Reference-Dependent Preferences and Loss Aversion: A Discrete Choice Experiment in the Health-Care Sector

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ABSTRACT

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A Discrete Choice Experiment (DCE) in the health-care sector is used to test the loss aversion theory that is derived from reference-dependent preferences: The absolute subjective value of a deviation from a reference point is generally greater when the deviation represents a loss than when the same-sized change is perceived as a gain. As far as is known, this paper is the first to use a DCE to test the loss aversion theory. A DCE appears to be a highly suitable tool for this testing because it estimates the marginal valuations of attributes, based on *deviations from a reference point* (a constant scenario). Moreover, loss aversion can be examined for *each attribute separately*. A DCE can also be applied to *non-traded goods with non-tangible attributes*. A health-care event is used for empirical illustration: The loss aversion theory is tested within the context of preference structures for maternity-ward attributes, estimated using data entailing 3850 observations from a sample of 542 women who recently gave birth. Seven hypotheses are presented and tested. Overall, significant support for behavioral loss aversion theories was found.

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REFERENCE-DEPENDENT PREFERENCES AND LOSS AVERSION:

A DISCRETE CHOICE EXPERIMENT IN THE HEALTH-CARE SECTOR

1   Introduction

A person's valuation of the benefit from an outcome of a choice is often determined by the intrinsic 'consumption utility' of the outcome itself, combined with its contrast with a reference point. The most noteworthy manifestation of such reference-dependent preferences is loss aversion: the absolute subjective value of a change in an endowment is generally greater when the deviation from the reference point represents a loss than when the same-sized change is perceived as a gain.

The most systematic general theory of this kind is probably Tversky and Kahneman's (1991) reference-dependence model, which builds on Kahneman and Tversky's (1979) *Prospect Theory*. Recently, Koszegi and Rabin (2006) presented an extended model of reference-dependent preferences and loss aversion, which is claimed to be more generally applicable. The 'loss aversion' assertion was shown to provide an elegant explanation for a wide set of behavioral phenomena. Famous examples are the 'endowment effect' (Kahneman et al., 1990); the 'status quo bias' (Samuelson and Zeckhauser, 1988); and the 'equity premium puzzle' (Benartzi and Thaler, 1995). Other studies that present evidence supporting the loss aversion hypothesis include: Hartman et al, 1991; Hardie et al, 1993; Andreoni, 1995; Camerer et al, 1997; Myagkov and Plott, 1998; Bowman et al, 1999; Jullien and Scilanie, 2000; Genesove and Mayer, 2001. The significance of loss aversion is highlighted in Camerer's (2000) review of the practical implications of 'prospect theory': seven out of the ten examples are derived from the loss aversion hypothesis[1].

What is the reference point that is used by the individual to evaluate gains ('positive' deviations) versus losses ('negative' deviations)? The majority of the empirical studies examined traded goods, and the reference point was the endowment of the commodity under consideration. Expectations were mentioned by other researchers as candidates for the reference point: Shalev (2000) used expectations in his game-theoretic model; and Koszegi and Rabin (2006) assumed that a person's reference point is her rational expectations held in

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[1] The two other main behavioral assertions that are captured by 'prospect theory' are: The certainty/possibility effect (overweighting of low probability outcomes) and the diminishing sensitivity (risk aversion in the gain domain and risk seeking in the loss domain). These two assertions are described before the presentation of the theory and are motivated with simple experiments. The loss aversion assertion is added during presentation of the theory and is not supported by experimental data (Ert and Erev, 2007).

the recent past about outcomes. They specified a rule for the endogenous derivation of this point, within the framework of an equilibrium utility-maximizing model.

This empirical study takes a new and different approach to the definition of the reference point and the testing of the loss aversion hypothesis. Discrete Choice Experiments (DCEs) are used for the estimation of a preference structure for a multi-dimensional consumption good or service, by establishing the relative importance of different attributes in the provision of the good/service under discussion, vis-à-vis a constant reference bundle. It follows that the employment of a DCE also facilitates the *testing of the loss aversion hypothesis for each attribute separately*. The decomposition into attribute-specific components adds richness and insight: It is not obvious that people are loss-averse regarding all kinds of attributes and there are most probably different degrees of loss aversion, which can be compared across attributes. As far as is known, this is the first published study that employs DCEs to test attribute-specific loss aversion that is derived from reference-dependent preferences.

The empirical illustration presented in this paper relates to a DCE that was conducted among 542 women who recently gave birth. Their preferences for five maternity-ward attributes (number of beds in hospital room; attitude of staff toward the patient; medical staff's professionalism; information transfer from staff to patients; and travel time from residence to hospital) were estimated and loss aversion was tested for each of the attributes separately.

Unfolding the existence and the degree of loss aversion of attributes can help planners of a public service, such as a health care service, design policies that will increase the patients' utility and thus better allocate the scarce health resources.

The main results of the study were that the loss aversion hypothesis was confirmed for four of the five hospital attributes investigated. The results were less conclusive for 'travel time from residence to hospital'.

The following section describes the DCE method employed for estimation. The third section presents the econometric model, followed by the hypotheses derived from the loss aversion theory. The preference structures used to test the outlined hypotheses are presented in section 5. The last section concludes and poses questions that merit further research.

2   Methodology

The statistical tool used to elicit preferences and detect loss aversion was a Discrete Choice Experiment[2], which was conducted in maternity-wards in three large public hospitals located in the Greater Tel-Aviv area in Israel. Women who had given birth were approached by interviewers and requested to fill out a questionnaire. In the questionnaire, DCE was used to present individuals with a series of pairs of hypothetical scenarios (maternity-wards), which were described in terms of some relevant attributes with different levels in the various scenarios. For each pair of scenarios the subjects were asked to choose which they prefer. It is assumed that subjects will choose the alternative that provides the higher level of utility. A DCE setup is appropriate for the analysis of public health-care services such as a delivery where relevant revealed-preference data are unavailable[3]. It is also especially appropriate for the assessment of utilities of intangible characteristics, such as, information transferred from supplier to purchaser or attitude of supplier/staff.

The attributes, their levels and the wording used in the questionnaire to describe the attributes and levels, were determined during three preliminary stages: (i) A literature survey (the most relevant studies are: McGuirk and Porell, 1984; Rahtz and Moore, 1988; Bronstein and Morrisey, 1991; Phibbs et al., 1993; Brown and Lumley, 1994; Wilcock et al., 1997; Janssen et al., 2000; Sadler et al., 2001); (ii) in-depth face-to-face interviews with ten women who had recently given birth; and (iii) a pilot study involving 48 women.

The following attributes (levels) were identified: (a) number of beds in hospital room (three beds; two beds; or a private room), (b) attitude of staff towards the patient (reasonable; very good), (c) medical staff's professionalism (good; very good), (d) information transfer from staff to patient (basic; extensive), and (e) travel time from residence to hospital (45; 30; or 15 minutes).

The levels of the first attribute - number of beds in hospital room - relate to the current facilities in most Israeli maternity-wards, where a standard room has two or three hospitalization beds. There are few private rooms and some hospitals have also rooms with more than three beds. A private room as one of the options could also have policy implications: if it will be found that a being hospitalized in a private room leads to a

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PT[2] TP DCEs were first introduced in Mathematical Psychology (Luce and Tukey, 1964; Green et al., 1972) and then adopted by economists for use in the fields of transportation (e.g., Wardman, 1988), environment (e.g., Opaluch et al., 1993), marketing (e.g., Cattin and Wittink, 1982 who survey the marketing literature), and recently in health (e.g., Ryan and Hughes, 1997; Bryan et al., 1998; Ryan et al, 1998a, 1998b; Vick and Scott, 1998; Salkeld et al., 2000; San Miguel et al., 2002; Scott, 2002).

PT[3] TPIsrael has a public health-care sector. Hospitalization data have been used to represent revealed preferences, but they suffer from basic statistical and methodological problems.

significant increase in utility, hospitals might consider favorably the costly transformation of multi-bed hospitalization rooms into one-bed rooms.

The three qualitative attributes – attitude of staff, professionalism of staff, and transfer of information – have two similar levels each. The levels are similar but not identical – the gap between 'reasonable' and 'very good' is larger than between 'good' and 'very good', because hospitals are believed to be more diverse in terms of attitude of staff than in terms of professionalism. Diversity is prevalent also in terms of information transfer and therefore the two levels are 'basic' and 'extensive'. The pilot survey and the pilot interviews indicated that uniformity simplifies the task of choice between scenarios and that respondents were fully aware of the gap between the two levels that were assigned to each of the attributes.

Travel time has the levels of 15, 30 and 45 minutes to reflect the fact that actual travel time is relatively short because several hospitals are located in the center of the country (the average *actual* travel time of the respondents from residence to the maternity-ward was 19 minutes, with minor differences between the three hospitals: 23, 20 and 16 minutes to each of the hospitals, respectively). A gap of 15 minutes between two successive levels seems therefore reasonable.

A full factorial design that will use all possible combinations of attributes gives rise to 72 scenarios ($2^3 * 3^2 = 72$; 2 attributes have 3 possible levels each, and each of the other 3 attributes has 2 alternative levels). In order to reduce the number of scenarios to a manageable size, the SPSS Orthoplan procedure was used to provide a fractional factorial orthogonal design. The procedure's application gave rise to 16 different scenarios, each representing a hypothetical maternity-ward. If all 16 options were pair-wise compared, a large number of possible discrete choices would emerge. To overcome this difficulty, one scenario was randomly chosen to be constant throughout the questionnaire (scenario A1) and each of the remaining 15 scenarios was compared to this chosen scenario, concluding in 15 pair-wise combinations. One pair of scenarios had a 'dominant option' (one alternative had superior or identical levels for all attributes) and was used to test for 'internal consistency'[4]. Realizing that it is difficult for women who recently delivered to cope with 15 complex pair-wise choices, the 15 paired combinations were split into two subsets. The 'dominant option' was included in each subset, thus giving rise to two questionnaires each with eight choices. The two subsets were randomly distributed among the respondents.

PT[4] TPA few women, who failed the test by preferring the inferior alternative, were excluded from the sample.

As will be elaborated below, the constant scenario serves as the respondent's reference point. One of the devices that will be used for the testing of the loss aversion theory is a comparison of preference structure that are based on different reference points (constant scenarios). For this purpose, we also experimented with an alternative constant scenario (A2) that was too randomly chosen from the full set of 16 orthogonal scenarios. Four 'dominant options' were detected within the 15 paired combinations. Three were excluded and one left for the 'internal consistency' test. The remaining pairs of scenarios were also split into two subsets with six or seven choices, respectively (the 'dominant option' was included in the two subsets) and distributed randomly among the interviewed women. The questionnaires based on each of the two constant wards, are Type 1 and Type 2 questionnaires. Table 1 presents the two alternative constant scenarios (A1 in Questionnaire Type 1 and A2 in Questionnaire Type 2).

Table 1 -- about here

Not all attributes changed levels in the two constant hypothetical scenarios: The attributes of 'attitude' and 'information' displayed the same level in A1 and A2, while 'Professionalism' appeared at the lower level (good) in Questionnaire Type 1 and at the higher level (very good) in Questionnaire Type 2. 'Number of beds' and 'travel time' was found on the middle level (out of 3 options) in Questionnaire Type 1 and yet on the least desirable level in Questionnaire Type 2.

Exhibit 1 contains an example of two of the pair-wise combinations presented to the respondents who filled out Questionnaire Type 1.

Exhibit 1: Discrete Choice Questions

Type 1 Questionnaire

You can choose for a delivery, either Ward A1 or Ward B. They differ with respect to a number of attributes.

- Assume that all other attributes (on top of the 5 listed ones) are identical in the two wards.
- In each question, Ward A1 is the same and ward B is different.
- Which ward would you prefer? (Please tick box below).
- Please answer all questions.

Question 1

Attributes	Ward A1 (constant)	Ward B
Number of beds	2 beds	private room (1 bed)

Attitude of staff (towards you)	reasonable	reasonable
Professionalism of staff	good	good
Information	extensive	extensive
Travel time to hospital	30 minutes	45 minutes

Prefer Ward A1   Prefer Ward B

Question 2

Attributes	Ward A1 (constant)	Ward B
Number of beds	2 beds	3 beds
Attitude of staff (towards you)	reasonable	reasonable
Professionalism of staff	good	good
Information	extensive	basic
Travel Time to hospital	30 minutes	15 minutes

Prefer Ward A1   Prefer Ward B

In hypothetical Ward B, one or more of the attributes were 'better' than in the constant hypothetical Ward A1 (representing a 'gain'), one or more attributes were 'worse' (representing a 'loss') and the rest identical. In Question 1: Moving from A1 to B results in one 'gain' and one 'loss', whereas in Question 2 the move leads to two 'losses' and one 'gain'. The respondent is in effect referring to scenario A1 as a reference point while considering deviations from A1 to B. She therefore must consider the gains versus the losses and trade-offs between the attributes when making her quite complex choices. The same applies to interviewees who completed Questionnaire Type 2: they refer to the constant hypothetical scenario A2 as their reference point.

3   The Econometric Model

Assuming a linear utility function, the marginal change in utility when moving from A[5] to B is given by

$$(1) \quad \Delta U_{A \to B} = \sum_{i=1}^{n} \beta_i X_i + u_i + \varepsilon \quad ;$$

The observed value of the dependent variable of the estimated preference equation (ΔU) is dichotomous and takes the value of 1 if maternity-ward B is chosen and the value of 0 if maternity-ward A is preferred.

The independent variables are the X_is, where X_i is the *difference* in the level of attribute í between B and A. They express changes from the reference level of the constant scenario and are outlined in Table 1. Each of the two three-level quantitative attributes was defined using two dummy variables (see note to table 1).

β_i are the parameters of the model that represent *marginal utility scores* (relative importance) of the attributes; u_i is the error term that represents differences between the various choices of the same respondent (each respondent provides 6-8 discrete choice observations); and ε is the error term representing differences between respondents. To account for the fact that each respondent makes several choices, a Random-Effects Probit was used for estimation.

The data compiled from the completed questionnaires of the two types were used to estimate two sets of *main-effects regressions.*

4   The Loss Aversion Hypotheses

A central statement of the loss aversion theory is that utility is reference-dependent and individuals value losses (vis-a-vis the attribute's reference level), significantly more (in absolute terms) than they value same-sized gains: e.g., adding one bed to the number of beds in the reference constant scenario (loss) leads to a larger decrease in utility than the increase in utility that is associated with the removal of one bad (gain). The very rich data set, generated by the discrete choice experimental design, is used to test several hypotheses, all derived from the reference-dependence assertion.

Two complementary approaches were employed for testing hypotheses: The first was a comparison of the marginal valuation (utility scores) of positive versus negative same-sized

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PT[5] TP The constant hypothetical scenario A is denoted by A1 in Questionnaire Type 1 and by A2 in Questionnaire Type 2.

deviations of attributes from the constant scenario. Such comparisons can be performed for attributes that exhibit at least three possible levels, with the constant scenario including the middle level. The utilities of same-sized positive and negative deviations can then be compared. If individuals are loss-averse, the disutility of negative deviations will be larger than the utility of positive deviations;

The second approach was the use of two questionnaire types, based on different constant scenarios (A1 and A2): If the respondent was referring to the constant maternity-ward as her reference point, then different constant scenarios should lead to different estimated utilities for the same attribute. A comparison of the preference structures estimated using data generated by the two questionnaires facilitates statistical testing of loss aversion theory. For instance, assume that a two-level attribute x has different levels in the two alternative constant scenarios: In the first questionnaire it exhibits the less favorable level and in the second it exhibits the more desirable one. It is expected that estimates of the marginal utility score of x based on data generated by the first questionnaire will be smaller than the respective estimates when based on data from the second questionnaire. The justification for this conclusion rests on the fact that in the first case a deviation represents a 'gain' vis-à-vis the reference point whereas in the second case, a deviation represents a 'loss'. The DCE is therefore a powerful instrument for soliciting preferences in general and loss aversion components in particular.

Exhibit 2 summarizes the seven hypotheses that are derived from loss aversion theory. For the sake of clarity, the attribute levels of the constant scenarios in the two types of questionnaires (A1 and A1), as well as the definition of all possible attribute levels, are repeated.

Exhibit 2: Loss Aversion Hypotheses

The following table outlines the levels of the constant scenarios that are used in the two types of questionnaires, as well as all possible attribute levels. Based on this information, seven testable hypotheses that are derived from loss aversion theory are formulated.

Attributes	Constant ward A1 (Type 1 Questionnaire)	Constant ward A2 (Type 2 Questionnaire)	All possible levels
Number of beds	2 beds	3 beds	1, 2, 3 beds
Attitude of staff	reasonable	reasonable	reasonable, very good
Professionalism of	good	very good	good, very good

Information	extensive	extensive	basic, extensive
Travel time to hospital	30 minutes	45 minutes	15, 30, 45 minutes

In Type 1 Questionnaire the attributes 'number of beds' and 'travel time' exhibit the **middle level in the constant ward A1**, facilitating the following hypotheses that are based on the coefficients of Type 1 regressions:

Hypothesis 1: The coefficient of the dummy variable for '3 beds', that represents a loss, will be significantly larger (in absolute value) than the coefficient of the dummy variable '1 bed' that represents a same-sized gain.

Hypothesis 2: The coefficient of the dummy variable for 'travel time of 45 minutes' that relates to a loss, will be significantly larger (in absolute terms) than the coefficient of the 'travel time of 15 minutes' dummy variable that relates to the same-sized gain.

Turning to a **comparison of regression coefficients based on data generated by the two questionnaires**, the following hypotheses can be derived:

Hypothesis 3: The coefficients of 'attitude of staff' will not statistically differ by questionnaire type, as in the two questionnaire types they represent the valuation of a gain in attitude.

Hypothesis 4: The coefficients of 'information' will not statistically differ by questionnaire type, as in the two questionnaire types they represent the valuation of a loss in information.

Hypothesis 5: The coefficient of 'professionalism of staff' will be significantly larger in the regressions based on Type 2 Questionnaires where it relates to the valuation of a loss (moving from 'very good' to 'good', represented by a difference of -1), whereas in the regressions based on Type 1 Questionnaires it represents the valuation of a gain (moving from 'good' to 'very good', represented by a difference of +1).

Hypothesis 6: A larger absolute coefficient for '3 beds' (a loss of one bed compared to the '2 bed' reference level) in the regression based on Type 1 Questionnaires will be obtained, in comparison to the coefficient of 'two beds' (a same-sized gain vis-à-vis the '3 bed' reference level) in the regression using the Type 2 Questionnaire data.

Hypothesis 7: The coefficient that relates to 'travel time of 45 minutes' in Type 1 regression (moving from '30 minutes' in the reference level to '45 minutes', that relates to a loss of 15 minutes) is expected to be significantly larger (in absolute terms) than the coefficient of 'travel time of 30 minutes' in Type 2 regression (same-sized gain, moving from the reference level of '45 minutes' to '30 minutes').

The hypotheses testing will be based on the preference structure for maternity-ward attributes that were estimated using the data generated by the two types of questionnaires.

5   Results

Five hundred and forty-two (542) women who had given birth in three large public hospitals located in the Greater Tel-Aviv area in Israel[6] comprised the primary study sample. They

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[6] Beilinson (in Petach Tikva), Sheba (in Ramat-Gan) and Meir (in Kfar Saba).

were surveyed while still in the hospital maternity-wards, by interviewers who provided explanations and instructions[7]. The overall response rate was about 50% and 542 questionnaires have been fully completed. Questionnaire Type 1 has been filled out by 219 women (109 and 110 women completed the two sub-versions, respectively), with a total of 1751 observations. Questionnaire Type 2 has been completed by 323 women (161 women completed the first version and 162 the second one), with 2099 observations.

The age range of the participants in the sample was 18–47: average age was 31. Four percent were aged over 40. Thirty-one percent of the interviewees were experiencing their first delivery; the rest, 69%, had had two or more deliveries. Over one quarter (28%) had undergone high-risk pregnancies. The socio-economic characteristics of the sample were representative of the general Israeli population for the relevant age group (see Appendix 1for details).

5.1 *Main-effects preference structures*

Table 2 presents the main-effects preference structure of maternity-ward attributes. Before examining if our respondents are loss-averse, by testing the seven hypotheses that were formulated above, it is instructive to investigate their preferences for these attributes. However, these two issues are intertwined: if loss aversion is in evidence, then the estimated preference structure will depend on the reference point (constant scenario) and data generated by experiments that are based on different reference points, will lead to different preference equations.

Table 2 -- about here

Indeed, Table 2 indicates that the two respective preference structures differ, not only in size of attribute coefficients but also in the ranking of attributes' utility: The most striking difference is related to the room facilities. In Type 2 regressions the two dummy variables that relate to the number of beds are not significant, indicating that the interviewed women do not gain utility from a decrease in the number of beds (from 3 beds to 2 beds and even to a private room). But, in Type 1 regressions a change in the number of beds has a significant effect on utility (or disutility): moving from a two-bed room to a three-bed room results in a significant

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drop of 0.711 in utility score (Z=8.32), and improving the room conditions from a two-bed room to a private room leads to a significant increase in utility (coefficient of 0.214, Z=2.29).

5.2 *Testing the loss aversion hypotheses*

Exhibit 3 summarizes the tests and conclusions of the seven hypotheses outlined above. The significance of the difference between respective coefficients of the two regression equations (Table 2) are derived from a χ^2 test for equality of coefficients.

Exhibit 3: Loss Aversion Hypotheses - Results

The following table summarizes the relevant regression results and the conclusions of seven hypotheses outlined in Exhibit 2.

Hypotheses	Regression Results	Conclusion: Hypothesis…
1. In Type 1 regression: absolute coefficient of '3 beds' (loss) > coefficient of 'private room' (gain)	0.711 > 0.214 significant difference	accepted
2. In Type 1 regression: absolute coefficient of '45 minutes' (loss) > coefficient of '15 minutes' (gain)	not significantly different (β s of 0.327 and 0.508)	not accepted
3. coefficient of 'attitude' in Type 1 regression (gain) = coefficient of 'attitude' in Type 2 regression (gain)	not significantly different (β s of 1.169 and 1.457)	accepted
4. coefficient of 'information' in Type 1 regression (loss) = coefficient of 'information' in Type 2 (loss)	not significantly different (β s of 0.588 and 0.840)	accepted
5. coefficient of 'professionalism' in Type 1 (gain) < coefficient of 'professionalism' in Type 2 (loss)	1.165 < 1.815 significant difference	accepted
6. absolute coefficient of '3 beds' in Type 1 (loss) > coefficient of '2 beds' in Type 2 (gain)	0.711 > 0.052 (the latter not significant)	accepted
7. absolute coefficient of '45 minutes' in Type 1 (loss of 15 minutes) > coefficient of '30 minutes' in Type 2 (same-sized gain)	not significantly different (β s of 0.327 and 0.479)	not accepted

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Discussion of the results follows:

Hypothesis 1: In Type 1 regressions: The absolute coefficient of the dummy variable for '3 beds' is more than three times larger compared to the coefficient of a 'private room' (respective coefficients of -0.711 and 0.214), indicating that a loss (one bed more) is much

more appreciated than a same-sized gain (one bed less) and thus supporting Hypothesis 1. Moreover, the results based on the Type 2 Questionnaire indicate that gains are not significantly valued at all. A two-bed hospital room or even a private room are not valued more than a three-bed room (the A2 scenario reference level), as is demonstrated by the insignificant coefficients of the two dummy variables.

Hypothesis 2: Hypothesis 2 that traveling 15 minutes more (a loss in relation to the reference level of 30 minutes) is more negatively valued than traveling 15 minutes less (a gain), is not supported. As Type 1 regressions indicate, the difference between the coefficients of the two dummy variables in not significant (at a 0.05 significance level), indicating that the interviewed women have a similar valuation of a loss and a same-sized gain.

Hypothesis 3: We find support for Hypothesis 3 that argues that the coefficients of 'attitude of staff' are not significantly different in the two regressions, based on Type 1 and Type 2 Questionnaires (P=0.289, for the test of equality of coefficients)[8]. The two coefficients represent a gain compared to the identical reference point in the two questionnaires that is 'reasonable attitude' and therefore give an estimate of the marginal utility score of a gain in attitude.

Hypothesis 4: Hypothesis 4 is also supported as the difference between the corresponding coefficients of the 'information' attribute in Type 1 and Type 2 regressions is not significant (P=0.120). In the two questionnaires this attribute is assigned the same level of 'extensive information', indicating that the estimated coefficients relate to the marginal valuation of a loss of information, from 'extensive' to 'basic'.

Moreover, combining the two pieces of evidence, namely that the marginal utility score of the 'attitude' attribute relates to a gain in attitude, while the marginal utility score of 'information' is associated with a loss in information (that is more highly valued than a gain), we can speculate that using the difference between the corresponding coefficients in order to evaluate the difference in the valuations of 'attitude' and 'information' is an underestimation and gives a lower-limit for the difference. Had 'information' also been associated with a gain, we would have arrived at a larger difference, i.e. at the conclusion that the attribute of 'attitude' ranks much higher than the attribute of 'information' (with a larger difference than is indicated by our preference equations).

PT[8] TP Based on a x^2 Test for significance between coefficients of two regressions. Not reported in the table.

Hypothesis 5: The coefficient of 'professionalism' is indeed significantly larger in Type 1 regression, thus supporting Hypothesis 5: there is a positive significant difference of 0.65 (P=0.00). These results are explained by the fact that in the data of Type 1 questionnaires a gain versus the reference level is in evidence (a change from 'good' to 'very good'), while is the data of Type 2 questionnaires the deviation from the reference scenario is associated with a loss (a change from 'very good' to 'good').

Hypothesis 6: The marginal utility score of '3 beds' in responses to Type 1 Questionnaire (absolute value of 0.711) is 14 times (!) larger compared to that of '2 beds' in the responses to the Type 2 Questionnaires (0.052, not significant). The former represents a loss compared to the '2 bed' reference level, while the latter manifests a gain versus the '3 bed' reference level. It appears that a gain, in terms of fewer beds in the room, is not appreciated by the women in our sample while a loss (more beds) is painful and highly (negatively) valued. This is a very distinct reconfirmation of the asymmetry between gains and same-sized losses.

Hypothesis 7: The difference between a 15-minutes gain in travel time (a decrease from 45 minutes to 30 minutes, Type 2 regression) and a same-sized loss (an increase from 30 to 45, type 1 regression) is not statistically significant (P=0.30). Hypothesis 7 is therefore not supported.

This result is consistent with the rejection of Hypothesis 2 and also with the observation that in the Type 2 regression, insignificant differences were found between the valuations of 15 and 30 minutes less travel time, i.e. the two different gains in time have a similar marginal utility score.

To conclude, five of the seven hypotheses have been supported by the regression results, indicating that loss aversion is relevant for the attributes of 'professionalism' 'attitude' 'information' and in particular 'number of beds in hospital room'. The rest two hypotheses, which relate to the 'travel time' attribute, did not obtain support but have not been reversed either. The inconclusive results for the 'travel time' attribute could be related to the small time interval between consecutive levels (15 minutes). The deviation of 15 minutes is probably not large enough to be conclusively or meaningfully evaluated as a loss or gain. Experimenting with larger deviations (e.g., of 30 minutes in each direction) could lead to a significant difference. Could also be that travel time is a minor factor within the maternity ward preference structure because the participants had experienced only two short episodes of travel (to the maternity ward and back home), leading to neutrality between the (absolute) valuation of a loss and a gain.

6   Summary and Discussion

In this study, DCEs were used to estimate preference structures for maternity ward attributes, which were later used to test seven hypotheses derived from the loss aversion theory. The data used for the estimation and testing reported here were based on two experiments conducted on large samples of 219 and 323 Israeli women, respectively (resulting in 1751 and 2099 discrete choice observation sets, respectively), interviewed in maternity wards

A DCE appears to be a highly suitable tool for loss aversion testing because it estimates the marginal valuations of attributes, based on *deviations from a reference point* (a constant scenario). Moreover, loss aversion can be tested for *each attribute separately* rather than for the service as a whole. The DCE method can also be applied to a *non-traded service having non-tangible attributes*, which implies its flexibility[9].

Loss aversion theory was confirmed for four of the five hospital attributes investigated. The results were less conclusive for 'travel time', probably because traveling is only a short and perhaps marginally meaningful episode for this specific sample population.

Our results in support of the loss aversion theory are even more pronounced and impressive in face of the fact that the respondents who were asked to choose between the pair-wise combinations of five attributes, made complex decisions, requiring instantaneous consideration of several 'losses' and 'gains'. Despite the complexity of the decision making and the (perhaps) sensitivity of their situations, statistically significant results were obtained, supporting the validity of the loss aversion theory.

The existence of loss aversion also implies that the choice of the constant scenario used in a DCE affects the estimated preference structure obtained: that is, different constant reference sets result in different preference structure estimates, if not in changes in the attributes' ranking. It follows that reports of preference structures should include descriptions of the

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PT[9] TP DCEs belong to a set of field experiments that are employed in the social sciences. Field experiments represent an empirical approach that bridges laboratory data and naturally occurring data (see List, 2006, for a discussion of the methodological contribution of field experiments and a comprehensive overview of the different types of these experiments that are employed in the fields of: Markets; The Economics of Charity; Environmental Economics; Development Economics; and Discrimination). Unlike laboratory experiments, DCEs do not involve any financial incentives for performance and respondents are not paid for answering. This strategy is in line with psychologists' view that intrinsic motivation is usually high enough to produce steady effort even in the absence of financial rewards; and that while more money may stimulate more effort, the effort does not always improve performance, especially if good performance requires subjects to induce spontaneously a principle of rational choice or judgment. On the other hand, economists presume that experimental subjects do not work for free and they work harder, more persistently, and more effectively, if they earn more money for better performance. Camerer and Hogarth (1999), who reviewed 74 experiments with no, low, or high performance-based incentives, basically found no effect of financial rewards on mean performance (although variance is usually reduced by higher payment).

constant reference scenario in order to facilitate an accurate description of the coefficients and a distinction between coefficients that present valuations of gains and those that relate to valuations of losses. Moreover, there are DCEs where the respondent is faced with pairs of scenarios that do not include a constant scenario. In this case, each discrete choice involves a different reference point and the coefficients of the estimated preference equation represent some weighted average of loss and gain valuations. Such experiments do not allow the hypotheses testing suggested in the fourth section; furthermore, the regression results are not very meaningful.

Three unsolved questions merit further study:

The first: *what affects the existence and magnitude of loss aversion regarding the various attributes of a composite commodity?* Is it possible to detect which attribute will be subject to a higher level of loss aversion when compared to the others? Our data indicated that 'travel time' is not subject to loss-averse preferences and that differences arose in the valuation of a 'gain' versus a 'loss' between the other four attributes. Further research, involving additional case studies of varied composite commodities or services, could lead to greater generalization of the results.

A second unresolved question is: *What is the role of experience?* Economists have claimed that loss aversion will erode as individuals accumulate more experience[10]. In most health-care events not much experience can (fortunately) be accumulated; hence the effect of repeated observations cannot be tested and becomes irrelevant[11]. Repeated experiences can be observed mainly when a patient had a series of treatments or a sequence of health diagnostic tests (e.g. pap smears, blood tests, EKG tests). Experiments conducted among people with chronic conditions can therefore be used to examine the effect of experience on the possible erosion of loss aversion.

Third and finally: *Are there gender differences in loss aversion?* Obviously, our sample, which was composed only of women and pertained to a distinctively feminine scenario – a maternity ward – cannot resolve this issue. However, the conduct of a similar study among men could shed some light on this interesting question.

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[10] Economists have referred mainly to the experience of selling and buying experience as reflected in the market place.
[11] More specifically, women do not have many repeated experiences with deliveries (the average number of children in Israel is 2.3. In European even less experience is evidenced).

Appendix 1:

Socio Economic characteristics of the sample

The socio-economic background of the respondents is representative of the Israeli general population in this age group (18 – 47).

The average age is 30.65 (10% were aged below 25 and 4% above 40).

The ethnic composition of the sample resembled the ethnic stratification in the Israeli population: 26% were born in Asian/African countries (referred to as Easterners or Mizrachim); 33% were born in European or English-speaking countries (referred to as Westerners or Ashkenazim); and the remaining 41% were native Israelis. The women were highly educated, with almost half (46%) having earned an academic degree; only 4 (less than 1%) out of 542 women had not studied beyond elementary school. The questionnaire also included questions on personal and household income. As all women were on maternity leave, many declared themselves as 'not working'. As to household income: 36% reported 'above average'; 56% - average; and 8% - below average income.

The respondents were also asked to relate to their religious affiliation: About half said they were secular, one quarter traditional and one quarter observant or ultra religious.

Despite the fact that Israel is an immigrant-absorbing country, only 8 (1.5%) of the women participating in the research had arrived less than 5 years previously. New immigrants are most probably under-represented in our sample because the questionnaire was in Hebrew and they had difficulties with its completion.

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TABLE 1: Attributes, Levels and Coding in Type 1 and Type 2 Questionnaires

Maternity-ward attributes	Ward A1 (Type 1 constant)	Ward A2 (Type 2 constant)	Ward B (all alternatives)	Coding of all alternatives	X_i Type 1 (Value of independent variable = difference B-A1)	X_i Type 2 (Value of independent variable = difference B-A2)
Number of beds in room	2 beds	3 beds	3 beds	3	+1 (loss)	0
			2 beds	2	0	-1 (gain)
			Private room	1	-1 (gain)	-2 (gain)
Attitude of staff (towards the patients)	reasonable	reasonable	reasonable	0	0	0
			very good	1	+1 (gain)	+1 (gain)
Professionalism of staff	good	very good	good	0	0	-1 (loss)
			very good	1	+1 (gain)	0
Transfer of information from staff to patient	extensive	extensive	basic	0	-1 (loss)	-1 (loss)
			extensive	1	0	0
Travel time to hospital	30 minutes	45 minutes	45 minutes	2	+1 (loss)	0
			30 minutes	1	0	-1 (gain)
			15 minutes	0	-1 (gain)	-2 (gain)

Note: 'Number of beds' was defined by two dummy variables: '3 beds versus 2 beds' and 'private room versus 2 beds' in Type 1 regressions; and by '2 beds versus 3 beds' and 'private room versus 3 beds' in Type 2 regressions. 'Travel time to hospital' included the two dummy variables of '15minutes versus 30 minutes' and '45 minutes versus 30 minutes' in Type 1 regressions; and '30 minutes versus 45 minutes' and '15 minutes versus 45 minutes' in Type 2 regressions.

TABLE 2: Main-Effects Regressions with Two Different Constant Scenarios:

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Explanatory variables Type 1 Questionnaires	Coefficients – Type 1 Questionnaires	Explanatory variables Type 2 Questionnaires	Coefficients – Type 2 Questionnaires
Number of beds (reference: 2 beds)		Number of beds (reference: 3 beds)	
Three beds (1 more)	-0.7115 (8.32)	Two beds (1 less)	0.0523 (0.67)
Private room (1 less)	0.2137 (2.29)	Private room (2 less)	0.1097 (1.38)
Attitude (reasonable=0; very good=1)	1.1691 (14.69)	Attitude (reasonable=0; very good=1))	1.4567 (17.11)
Professionalism of staff (good=0; very good=1))	1.1655 (15.76)	Professionalism of staff (very good=0; good=-1)	1.8154 (20.34)
Information (extensive=0; basic=-1)	0.5882 (8.48)	Information (extensive=0; basic=-1)	0.8402 (11.61)
Travel time to hospital (reference: 30 minutes)		Travel time to hospital (reference: 45 minutes)	
45 minutes (15 more)	-0.3270 (4.13)	30 minutes (15 less)	0.4794 (5.69)
15 minutes (15 less)	0.5077 (4.89)	15 minutes (30 less)	0.5094 (5.25)
Sample size	1751	Sample size	2099
Number of women	219	Number of women	323
Log Likelihood	-800.25	Log Likelihood	-919.81
ρ	0.1816	ρ	0.4461
x^2 to test $\rho =0$ (significance level)	32.36 (0.00)	x^2 to test $\rho =0$ (significance level)	172.02 (0.00)
Note: The coefficients of the following pairs of attributes are not significantly different(at a significance level of 0.05):	Attitude and Professionalism; Time of 15 minutes more and of 15 minutes less (in absolute values); Information and Time of 15 minutes less; A private room and Time of 15 minutes more (in absolute value); Three beds and Information (in absolute value).	Note: The coefficients of the following pairs of attributes are not significantly different (at a significance level of 0.05):	Two beds and Private room; Time of 15 minutes less and Time of 30 minutes less.

Notes: - Z - statistics in parentheses.
- Stata 9 was used for estimation (Random-Effect Probit, with no constant).
- The constant set in Type 1 questionnaires has the following attributes: Number of beds – 2, Attitude – reasonable; Professionalism of staff – good; Information – extensive, Travel time – 30 minutes. The constant set for Type 2 questionnaires has the following attributes: Number of beds – 3; Attitude – reasonable; Professionalism of staff – very good; Information – extensive; Travel time – 45 minutes. The levels of Attitude and Information are therefore the same. Levels of all other attributes are different.
- The significance of the differences between the main-effects of two groups (not reported) are derived from a χ^2 test for equality of coefficients.