VALUE IN HEALTH 18 (2015) 413–424

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/jval

Preference-Based Assessments

Do Probability and Certainty Equivalent Techniques Lead to Inconsistent Results? Evidence from Gambles Involving Life-Years and Quality of Life

Matteo Ruggeri, MA, MSc, PhD[1,*], *Silvia Coretti, MA, MSc, PhD*[2]

[1]*Institute of Policy and Economics, Università Cattolica del Sacro Cuore, Rome, Italy;* [2]*Graduate School of Health Economics and Management, Università Cattolica del Sacro Cuore, Rome, Italy*

ABSTRACT

Background: Within the standard gamble approach to the elicitation of health preferences, no previous studies compared probability equivalent (PE) and certainty equivalent (CE) techniques **Objective:** This study aimed to explore the differences between CE and PE techniques when payoffs are expressed in terms of life-years or quality of life. **Methods:** Individuals were interviewed through both CE and PE techniques within an experimental setting. Inferential statistics and regression analysis where applied to process data. Order and sequence effect were also investigated. **Results:** On average, the elicitation technique did not affect individuals' risk attitude significantly. Individuals proved to be risk averse in gambles concerning life-years and risk seekers in those concerning quality of life. No order or sequence effect was observed. Risk premium, measuring the strength of risk attitude as the percentage variation between the individual's estimated PE or CE and the risk neutral PE or CE, was affected by the kind of gamble that the interviewee is presented with. It increased in gambles concerning health profiles, denoting a stronger risk propensity, and decreased in gambles concerning life years, denoting a stronger risk aversion. **Conclusion:** The choice of the elicitation technique did not affect the individuals' risk attitude significantly, which instead was sensitive to the kind of gamble.

Keywords: preferences, standard gamble, utility assessment.

Introduction

Risk attitude elicitation is a major topic in uncertainty economics literature. Despite this important role and the huge literature within several fields and applications [1–9], small empirical evidence is available when payoffs are expressed in terms of gains of life-years or quality of life. An empirical study by Wakker and Deneffe [10] tested the gamble trade-off method for the elicitation of utilities under uncertainty concerning both monetary and life duration outcomes. The results of the study revealed higher individuals' risk aversion for life duration outcomes, even though a similar curvature of utility was observed [10]. In 2001, Bleichrodt et al. [11] investigated discrepancies between the probability and certainty equivalence methods and tested a quantitative adjustment method within an experimental study in which outcomes were expressed in terms of life duration gains and losses. More recently, Bleichrodt et al. [12] explored inconsistencies that occur in utility measurement under risk when assuming expected utility theory and investigated the possible advantages of using the prospect theory. In this study, outcomes were expressed in terms of health profiles.

Nevertheless, the debate around the different methods used to elicit health utilities, which are used in cost-utility analyses to assess health care technologies, is still very vivid [13–15]. In addition, health care decision makers consider the study of health-affecting behaviors more and more relevant [16].

Previous evidence suggests that an important research field concerns the study of risk attitude within different health domains such as health profiles and life-years or chance of death [9,17–19].

In two previous experiments, it was explored whether individuals' risk attitude varied across outcomes in the health domain, using the most popular way of eliciting risk attitude, by establishing an indifference point between a certain outcome and a gamble [18,19]. The authors investigated the difference in individuals' risk attitude when dealing with gambles involving gains in life-years or health profiles. In the first study, the certainty equivalent (CE) technique was used on a UK sample

* *Address correspondence to:* Matteo Ruggeri, Institute of Policy and Economics, Università Cattolica del Sacro Cuore, Largo Francesco Vito Square, 1, 00168, Rome, Italy.

E-mail: mruggeri@rm.unicatt.it.

1098-3015$36.00 – see front matter

http://dx.doi.org/10.1016/j.jval.2014.12.019

Table 1 – Summary of the four versions of the questionnaire containing four gambles.

Version A		Version B	
Outcomes of the gamble	Certain outcome	Outcomes of the gamble	Certain outcome
1. LY (0; 5)	2.5 y	1. LY (0; 5)	2.5 y
2. LY (5; 15)	10 y	2. LY (5; 15)	10 y
3. QOL_{FH-IH} (22222)	5 y in FH followed by 5 y in the state 22222	3. QOL_{IH-FH} (22222)	5 y in the state 22222 followed by 5 y in FH
4. QOL_{FH-IH} (23232)	5 y in FH followed by 5 y in the state 23232	4. QOL_{IH-FH} (23232)	5 y in the state 23232 followed by 5 y in FH
Version C		**Version D**	
Outcomes of the gamble	Certain outcome	Outcomes of the gamble	Certain outcome
3. QOL_{IH-FH} (22222)	5 y in the state 22222 followed by 5 y in FH	3. QOL_{FH-IH} (22222)	5 y in FH followed by 5 y in the state 22222
4. QOL_{IH-FH} (23232)	5 y in the state 23232 followed by 5 y in FH	4. QOL_{FH-IH} (23232)	5 y in FH followed by 5 y in the state 23232
1. LY (0; 5)	2.5 y	1. LY (0; 5)	2.5 y
2. LY (5; 15)	10 y	2. LY (5; 15)	10 y

Note. Health profile 22222 is characterized by moderate problems in walking about, moderate problems in self-care, moderate anxiety, moderate difficulties in performing usual activities, and moderate pain or discomfort. Health profile 23232 is characterized by moderate problems in walking about, severe problems in self-care, moderate anxiety, severe difficulties in performing usual activities, and moderate pain or discomfort. FH, full health; IH, ill-health; LY, life-years; QOL, quality of life.

through a Web-based questionnaire. The study results showed that most of the individuals were risk averse with respect to a life-years gamble involving the chance of immediate death, but risk seeking with respect to both life-years gambles not involving the chance of immediate death and health profiles gambles. In the second experiment, the probability equivalent (PE) technique was used on an Italian sample of individuals through frontal interviews. The results showed that most of the individuals were risk averse with respect to life-years gambles both involving and not involving the possibility of death and were risk seeking with respect to gambles involving health profiles.

In the studies mentioned, the modal pattern of risk attitudes was similar under the two elicitation methods with the exception of life-years gambles not involving the chance of immediate death. In both the experiments, interviewees proved to be risk averse with respect to life-years gambles involving immediate death and risk seekers about health profiles gambles. Differences in the degree of risk attitude, which was larger for the CE method, however, occurred.

The choice of the elicitation techniques could justify the occurrence of different results in terms of the strength of risk attitude and risk aversion in gambles not involving immediate death [20]. In the first experiment, the CE method varies the magnitude of the certain outcome to establish the indifference point between the gamble and the certain outcome. The disadvantage of the CE method in the health profiles gambles is that results may be biased by time preference as the time in the imperfect health state was varied. In the second experiment, the PE method avoids this potential bias in health profiles gambles.

Nevertheless, other potential biases could have influenced the results and the comparability between the two studies. Therefore, differences cannot be attributed only to the different elicitation techniques used.

A first source of bias involves the techniques used for data collection. A Web-based questionnaire was used to elicit risk attitude in the first experiment, whereas face-to-face interviews were used in the second experiment. Second, the incentives offered to participants might have played a role. In the first experiment, participants were involved in a prize draw. Although financial incentives may improve the quality of data, incentives such as prize draws may be more attractive to risk-seeking individuals and this may have influenced the results. In the second experiment, no financial incentives were offered.

Finally, another complicating factor is that the two studies were performed in different countries. The first experiment was conducted in the United Kingdom, and the second experiment was conducted in Italy. Different populations can exhibit different risk attitudes, and in this case, with one in Northern Europe and the other in Southern Europe, this could hold particularly true [21].

The two mentioned studies also tested whether changing the order of the questions had an impact on the estimates of risk attitude (i.e., order effect). Also, a sequence effect was tested with respect to the time of experiencing the imperfect health state in the health profiles gambles (before or after having experienced perfect health states). No evidence of systematic order effect was found. A sequence effect was present in those individuals who tended to be more risk seeking when the years of ill-health occurred first.

The aim of this study was to provide a better understanding of whether individuals exhibit different risk attitudes (in terms of type and intensity) when faced with CE- and PE-based gambles in which payoffs are expressed in terms of either life-years or health profiles. Cases in which the type and the strength of the individual's risk attitude changes according to the elicitation technique will be referred to as "inconsistencies" in this article. Therefore, discrepancies arising when the utility for the same outcome differs from one method to another, inducing a failure of procedure invariance, is outside the scope of our article.

This new experiment is the first study in investigating differences in risk attitudes between CE and PE techniques when payoffs are life-years or health profiles. The same population is administered both the CE technique and the PE technique on a 3-day distance. Data are collected through face-to-face interviews without financial incentives. As a second aim, the experiment