8-1-2017

A simulation experimental study on the utility of pay changes

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A SIMULATION EXPERIMENTAL STUDY ON THE UTILITY OF PAY CHANGES

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MPHIL

LINGNAN UNIVERSITY

2017

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THE UTILITY OF PAY CHANGES

by

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A thesis
submitted in partial fulfillment
of the requirements for the Degree of
Master of Philosophy in Business

Lingnan University

2017

ABSTRACT

A SIMULATION EXPERIMENTAL STUDY ON

THE UTILITY OF PAY CHANGES

by

YE Liu

Master of Philosophy

In this thesis, we conduct an experimental simulation of 131 students from a university in Hong Kong and investigate the relationship between pay changes and the perceived values (i.e., utility). Applying traditional psychophysical methods, we measure the utility of pay changes (i.e., pay raises and pay cuts) of different sizes by individual responses (i.e., happiness/unhappiness). Drawing on utility theory and expectancy theory, we examine the function that best fits this relationship by considering common function forms including linear, quadratic, logarithmic, and power functions. Using regression techniques, we find that a quadratic function best fits the data, and the utility function is concave in the pay change. When we examine the best form of utility functions for pay raises and pay cuts separately, we find that the utility of pay raises and that of pay cuts are best described by a quadratic function and a linear function, respectively. We further show that a single model involving all pay changes better describes the utility than two separate models for pay raises and pay cuts. In addition, our best-fit utility model reveals that a sufficiently small amount of pay increase may generate a negative value of utility, and we calculate the percentage of smallest meaningful pay increase that results in non-negative utility. We also discuss the theoretical contributions of our findings to the literature and their implications to practitioners.

Keywords: pay change, utility function, pay raise/cut, regression, experiment.

DECLARATION

I declare that this is an original work based primarily on my own research, and I warrant that all citations of previous research, published or unpublished, have been duly acknowledged.

(YE LIU)
Date

CERTIFICATE OF APPROVAL OF THESIS

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Master of Philosophy

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ACKNOWLEDGEMENT

This dissertation is a journey filled with both challenges and joy, guiding me to discover about the world and myself. Here I would like to take this chance to express my sincere gratitude to all the people who have made this journey worthwhile.

I dedicate my deepest appreciation first to my two wonderful supervisors, Prof. Liang Liping and Prof. Nancy Chen. Prof. Liang is an excellent scholar, and a great mentor. She has educated me in accordance of my aptitude and offered me tremendous inspiring during the development of my research ideas. She has also provided me enormous guidance throughout the production process of my thesis and my learning path. Prof. Chen has offered me tremendous inspiring and professional guidance during the procedure of my experiment. She is also a loving supervisor who always spreads her positive energy and care for others. I am really proud to have both Prof. Liang and Prof. Chen to be my supervisors.

I also feel grateful to faculty members and MPhil students in the department of Computing & Decision Sciences and the department of Management. Ms. Eva Cheung, Ms. Jenny Mak, and Ms. Jessie Wang have assisted me with the information and administrative procedures during my MPhil life. Last but not least, I express my deepest gratitude to my parents for encouraging and believing in me. Many thanks all of you!

1 INTRODUCTION

In the past decade, organizations have increasingly emphasized on compensation schemes and pay satisfaction. According to the U.S. Bureau of Economic Analysis (2003), employee compensation is one of the largest costs of doing business, representing 57 percent of the total value of goods and services produced in the United States in 2002. As noted by Dreher et al. (1988), there is the expectation that the relation between compensation and work outcomes is mediated by attitudinal reactions to pay. Thus, pay satisfaction may be regarded as a necessary but not a sufficient condition for organizations to achieve the goals of their compensation systems, such as employee retention and motivation.

In the fields of organizational behavior and economics, pay level and its outcomes are important concepts. Extant publications have provided insights into the effects of pay level, merit pay, and performance on satisfaction. Merit pay is significantly associated with employee motivation, performance, and satisfaction (e.g., Jenkins et al. 1998, Gerhart and Rynes 2003, Green and Heywood 2008). And there are studies indicating that pay raises apparently have a positive impact on employee outcomes including behavioral intentions, performance, and satisfaction (Heneman 1992, Jenkins et al. 1998, Nyberg et al. 2016).

Various utility functions have been developed to quantify the subjective value of different pay levels. For example, Heneman et al. (1997) regarded the true utility as a real number on a cardinal scale, and indicated that a power function explained pay satisfaction variance treated by pay level better than a linear function. In this thesis, integrating relevant theories from the fields of organizational behavior and economics, we investigate the utility function of pay changes in the context of employment.

Pay satisfaction can be viewed as the "amount of overall positive or negative affect (or feelings) that individuals have toward their pay" (Miceli and Lane 1990). In economics, utility is regarded as a measure of preferences that represents the satisfaction experienced by the consumer of a good. To some extent, the practical meaning of "utility" in the context of employment is pay satisfaction.

1.1 Motivation and Objectives

Many practitioners have examined the relationship between pay raises and satisfaction or the relationship between pay level and satisfaction. Pay satisfaction is positively related to the level of pay (Diener et al. 1999, Malka and Chatman 2003, Diener and Seligman 2004, Williams et al. 2007). Economists and researchers have investigated the utility function of income/pay level or pay increase (Giles and Barrett 1971, Schuster et al. 1973, Worley et al. 1992, Heneman et al. 1997, Porter et al. 1990). Mitra et al. (2015) considered the effect of pay cuts, and identified the form of utility of pay raises and that of disutility of pay cuts.

In addition, some researchers argued that there is a pay raise threshold. The point at which individuals begin to react to pay raises is called the smallest meaningful pay increase (SMPI). Since the economic costs of small pay increases may be high for an organization, there is an increasing attention from researchers on this threshold of pay raise. If pay increases are not large enough to be perceived as attractive by individual employees, the economic benefits expected from increased motivation or productivity may not materialize. Then the organization will suffer from the cost of spending a lot of money for nothing. The effect of pay increases therefore represents an important subject for research.

In short, we can find research gaps between the practice and the literature. First, very little research has investigated individual reactions to pay cuts. Researchers have focused on the consequences of pay increases, not pay cuts. However, in practice, the increasing volatility in stock option value, especially the pay cuts, can lead to significant reduction in overall pay for managers; during the recent recession, many companies implemented pay cuts instead of opting for lay-offs (Mitra et al. 2015). Gerlach et al. (2006) conducted a study in North America and Germany showed that wage-cuts were treated as fairer when the company incurs losses and is not profitable, compared to the time when the company makes a positive profit. This reinforces the finding from the literature that the cause of a wage-cut is important for its assessment. Therefore, studying the reactions to pay cuts is as important as that to pay raises. Although Mitra et al. (2015) investigated the disutility of pay cuts, they only considered two separate utility functions for the positive limb and negative limb, respectively, but they didn’t investigate the case of a single model. Moreover, the effect of a very small pay increase is often ignored in the study of pay satisfaction, or perceived value (i.e., utility) of pay changes, especially, the study of utility function. Both theories in organizational behavior and economics have been used in previous researches on the relationship between objective raises in pay and subjective assessments of the influences of those raises, but have rarely been used together to frame a single research study.

In this study, we attempt to fill in these research gaps by addressing three issues. We conducted an experimental simulation to measure the utility of pay change, and identified the suitable utility function among the linear, quadratic, logarithmic, and power function forms. Secondly, we examined the best form of utility functions for pay raises and pay cuts separately, and compared the relative validity of the single function that best fits our data to those two separated utility forms. Finally, we investigated the influence of a very small pay raise on subjects' responses to pay changes, and through the observation of the suitable utility function, we calculated the size of pay raise thresholds.

Therefore, this thesis makes the following contributions. First, it adds to the study of utility of pay changes by combining both pay cuts and pay raises and empirically supports the use of a single function for the utility of pay changes. Secondly, the estimated SMPI implies that in order to generate positive behavioral and affective responses at the lowest cost, management should consider rewarding their employees with pay increases beyond a certain level.

1.2 Structure of the Thesis

This thesis consists of six sections. Section 1 introduces the background and motivation for this research as well as research objectives. Section 2 reviews the relevant literature including the theoretical background for our research. Section 3 discusses the preliminaries for the development of utility function. Sections 4 and 5 describe the methodology, analytical approach, and results of this study. Finally, Section 6 discusses the theoretical contributions, practical implications, and limitations of this study as well as the directions for future research.

2 LITERATURE REVIEW

This study integrates the theories from economics and organizational behavior. Thus, our literature review consists of two parts. First, we review the economics literature. Then, we review publications that concern the relationship between pay and satisfaction in the psychophysical perspective.

2.1 Utility Theory

In this section we review the development of utility theory to provide a theoretical framework for addressing the research questions in this study. We then describe the concept of utility of money, including its conceptualization and the related descriptive theories. In addition, we present two forms of utility and empirical approaches to the measurement of utility.

The term of "utility"

The term of "utility" was brought by Daniel Bernoulli to explain the St. Petersburg paradox. This paradox was first proposed by Nicholas Bernoulli in 1713. In 1738, Bernoulli argued that the paradox could be resolved if decision-makers displayed risk aversion and argued for a logarithmic cardinal utility function. He presented the distinction between wealth and utility in his paper: *Exposition of a New Theory on the Measurement of Risk*, which serves as the basis for the economic theory of risk aversion, risk premium, and utility. Then, at the beginning of the nineteenth century, Jeremy Bentham provided the principle of utility. "The utility," he stated, "is meant that property in any object, whereby it tends to produce benefit, advantage, pleasure, good, or happiness - (all this in the present case comes to the same thing) or (what comes again to the same thing) to prevent the happening of mischief, pain, evil, or unhappiness to the party whose interest is considered.” This means the “principle of utility” is the principle that actions are to be judged by their usefulness in this sense: their tendency to produce benefit, advantage, pleasure, good, or happiness. This principle of utility, introduced by Jeremy Bentham, was to be understood much more broadly in economics. Jevons announced that Bentham's definition of “utility” perfectly expresses the meaning of the term in Economy (1871).

In the long history the economical meaning of “utility” shifted many times. Since the interpretation of an author’s intentions is often debatable, it is difficult to build an authoritative history of utility in meaning. Some but not all illustrations of “utility” are listed. Jevons (1879) quoted Bentham's sense and thought “utility” definitely meant usefulness. Marshall (1961) illustrated that, “the total utility of a thing to anyone (that is, the total pleasure or other benefit it yields to him) increases with every increase of his stock of it, but not as fast as his stock increases”. *Principles of Economics* was the dominant economic textbook in England for many years at that time. The book proposed the ideas of marginal utility. Marshall (1961) thought utility is “the satisfaction or benefit derived by consuming a product, thus the marginal utility of a good or service is the change in the utility from increase or decrease in the consumption of that good or service”.

The studies of utility can make enormous contributions in both economic and social developments. Many mathematicians, economists, and philosophers have been keen on the study of utility (Broome 1991). The utility theory has won a place in economics.

The development of utility theory

Utility theory has been widely used for studying how consumers can allocate their income among various goods and services in order to achieve the maximization of their satisfaction (Stigler 1950). The beginning of the modern utility theory can be traced back to the 1870's, when Jevons first criticized the Ricardian theory and then popularized the Bentham's concepts of utility. Jevons thought Ricardos' labor value theory lacked generality. He emphasized that economic theory is a kind of computation of pleasure and pain, and showed that a rational person should make his or her consumption decision by considering increased pleasure of adding each item (the marginal utility). At that time, many utilitarians believed that utility was a psychological base, in existence, and can be directly measured, like the length and the temperature. These utilitarians concluded the establishment of diminishing marginal utility through their own feelings and emotions.

Then, Menger from Austria and Walras from France took fundamentally the same position of Jevons. These three neoclassical economists are the representative of the school of marginal utility theory. The school of marginal utility has made a great development at the end of the nineteenth century. On one hand, the study of marginal utility has been systematized; on the other hand, this utility theory was expanded in subareas, achieving further generalization.

Expected utility theory is another branch of utility theory that takes account of uncertainty. In the 1950s, Von Neumann and Morgenstem provided the analytical framework in which a rational actor makes a decision in a condition of uncertainty.

Expected utility theory deals with the analysis of choices among risky projects with multiple (possibly multidimensional) outcomes. Other concepts of utility (such as "experienced utility" and "decision utility") and two types of utility functions (e.g., cardinal and ordinal) have been suggested to analyze a person's choice behaviors in consuming conditions.

During the development of utility theory, the effects of contemporary economic and social conditions can be traced; and the human behaviors in decision making, supply and demand, maximizing the pleasure, etc., can be understood better in modern economics.

The utility of money

One of the most common use of the concept of utility is the utility of money. In 1937, Adam Smith indicated that the term "value" has two different meanings: "value in use" and "value in exchange." Sometimes "value" refers to the inherent utility of a particular object, which is the "value in use"; the term "value" also expresses the power of purchasing other goods in object conveys, which is the "value in exchange". This concept has been accepted by his immediate successors. Money doesn't have any inherent value (Tang 1993). As people assign value to money, these pieces of paper derive the utility from its instrumentality in acquiring other useful objects (Black 1990, Lawler 1971).

Utility theories, such as expected utility theory, is frequently used to explain the rational decision making under risk. Prior researchers labeled the modern notion of utility as "decision utility" (Kahneman et al. 1997). Within the context of employment, this decision utility is more likely to an employee's preferences of effort to reach the performance targets. Based on the theory of utility, organizational psychologists focus on employees' behaviors to get the maximized monetary outcomes, individual performance goals or successful achievement. The utility function for money has been developed in decision making processes: in situations where outcomes of choices influence utility through gains or losses of money. Many researchers suggested that the utility of money reflects a concave in positive limb, and this phenomenon is called diminishing marginal utility of money (Jevons 1879, Allen 1933, Giles and Barrett 1971).

Cardinal utility and ordinal utility

In economics, utility can be interpreted as the satisfaction that a person obtains from the purchase and use of commodities and services (Kahneman et al. 1997). However, there has been some controversy over the issue whether the utility can be measured or not. Today utility functions, expressing utility as a function of the amounts of various goods consumed, are treated as either cardinal or ordinal. These two concepts are proposed to measure the satisfaction of individuals, by analyzing whether the satisfaction can be interpreted as providing more information than simply the rank order of preferences over bundles of goods.

Cardinal utility states that the satisfaction that a consumer derives by consuming goods and services can be measured with numbers. At one time, it was assumed that the consumer was able to say exactly how much utility he obtained from the commodity. The economists who made this assumption belonged to the "cardinalist school" of economics. In cardinal utility, it is assumed that consumers derive satisfaction through consumption of one good at a time (Bernoulli 1954). Early theorists of utility considered that it had physically quantifiable attributes. They thought that utility behaved like the magnitudes of distance or time, in which the simple use of a ruler or stopwatch resulted in a distinguishable measure. "Utils" was the name actually given to the units in a utility scale. When cardinal utility is used, the magnitude of utility differences is treated as an ethically or behaviorally significant quantity. For example, suppose a cup of coffee has utility of 120 utils, a cup of tea has a utility of 80 utils, and a cup of water has a utility of 40 utils. With cardinal utility, it can be concluded that the cup of coffee is better than the cup of tea by exactly the same amount by which the cup of tea is better than the cup of water.

Another important issue of cardinal utility is the location of the “zero” value of utility. Thus in the above example of coffee, it is not a common conclusion that the cup of tea is two thirds as good as the cup of juice, because the quantitative comparison with multiple would depend not only on magnitudes of utility differences, but also on the "zero" of utility. To be specific, if the "zero" of utility was located at -40, then a cup of coffee would be 160 utils more than zero, a cup of tea 120 utils more than zero, and the correct conclusion is that the cup of tea is three fourths as good as the cup of coffee. The “zero” of utility is regarded as the “reference point,” which is discussed in Section 3.3.

Compared with cardinal utility as a quantitative measure, ordinal utility is a qualitative measure. Ordinal utility states that the satisfaction that a consumer derives from the consumption of goods and services cannot be measured in numbers. Rather, ordinal utility uses a ranking system in which a ranking is provided to the satisfaction that is derived from consumption.

In cardinal utility, economists considered that the utility had physically quantifiable attributes. However, in ordinal utility it is assumed that a consumer may derive satisfaction from the consumption of a combination of goods and services, which would be ranked according to preference. The differences in utils (values taken on by the utility function) are treated as ethically or behaviorally meaningless: the utility index encodes a full behavioral ordering between members of a choice set, but tells nothing about the related strength of preferences. Ordinal utility functions are unique up to increasing monotone transformations. In the above example, it would only be possible to say that coffee is preferred to tea to water, but no more.

Neoclassical economics has largely retreated from using cardinal utility functions as the basis of economic behaviors. A notable exception is in the context of analyzing choice under conditions of risk. In welfare economics, the concept of cardinal utility is often used to aggregate utilities across persons, to create a social welfare function (Harsanyi 1953), and the marginal utility theory is developed on the basis of cardinal utility, which describes the utility as quantifiable (Kauder 2015). In this study, since we measure the satisfaction that the subjects derives from the level of pay change in number, and then calculate the size of the threshold of pay raise, the utility of pay changes is treated as the calculable one: cardinal utility.

Prospect theory

Integrating the perspectives of both utilitarian and psychophysical views, prospect theory (Kahneman and Tversky 1979, Tversky and Kahneman 1992) was proposed to present several modifications and extensions to cardinal utility theory. In prospect theory, the empirically derived S-shaped value function is assumed, and it is considered that this utility theory function may be more pronounced than previous studies (Boettcher 2004, Etchart-Vincent 2004, Schunk and Betsch 2006, Booij and Van de Kuilen 2009).

The utility function described by prospect theory is depicted in Figure 1. Three mechanisms of prospect theory are particularly relevant to the study of the utility of changes in pay (Tversky and Kahneman 1992, Fennema and Van Assen 1998, Abdellaoui 2000). First, the theory suggests the use of reference point to assess gains (pay raises) or losses (pay cuts). Reference point, in geometry, refers to a point used to define the location of another point. Based on prospect theory, the inflection point in the satisfaction function corresponds to the reference point. Choice of the reference point is a non-trivial matter because it is a central variable for theory. Second, it indicates convex utility on the loss domain and concave utility on the gain domain, and derives S-shaped value function, as shown in Figure 1. Moreover, it should be steeper for losses than for gains, which means a pay cut of $100 should incur a more negative reaction than the positive reaction incurred by a pay raise of $100. Third, prospect theory asserts that people prefer certain outcomes over risky outcomes. This is called loss aversion, which means people have the tendency to strongly prefer avoiding losses to acquiring gains.

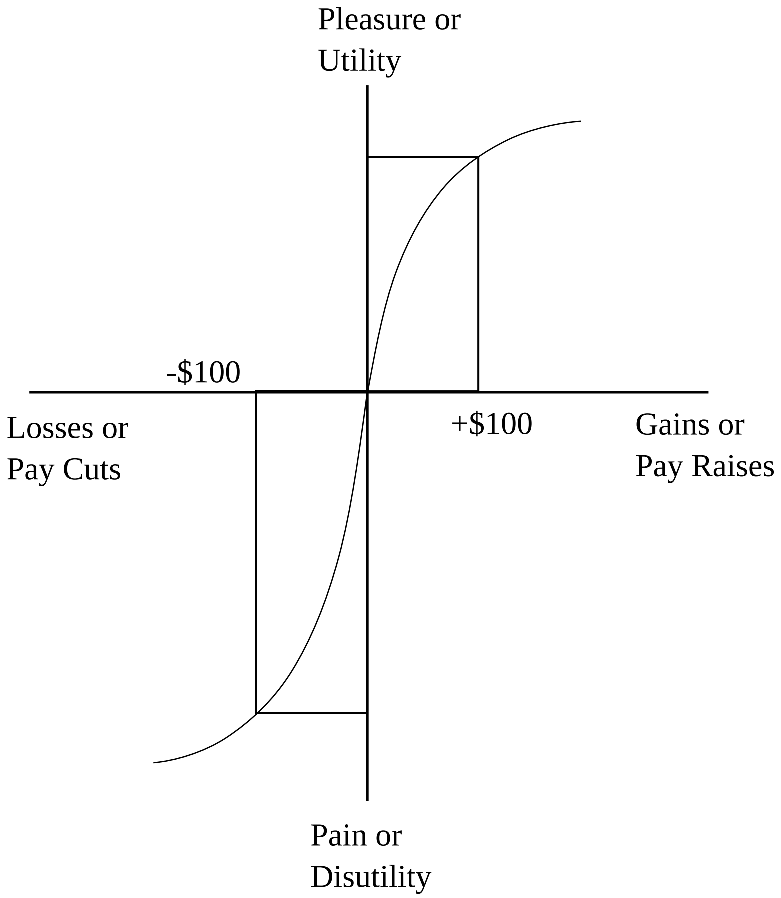


Figure 1: Prospect Theory

Prospect theory can better explain choice behavior because it makes the plausible assumption that risk attitudes are not only driven by sensitivity towards outcomes (utility curvature), but also by sensitivity towards probabilities (probability weighting), and by sensitivity towards whether outcomes are above or below a reference point (loss aversion).

The measurement of utility

Starting from the mid of the twentieth century, several studies have considered money utility (Champlin and Kopelman 1991, Galanter 1990, Giles and Barrett 1971, Hamblin 1971, Hinrichs 1969, Mosteller and Nogee 1951, Rambo and Pinto 1989), which mainly addressed the question of whether or not the marginal utility of money will decline with each extra money unit added. Brandstatter and Brandstatter (1996) reviewed three empirical approaches to the measurement of utility that prior researchers used: (1) the Bernoulli approach to establishing a person's indifference (with respect to expected utility) between pairs of lotteries differing in (objective) probabilities and values of outcomes; (2) the attitude rating approach by which subjects indicate the degree of satisfaction with various pay levels or pay or price rises; (3) the psychophysical ratio scaling approach by which ratios of money amounts are equated with ratios of intensities of emotions (joy/anger over winning/losing money).

Specially, as a traditional empirical approach, Bernoulli approach is often used in lotteries and gambling settings. Mosteller and Nogee (1951) first applied this approach in experiments to measure the utility of money. The experiments were conducted among college students and provided support for a decreasing marginal utility of money, whereas for national guardsmen increasing marginal utility of money seemed appropriate. By establishing a person’s indifference between a sure amount of money and a lottery differing in probabilities, the researchers showed that the utility of money is a function. The subjects who have low income may be more likely to experience a high utility of money, which means the subject who has low emotional stability may be more likely to experience a high extroversion and utility (Mosteller and Nogee 1951, Brandstatter 1987).

The attitude rating approach is regarded as a useful measuring device, consisting of a number of statements to which the respondent must express his or her degree of agreement or disagreement. Usually, the higher the score, the more favorable the respondent's attitude. When measuring the utility of money in the empirical study, the particular score is marked by asking the subjects' degree of satisfaction with various pay levels or pay raises, and the total score places the respondent on a continuum from least favorable to most favorable. For example, Kapteyn and Wansbeek (1985) reexamined the Individual Welfare Function (IWF) through a survey question with 9 response options (from "very bad" to "excellent"). Depending on the respondent's endorsement of each statement, the options 'excellent', 'good', etc. were translated into numbers between zero and one. They concluded that the utility function should be assumed to be S-shaped. Similar to the results from Bernoulli approach, the empirical results by this approach also support that there exists a relationship between the level of income and the marginal utility of the same additional amount of money. In other words, the marginal utility should be higher for poor than for rich people under the same amount of pay raises.

With the psychophysical ratio scaling approach, a continuous dependent-response rating line about happiness and unhappiness in different sizes of pay changes is used. Moreover, the typical survey form has a limitation when subjects rate their perceived utility. That is, respondents may scan the questionnaire and familiarize themselves with the levels, and fill in the responses with the aim for being consistent when a range of pay raises and pay cuts appear in the survey (Worley et al. 1992). Giles and Barrett (1971) conceded the same problem in their study, noting that "in responding to a questionnaire of this type, employees might attempt to order the merit increases in ascending values and adjust their responses accordingly.” To avoid this problem, Giles and Barrett (1971) suggested presenting each increase on a separate sheet of paper or using a projector. This approach is psychometrically different from Likert-type pay satisfaction measures, and is tied to specific stimulus intensities to generate ratio scales (Galanter 1990, Worley et al. 1992). Russell and Bobko (1992) examined the properties of continuous dependent-response rating formats and demonstrated that they were superior to coarser Likert-type rating scales when researchers attempt to detect moderator effects in multiple regression analysis.

In this study, in order to examine the best fitting utility function, we employ the third approach (i.e., the psychophysical ratio scaling approach) to measure the utility of pay changes.

2.2 Pay and Satisfaction

Management and applied psychology researchers tend to adopt a linear function in the study of utility of pay changes, and assume that higher raises are incrementally more valuable. Gupta (1980) showed that merit pay raises are positively related to reactions such as pay raise happiness and pay satisfaction. Green and Heywood (2008) investigated the impact of performance-related pay on several dimensions of satisfaction. With the consideration of psychological factors, Schaubroeck et al. (2008) examined the role that expected merit pay raises and pay-for-performance perceptions play in the relationship between merit pay raises and pay satisfaction. Shaw et al. (2003) explored the relationships among merit pay raises, trait positive affectivity (PA), and reactions to merit pay increases (pay attitudes and behavioral intentions). By using meta-analysis, researchers also estimated the population correlation between the pay level and pay satisfaction. The results suggested that the level of pay bears a positive, but quite modest, relationship with job and pay satisfaction (Williams et al. 2006 and Judge et al. 2010).

Some researchers adopted a nonlinear, psychophysical approach and assumed that pay raises below a certain threshold may go completely unnoticed. Mitra et al. (1997) conducted an experimental simulation and found that 7% is the smallest meaningful pay increases (SMPIs) for employees. Mitra et al. (2016) did field tests in both the United States and Finland, and identified the smallest meaningful pay increase thresholds (5% and 8%, respectively) across behavioral intentions and affective reactions.

Heneman et al. (1997), based on economic theory, suggested that there is a negative relationship between the level of income and the marginal utility of the same additional amount of money. Back in 1728, the mathematician Cramer postulated that the value of money might be a power function of the number of dollars (Bernoulli 1954). Giles and Barrett (1971) determined the relationship between merit increases and satisfaction, and the results gave the most support to the power function and least support to the logarithmic function. However, the philosopher Bernoulli (1954) hypothesized that the utility function is logarithmic. Mitra et al. (2015) indicated that a quadratic function is the most descriptive to the relationship between the utility and pay raise among four functional forms (linear, logarithmic, power, and quadratic) and pay cut is linearly related to the disutility.

3 PRELIMINARIES

In order to find the function that best describes the utility of pay changes, in this section we discuss the development of four common utility functions that are considered in this study. Based on the literature of psychology and organizational behavior, we first assume that the utility function of pay changes has a linear form. As hyperbolic absolute risk aversion (HARA) utility is widely used in both empirical and analytical studies in economics, finance, and decision theory, we also consider three representative function forms of HARA utility, which are quadratic, logarithmic, and power functions.

3.1 Linear Utility Function

Traditionally, in the fields of psychology and organizational behavior, researchers generally assume a linear relationship between two different concepts. Thus, the relationship between pay increase and satisfaction is considered as linear. This simple relationship is the basic assumption in the study of other complex monetary relationships or complicated theoretical structures. For example, Tang et al. (2005) examined a mediating model of income and pay satisfaction. A direct path is that income is positively related to pay satisfaction. Meanwhile, there is an indirect path in the relationship between income and pay satisfaction: income is positively related to the love of money, and the love of money is positively related to pay equity comparison, then the pay equity comparison is positively related to pay satisfaction. They also tested the model across two moderators: culture and gender. In this complex model, all the relationships are assumed to be linear. Moreover, the relationship between negative pay changes and individual affective responses is assumed linear as well. For pay cuts, Smith (2002) tested the influential theory and found that pay cuts would make workers less happy, and thus a linear relationship was assumed. Based on the above studies, the relationship between pay change and individual affective reaction (utility) can be assumed to have a linear function form, which is presented in Figure 2.

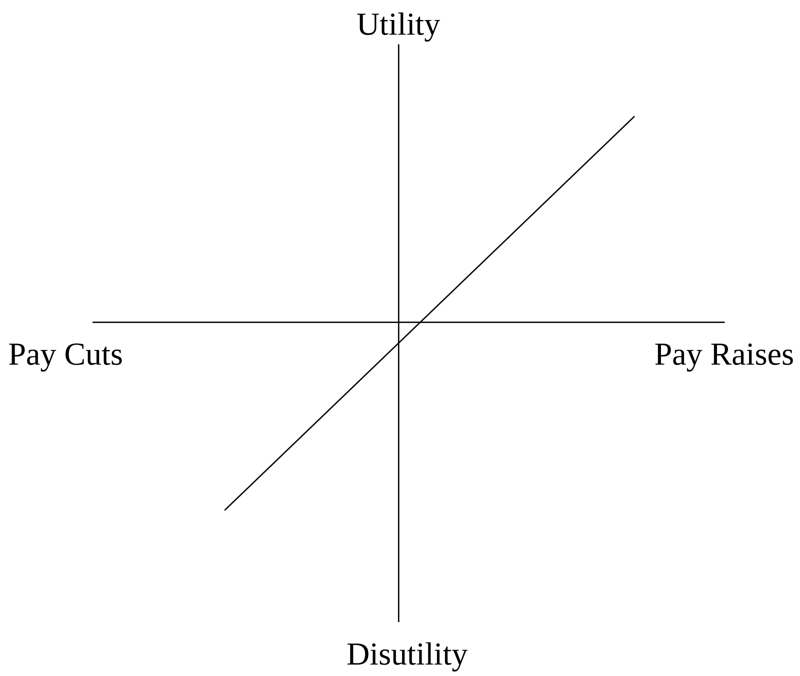


Figure 2: Linear Relationship between Pay Raises/Cuts and Utility

3.2 Curvilinear Utility Function

Based on traditional utility theory, a large number of economists have proposed that there is a nonlinear relationship between changes in pay and the utility/disutility of money. Some of these researchers, especially neo-economists, focus on the change in the marginal utility with the change in the level of income. As indicated by Bernoulli (1954), a utility function with exponential form for the value of money was postulated by the mathematician Cramer in 1728. Moreover, not only the power function but also the logarithmic and quadratic function have been adopted in a series of studies to investigate the relationship between merit increases and satisfaction. Figure 3 illustrates a nonlinear relationship between pay changes and utility.

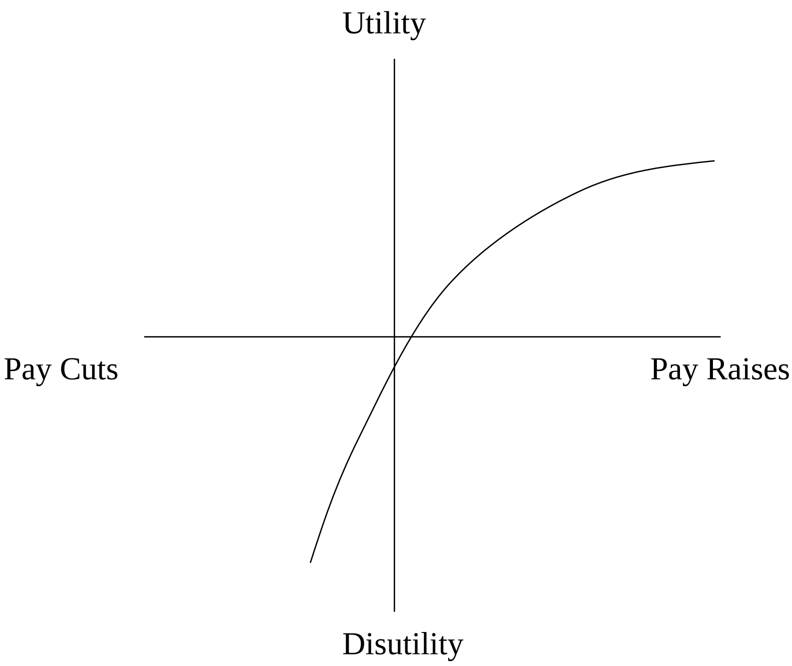


Figure 3: Curvilinear Relationship between Pay Raises/Cuts and Utility

Hyperbolic absolute risk aversion (HARA) is the most general class of utility functions used in practice. Constant relative risk aversion (CRRA), constant absolute risk aversion (CARA), and quadratic utility all exhibit HARA.

Let X denote the pay levels and Y denote the utility of this pay change. In this study, the three common function forms of nonlinear relationship that we investigate are as follows:

1. Logarithmic: $Y = b_0 + b_1 \times \log X$
2. Power (Nonlinear) with constant: $Y = b_0 + X^{b_1}$ (1)

   Power (Nonlinear) without constant: $Y = b_0 \times X^{b_1}$

The non-linear power function without constant can be adjusted as below:

Power (Log linear) without constant $\log Y = b_0 + b_1 \times \log X$

It may be noted that the nonlinear power function in Eq. (1) is known as a constant relative risk aversion (CRRA) utility function in economics and is widely used in the literature. Thus, we consider the power function form of Eq. (1).

3. Quadratic $\mathrm{Y} = b_0 + b_1 \times X + b_2 \times X^2$

3.3 Reference Point

According to cardinal utility theory, it is important to locate the “zero” value of utility. Here, the “zero” of utility is regarded as the “reference point”. It is discussed in Section 2 that the quantitative comparison between the utilities of two objects depends on both the magnitude of utility difference and the location of the "zero" of utility. Kahneman and Tversky (1979) suggested the employment of reference point is to place a value on gains or losses. In this study, we assume that the reference point of utility of pay change corresponds to the situation when a person has no psychological change given zero change in the pay; that is, the reference point is the origin in Figures 2 and 3.

Moreover, a person’s base pay could play a significant role in the utility/disutility of pay changes. According to prospect theory, the changes in utility should focus on the stimulus level. That is, the pay change is a relative concept, which is the comparison of the stimulus with respect to the reference point, rather than the absolute cumulative or decrease amount of pay level (Kahneman and Tversky 1979). For instance, it is an intuitive notion that a person with a current salary of $1,000 would obtain more joy from a pay increase of $1,000 than a person with a current salary of $5,000.

3.4 Smallest Meaningful Pay Increase

As discussed previously, empirical studies in economics have investigated the curvilinear relationship between pay changes and individual reactions. Bernoulli (1954) supported a logarithmic utility function; Giles and Barrett (1971) supported a power function; Worley et al. (1992) and Heneman et al. (1997) identified a quadratic or inverted-U function. However, these studies paid little attention to the disutility of small pay increase. Ernst Weber, a nineteenth-century German scientist, first asserted Weber's law (Champlin and Kopelman 1991, Gescheider 1976): "the change in stimulus intensity ($\Delta\Phi$) that can just be discriminated is a constant fraction (k) of the starting intensity of the stimulus (Φ)" (Gescheider 1976). Mitra et al. (1997) stated that there is a threshold on monetary gains as well. Working settings and culture can affect the amount of the threshold (Katkowski et al. 2002, Mitra et al. 2016). According to Weber's law and previous studies, we need to consider the situation that a small gain may result in disutility.

4 METHODOLOGY

In this study we conduct an experimental simulation to collect data in order to empirically study the relationship between pay change and utility. This section provides an overview of the methodology adopted in the experiment. We first describe the participants, procedures, and the pilot test. We then explain the measurement used for capturing the related variables. At the end, we introduce the approach and methods applied to the data analysis.

4.1 Participants

In our experimental simulation, the final sample consists of 131 students from diverse background at a university in Hong Kong, and these students were recruited as part-time research assistants. These participants include undergraduates and master students, and they were recruited through campus posters, email announcements, and personal networks from various sources, such as friends, classmates, and roommates.

Table 1 presents the detailed breakdown of participants' demographic characteristics. Due to missing data and data mismatch for some subjects, the reported data for this study are 131 participants' responses. Among all 131 participants, 17.55% (23) were male and 82.45% (108) were female, the participants' ages ranged from 18 to 26 and the average age was 21.04 (with SD = 1.79). Regarding the education level, the majority of the participants were undergraduate, accounting for 87.79% (115) of the sample. A total of 10.68% (14) of the participants were master students, and 1.53% (2) participants were PhD students. In terms of birthplace, 44.27% (58) were from Mainland China, and 55.73% (73) from Hong Kong.

4.2 Procedure

Gerhart and Rynes (2003) indicated that the experimental simulation study could be appropriate for investigating the casual relationship, especially for studies of the compensation system. Jenkins et al. (1998) also demonstrated that the effects of financial incentives could be best demonstrated in experimental simulations. Thus, we adopt the experimental simulation study for this research.

The participants voluntarily applied to the experimenter to perform a data-coding task. They were not allowed to talk with each other or access the Internet in a simulated working environment during the whole experiment process. The participants signed a consent form before the experiment. At the end of the experimental simulation, they were informed about the true purpose of the study (the utility of pay raises/cuts) and all participants received a payment of HK$80.

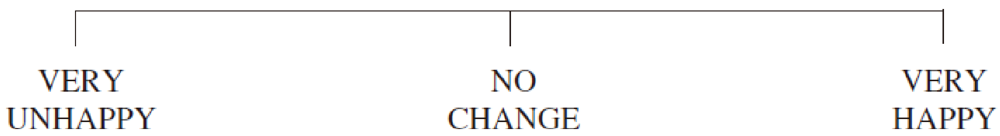
In the first stage of the experiment, we collected the demographic characteristics of participants. The students completed a questionnaire about their background information, such as gender, age, education level, and birthplace.

In the second stage, each participant was required to individually complete a coding task which took 30 minutes. At the start of the task, the written instructions were distributed to each participant, and the experimenter gave a brief explanation to make sure that each individual could understand the task requirements. After the task, the experimenter collected the task books and answer sheets.

In the third stage, we collected the utility data of pay change. The participants were required to complete another questionnaire about their individual responses to pay changes. This questionnaire assumed that each participant was hired for this coding job for six months at 20 hours per week. The starting payment was HK$80 per hour, the average level in the industry. Participants' payment would be adjusted after working for three months. In this questionnaire, participants were asked about how satisfied they were with various pay changes (including 15 pay raises, 9 pay cuts, and one with "no" pay change), and these pay changes were randomly-ordered to avoid the response bias. Specifically, the questionnaire contained the following instructions to participants for completing the questions.

"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 HK$80 per hour. This booklet of questions contains 25 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 compared to 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. There is no exact right answer, so mark each page and move along. You should not go back over the pages. We just want your initial reactions."



4.3 Pilot Test

Before the formal experiment, the experimenters conducted two pre-tests. Three students participated in the first pre-test to complete the questionnaires. Based on their feedbacks, the experimenters modified the statements of questions to ensure that students could fully understand the questions. The demographic questionnaire was also modified for a few questions.

After a week, the second pilot test of the experimental simulation was conducted among 7 students (3 male and 4 female). Long duration experiment may lead subjects to feel tired and bored, which may reduce the accuracy of the utility measure. Therefore, based on these seven students' feedback, the experimenters redesigned some sections of this experiment to ensure that the duration is appropriate and each section can proceed smoothly.

After two rounds of pre-tests, all related documents, such as the consent form, demographic questionnaire, and coding task, were made ready for data collection, and the final version of the experiment process was confirmed.

4.4 Measurement

The participants' individual responses (i.e., happiness/unhappiness) as a result of pay changes were measured by using 100-mm continuous dependent-response rating line. In order to collect data for utility of different pay changes, participants were asked to compare their new pay level (25 pay levels from HK$60 to HK$130) with their old pay level (HK$80 in this experiment), and record their responses with an "X" at a point on the line to indicate their degree of happiness (from "very unhappy" to ''no change'' to "very happy"). As mentioned in the literature review (Section 2), the empirical measurement approach used in this study is a traditional psychophysical method. Mitra, et al. (1997) developed the approach in their pay raise study. The approach was also adopted by Shaw et al. (2003) in their longitudinal study to investigate employees' reactions to merit pay increase. The continuous dependent-response rating line was used to assess the employees' responses. All participants provided their affective reactions to the 25 pay levels. Details of these pay levels are shown in Table 2.

The range of pay changes was chosen for two considerations. Prior studies suggest that this range should be sufficiently large to contain the SMPI and should take reasonable values in the context of employment. And the use of a length of line to estimate the utility may involve two issues. One issue is related to the consistency bias. In a common method, participants would be required to give their response to numerically presented pay changes. When the utility is also assessed as a numerical measurement, 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 and Pliner 1974, Worley et al. 1992). Stevens (2012) proposed that a length of line as a direct cross-modality matching technique to estimate utility can solve the problem of consistency. Later, other researchers also confirmed it (Cross 1982, Giles and Barrett 1971). Moreover, Galanter (1990) and Worley et al. (1992) identified that randomly providing different pay changes on each page may preclude cognitively consistent, but not necessarily true responses to subjects.

Another issue is that in this experiment, each participant was required to mark his or her happiness for 25 pay changes, that is, for every pay change, we have the data of all participants' individual utilities. In summary, the continuous dependent-response rating format with 25 randomly presented pay levels was adopted in the experiment.

4.5 Data Analysis and Regression

The data for this study were 131 subjects' responses to 25 pay changes and their demographic characteristics. We calculated the correlation between each of the three demographic dimensions (gender, age, and education level) and utility.

The responses were analyzed to assess the relative validity of linear, power, logarithmic, and quadratic utility functions through regression techniques. Since a single function can be used to analyze both pay raises and pay cuts rather than using two separate functions for the positive and negative limbs, a single utility model involving all pay changes was be considered.

The positive and negative limbs (i.e., pay raises and pay cuts) can also be analyzed separately (Galanter 1990, Giles and Barrett 1971). After we identified the best function for the utility model, we also considered the positive and negative limbs separately. In order to assess the relative validity of a single utility model and separated utility model, the data were analyzed using hierarchical regressions method (Cohen et al. 2013).

Hierarchical regression analysis is commonly used to assess statistical superiority of different theoretical models that involve incremental addition of independent variables and interactive terms (Cohen et al. 2013). 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. 2013). Thus, as a first step of the hierarchical regression we added three demographic variables as the independent variables. Gender was regarded as a dummy variable in the model, while age and education level were considered as continuous variables. Accordingly, the pay level (i.e., the pay change) was added in the second step to examine its effect on the utility. Finally, the square of pay change was added to the equation. F-statistic was then used to identify the additional variance explained in each step. We used statistical program SPSS for our analysis, which uses the change in R^2 instead of the change in adjusted R^2 to report F-statistic for additional variance explained in each step, a practice well accepted in the statistical literature (Cohen et al. 2013). Thus, using hierarchical OLS regression, it is possible to statistically test the superiority of a quadratic functional form compared to a linear functional form. After we identified the best-fit single utility model, we used the model to smallest meaningful pay increase.

Table 1: Demographic Characteristics of Participants

Dimension	Category	Code	No. of Participants	Percentage	Mean	SD
Gender	Male	0	23	17.55%	.82	.38
	Female	1	108	82.45%		
Age	-	-	-	-	21.04	1.79
Education Level	Undergraduate	0	115	87.79%	.21	.55
	Master in Science	1	7	5.34%		
	Master in philosophy	2	7	5.34%		
	Doctor	3	2	1.53%		
Birthplace	Mainland China	0	58	44.27%	0.56	0.55
	Hong Kong	1	73	55.73%		

Note: n=131.

Table 2: Pay Changes for the Experiment

Pay Raises			**No Change**			**Pay Cuts**		
Amount (HK$)	**Pay Change (HK$)**	**%**	**Amount (HK$)**	**Pay Change (HK$)**	**%**	**Amount (HK$)**	**Pay Change**	**%**
81	1	1.25%	80	0	0%	79	-1	-1.25%
82	2	2.50%				78	-2	-2.50%
84	4	5.00%				77	-3	-3.75%
85	5	6.25%				74	-6	-7.50%
88	8	10.00%				71	-9	-11.25%
90	10	12.50%				68	-12	-15.00%
92	12	15.00%				65	-15	-18.75%
95	15	18.75%				62	-18	-22.50%
100	20	25.00%				60	-20	-25.00%
102	22	27.50%						
105	25	31.25%						
110	30	37.50%						
118	38	47.50%						
125	45	56.25%						
130	50	62.50%						

Note: The amount of base pay is HK$80.

5 RESULTS

This section presents the findings for a series of analyses conducted in the experiment. First, we tested four functional forms for the utility data. Secondly, we calculated the correlation between each demographical variable and the utility. Thirdly, we assessed the relative validity of the single utility model involving all pay changes, and compared it with the separate models for pay raises and pay cuts. Finally, the best-fitting utility model that we identified reveals that a sufficiently small amount of pay increase may generate a negative value of utility, and we calculated the percentage of the smallest meaningful pay increase resulting in non-negative utility.

5.1 Curve Estimation

Table 3 shows the results of the curve estimation using regression analyses for subjects' affective reactions. To use logarithmic and power functions, we made a transformation on the data first by using the pay level (pay level = pay change + base pay level HK$80) as the independent variable. Thus the independent variable takes the values between 60 (HK$) to 130 (HK$). The dependent variable is the utility, shown by each subject's marked length in 100-mm continuous dependent-response rating line, from 0 (mm) to 100 (mm).

Through the statistical program SPSS, R^2, F-statistic, p value, the constant and the estimated unstandardized parameters are reported for each functional form. We found that the quadratic function has the highest R^2 value (.663) and is thus superior to the other three functional forms. Our results also suggest that the linear function (R^2=.628) is superior to the power function (R^2=.638). In addition, the logarithmic model

(R^2=.653) is a better fit than the linear function and power function. Therefore, the results of curve estimation by SPSS for the four functional forms supports the quadratic functional form for describing the utility of pay changes for our data.

5.2 Correlational Analysis

A correlation analysis was conducted to examine the impact of social desirability bias on the data set and obtain an initial understanding of the relationships among variables. In this step, the variable of pay change is the amount of change in pay, from -20 (HK$) to 50 (HK$), and the utility is the individual perceived value, from -50 (mm) to 50 (mm). The calculation results show that the correlation coefficients of the social desirability scales to utility range from -.025 to .017. Since the coefficients were all below the threshold of .30 as recommended in previous studies (e.g., Mitchell and Ambrose 2007), we can conclude that social desirability bias does not cause a significant threat to the data.

Table 4 presents the mean, standard deviation, and correlation calculated for the variables. Results of the correlation analysis demonstrated that gender has an insignificant negative relationship with the utility of pay change ($r = -.025$, $p > .05$). Nevertheless, previous research has shown that gender differences could play an important role in individual’s attitudes towards money. Women tend to value the social needs (e.g. work with people and being helpful to others) more important than men, while men tend to consider pay more important than women (Lawler 1971). That is, men are more likely to response a higher level of utility than women. Men and achievement-oriented employees tend to favor merit pay (Heneman 1992). In our data, the number of females is more than four times of males, which could be a reason for the insignificant relationship between gender and utility. On the other hand, Table 4 indicates that both age and education level have an insignificant correlation with the utility of pay change. Therefore, there is no obvious correlation between the demographical variables and utility.

In addition, there is a significant positive relationship between pay change and utility ($r = .792$, $p < .001$). This relationship is the main focus of the study. Accordingly, hierarchical multilevel analysis was used to examine the relationship.

5.3 Hierarchical Multilevel Analyses

According to Table 3, we can conclude that for the single utility model, the quadratic function is the best fit model for our data among the four common function forms. Although the results in Table 4 indicate that demographical characteristics (i.e., gender, age and education level) may not have a significant effect on the utility, they can still be regarded as control variables and included in the first step of hierarchical regressions. Then, the amount of pay change was added in the second step to test the linear effect. In the last step, the square of pay change was added to test the quadratic effect. F-statistic was then used to identify the additional variance explained in each step. The results of hierarchical OLS (ordinary least square) regression for the relationship between the utility and pay changes as well as the relationship between the utility/disutility and pay raises/cuts are reported in Table 5 and Table 6, respectively.

Table 5 presents the results of hierarchical regression for a single utility model. For the utility of pay change, the results suggest that the addition of a quadratic term can significantly explain an additional unique variance over and above the variance explained by the linear function (ΔF =341.439, $p<.001$). Moreover, the estimated unstandardized parameters were reported in Model 3 of Table 5. Thus, in the range of our pay changes (from -25% to +62.5% of the base pay), the utility function is concave. Our findings supports that the quadratic function is superior to the linear function to describe the utility of pay change. The results of separate models for positive and negative pay changes were shown in Table 6. We find that, for pay cuts (i.e., the negative limb of pay change), Model 2 is significant, whereas Model 3 is not significant (ΔF =.337, $p>.05$). Thus the relationship between the utility and pay cut is linear, not quadratic. On the other hand, for pay raises (i.e., the positive limb of pay change), Model 3 with the variable of square of pay raise has a superior fit to Model 2 (ΔF =57.154, $p<.001$). In summary, when we examine the best utility functions for pay raises and pay cuts separately, we find that the utility of pay raises and that of pay cuts are best described by a quadratic function and a linear function, respectively.

The utility of pay raise and the disutility of pay cut

Table 6 shows a linear utility on the loss domain and a concave utility on the gain domain within the scope of our data (from HK$20 of pay cut to HK$50 of pay raise). Many researchers have investigated the utility / disutility of monetary gains / losses in the study of the gambling. For example, according to prospect theory, the utility function should be concave for gains and convex for losses (Kahneman and Tversky 1979, Kahneman and Tversky 1992). However, in the employment context, psychological factors may affect the utility of pay change. Mitra et al. (2015)

conducted an empirical study in a simulated working environment. Their results indicated that a quadratic function is the most descriptive to the relationship between the utility and pay raise among four functional forms (linear, logarithmic, power, and quadratic), and pay cut is linearly related to the disutility. The findings in this study support past research. Marginal utility theory for money and reactance theory can explain the shape of the utility function in positive limb and negative limb, respectively. According to Brehm (1966), reactance theory concerns people's reactions to the loss of behavioral freedom or to the threat of such loss. Mitra et al. (2016) believed that individual's heightened reactions to negative issues occur partly because of the following four reasons. First, the negative issues may evoke stronger physiological responses than positive issues; secondly, under the negative issues, individual's reactions may focus on how to address the immediate dangers or toxicities; thirdly, people seldom expect to meet any negative issues; and lastly, negative events involve more cognitive effort (Duffy et al. 2002, Taylor 1991). Thus, the joint impact of under-met expectations and mobilization effects leads to a linear relationship between negative pay changes and subjective assessment.

For the negative limb, it is asserted that any pay cut, irrespective of its size, 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, the disutility resulting from a small pay cut is in part affected by the under-met expectation of pay raise. Furthermore, it is well-established that losses loom larger than gains (Kahneman and Tversky 1979, 1984). Thus, a pay cut should evoke stronger disutility.

A single model or separated models

A few additional results can be presented from Table 5 and Table 6. When we consider the utility function of pay cuts and pay raises separately, the function can be represented as follows:

$$\mathrm{Y} = \mathrm{f(x)} = \begin{cases} \mathrm{f(x_-)}, & \mathrm{x} < 0 \\ \mathrm{f(x_+)}, & \mathrm{x} \geq 0 \end{cases}$$

According to the formulas of R^2, we can calculate the R^2 value of this piecewise function as .378.

$$R^2 = \frac{\sum(Y_1 - \bar{Y})^2}{\sum(Y - \bar{Y})^2}$$

where $\bar{Y}$ refers to the mean of Y (utility), Y_1 refers to f(x), and Y refers to the real value of utility.

The R^2 of a quadratic utility model for all pay changes is higher than the R^2 value of the piecewise function (.664 vs .378). This result shows that a single utility model involving all pay changes has a better fit for the data than two models for pay raises and pay cuts separately.

The smallest meaningful pay increase

Using the above results of utility models, we did a further analysis of the best fit utility function (i.e., the quadratic function) to find the threshold of pay raise.

In Table 3, for the quadratic function, the estimated parameters are b_0=-171.175, b_1=2.971, and b_2=-0.011. The relationship between utility Y and pay level X is given as follows:

$$\mathrm{Y} = -171.175 + 2.971\mathrm{X} - 0.011X^2.$$

Since we have applied a transformation before estimating the utility functions, the conversion from pay level back to pay change is necessary when we study the characteristics of the utility function of pay change. Let X_0 denote the amount of pay change and Y the utility of pay change. The equation can be expressed as:

$$Y = -171.175 + 2.971 \times (X_0 + 80) - 0.011 \times (X_0 + 80)^2.$$

Thus the relationship between utility and pay change is given as:

$$Y = -2.3607 + 1.2494 \times X_0 - 0.0108 \times {X_0}^2 \qquad (2)$$

with $R^2 = 0.664$ and n=131, which is shown in Figure 4. We can see from Figure 4 that there is a threshold in pay raises. That is, subjects would feel unhappy when they face a "zero" pay raise or a very small pay increase. Letting Y in (2) equal to 0, we can calculate this threshold (i.e., the smallest meaningful pay increase) as HK$1.92, which is 2.402% of the base-pay level.

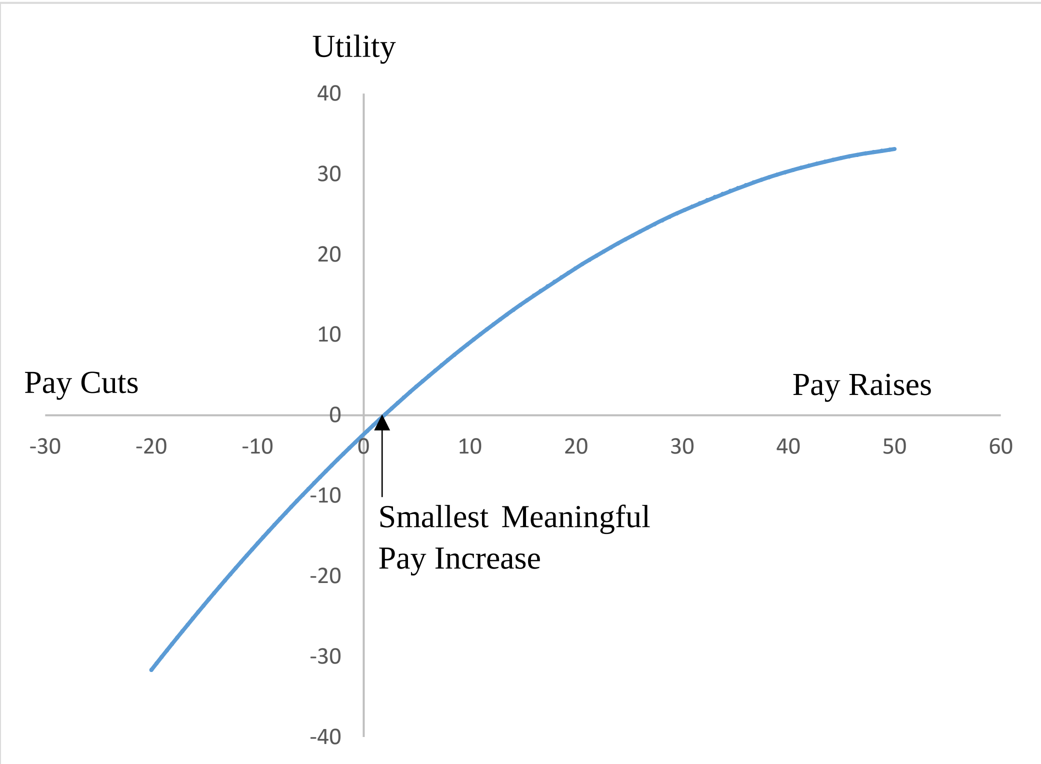


Figure 4: The Quadratic Utility Function of Pay Changes.

Based on expectancy theory, Lawler and Jenkins (1992) showed that both the amount of pay raise and individual's expectations on the pay raise may affect his/her reaction to the pay increase. A person's expectation to the pay raise can be influenced by complicated factors, such as the base pay level, the performance appraisal standards, and other's pay raise. For instance, an employee may have an expected magnitude of a merit pay raise, and thus a smaller-than-expected raise could produce an experienced disutility or negative affective reaction. Thus, according to expectancy theory, ‘‘actual pay raises’’ that are less than ‘‘expected pay raises’’ could evoke disutility or negative reactions. Recent work on experienced utility seems to support the need for this refinement. Carter and McBride (2013) suggested that at least three factors influence an individual's reference point: past outcomes, expected outcomes, and outcomes received by the peer-group. Furthermore, prior research described that not only the past outcomes, but also the social comparison process may impact the individual's expectations to a pay raise (Elster, 2000, Milkovich et. al. 2011). To summarize, pay raise expectations play a critical role in determining the affective reactions of pay raises, and it is reasonable that small pay raises may evoke negative affective reactions. We note that a quadratic function is unimodal. Using the quadratic model in (2), we can calculate the extreme point for the utility of pay change as HK$57.84 (i.e., 72.3% of base pay). The utility is increasing in pay change before this point, but is decreasing after this point. Since the maximum pay raise in our study is HK$50, smaller than this extreme point, we do not need to consider the extreme point of utility function in the study.

5.4 Summary

In summary, a number of conclusions can be drawn from our results. (i) The quadratic function best fits the relationship between the utility and pay change than other three common functional forms including the linear, logarithmic, and power functions. (ii) Through separate hierarchical multilevel analyses for pay raises and pay cuts, we showed that quadratic and linear functions are the most descriptive of the positive and negative limbs, respectively. (iii) A single quadratic utility model involving all pay changes has a better fit for the data than two models for pay raises and pay cuts separately. (iv) The best-fit utility model reveals that a sufficiently small amount of pay increase may generate a negative value of utility, and this percentage of smallest meaningful pay increase is calculated to be 2.402% of the base-pay level.

Table 3: Regression Results of Individual Responses to Pay Levels

Equation	Model Summary					Parameter Estimates		
	R^2	**F**	**df1**	**df2**	**Sig.**	**Constant**	**b_1**	**b_2**
Linear	.628	5523.318	1	3273	.000	-80.449	.951	
Logarithmic	.653	6169.922	1	3273	.000	-387.258	87.638	
Quadratic	.663	3218.425	2	3272	.000	-171.175	2.971	-.011
Power	.638	5762.867	1	3273	.000	-171.058	.436	

Note: n = 131. Independent variable: pay level, dependent variable utility.

Table 4: Correlations and Descriptive Statistics

Variables	**Mean**	**SD**	**1**	**2**	**3**	**4**	**5**
1. Gender	.824	.381	-	-.202**	.027	-	-.025
2. Age	21.046	1.786		-	.583***	-	.004
3. Education level	.206	.548			-	-	.017
4. Pay change	8.040	18.512				-	.792***
5. Utility	3.303	22.224					-

Note: n = 131.
* p < .05
** p < .01
*** p < .001

Table 5: Hierarchical Multilevel Analyses for Utility of Pay Change (Involving all Data of Pay Changes)

Predictor	Utility of pay change		
	Model 1	**Model 2**	**Model 3**
(constant)	9.403	1.755	3.739
Gender	-1.753	-1.753*	-1.753**
Age	-.233	-.233	-.233
Education level	1.183	1.183*	1.183*
PC(Pay change)		.951***	1.249***
PC^2			-.011***
ΔR^2	.001	.628	.035
$AdjR^2$	.000	.629	.664
R^2	.001	.629	.664
ΔF	1.303	5536.010***	341.439***

Notes: n = 131.
* p <.05,
** p<.01,
*** p<.001

Table 6: Hierarchical Multilevel Analyses for Utility of Pay Change (Pay Cuts and Pay Raises Separately)

	Utility of pay change					
Predictor	Negative limb			Positive limb		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
(constant)	4.406	15.455*	15.888*	11.628*	-.488	-2.660
Gender	-1.054	-.931	-.935	-1.971*	-2.115**	-2.192**
Age	-.997**	-.984**	-.984**	.216	.200	.192
Education level	2.741*	2.735**	2.735**	.298	.305	.309
PC(Pay change)		1.200***	1.346***		.703***	1.116***
PC^2			.007			-.009***
ΔR^2	.008	.247	.000	.003	.441	.015
$AdjR^2$	.006	.252	.252	.002	.443	.458
R^2	.008	.255	.255	.003	.445	.459
ΔF	3.271*	387.807***	.337	2.409	1662.883***	57.154***

Notes: n = 131.
* p <.05,
** p<.01,
*** p<.001

6 DISCUSSION

This section consists of two parts. First, we discuss the theoretical contributions and practical implications of our findings. Then, we discuss the limitations of this study, and provide the directions on further research.

6.1 Contributions and Implications

Our research has a number of contributions to the literature. First, this study provides an empirical evidence about the specific relationship between utility and pay change in the context of employment. Previous studies have proposed a nonlinear utility function, such as the logarithmic form, the power form (Giles and Barrett 1971, Stevens 2012, and Brandstateer and Brandstateer 1996), and the quadratic form or inverted-U function (Heneman et al. 1997, Mitra et al. 2015). Our study provides additional experimental evidences for the curvilinear utility function.

Secondly, our results offer a support for the decreasing marginal utility of pay change in the reasonable range of pay levels from 75% to 162.5% of the base pay, and the quadratic function is a best fit to our data. Concave utility in the pay raises means that a pay raise of $200 does not yield twice the benefit that a pay raise of $100 does. The findings confirm previous research with respect to the decreasing marginal utility of pay raises (Layardy and Nickellx 2006). However, no prior study has jointly considered pay cuts and pay raises to investigate a best fit utility function form in the context of employment. We found that the change in utility for all pay changes can be described by a single utility function, and the utility function is shown to be concave.

Our third contribution is that the results highlight the problems inherent in small pay raises, revealing the disturbing effects of small pay raises. In both work and non-work settings, prior studies rarely considered the influence of a very small pay raise on subjects' reactions to monetary changes. All previous studies on monetary gains in the economics literature assumed that positive gains would always have a positive utility. We demonstrated that small gains can have disutility, which represents a logical extension, namely, the identification of stable SMPI thresholds.

Our findings also have implications to the practice. It is important for managers to recognize that very small pay raises may cause disappointment, rather than be perceived as a reward. The finding is consistent with the research on the smallest meaningful pay increases (Mitra et al. 1997, Champlin and Kopelman 1991, Mitra et al. 2016, Worley et al. 1992). In the working settings, the allocation of monetary increase presumably enhances employees' motivation, performance, and retention (Heneman 1992). Unfortunately, with the economic crisis or low inflation, companies may have small budget increases, and little growth often means that there is little merit money to distribute. Even so, companies continue to allocate merit raises. Our finding points to a problem with this approach. If cognitive recognition of pay raises does not even occur until pay raises reach about 2 per cent of the base pay, then smaller raises may not evoke any positive cognitive and behavioral reactions.

6.2 Limitation and Future Work

First of all, the composition of the sample of participants may limit the generalizability of our results in this study. In order to empirically test the specific utility functional forms, we conducted an experimental simulation. In the simulated working environment, various realistic factors were controlled, and we could get desirable data for employee reactions to pay raises and pay cuts. However, this may not be feasible in field settings, and a complex set of organizational factors may influence employees' reactions to pay changes. Moreover, the compensation structure is more complicated in the working settings. Laboratory studies, on the other hand, involve the issues of generalizability to reality.

Base pay

In our experimental simulation, the pay structure was simple and there was only one base pay level. In our results, the smallest meaningful pay increase is approximately 2.4% of the base pay level. Previous studies indicated that an increase of about 5–8% of the base pay level can be regarded as meaningful (Mitra et al. 1997, Mitra et al. 2016, and Worley et al. 1992). The magnitude of SMPI in the previous studies is two to three times larger than our result. One possible reason is that our experimental simulation where subjects are paid real money differs from the complex field contexts. The duration of work and the frequency of payoff (i.e., hourly or monthly) may influence individual responses to pay changes. Future research can investigate the impact of base pay level on the magnitude of SMPI.

Performance and performance feedback

Performance-based pay change is the second direction for future research. In recent years, organizations have increasingly adopted performance-based compensation schemes. Hewitt Associates (2005), an American provider of human capital and management consulting services, reported that 47 percent of more than 1,000 companies surveyed had incentive systems where rewards were based on specific employee performance criteria. In addition, the performance-related pay has attracted great attention from academics. Extant publications have provided insights into the effects of pay level, merit pay, and performance on satisfaction. Merit pay is significantly associated with employee motivation, performance, and satisfaction (e.g., Gerhart and Rynes 2003, Green and Heywood 2008, and Bassett 1994).

Different types of performance feedback may lead to different levels of expected pay, and influence people’s subjective value of pay changes. However, little research has studied the impact of performance feedback on the utility of pay changes.

Individual differences

Individual differences are often ignored in the study of pay satisfaction, or perceived value (i.e., utility) of pay changes. For example, the concept of attitudes towards money can be involved in the relationship between pay change and utility. Extant studies generally considered money attitudes as a psychological factor, but seldom associated it with the reactions to pay changes. As found by Roznowski and Hulin (1992), jobs that provide good income may be satisfactory to some individuals, but people with fewer material desires may not find money particularly satisfying. Tang et al. (1997) indicated three major components of money attitudes: affective (Good and Evil); cognitive (Achievement, Respect, and Power); behavioral (Budget). People with different levels of money attitudes have different patterns of pay satisfaction (Roznowski and Hulin 1992). The affective, as an important component of money attitudes, plays a major role in the relationship between pay level and pay satisfaction.

Other researchers (e.g., Pfeffer and Langton, 1993 and Tang et al. 2005) also indicated that the love of money moderates the income-pay satisfaction relationship. For high-love-of-money individuals, the relationship between income and pay satisfaction was positive and significant, however, for low-love-of-money individuals, the relationship was not significant. And they also argued the high- and low- love-of-money regression lines intersected at a point. Therefore, our future research can investigate whether individual differences, such as the love of money, mediate the relationship between pay change and utility.

6.3 Conclusion

We conducted an experimental simulation to investigate the relationship between pay changes and utility. We evaluated four functional forms including linear, quadratic, power, and logarithmic functions, and found that a quadratic function best fits the utility of pay change including reasonable pay raises and pay cuts. We also showed that a single utility model is preferred over two separate models for pay raises and pay cuts. In addition, we calculated the smallest meaningful pay increase and discussed its practical implications.

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