eq. (1): Linear ($\lambda = \mu = 1$)	.935	.813
Eq. (2): Logarithmic ($\lambda = 1;\ \mu = 0$)	.968	.781
Eq. (3): Power ($\lambda = \mu = 0$)	.867	.768
Eq. (4): Quadratic	.973**	.844

[a] The Box–Cox transformation does not offer a direct test for the quadratic function. In order to compare the linear, log-linear (logarithmic and power), and quadratic functions, we added a quadratic term to the linear function ($\lambda = \mu = 1$). Next, a hierarchical regression was used to assess the significance of the additional variance explained by the quadratic term.

[b] The p values indicate whether the addition of a quadratic term resulted in a significant increment in the variance explained. The p values are denoted as follows: $^{*}p < .05$; $^{**}p < .001$; $^{***}p < .0001$; $^{?}p < .1$.

5.2. Disutility function for pay cuts (negative limb, Fig. 2b)

We proposed that the disutility function for pay cuts will follow a linear form. Results shown in Tables 1–3, however, do not clearly support our assertion for the linear form for disutility of pay cuts. For the averaged approach, a linear function, with a slope close to .10, appears to fit the data well. This is inconsistent with the results of the *pooled* approach, which supported a quadratic function. Results of the Box–Cox analyses shown in Table 3 for the negative limb suggest that the quadratic term added significant explanatory power only in one case. Overall, our results offer limited and mixed support for the linear functional form for disutility of pay cuts.

We conducted a qualitative supplementary analysis to investigate the range of pay raises or pay cuts associated with negative reactions. The summary of the results of our qualitative analysis is shown in Table 4.[11] As can be observed from Table 4, for pay cuts, the average negative reaction was almost identical whether the cut was 1.4% or 23.5%. In terms of pay raises, averaged negative reactions could be observed for raises up to 11.3%. In fact, roughly half of subjects displayed negative reactions for pay raises of up to 11.3% of base pay. We also tested the non-monotonicity of utility of very large pay raises. We defined the occurrence of non-monotonicity in utility with two sequential incidences of declining utility of larger pay raises. As an example, we tallied a subject showing evidence of non-monotonicity in utility when her value for pay raise of say 35.3% was larger (associated with utility value = 58) than next two larger pay raises of 41.2% (associated with utility value = 21) and 47.0% (associated with utility value = 53). Our analysis showed that 97 out of 192 subjects showed non-monotonicity in utility. Furthermore, non-monotonicity for most subjects occurred for pay raise range of 23.5–35.5%. This result offers qualitative support of quadratic functional form, possibly due to disutility resulting from reactance.

In summary, the results of the hierarchical regression analyses as well as Box–Cox test clearly support a non-linear subjective utility function for pay raises in terms of the positive limb, the quadratic function yielding the greatest explanatory power. The results are a bit more ambiguous for the negative limb, with the *averaged* approach pointing to a linear trend and the *pooled* approach to a quadratic trend. The results of the Box–Cox test clarify this issue somewhat by suggesting that the linear function offers better statistical fit than alternative functional forms. Overall, the results support the utility function depicted in Fig. 2b.

6. Discussion

This paper was designed primarily to combine knowledge from disparate disciplines – psychophysics, economics, and organizational behavior – in developing an integrative mathematical framework for understanding the utility of pay raises and pay cuts, and to begin assessing the empirical applicability of the framework. The results of this work raise both substantive and methodological issues.

[11] We thank a reviewer for suggesting inclusion of the qualitative analysis.

Table 4
Qualitative assessment of the disutility profile of changes in pay.

Pay change (decrease or increase in %)	Average (std dev) utility	Number of subjects with disutility (negative affect) for the given pay increase	Minimum utility (scale values range = −64 to +64)	Maximum utility (scale values range = −64 to +64)
−23.5	−58.64 (10.66)	191[a]	−64	−8
−18.8	−58.69 (9.91)	192	−64	−9
−14.1	−56.11 (12.06)	191	−64	0
−11.3	−58.92 (10.35)	191[a]	−64	−16
−8.5	−58.92 (11.49)	192	−64	−8
−7.0	−52.09 (16.42)	192	−64	−10
−4.7	−47.42 (20.00)	191	−64	0
−2.8	−49.93 (17.55)	191	−64	0
−1.4	−51.99 (16.25)	191	−64	0
1.0	−36.89 (25.84)	158	−64	45
2.4	−11.91 (24.80)	80	−64	58
4.7	−7.28 (23.54)	74	−63	35
7.0	−5.42 (23.78)	69	−64	44
9.4	1.16 (23.04)	58	−64	48
11.3	−5.14 (28.34)	82	−64	64
14.1	5.14 (28.25)	60	−64	64
18.8	18.95 (17.32)	15	−61	64
23.5	21.54 (16.56)	10	−64	64
29.4	22.86 (18.58)	9	−64	64
35.3[b]	37.35 (19.25)	4	−52	64
41.2	38.19 (18.20)	4	−58	64
47.0	40.35 (17.34)	3	−60	64
58.8	48.76 (17.51)	3	−62	64
70.5	54.58 (13.72)	0	−52	64

[a] Missing data for one (1) subject with total $n = 192$.
[b] Largest percent of subjects showed lower utility for pay changes greater than this amount of pay raise (in percent). Almost all the non-monotonicity occurred for pay changes between 23.5% and 35.3%. Number of subjects that showed non-monotonicity = 97/192 (i.e., 50.5%). As an example, a qualitative assessment of Subject ID #144 data pattern showed that s/he indicated utility value of 49, 58, 21, and 53 for raises 29.4%, 35.3%, 41.2%, and 47.0%, respectively. About half of subjects showed similar patterns of non-monotonicity for large pay raises.

6.1. Methodological limitations

In order to empirically test specific utility functional forms, a carefully controlled realistic investigation of employee reactions to pay raises and pay cuts is desirable. This is usually not feasible (and it is ethically questionable) in field settings – pay dynamics are too central to organizational functioning for random manipulation to be possible in most cases. Laboratory studies, on the other hand, raise issues of generalizability and realism. A third approach is to examine people's reactions to hypothetical raises/cuts, but this approach also suffers from obvious limitations.

Our empirical approach circumvented these issues to a degree, but was still an experimental simulation with its inherent potential for limited external validity. Many features were incorporated into the study design to enhance realism and to mitigate this threat to generalizability. The experimental task was realistic for a university setting, subjects were paid reasonable rates for this kind of job, subjects were recruited through advertisements, and subjects believed in the long-term potential for employment. Many post-experiment comments from the subjects reinforced the notion that the manipulation "took," and the simulation was "real" to the subjects. The debate about realism or the "stakes debate" (i.e., the stakes in laboratory settings are too small to be predictively useful for real world) continues in both management and economics fields despite evidence to the contrary (Locke, 1986). Rabin (1998, 2002) offers convincing support for the market-based economic predictions based on a comprehensive review of laboratory-based studies of effects of economic incentives (see also Abdellaoui et al., 2007; Camerer, 1995). Indeed, Jenkins, Mitra, Gupta, and Shaw (1998) demonstrated that the effects of financial incentives could be best demonstrated in experimental simulations.

6.2. Substantive issues

Our results support the idea of the decreasing marginal utility of pay raises. A pay raise of $1000 does not yield twice the benefit that a pay raise of $500 does. The results from this study are not definitive enough to suggest the precise point in the curve where the utility function levels off, but the data are clear and consistent in suggesting that the actual *size* of pay raises should be carefully considered in any pay raise decisions. For the positive limb, our data provide support for the quadratic function. The observation of a quadratic function offers validation for the inclusion of psychological factors in explanatory models of people's reactions to pay raises, and is consistent with results reported by Heneman et al. (1997), Porter et al. (1990), and Worley et al. (1992). In general, the power and linear functions did not provide equal explanatory potential.

Two other intriguing results were unearthed with respect to the positive limb, i.e., with respect to reactions to pay raises. One, several subjects consistently exhibited negative reactions to small pay raises. Pay *raises* ranging from about 1–10% of base pay evoked feelings of unhappiness among subjects. Past research has often ignored the possibility of small gains resulting in disutility (Galanter, 1990; Giles & Barrett, 1971; Kahneman & Tversky, 1984). Our data highlight the exchange/instrumental role of money, in that small raises were not seen as sufficient reward for good work (Heneman & Judge, 2000). The results of our study may be preliminary, but they do suggest that researchers and practitioners alike give serious consideration to the likelihood that very small pay raises may be perceived as punishing, rather than rewarding, desired behaviors (this is not unlike a waitperson perceiving a small tip as a punishment, not a reward). These findings are consistent with those reported in the growing body of work on the smallest meaningful pay increases (SMPI) (e.g., Champlin & Kopelman, 1991; Mitra et al., 1997; Rambo & Pinto, 1989; Worley et al., 1992) showing that pay raises must be above about 6–7% to be seen as meaningful. Obviously, people prefer *any* raise to no raise at all. But small raises, *when presented as rewards for merit*, can be dysfunctional. Organizations with small pay raise pools may wish to think seriously about their allocation of *merit* raises. Likewise, motivation theories should address these dynamics.

The results for *negative* limb of the utility/disutility function mostly did not support the non-linear function suggested by prospect theory. The results show instead that *any* pay cut, regardless of size, evoked a negative reaction. Disutility was not substantially affected by whether the pay cut was large or small. Although the results of the *pooled* approach support a quadratic function for the negative limb, the increments in explained variance were small (.56%). In fact, the slope of the negative limb of the utility curve was unexpectedly flat. Nonetheless, we hope that future research investigates this critical issue with respect to the disutility of pay cuts: Is a quadratic function superior to a simple linear one? Or the disutility of pay cuts is almost a linear, relatively flat function?

Although our results with respect to the negative limb did not fully align with the previous results with respect to money, they are consistent with results obtained with other aversive stimuli (e.g., electric shocks, Stevens, 1975). In fact, Stevens (1975) suggested that the exponent for aversive stimuli would be large initially, and become much smaller for the rest of the range. Our results in some ways mirrored this, in that there were extreme negative reactions to small positive raises, and the exponent was close to zero for pay cuts. We used two base pay conditions in our study to provide different frames of reference, and frames of reference did affect the steepness of the utility function (Kahneman & Tversky, 1979). But the results were *similar* across the two conditions, indicating that the utility functions were comparable across the two base pay conditions. It is important to identify the reference standard against which people evaluate their pay raises, but people may react to pay changes in the same way regardless of where on the pay continuum an employee may happen to be.

Taken together, these results have critical managerial implications. The utility function for the positive limb indicates that we do not get our money's worth from huge pay raises. We may also hurt employees pay raise satisfaction by giving small raises based on pay-for-performance (p-f-p) systems because p-f-p systems can generate disutility effects by building pay raise expectations. In an era of budget cuts and salary compression, the allocation of merit raises to reward and improve employee attitudes and behaviors may backfire if the raises are too small and below historically expected pay raises. Alternative ways of allocating merit raises must be devised in light of this research. Perhaps *merit*-based raises are less potent unless the pay raise pool is large enough. Much as it may go "against the grain," it may be prudent to allocate across-the-board cost-of-living adjustments, seniority-based raises, or raises based on some other non-merit consideration, when reasonable-sized raises are not possible. In addition, any pay cut evokes strong negative reactions.

Of course, our results are somewhat preliminary and have limitations. First, based on the regression results from pooled-approach, we were able to find support for individual difference effects on the utility of money. However, we could not examine them specifically as related to equity or normative considerations. Anecdotal evidence suggests that equity dynamics (Adams, 1965) may interact with contextual factors to determine the size of a raise that is functional (Schaubroeck et al., 2008). Alternatively, over time people may come to see national averages defining the size of a meaningful merit raise (Rabin, 1998). These arguments are admittedly preliminary, but it is critical to resolve these issues empirically. Second, the use of experimental simulation, though necessary for internal validity, did suffer from generalizability concerns. Third, we pooled 24-data points from each subject for our pooled approach. This could raise concerns about the independence of observations, and our pooled results should be viewed with this concern in mind. Finally, our pay structure was simple and involved only two base pay levels which did not reflect fully the pay structures in a long-term employment relationship.

In conclusion, our results, by offering a support for the quadratic function, confirm previous research with respect to the decreasing marginal utility of pay raises, highlight problems inherent in small pay raises, point to some disturbing effects of small pay raises, and demonstrate the harmfulness of pay cuts. With the help of Box–Cox transportations, a comparison of different utility functions showed quadratic and linear functions to be most descriptive of the positive and negative limbs, respectively. Our results suggest that the utility scale for pay raises is influenced by a complex set of organizational factors, and the temporal nature of the exchange involved in allocating pay raises introduces further complexities. These must be systematically incorporated into theoretical and empirical research on utility/disutility of pay raises to illuminate when we are getting our money's worth from a pay raise and when we are not.

Appendix A. Experimental design and experiment task protocol

Context of the task: Each participant was hired for one 3.5 hours block. They were informed that the ostensible purpose of the study was to identify appropriate pay levels for two alternative data coding strategies. All participants signed a consent form and knew that their participation was voluntary. While these participants took the manipulations for the study well, at the end of the experimental simulation, they were informed about the true purpose the study and all participants were given payment based on the maximum payout condition.

Experimental design: It was a between subjects design, with two base-pay levels and six new pay levels (pay raises) provided twice during the data collection period. In other words, each participant experienced two pay raises prior to providing affective reactions for 24 hypothetical pay new pay rates, with one new pay rate per page. The actual pay raises experienced by subjects are listed below:

Pay raises for base pay level #1: 0, 10, 20, 45, 60, 80 (in cents)
Pay raises for base pay level #2: 0, 15, 30, 69, 92, 112 (in cents)

Instructions and protocol for the current study: Assume that we offered you the coding job for six months at 20 hours per week and that you accepted. Assume that your starting rate is *x*-amount per hour, and that you will get a pay raise after three months if you are a good coder. The attached booklet contains 24 different pay rates, which may be more or less than the starting rate. We want to know how you would *feel* about each pay rate given your starting pay rate. In other words, tell us how *happy* you would be with each pay rate compared to your starting pay rate. Mark your answer on each page by putting an *X* on the line at the point that corresponds to your feelings.

This can be time-consuming, and we want you to do it quickly. So mark each page and move along. You should not go back over the pages. We just want your initial reactions.

Participants were given an example using room temperature as the basis to ensure they understood instructions correctly. This was followed by a booklet containing the following cross-modality activity for 24 randomly listed pay rates:

Compared to your starting pay rate of *x*-amount, how would you feel if after three months on the job your new pay rate was *y*-amount?

VERY UNHAPPY	NO CHANGE	VERY HAPPY

All participants provided their affective reactions to following 15 pay raises, and 9 pay cuts:

Pay raises: 4, 10, 20, 30, 40, 48, 60, 80, 100, 125, 150, 175, 200, 250, 300 (in cents)
Pay cuts: 6, 12, 20, 30, 34, 48, 60, 80, 100 (in cents)

Appendix B. Box–Cox transformation method

The Box–Cox transformation can be given as follows:

$$\frac{Y_i^{\lambda}-1}{\lambda}=\alpha+\beta\cdot\left(\frac{X_i^{\lambda}-1}{\lambda}\right)+\varepsilon_i \tag{7}$$

A generalized Box–Cox transformation suggested by Kmenta (1986) is as follows:

$$\frac{Y_i^{\lambda}-1}{\lambda}=\alpha+\beta\cdot\left(\frac{X_i^{\mu}-1}{\mu}\right)+\varepsilon_i \tag{8}$$

where λ and μ can assume different values. Thus, when $\lambda = 1$, and $\mu = 0$, the Box–Cox equation decomposes to Eq. (2). The power function in Eq. (3) results when $\lambda = 0$, and $\mu = 0$, and the linear function in Eq. (1) is derived when $\lambda = 1$, and $\mu = 1$. That is, the Box–Cox transformation enables a comparison of the functional relationships of interest in this study.

A comparison of these relationships involves obtaining an estimate of λ and its standard error and using the maximum likelihood method (Kmenta, 1986; Maddala, 1992; Pindyck & Rubinfeld, 1991). For this comparison, one must: (a) divide each *y* by the geometric mean of the *y*s; (b) compute $y(\lambda)$ for different values of λ, regress these on *x*, and compute the residual sum of squares (or the R^2); and (c) choose the value of λ that shows the lowest residual sum of squares (or the largest R^2). This function is considered the best fit to the data, and the corresponding value of λ is the maximum likelihood estimator of λ. We used these steps to compare the relative efficacy of the different functions.

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