ESTIMATING MODELS OF DETERMINATION OF CONSUMER SATISFACTION: AN ALTERNATIVE APPROACH

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ABSTRACT

The main objective of this paper is to propose a different approach to analyze the functional relationship between the Satisfaction, Expectations and Disconfirmation variables within the framework of the theory of consumer satisfaction determinants. The approach suggested in this article presents significant advantages in comparison with those generally used in such analyses. First, it proposes a discrete formulation which does not impose, a priori, a definite form to the functional relationship between the dependent variable (Satisfaction), and the explanatory variables (Expectations and Disconfirmation). This is all the more important because different hypotheses have been put forward in the scientific literature on the nature of the relationship between these three variables. Second, it uses an ordered probit to estimate the model. The ordered probit offers, on theoretical grounds, a definite superiority over the multiple regression model because it does not presume cardinality of the values associated with the dependent variable (levels of satisfaction).

INTRODUCTION

Different theories have been put forward to explain the determinants of consumer satisfaction. It seems, however, that the theory based on the Expectations/Disconfirmation paradigm is one of the most commonly accepted. According to this theory, the level of satisfaction or dissatisfaction is considered the result of an evaluation process by which the consumer compares the perceived product performance with his previously held expectations about the commodity (or service). There is positive disconfirmation (D^+) when the product performs better than anticipated and negative disconfirmation (D^-) when the product performance falls short of expectations. When the product performance equals the consumer's expectations, disconfirmation is said to be null (D^o).

The Expectations (E) and Disconfirmation (D) variables appear explicitly in most of the models derived from this theory. Moreover, a formulation commonly used to test this theory implies that the greater the values associated with the Expectations and/or Disconfirmation variables, the higher the consumer satisfaction level (S) and conversely, the lower these same variables, the lower the level of consumer satisfaction (hypothesis H1) (Tse and Wilton 1988; Bearden and Teel 1983; Churchill and Surprenant 1982; Swan and Trawick 1981; Oliver 1980), which is to say that $\delta S/\delta E > 0$ and that $\delta S/\delta D > 0$, for any value of E and D.

However, as Kamins and Assael (1987) pointed out, "Contrast Theory (derived from cognitive psychology) hypothesizes that a negative disconfirmation of expectations resulting from poor product performance will result in magnification of the disparity between expectation and performance. As a result, consumers with high expectations have the potential of being much less satisfied with the product than consumers with lower expectations" (p. 238). For example, Kamins (1985) observed such a contrast. The results of Duhaime (1988) also suggest that, at least for some types of goods and services, consumers whose expectations are high generally show a greater satisfaction when the performance of the product matches their expectations, but are all the more dissatisfied when the perceived performance falls short of their expectations. This implies (hypothesis H2) that the higher the level of consumer expectations, the higher the degree of consumer satisfaction when disconfirmation is positive (or null), but, the higher the level of **dissatisfaction** when disconfirmation is negative. According to this theory $\delta S/\delta D > 0$ but $\delta S/\delta E > 0$ only if the disconfirmation is either positive or null; in cases of a negative disconfirmation, $\delta S/\delta E < 0$. Figure 1 illustrates linear and non linear versions of these relationships (H1L, H2L, H1NL, H2NL).

Thus, if H2 would represent more adequately the true relationship between the variables S, E and D for some types of goods and services, some of the equations used in the scientific literature to model this relationship would not permit to identify this kind of relationship. This would definitely be the case for linear specifications, which assume that the level of satisfaction is an additive function of the Expectations and Disconfirmation variables:

$$S = B_o + B_1E + B_2D + U \qquad (1)$$

In this case, H1 is imposed a priori. The more sophisticated form which allows for some interaction of the explanatory variables:

$$S = B_o + B_1E + B_2D + B_3ED + U \qquad (2)$$

admits the two possibilities H1 or H2. Indeed depending on the values taken by the B's $\delta S/\delta E$ can be either positive or negative for different values of D. However this formulation does not always permit to grasp the full complexity of the relationship. It imposes a linear relationship between S and D for a given level of expectations, and between S and E for a given level of disconfirmation, which might not always be the case. Indeed: $\delta S/\delta E = B_1 + B_3D$ and $\delta S/\delta D = B_2 + B_3E$ are both linear functions. One should also mention that with this formulation it is difficult to obtain good estimates of the parameters due to the collinearity existing between D and ED and between E and ED. In the presence of collinearity, the estimates are not biased but their variances are larger, so that very often, one cannot reject the hypothesis that some of the B's are equal to 0.

Given these difficulties, we wish to propose an alternative formulation to model the relationship between the Satisfaction and the Expectations and Disconfirmation variables.

THE MODEL

Mathematical Formulation

The suggested formulation is the following:

$$S_i^* = B_o + \sum_{j=1}^{n} B_j X_{ij} + U_i \quad (i=1...n) \text{ and } (j=1...K) \qquad (3)$$

where: S_i^* represents the level of satisfaction reached by consumer i.

X_{ij} is a dichotomous variable which is equal to 1 if consumer i belongs to group j and 0 otherwise. The groups are made up according to the levels of expectations and of disconfirmation experienced by the consumer.

n and K represent the number of respondents and the number of groups respectively.

In the case where three levels of expectations [high expectations (E^+), medium expectations (E^o) and low expectations (E^-)], and three levels of disconfirmation [positive disconfirmation (D^+), null disconfirmation (D^o) and negative disconfirmation (D^-)] are considered, nine groups can be defined ($X_1 \ldots X_9$) as follows:

X_1 groups all individuals with **low** expectations and **positive** disconfirmation: group E^-D^+.
X_2 groups all individuals with **low** expectations and **null** disconfirmation: group E^-D^o.
X_3 groups all individuals with **low** expectations and **negative** disconfirmation: group E^-D^-.
X_4 groups all individuals with **medium** expectations and **positive** disconfirmation: group E^oD^+.
X_5 groups all individuals with **medium** expectations and **null** disconfirmation: group E^oD^o.
X_6 groups all individuals with **medium** expectations and **negative** disconfirmation: group E^oD^-.
X_7 groups all individuals with **high** expectations and **positive** disconfirmation: group E^+D^+.
X_8 groups all individuals with **high** expectations and **null** disconfirmation: group E^+D^o.
X_9 groups all individuals with **high** expectations and **negative** disconfirmation: group E^+D^-.

Figure 1

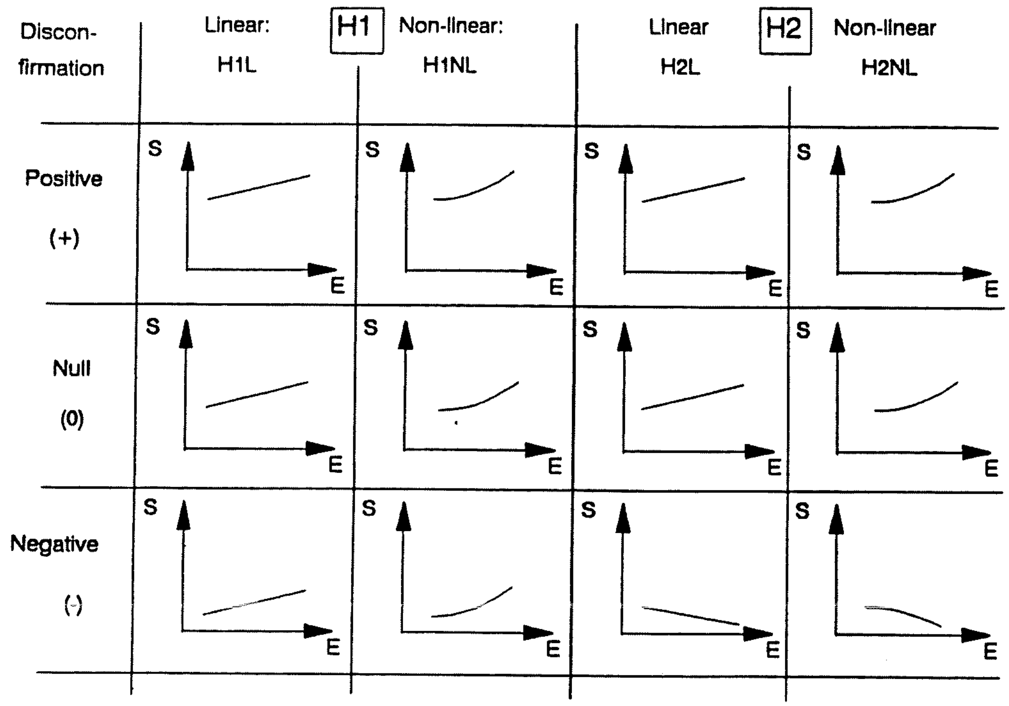
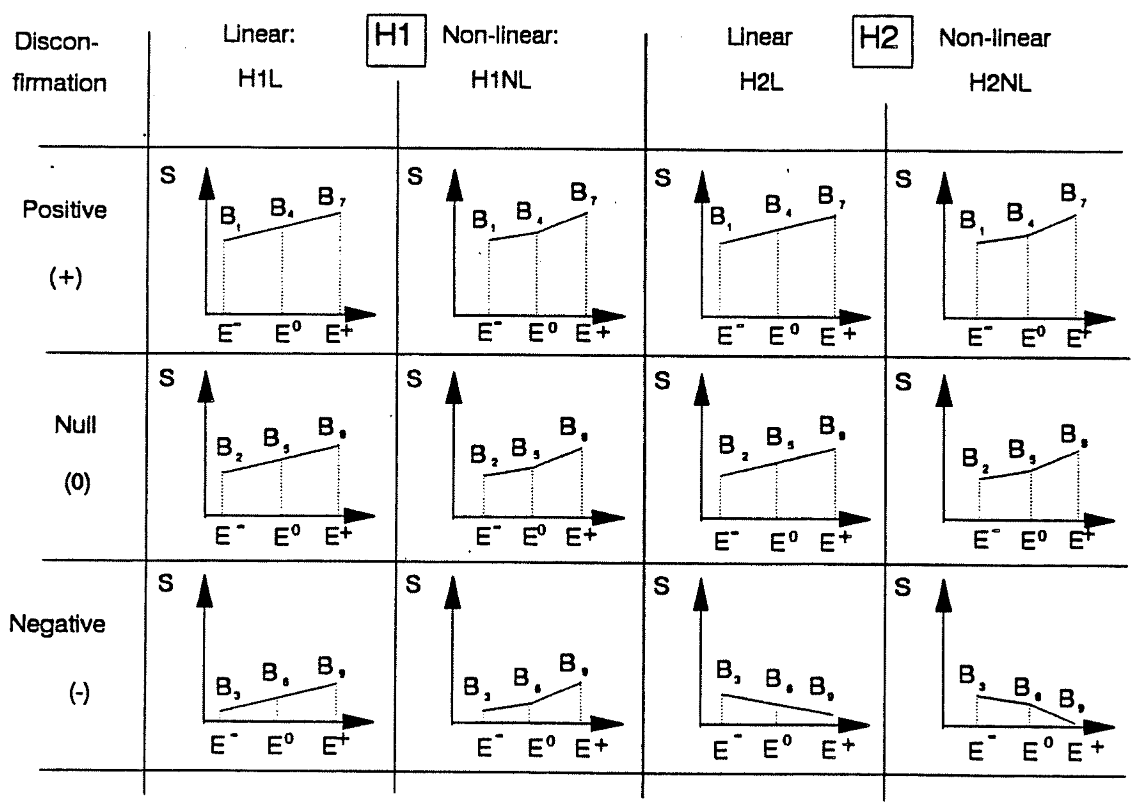


Figure 2



We note that by using this qualitative variable formulation, no precise relationship between the S, E and D variables is a priori imposed. It simply states that the level of satisfaction reached by the consumer depends on the group to which he belongs. The groups are formed according to the level of expectations and disconfirmation experienced by the consumer. However, regardless of the hypothesis retained (whether Hl or H2), we expect the values of the coefficients to be such that:

$$B_1 > B_2 > B_3$$
$$B_4 > B_5 > B_6$$
$$B_7 > B_8 > B_9 \qquad (4)$$

(see Figure 2 for a representation of these inequalities) which is the same as saying that, given identical levels of expectations, the higher the disconfirmation, the higher the consumer's satisfaction (which correspond to $\delta S/\delta D > 0$). This is consistent with disconfirmation theory discussed recently by Oliver and DeSarbo (1988) and Tse and Wilton (1988) as reported by Oliver and Swan (1989): "The degree of incremental (dis)satisfaction is a direct function of positive (negative) disconfirmation" p. 373.

We also expect:

$$B_8 > B_5 > B_2 \qquad (5)$$

which is to say that when perceived product performance matches expectations, the higher the level of expectations the higher the consumer's satisfaction (which corresponds to $\delta S/\delta E > 0$ when $D = D^o$).

Moreover, according to Hl, we should observe:

$$B_7 > B_4 > B_1 \text{ and } B_9 > B_6 > B_3 \qquad (6)$$

since it is assumed that, given identical levels of disconfirmation, the higher the expectations the higher the consumer's satisfaction. If however H2 represents more adequately the relationship between S, D and E, we should have:

$$B_7 > B_4 > B_1 \textbf{ but } B_9 < B_6 < B_3 \qquad (7)$$

since it is assumed that, following negative disconfirmation, the higher the consumer's expectations the higher his dissatisfaction.

Estimation Method

We propose, for estimating the parameters, to use a qualitative dependent variable model rather than a regression model. Indeed, there are two drawbacks associated with the use of the regression model for analyzing the determinants of consumer satisfaction, namely:

1. The regression model assumes that the **observed** dependent variable is continuous, while in practice the level of satisfaction felt by each respondent is generally reported on a discontinuous scale, with a very limited number of steps (for example S can take the values 1, 2, 3, 4, or 5).
2. In the regression model, the values associated with the different levels of satisfaction (for example 1, 2, 3, 4 and 5) represent a cardinal measure of respondent satisfaction. However it seems more reasonable to assume that these numbers represent rather a simple ranking of the respondent level of satisfaction.

Given these drawbacks, the ordered probit shows, on theoretical grounds, a definite superiority over the multiple regression model. The ordered probit is, in fact, a discrete dependent variable model which does not presume the cardinality of the values associated with the dependent variable but only a ranking of these values.

The parameters of the ordered probit model are estimated by the maximum likelihood method. The resulting estimators therefore possess satisfactory asymptotic properties, namely: consistency, efficiency and normality. Note also that the assumptions of normal residual errors underlying the probit model is easier to justify on theoretical grounds than the error distribution assumptions associated with alternative models for qualitative dependent variables such as the logit (see Maddala 1983, or Amemiya 1981).

In the relationship which we intend to estimate for each single individual:

$$S^* = B_o + \mathbf{XB} + U, \qquad (8)$$

where **X** is a (1 x K) vector, **B** is a (K x 1) vector and B_0 is a scalar, the variable S^* is a non-observed, or «latent» variable. In fact, even though the individual's actual satisfaction level may be a continuous variable, the observed levels of satisfaction reported in our sample are divided into categories which range from «very dissatisfied» to «very satisfied». The observed S variable is therefore actually a qualitative variable which corresponds to one of the five following categories:

$S = 1$, if the individual is very dissatisfied, i.e. if $S^* < \Theta_1$
$S = 2$, if the individual is dissatisfied, i.e. if $\Theta_1 \leq S^* < \Theta_2$
$S = 3$, if the individual is neither satisfied nor dissatisfied, i.e. if $\Theta_2 \leq S^* < \Theta_3$
$S = 4$, if the individual is satisfied, i.e. if $\Theta_3 \leq S^* < \Theta_4$
$S = 5$, if the individual is very satisfied, i.e. if $S^* \geq \Theta_4$

where the Θ's represent unknown constants such as $\Theta_1 < \Theta_2 < \Theta_3 < \Theta_4$.

We can then write:

$S = 1$ if $B_o + XB + U < \Theta_1$
or $U < C_1 - XB$ where $C_1 = \Theta_1 - B_o$

Hence, if we assume that U is normally distributed $N(O, \sigma^2)$ and that, without loss of generality, the model coefficients are normalized so that $\sigma^2 = 1$,

$$Pr(S = 1) = \int_{-\infty}^{C_1 - XB} \left(1/\sqrt{2\pi}\right) e^{-t^2/2}\, dt \,. \qquad (9)$$

Similarly,

$S = 2$ if
$\Theta_1 \leq B_o + XB + U < \Theta_2$ and,

$$Pr(S = 2) = \int_{C_1 - XB}^{C_2 - XB} \left(1/\sqrt{2\pi}\right) e^{-t^2/2}\, dt \qquad (10)$$

where, $C_2 = \Theta_2 - B_o$

and so on.

IMPLEMENTATION OF THE PROPOSED APPROACH

The Data

The data used to estimate the model (Duhaime 1985 and 1988) were collected through a mail survey of new car owners in Ontario (Canada). The owners' names were obtained through license plate registrations and the respondents were chosen by means of a random sampling procedure. One thousand, two hundred questionnaires were mailed, of which 380 were returned and 347 were usable (29% of the original sample). The person who answered the questionnaire was the principal driver and owner of the car. All the respondents had purchased their cars within the previous eleven months so it was assumed that the majority of cars was still under warranty at the time of the survey. One of the objectives of this survey was to analyze the relationships between the Expectations (E), Disconfirmation (D) and Satisfaction (S) variables at different stages in the process associated with the acquisition of a new car. The present model is estimated using the data derived from the answers on after-sales service. Thus, the three variables concern the servicing of the new car.

Satisfaction was measured through a five point single item scale ranging from "Very satisfied" to "Very dissatisfied". Disconfirmation was measured in a similar fashion through another five point single item scale ranging from "Much worse than expected" to "Much better than expected". However, Expectations was obtained through a composite measure since it was considered preferable to make use of an evaluation technique which enables the respondent to recall more easily his level of expectations prior to experiencing the dealer's after-sales service. This measure was derived from a series of sub-questions concerning 18 factors consumers usually consider important in their evaluation of the after-sales service for a new car. Expectations thus consisted of a global measure obtained by a weighted sum of the answers. Since the sub-questions referred to a five level scale going from poor to excellent and numbered from 1 to 5, the values associated with the expectation measure could, theoretically, vary from 1 to 25.

Estimation

The formulation presented in the Mathematical Formulation section implies a regrouping of respondents according to their levels of expectations (E^+, E^o and E^-) and disconfirmation (D^+, D^o and D^-) and consequently the setting of bounds for these different categories. These bounds can be deduced directly for disconfirmation. The disconfirmation variable is represented by five levels of disconfirmation going from "much worse than expected" to "much better than expected". The two lower levels correspond to a negative disconfirmation, the third level to a confirmation of expectations and the two higher levels to a positive disconfirmation.

Since the Expectations variable was obtained through a composite measure, a different procedure had to be followed. After trying two procedures, the bounds were finally set at 15 and 20. Indeed, a first estimation was done with the entire range of answers, which runs from 4 to 25, divided into three equal parts. However, less than 3% of the observations lie between 4 and 10, so that the low expectations category was definitely underrepresented. A second attempt was made in which the limits were set so as to have the same number of respondents in each category (E^+, E^o and E^-). The results in this case, were quite similar to those presented here, but the maximum value of the likelihood function was slightly lower.

Analysis of the Results

In order to distinguish the question of the formulation of the model from the question of the statistical technique suggested we will first use the multiple regression model to estimate the relationship between the dependent variable S and the explanatory variables D and E. The formulation which uses dummy explanatory variables (equation 3) will be compared with the more classical ones, namely, the simple additive model (equation 1) and the more elaborate one which contains an interactive term (equation 2). Then, we will re-estimate the functional relationship with dummies, using the ordered probit model, in order to compare the goodness of fit obtained with this approach to that derived from the multiple regression model.

The results of the estimation using dummies as explanatory variables and the multiple regression model are presented in Table 1. To avoid perfect multicollinearity, one of the nine categories has to be merged with the constant term and considered as the reference group (Johnston, 1974, p. 275). The last group of individuals, who had high expectation and experienced negative disconfirmation (E^+ D^-), was included in the constant term. In consequence, the estimated coefficients ($b_1 \ldots b_8$) associated with groups 1 to 8 correspond in fact to the original coefficients minus B_9, while the estimated coefficient associated with the constant term includes B_9. The fact that the estimated coefficients b_8 and b_6 are significantly > 0 implies in term of the original coefficients that $B_8 - B_9 > 0$ and $B_6 - B_9 > 0$, hence $B_8 > B_9$ and $B_6 > B_9$.

Table 1
Parameter Estimates of the Regression Model

Coefficients	Explanatory variables	Parameter estimates
const.	Constant	1.61
		(8.49)
b_1	$(E^-D^+)\ X_1$	2.54
		(9.70)
b_2	$(E^-D^o)\ X_2$	1.77
		(8.34)
b_3	$(E^-D^-)\ X_3$	1.10
		(3.84)
b_4	$(E^oD^+)\ X_4$	2.84
		(12.31)
b_5	$(E^oD^o)\ X_5$	2.54
		(12.25)
b_6	$(E^oD^-)\ X_6$	0.58
		(2.08)
b_7	$(E^+D^+)\ X_7$	3.34
		(12.60)
b_8	$(E^+D^o)\ X_8$	2.82
		(12.98)

Number of observations	347
R^2 (adjusted)	.51
Standard error of the residuals	.81

a. The numbers in parentheses correspond to the Student's statistics.

We note that the values of the different coefficients confirm once again the Disconfirmation theory as stated by Oliver and Swan(1989). Indeed, these results imply,

$$B_1 > B_2 > B_3$$
$$B_4 > B_5 > B_6$$
$$B_7 > B_8 > B_9 \qquad (4)$$

Hence, given the same level of expectations, the consumer's degree of satisfaction increases with his level of disconfirmation (D^-, D^o or D^+). Moreover,

$$B_8 > B_5 > B_2 \qquad (5)$$

That is to say that the level of satisfaction of a consumer whose expectations are confirmed increases with the level of his expectations. Finally, we also note that

$$B_7 > B_4 > B_1 \text{ but } B_9 < B_6 < B_3, \qquad (7)$$

which means that, in the case of positive disconfirmation, the higher the consumer's level of expectations, the higher is his level of satisfaction; but in the case of a negative disconfirmation, the higher the consumer's expectations, the lower is his level of satisfaction. These results suggest that H2 represents more adequately the relationship between S, D and E. Indeed, since b_6 is positive with a large t statistic, we can accept the hypothesis that $B_6 - B_9 > 0$ and, since $b_3 - b_6$ is also positive with a large t statistic (1.8), we are led to accept $B_3 > B_6$.

The estimates obtained for each of the parameters are indeed consistent with all the partial orderings which can be inferred from the relationships (4), (5), and (7) presented in The Model section and illustrated in Figure 2 and which follow from H2.

For comparison purposes, estimates of the following additive model:

$$S = B_o + B_1E + B_2D + U \qquad (1)$$

have been calculated using the multiple regression model (Table 2). Clearly, the original data were used for this estimation instead of the regrouping in categories ($E^-D^+ \ldots E^+D^-$). Column "a)" shows the estimates obtained with the total sample (347 individuals).

The coefficients which affect the Expectations variable (E) and Disconfirmation variable (D) are both positive and significant, with Student's statistics above 5 and a coefficient of determination (R^2) comparable to those usually obtained in studies of this type. These results would appear, at first sight, to confirm that this specification is totally adequate for analyzing the relationship between S, E and D. However, we estimated the same model but only with the individuals who have been disappointed with the after-sales service. Such a selection would not bias the parameter estimates since it is based on the values associated with one of the explanatory variables and not on the values of the dependent variable. The results obtained are very different (see column b). The sign of the coefficient affecting the variable E is now negative and significant with a Student's statistic above 2 in absolute value. One could not, in this case, reject the hypothesis which postulates that given the same level of negative disconfirmation, the higher the individual's expectations, the higher is his level of dissatisfaction.

Table 2
Parameter Estimates of the Additive Model Using the Regression Method

Explanatory variables	a) Total Sample	b) D^- group only
Constant	.018	1.91
	(0.06)	(1.99)
Expectations	.06	-.07
	(5.16)	(−2.15)
Disconfirmation	.88	.85
	(14.31)	(2.64)
Number of observations	347	48
R^2 (adjusted)	.39	.27
Standard error of the regression	.891	.913

a. The numbers in parentheses correspond to the Student's statistics.

Table 3
Parameter Estimates for the Model With an Interactive Term

Explanatory variables	Parameter estimates
Constant	3.16
	(3.24)
Expectations	−0.107
	(−2.07)
Disconfirmation	−0.15
	(−0.49)
Disc. •Exp.	0.056
	(3.37)
Number of observations	347
R^2 (adjusted)	0.41
Standard error of the regression	0.88

a. The numbers in parentheses correspond to the Student's statistics.

This second result implies that the simple linear model corresponding to equation (1) is not adequate to analyze the relationship existing, in this particular sample, between the Satisfaction, Expectation and Disconfirmation variables or to test alternative functional relationship between S, D and E. In fact, when the estimation is performed on the total sample, the coefficient which affects variable E, in equation (1), is the net result of two different effects working in opposite directions, depending on whether the perceived performance of the commodity or service has at least matched the consumer's expectations, or whether, on the contrary, it has not come up to his expectations (see Figure 1).

We also estimated the model represented by equation (2) which contains an interactive term (ED). The results are presented in Table 3. We kept the disconfirmation variable in this model even if the Student's Statistic of the parameter estimate was very low because this variable is highly correlated with the two other explanatory variables. Indeed, the square multiple correlation coefficient of the regression of D on E and E·D is equal to 0.96. The risk was too high that dropping this variable would lead to a specification error (Johnston, 1984, p. 259). As mentioned previously, the collinearity problem is another drawback of this kind of specification.

We note that the results tend to favor hypothesis H2. Indeed for notably negative disconfirmation (less than 1.91), $\delta S/\delta E < 0$. (In our sample, negative disconfirmation takes the values 1 or 2). Otherwise $\delta S/\delta E > 0$. Indeed, $\delta S/\delta E = B_1 + B_2 D = -.107 + .056D$ for $D = D^- = 1$, $\delta S/\delta E = -0.051$ while for $D = D+ = 4$, $\delta S/\delta E = +.117$. However, applying formal t tests does not permit the rejection of either H1 or H2. We note also that the adjusted R^2 is not very much higher when using this formulation than the adjusted R^2 obtained with the simple additive model (0.4 vs 0.39) These R^2 are notably lower than the R^2 obtained with the qualitative formulation (0.51) . Moreover, the latter formulation, which suggests that H2 is to be preferred, permits also to reject the linear assumption which underlines the model with the interactive term. For example we tested the linearity of the relationship between S and E for a level D^0 of disconfirmation, that is: $B_8 - B_5 = B_5 - B_2$. We had to reject this hypothesis. The Student Statistic was equal to 2.2. This latter result suggests that, in the case at hand, the model with an interactive term, which imposes a linear relationship between S and E for a given level of disconfirmation, is not appropriate to analyze adequately the relationship which exist between S, D and E.

We then proceeded to the estimation of the formulation suggested in this paper, using the ordered probit as the statistical model instead of the multiple regression. The results are presented in Table 4. The parameters $C_1 \ldots C_4$ have been defined in the Estimation Method section. They represent the constant terms associated with the boundaries of the latent variable S^*. The parameter estimates $(c_1 \ldots c_4)$ include the B_9 coefficient, since the reference group E^+D^- has been included in the constant terms to avoid again perfect multicollinearity. One can observe that, as in the case of the multiple regression, the coefficients conform to the partial orderings represented by H2.

We mentioned earlier that the ordered probit offers, on theoretical grounds, a net superiority over the multiple regression model because it does not presume cardinality of the values associated with the dependent variables and also because it does not assume that the observed dependent variable is continuous. We wanted to verify if this theoretical superiority would also show in terms of the quality of the statistical adjustment. One way to do this is to calculate, using the estimated coefficients, the probability that an individual belonging to a specific group be included in each of the satisfaction categories considered [that is: Pr(S = 1), Pr(S = 2),..., Pr(S = 5)]. Therefore, for the ordered probit model, we calculated, the "expected" number of individuals (EN) in each satisfaction category, for each group. The probabilities (P) are shown in Table 5a, together with the corresponding EN, and, for comparison purposes, the real number of individuals (RN) from each group in each category.

Table 4
Parameter Estimates of the Ordered Probit Model

Coefficients	Explanatory variables	Parameter estimates
c_1		−0.019
		(−0.06)
c_2		1.26
		(3.44)
c_3		2.18
		(5.81)
c_4		3.37
		(8.94)
b_1	X_1 (E^-D^+)	3.05
		(6.57)
b_2	X_2 (E^-D^o)	2.13
		(5.26)
b_3	X_3 (E^-D^-)	1.42
		(2.97)
b_4	X_4 (E^oD^+)	3.47
		(7.84)
b_5	X_5 (E^oD^o)	3.06
		(8.19)
b_6	X_6 (E^oD^-)	0.73
		(1.91)
b_7	X_7 (E^+D^+)	5.01
		(8.12)
b_8	X_8 (E^+D^o)	3.50
		(8.85)
Number of observations		347
Logarithm of the likelihood function		−377

a. The numbers in parentheses correspond to the Student's statistics.

Table 5a shows, for instance, that individuals in group E^+D^+, (high expectations and positive disconfirmation) whose coefficient (B_7) is the highest, have a probability close to 95% of being included in the category representing the highest level of satisfaction (S = 5) and an almost null probability of being included in any category lower than S = 4.

On the other hand, at the other extreme, individuals with high expectations who experienced a negative disconfirmation (E^+D^-) have an almost null probability (.0148) of being satisfied (i.e. of belonging to the S = 4 or S = 5 categories) and a high probability (almost 50%) of being very dissatisfied (S = 1).

If we compare, for each of the nine groups, the expected number of individuals in each satisfaction category with the observed number, we note that these values are extremely close. In fact, in more than 85% of the cases, the difference between these two figures is equal to or less than 2 and, in one third of the cases, the estimated value and the observed value coincide.

The same calculations were done based on the estimates obtained from the multiple-regression model (Table 5b). We note that the ordered probit which is clearly more satisfactory from a theoretical standpoint, also yields a much better statistical adjustment. In fact, with the regression model, the expected numbers of respondents in each category differ generally more from the observed numbers than in the case of the ordered probit. With the regression model, the difference between the expected numbers and the real numbers is particularly significant for the groups E^+D^o, E^+D^+ and E^oD^-.

CONCLUSION

The formulation proposed in this paper to analyze the relationship between the Satisfaction, Expectations and Disconfirmation variables presents significant advantages over models generally used to analyze this phenomenon. The suggested formulation does not, a priori, impose a definite relationship between the dependent variable (S) and the explanatory variables E and D. The model can therefore encompass various types of interaction between these same variables. This is all the more important because the scientific literature in this particular field suggests different types of relationships between the

Table 5a
Expected and Real Numbers of Individuals Belonging to Each Satisfaction Category Per Group
(Estimation Method: Ordered Probit)*

	E^-D^+			E^-D^o			E^-D^-			E^oD^+			E^oD^o		
S	P	EN	RN	P	EN	RN	P	EN	RN	P	EN	RN	P	EN	RN
5	0.372	7	7	0.1073	8	5	0.0255	0	1	0.5375	20	18	0.3774	35	37
4	0.4356	9	9	0.3746	26	27	0.1992	3	2	0.3639	14	19	0.4341	41	39
3	0.1553	3	4	0.3260	23	28	0.3385	5	3	0.0849	3	1	0.1525	14	14
2	0.0361	1	0	0.1764	12	10	0.3621	5	8	0.0135	1	0	0.035	3	3
1	0.0011	0	0	0.0157	1	0	0.0748	1	0	0.0002	0	0	0.001	0	1
Number of observations	20					70			14			38			94

	E^oD^-			E^+D^+			E^+D^o			E^+D^-			Total		
S	P	EN	RN	P	EN	RN	P	EN	RN	P	EN	RN	EN	RN	EN-RN
5	0.0041	0	1	0.9486	18	18	0.551	32	34	0.0004	0	0	121	121	0
4	0.0700	1	2	0.049	1	1	0.3562	21	17	0.0143	0	0	115	116	1
3	0.2239	4	2	0.0023	0	0	0.0802	5	5	0.0887	2	1	58	58	0%
2	0.476	8	5	0.0000	0	0	0.0124	1	2	0.4044	7	9	38	37	3%
1	0.226	4	6	0.0000	0	0	0.0002	0	0	0.4923	9	8	.15	15	0%
Number of observations	16					19			58			18		347	

Table 5b
Expected and Real Numbers of Individuals Belonging to Each Satisfaction Category Per Group
(Estimation Method: Regression)*

	E^-D^+			E^-D^o			E^-D^-			E^oD^+			E^oD^o		
S	P	EN	RN	P	EN	RN	P	EN	RN	P	EN	RN	P	EN	RN
5	0.3357	7	7	0.0847	6	5	0.0161	0	1	0.4743	18	18	0.3323	31	37
4	0.4488	9	9	0.3592	25	27	0.1569	2	2	0.4030	15	19	0.4563	43	39
3	0.1927	4	4	0.4186	29	28	0.4285	6	3	0.1143	4	1	0.1906	18	14
2	0.0221	0	0	0.1274	9	10	0.3260	5	8	0.0083	0	0	0.0203	2	3
1	0.0007	0	0	0.01	1	0	0.0726	1	0	0.0002	0	0	0.0005	0	1
Number of observations	20					70			14			38			94

	E^oD^-			E^+D^+			E^+D^o			E^+D^-			Total		
S	P	EN	RN	P	EN	RN	P	EN	RN	P	EN	RN	EN	RN	EN-RN RN
5	0.0027	0	1	0.706	13	18	0.4662	27	34	0.0002	0	0	103	121	15%
4	0.2542	2	2	0.2542	5	1	0.408	24	17	0.011	0	0	124	116	7%
3	0.2964	5	2	0.0384	1	0	0.1171	7	5	0.1301	2	1	76	58	31%
2	0.4430	7	5	0.0015	0	0	0.0086	1	2	0.4121	8	9	31	37	16%
1	0.2038	3	6	0.000	0	0	0.0002	0	0	0.4466	8	8	13	15	13%
Number of observations	16					19			58			18		347	

* By rounding off numbers, the totals of expected numbers (EN) may not always coincide exactly with the column or line totals.

variables S, E and D.

The results of the estimations performed in this particular research as an illustration of the proposed approach, suggest that functional relationship H2 should be preferred to H1. If this functional relationship should be confirmed repeatedly for different types of goods or services, it could have significant theoretical and managerial implications. Indeed, from a theoretical standpoint, these results bring support to the Contrast theory which can be traced to research undertaken by Sherif and Hovland (1961) and to Helson's (1964) Adaptation Level Theory. According to the Contrast theory, "a consumer who receives a product or brand which performs more poorly than expected (i.e., his expectations are negatively disconfirmed), will magnify the difference between the product received and the product expected. Hence, this consumer will be much less satisfied with the product (resulting in lower product ratings) than will a consumer whose expectations for the same product are lower" (Kamins and Assael, 1987, p. 92). This theory holds some managerial implications, especially in the field of advertising. Indeed, a number of advertisers have advocated, in the past, the use of "puffery" as a way to improve sales, claiming that it could not harm a brand since it was a common practice generally understood by consumers. However, the Contrast theory suggests that advertisements designed to raise consumer expectations can backfire if the product performance cannot meet consumer expectations, generating a very dissatisfied consumer who may switch to another brand, a behavior that goes against the long run interest of the firm.

The results also suggest that the additive model, and even the model which contains an interactive term, may not be always adequate to analyze the full complexity of the relationship between S, D and E. Finally, the comparisons of the results obtained using the ordered probit and the multiple regression to estimate the model, suggest that the ordered probit offers not only a definite theoretical superiority, but it also allows for a far better statistical adjustment than the multiple regression model commonly used in this type of analysis.

Additional research is needed to validate these results across products and services. Indeed, one would need to replicate this study using different products and services in order to see if the Contrast theory is valid for a wide range of products or if it applies only to certain kinds of products or situations. In addition, one would need to improve the measure of expectations, preferably by using a longitudinal design which eliminates the problems associated with recall measures, thus eliminating the need to create artificial boundaries for this measure.

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ACKNOWLEDGEMENTS

We wish to thank Anne Beaulieu, Denis Senécal and Alain Tremblay who have contributed to this project as research assistants.

We also wish to thank an anonymous referee for his helpful comments.

This research was supported by the Fonds F.C.A.R. du Québec.

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