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Rationality of choice in discrete choice experiments

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Summary

Discrete choice experiments (DCEs) are being increasingly used in health economics. As with any stated preference (SP) technique, it is important to test whether respondents are answering the experimental questions posed in a rational manner. This paper addresses the question of the rationality of choices within DCEs. The paper begins by outlining methods that have been used to test for rationality in both mainstream economics and health economics. Based on the rationality criteria developed in the revealed preference (RP) theory, new rationality tests that could be applied to DCEs are proposed. Following on from this, it is argued that research concerned with the rationality of responses in experimental studies should attempt to explore the reasons for "irrational" responses. A distinction is made between "true" and "observed" irrationality.

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1. Introduction

Due to the lack of a market in publicly financed health care systems, experimental or stated preferences (SP) techniques are used to elicit consumer preferences. Discrete choice experiments (DCEs) are being increasingly used in health economics to measure such preferences (Ryan, 1999a). Given the lack of revealed preference data to 'validate' preferences elicited using experimental techniques, it is important to include tests to ensure that respondents are answering in a 'rational' manner, and that, following on from this, a utility function can be estimated. This paper aims to explore possible tests of rationality within DCEs. The paper begins by reviewing tests of rationality carried out in mainstream economics. More specifically, attention is given to rationality tests employed in utility theory and revealed preference theory. Following on from this, a review is provided of rationality tests used within health economics. Based on revealed preference theory, alternative tests of rationality that could be used with DCEs are proposed. Finally, consideration is given to possible reasons for 'irrational' responses, and what to do with respondents that do not satisfy some theoretically desirable condition of rationality. This paper is very much work in progress, and the authors would welcome comments.

2. Rationality in Economics

2.1 Rationality in Utility Theory under Certainty

In economics it is assumed that individuals have preferences which are described by a preference ordering. The rationality of individuals is determined by placing assumptions on such preferences (Uzawa, 1959). Three basic assumptions are made on the preference relation "at least as good as" ($\succeq$)

1) Reflexivity: Any good is at least as good as itself. ($a \succeq a$)
2) Completeness: For any pair of goods, a, b one of the following holds: $a \succeq b$, $b \succeq a$ or both.
3) Transitivity: Assuming three goods a, b and c, if $a \succeq b$, $b \succeq c$ then $a \succeq c$

If these three conditions are satisfied, ($\succsim$) is defined as a preference ordering. If the preference relation ($\succsim$) satisfies continuity then such preference ordering can be represented by a utility function unique up to a monotonic transformation such that if $a \succsim b$ then $U(a) \geq U(b)$. Individuals behaving according to such a preference ordering can be represented as maximising utility, and therefore as behaving in a rational way.

Due to the greater difficulty of empirically testing the assumption of completeness empirical work has focused on testing the assumption of transitivity (May, 1954; Edwards, 1954). Evidence has been found of circularities of preference patterns, with individuals making 'intransitive' choices, i.e. cases where xPy, yPz and zPx. A classical example is the 'paradox of voting' where the votes for three candidates (x, y, z) following a majority rule are circular: the majority votes result on xPy, yPz and zPx. Rose (1957) carried out a study of irrational judgement by testing acyclicity. He argues that transitivity may be too strong a requirement for the theory of decision-making and that it may sufficient if acyclicity is satisfied i.e. if A is preferred to B and B is preferred to C then C cannot be preferred to A but it does not impose that A should be preferred to C, these two bundles may not be comparable. He therefore tests for acyclicity rather than transitivity (although he talks about 'transitivity'). He distinguishes between true intransitivity and apparent intransitivity. True intransitivity is where an individual consistently makes the same intransitive choices when facing the same alternatives. He hypothesises that all choices are subjectively transitive (there is a rank order of values) which may change due to some external factors. The author tested this hypothesis in an empirical study where a sample of respondents were asked to rank 13 crimes in order of severity. The same study was reproduced two months later. The results showed that true intransitivity can be considered to be a rare phenomenon. Most of the intransitivity observed could plausibly be explained by carelessness (lack of respondents' involvement in the experiment) or random error in the responses.

2.2 Rationality in Expected Utility Theory

In many situations the outcomes of individual's actions are uncertain. Under uncertainty rational individuals are assumed to maximise expected utility (Von Neumann and Morgenstern, 1947). Similar to the case of certainty, if certain axioms on individual's

preferences facing uncertain choices are satisfied, then it can be said that individuals' preferences can be represented as an order, and that a utility function exists.[1]

A considerable amount of work has been carried out to test whether individuals behave according to the axioms of expected utility theory (EUT). The generally negative results have led to controversy between the adequacy of EUT used by economists and the validity of the studies carried out. Different explanations have been given to explain violations of the axioms of EUT. These include: the existence of framing effects; the way people process information when making decisions (Kahneman and Tversky, (1979); the existence of bounded rationality (Simon, 1978) whereby due to computational limitations people use rules of thumb to solve complex problems; regret and disappointment theories (Bell, 1982; Loomes and Sugden, 1982) whereby people make decisions bearing in mind the potential consequences of their choices in case of a non-wanted outcome; and theories of subjective probabilities (Savage, 1954). Hence, the results from these studies provided evidence of 'rational' explanations of violations of the axioms of expected utility theory.[2]

2.3 Rationality in Revealed Preference Theory

The starting point of (expected) utility theory is that if individual behaviour satisfies certain axioms, a utility function can be estimated. However, utility is not observable. What we observe is consumption behaviour, demands or choices. This was the starting point in the theory of revealed preference (Samuelson, 1938). Given the difficulty of observing preferences and defining the notion of utility, Samuleson aimed to "*develop the theory of consumer's behaviour freed from any vestigial traces of the utility concept*". The aim was to develop a consumer theory without the need to define concepts such as preferences and utility, or to impose conditions on them. Under this approach, individuals' preferences can be inferred by observing their actual market behaviour. This defines the notion of revealed preference i.e. if consumption bundle A is chosen when consumption bundle B is available then A is said to be revealed preferred to B. The rationality condition imposed by Samuelson, known as the weak axiom of revealed

[1] For a review of the axioms of expected utility theory see Schoemaker (1982).

[2] While expected utility theory aims to be a normative theory (how rational consumers should make decisions), these alternative theories are descriptive ones i.e. axioms are developed from the observation of consumers' behaviour.

preference, establishes that if A is revealed preferred to B then, if A is available, B cannot be revealed to A. From this assumption Samuelson showed that the significant results of utility theory could still be obtained.

Houttaker (1950) later introduced the strong axiom of revealed *preference (which implies the "semi-transitivity" of revealed preference*[3]*)* arguing that Samuelson's axiom of revealed preference was not enough to determine whether consumers' preferences could be represented by an ordinal utility function, except for the unrealistic case of two commodities. There is a debate around this issue since some authors argue that Samuelson's weak axiom implies Houtthaker's strong axiom, at least under some demand conditions (Uzawa, 1959).

Within the framework of revealed preference further work has been carried out defining and establishing the rationality conditions that choice functions should satisfy (Arrow, 1959; Richter, 1966; Kreps, 1988). These are presented here, and later discussed within the context of DCEs.

We assume a finite choice set X, i.e. a set of alternatives and A, B, C, etc. non-empty subsets of X. A choice function $C(\cdot)$ assigns to any non-empty subset $A \in X$ a non-empty subset $C(A) \in A$ called the choice set of A, i.e. C(A) is the set of alternatives that is chosen from the set A.

Assuming a binary relation R and a set A, we define the choice function C(A, R) derived from R as:

$$C(A, R)=\{x \in A: \text{for all } y \in A, \text{ not } (yRx)\}$$

In a similar way, for any choice function C(X),

$$xRy =_{df.} x \in C(\{x, y\})$$

is defined as the relation generated by C(X).

[3] A transitivity postulate need only involve three elements, while semi-transitivity involves T+1 elements, where T is a finite number.

The notions of revealed preference can be defined in terms of choice functions:

- x is revealed preferred to y (xPy) if and only if $x \in C(X)$ and $y \in X-C(X)$
- x is indirectly revealed preferred to y (xP*y) if and only if there exist x^i (i=0,...,n) such that $x^0=x$, $x^n=y$ and $x^{i-1}P^*x^i$ (i=1,...,n)

Several definitions have been given in the literature of rational choice functions defining the criteria that such choice functions should satisfy. The weak axiom of revealed preference is defined as:

1. If xPy, then there exists no Y such that $x \in Y$ and $y \in C(Y)$

An alternative form of Houthakker's (strong) axiom of revealed preference is defined as:

2. For all x and y, if there exists an X for which $x \in C(X)$, $y \in C(X)$ then not(xP*y).

Alternatively, the same axiom can be presented as: If x and y are both in A and B and if $x \in C(A)$ and $y \in C(B)$, then $x \in C(B)$.

Houthakker's axiom is broken into two axioms by Sen (1993):

3. Sen's property β: If x, $y \in C(A)$, $A \subseteq B$ and $y \in C(B)$, then $x \in C(B)$. i.e. if both x and y are chosen from set A and the choice set is expanded to B, if y is chosen in B, then x must also be chosen. An identical interpretation is that any option not chosen from a choice set, should not be chosen if the choice set is widened.
4. Sen's property α: If $x \in B \subseteq A$ and $x \in C(A)$, then $x \in C(B)$. i.e. if x is chosen from a choice set A which is narrowed to B, if x still belongs to B then x should also be chosen from B. Identically it can be said that if a choice set A is narrowed and the alternatives (or some of them) chosen from A are still in B, then no unchosen alternatives are chosen now and no chosen alternatives are unchosen now.

Property α is stronger than property β. It is shown that Houthakker's axiom implies the other three presented earlier (Arrow, 1959). Sen's property α and the weak axiom of revealed preference are equivalent and imply Sen's property β. Arrow (1959) and Kreps (1988) present also the interrelation between choice functions and preference relations. If R is a weak order (i.e. a weak preference relation ($\succeq$) satisfying, reflexivity and transitivity or alternatively a strong preference relation ($\succ$) satisfying asymmetry and acyclicity) then the choice function C(X) derived from it satisfies properties 1-4 defined above. If a choice function C(X) satisfies condition (1), (2) or (4) then the preference relation (R) derived from C(X) is a weak order and the choice function derived from such it C'(X)=C(X).

2.4 Do 'Irrational' Responses represent 'Irrational' respondents?

From the arguments and evidence presented above it may be too restrictive to explain individuals' behaviour based only on definitions of rationality provided in the economic theory. There may be factors and possible explanations that should be considered before labelling consumers who do not behave according to theory as 'irrational'. May (1954) argues that the question researchers should be interested in is not whether preferences are irrational, but rather under what conditions does rationality fail? It may be the case that irrational behaviour from an economics theory point of view is actually rational when taking a closer look at the framework in which the choice is made. Sen (1993) argues that imposing conditions of rationality without considering external factors, tastes or believes that may influence choice is not appropriate. That is, irrationality cannot be just by the failure of irrationality tests: "*...can a set of choices really be seen as consistent or inconsistent on purely internal grounds, without bringing in something external to choice, such as the underlying objectives or values that are pursued or acknowledged by choice?.....the possibility of getting one set of "internal consistency" conditions that would invariably "work" is extremely limited*". Sen (1993) gives the following example to demonstrate how apparently 'irrational' choices may be rational: "*Suppose a person faces a choice at a dinner table between having the last remaining apple in the fruit basket (y) and having nothing instead (x) forgoing the apple. If instead the basket contained two apples, and she had encountered the choice between*

having nothing (x), having one apple (y) and having another apple (z), she could reasonable enough choose one (y) without violating any rule of good behaviour. This combination of choices would violate the standard consistency conditions, including Property α, even though there is nothing particularly "inconsistent" in this pair of choices (given her values and scruples)".

Following Sen (1993), three reasons may explain violations of theoretical axioms implying rationality:

a) *Positional choice*: Some choices may not satisfy the assumed "rational" behaviour depending on the context in which they are made without necessarily implying inconsistency.

b) *Epistemic value of the menu*: Individuals may infer information from the choices offered, influencing their preferences over the alternatives as they see them. It makes reference to ideas or feelings (pre-defined perceptions) that we may have about different goods which may influence the choices made, not always resulting on 'internally consistent' choices.

c) *Freedom to reject*: Some choices are geared to rejecting in a free way particular actions or outcomes in favour of a prominent alternative.

Beesley and Hensher (1987) tried to explain reasons for inconsistent respondents by regressing such responses on socio-economic characteristics of respondents. Whilst this represented an attempt to explain the reasons for the existence of inconsistent answers, the external correspondence factors may not only be related to the socio-economic characteristics of respondents.

3. Rationality using stated preference techniques in health economics

Within health economics attempts have been made to test for rational responses to SP techniques.[4] In a study looking at the rationality of the rating scale, Bleichrodt and Johannenson (1997) tested the consistency hypothesis that the values obtained by the rating exercise for any scenario should be the same in different contexts i.e.

[4] Whilst the tests outlined have been referred to by the authors of the papers as tests of rationality, some may be considered as tests of other issues (e.g. convergent validity, framing effects).

independently of which were the comparisons made. This should hold under the null hypothesis that rating-scale valuations elicit a measurable value function. The results showed that the rating-scale valuation obtained depended on the number of health states preferred and not preferred to the health state valued and therefore no theoretical support could be given from the theory of measurable value functions.

Dolan et al (1995) argued that if individuals' preferences are consistent with EUT the results from standard gamble experiments should be the same as those obtained from a risk-risk approach. This was not found. The authors argue that the results obtained could be explained by alternative theories such as prospect theory or disappointment aversion.

The study by Dolan et al (1995) also found that, using the risk-risk approach, 70% of respondents provided a higher utility value to a 'worse' health state. This approach, often referred to as the dominance criteria (i.e. assessing whether a priori better health states are assigned higher utility scores), has been used to value the rationality of results obtained from other methods of eliciting preferences for health states. Mauren et al (1995) compared the consistency of the responses to the standard gamble and the rating scale approaches assessing violations of dominance. The number of violations found was low, with most falling in the bounds of measurement error. Krabbe et al (1997) compared the consistency of five health-state valuation methods (standard gamble, time trade-off, rating scale, willingness to pay and the paired comparison method). The greater number of inconsistent responses were obtained with the WTP approach.

Dominance tests were also carried out to assess the rationality of responses when devising the generic EuroQol instrument (Euroqol, 1990; Dolan et al, 1996). Here health states are represented by five dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each of these dimensions has 3 levels: none, moderate and extreme. Rationality tests assume that, for example, a health state described as 11111 should be preferred to 11211 and also 22122 should be preferred to 22222 (assuming independence). Hence assigning higher utility scores to 11211 and 22222 is considered as inconsistent.

The rationality of responses to WTP questions has been tested by arguing that if commodity A is preferred to B, then individuals should be willing to pay more for A than

B. San Miguel and Ryan (1998) applied this test when looking at women's preferences for two alternative treatments for menorrhagia: conservative treatment versus hysterectomy. The results suggest that 30% of respondents fail to provide rational responses i.e. they were willing to pay more for their least preferred option. A similar result was found by Donaldson et al (1997). On examining preferences for cystic fibrosis screening, the authors found that a high proportion of respondents were willing to pay more for their less preferred option.

The rationality of DCEs in health economics has also been mainly tested through the satisfaction of the dominance criteria. Here choices are included where one of the options is better (or equal) on all attributes. For example, trying to define arguments in the utility function of infertile women, Ryan (1995) assumed that patients prefer good staff attitudes to bad, a higher chance of taking home a baby, continuity of contact with the same staff, less time on the waiting list, a lower cost to a higher cost, and made no *a priori* assumption about follow-up support. On the basis of these assumptions, the DCE questionnaire included 4 choices where, *a priori*, one alternative should be preferred to the other. Respondents who chose dominated scenarios were considered as "inconsistent". This way of testing for consistency has been applied also in other DCEs within health economics (Bryan et al, 1998; Ryan and Hughes, 1997; Ryan et al, 1998; Ryan, 1999b; Vick and Scott, 1998; van der Pol and Cairns, 1998).

McIntosh and Ryan (1999) tested for transitivity of preferences in a study concerned with preferences for elective surgery.

Within the framework of DCEs in health economics very little work has attempted to explore the reasons for the inconsistent responses provided. Generally, inconsistent respondents have been dropped from the analysis on the basis that such respondents were not understanding the questionnaire.

5. Alternative methods of assessing rationality of choice in DCEs

To date tests of rationality in DCEs have concentrated mainly on dominance tests, though one study has explored transitivity. The design and characteristics of DCEs allow applying tests directly from revealed preference theory. Two types of responses can be

obtained from DCEs. Respondents may be asked to *choose* an option from a number of pairs of choices presented (obtaining an "expressed choice") or to state their *preference* (obtaining statements about preference relations). This distinction may allow testing the assumptions of rationality defined in revealed preference theory (on choices) or in utility theory (on preferences). It may be argued that when choices are made between pairs of goods, the chosen option must be the preferred one (and therefore no differences exist between choice and preference). However, "observing" a choice may not be enough to know the type of preference that motivates that choice, i.e. although option A is chosen instead of B, this may be because A is at least as good as B or may also be because A is strictly preferred to B. This distinction may need to be clear in order to test the assumptions done on preference relations (Richter, 1971).

The proposed rationality tests in this paper are based on choices as the starting point. We want to see whether the choices made in DCEs satisfy some desirable rationality conditions. For that, the revealed preference theory can be seen as an appropriate framework. A main difference obviously is that while revealed preference theory is based on observed choices, real choices are not observed when experiments are used. However, if the responses obtained from DCEs are used as a measure of preferences, then it may be appropriate to find out whether such choices satisfy the rationality criteria defined in the revealed preference literature.

Definitions

In what follows some of the axioms of revealed preference are defined in the framework of DCEs. As mentioned earlier, in DCEs, individuals are asked to choose between pairs or groups of alternatives. These alternatives are different descriptions of the goods valued in terms of their attribute levels. The available choice set is defined by all the possible scenarios from which preferences will be obtained, X. A Cartesian product Z=(X*X) may be defined i.e. all the possible pairs of alternatives arising from X. Usually, the number of pairs of alternatives is too high to present respondents with and a subset (A) of pairs of such set is presented to respondents. For any pair or subset (A') in A, every respondent is identified as a choice function C(A', R) such that for every pair or subset A', it provides

that option x which is preferred (following a preference relation R) to all y in A'. Opposite to the definitions in the revealed preference theory, C(A', R) is a singleton:

$$C(A', R)=\{x \in A': \text{for all } y \in A', \text{not } (yRx)\}$$

Having defined respondents facing a number of choices as choice functions (Richter, 1966), we want to know whether such choice functions satisfy the rationality criteria defined in the revealed preference theory. Two conditions of rationality defined on choice functions may be applied: Sen's contraction (α) and expansion (β) properties. In a DCE framework, these properties may be defined as follows:

a) *Sen's expansion property (β): If $x, y \in A'$, $x \in C(A')$ and $A' \subseteq B'$ then $y \notin C(B')$.*
If respondent is given a choice between x and y (set A') and x is chosen and the choice set is expanded to B' (x, y, z), then y cannot be chosen in B, i.e. any option unchosen from a choice set, should not be chosen if the choice set is widened. The same applies when the initial choice set has more than two alternatives but only one alternative must be chosen.

b) *Sen's contraction property (α): If $x \in B' \subseteq A'$ and $x \in C(A')$, then $x \in C(B')$.*
If x is chosen from choice set A' (x, y, z) which is narrowed to B' (x, z), if x still belongs to B' then x should also be chosen from B', i.e. if a choice set A' is narrowed and the option chosen from A' is still in B', then no unchosen option is chosen now and no chosen alternative is unchosen now.

Although these definitions may be more restrictive than those in the revealed preference literature where the choice functions may have more than just one element and infinite choice sets may be defined, they may not be unrealistic in the health care market, i.e. for many interventions the number of available treatments is discrete and small and also choices in many situations imply choosing just one option since many treatments may be independent i.e. having a type of treatment implies not having an alternative one.

Within the framework of DCEs failures of rationality tests included may be due to:

(i) *The difficulty of the exercise* - the exercise may be difficult to understand, the number of choices or attributes may be too large or the levels of the attributes may be too similar so respondents may not be able to distinguish between them (this may be more likely to happen if the levels are expressed in percentage terms).

(ii) Respondents do not follow a decision process assumed by the researcher or such decision process changes during the completion of the questionnaire. When conflicting values exist, individuals may adopt different strategies in different situations, which potentially may be lead to irrational responses (Payne et al, 1992).

(iii) The respondent includes some belief, taste, or external information not known by the researcher which explains 'irrational' responses.

The way to deal with 'irrational' respondents may depend on which is the source of such "irrationality". From an academic point of view, perhaps detecting them may be enough. From an applied economics point of view, i.e. helping decision-makers in their decisions, may be different and some action may have to be taken. The three cases presented above may be handled differently: the first case may be the most suitable one to be dropped from the analysis. The third case should not be dropped from the analysis. The second one may be more difficult to handle. Whatever the approach, we may argue against the approach followed in the applications of DCEs in health economics whereby, as mentioned above, those respondents not satisfying some consistency criteria were systematically dropped from the analysis.

Study design

The way these tests may be applied is shown in Figure 1. Three different questionnaires may be used, with 6 (Q6), 8 (Q8) and 10 (Q10) choices respectively. Given the potential influence of the questionnaire in the results of the tests, the questionnaires are designed in a way that allows testing the effect of the questionnaire design on the rationality tests results. Sen's expansion (β) and contraction (α) properties may be tested using dominant (and dominated) options which a priori may be thought to be easier to answer as compared to choice sets where no dominant options are included. Under the assumption of rationality of choice no differences should be found. Hence, different versions of the

axioms are tested, (weak or strong) depending on whether the options on the choice sets are dominated or not.

Each box in Figure 1 represents a choice. Numbers in brackets represent the number of options presented in each choice. The type of test being carried out is also described (shadowed boxes).

Sen's expansion property (β) may be tested by asking respondents to choose an option out of a set of alternatives (2 options plus a neither option). This choice set is then widened to a set of three options (plus a neither option) and respondents are asked again to choose one of the options. This test is applied in Q6 and Q8 (Figure 1).

Sen's contraction property (α) may be tested by asking respondents to choose an option out of a set of alternatives (3 options plus a neither option). This choice set is then narrowed to a set of two options (plus a neither option) and respondents are asked again to choose one of the options. This test is applied in Q8 and Q10 (Figure 1).

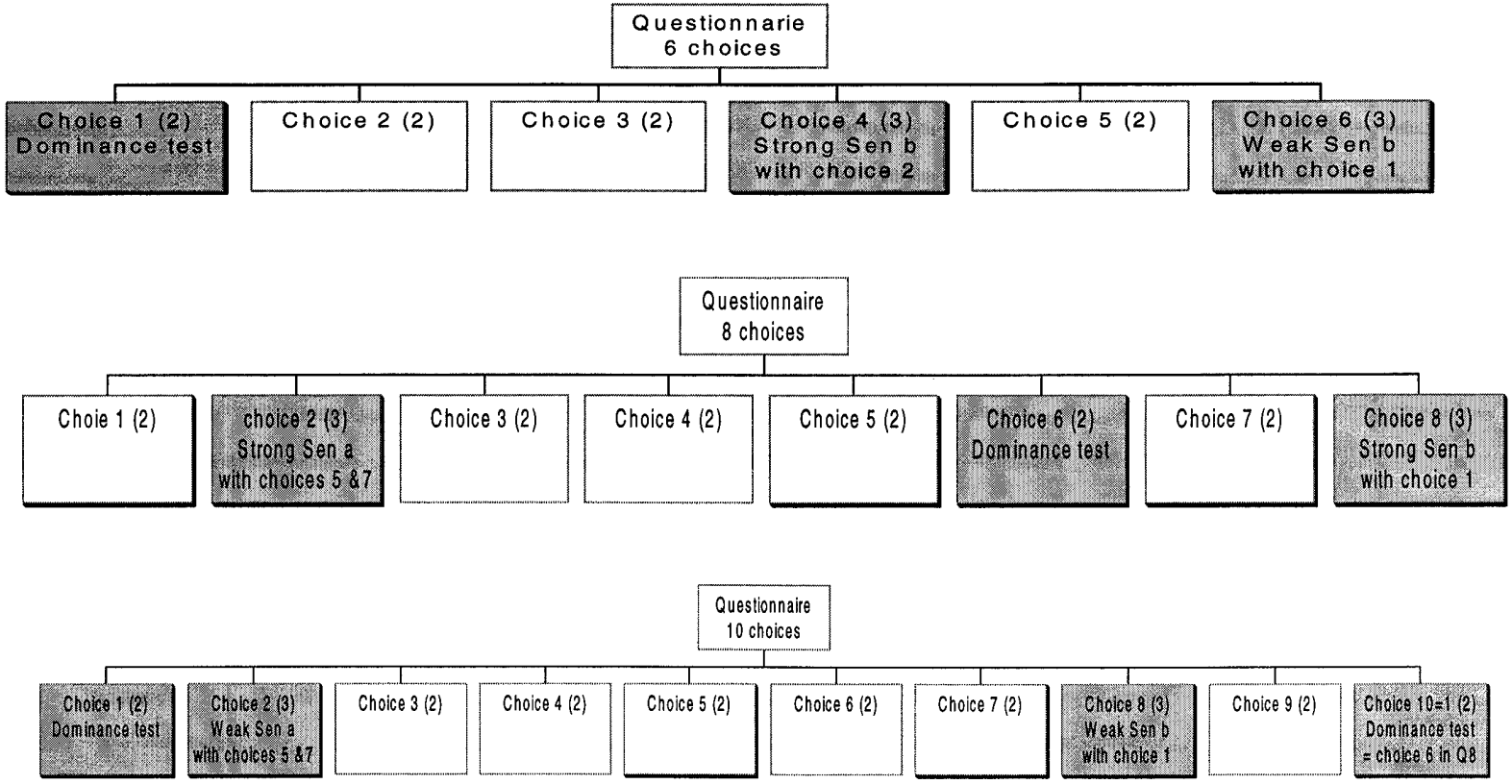
In Q6, both the strong and weak versions of Sen's expansion property (β) are tested. This may allow testing whether there are differences in the results of the tests due to its complexity, since it is argued that choosing is "easier" when one of the options is dominant, i.e. when no conflicting criteria exists. Failures of the tests may be due also to the complexity of the choices when three options are included in each choice. This may be analysed by comparing the results on tests in choice 1 and 6. Since dominance implies Sen's expansion property (β), failure of such test (in choice 6) but not the failure of dominance (in choice 1) may provide evidence of a complexity effect.

In Q8, Sen's strong expansion (β) and contraction (α) properties are tested in choices 2 and 8. Strong Sen's expansion property is tested using choices that are 6 choices apart (choices 1 and 8). In Q6, strong Sen's expansion property is tested using choices that are 1 choice apart (choices 2 and 4). This may be used to test whether differences in these tests results arise due to the length of the questionnaire or the number of choices between the test choices. In Q8 a dominance test is also included to compare the results between this test and the strong versions of Sen's α and β properties. If the dominance test is satisfied but Sen's tests are not, it may give evidence of failures due to the complexity of choosing between three (non-dominant) options rather than "irrationality" of choice.

In Q10, dominance and Sen's weak contraction and expansion properties are tested. The dominance test included in choices 1 and 10 is the same. This dominance test is also the same as the one in Q8 (choice 6). This may allow testing whether differences in the dominance test arise due to the length of the questionnaire. Comparing the results of Sen's weak expansion and contraction properties in Q10 and Sen's strong expansion and contraction properties in Q8 may allow testing the effect of task complexity and the effect of conflicting criteria on the rationality results, i.e. if higher "irrationality" is found in the tests in Q8 (which a priori may be expected) this may be due to a higher complexity of the tasks implied when comparing non-dominant options (if respondents to both types of questionnaires are not significantly different). The choice gap between the test choices is the same in both questionnaires to avoid a "length of questionnaire" effect.

Following Sen's argument (Sen, 1993) it is not sufficient just to test for rationality. Consideration must be given to 'external' factors which may influence choice. A possible way of doing so is by asking respondents their reasons for the choices they make in choices involving a rationality test. The aim of such questions as well as the design of the questionnaires is to distinguish 'true irrationality' from 'observed irrationality'. This is a key element when analysing rationality of choice.

Figure 1. The three types of questionnaires used in the study



6. Discussion and conclusions

This paper is an attempt to discuss the issue of rationality in experimental studies with specific reference to DCEs. Given the theoretical character of the stated preference (SP) techniques used in health economics to measure preferences, the rationality of such experiments is usually analysed by carrying out internal consistency tests. Alternative approaches are proposed here to measure the rationality of choice in DCEs. These tests are based on definitions of rationality in the revealed preference theory. Given the limitations imposed by using SP methods, it is understood that the tests are not applied on all the possible choice sets in a given experiment. This may impose limitations on the conclusions that may be derived from the results on the tests, i.e. if the results show a good level of rational responses, it may be argued that the results are obtained for a reduced number of subsets our of all the possible ones (however this is the case for any consistency test). Also, this may impose limitations on the conclusions that can be obtained about the preference relations generating choice functions. However the tests used are not intended to be applications of the revealed preference theory axioms but have been used instead as "inspiration" of what other desirable conditions of rationality can be applied and tested in DCEs. Moving on from the tests that have been carried out to date in health economics, it is argued that just applying some rationality (internal consistency) criteria is not enough to find out whether respondents are inconsistent or not. Hence, in the proposed study, the three questionnaires are designed to control for the effect of the questionnaire design on the rationality tests results. Also, by asking respondents their reasons for their choices, we may be able to distinguish between "true irrationality" and "observed irrationality". Finally socio-economic information will be obtained from the responses which may allow to find out whether differences in the tests results are due to differences between respondents. The way that such "irrational" responses should be handled will depend on which is the reason explaining "irrational" responses. In general, it is argued that dropping inconsistent respondents without analysing external factors to choice, may not be appropriate and may have a negative effect on the results.

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