

# **Using Expectation Disconfirmation Theory to Explore the Relationship Satisfaction between Businesses to Businesses**

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## **ABSTRACTS**

A stochastic model provides a macroscopic view to predict the probability of customers' behavior with numerical analysis. This paper bases on this view of point, to make the theory of expectation disconfirmation becoming a concrete model which can be actual calculating and estimation. We use this model to discuss the relationship satisfaction between businesses to business and explore the dynamic process that the satisfaction is constructed with company's expectation before partnership and the perceived performance after partnership. The experiment method is designed to measure expectation disconfirmation effects and we also use the collection data to estimate the parameters and model calibration. The results show good fitness between the model and the real data. This model can be made application for business marketing area to manage relationship satisfaction.

Keywords: expectation disconfirmation theory, relationship satisfaction, stochastic model.

## **INTRIDUCTION**

In recent years, improvements in information technology have resulted in the increased availability of industrial marketing data. This trend is closely linked to an ever-growing desire on the part of the marketing manager to use this B to B database to learn as much as possible about his industrial customer base(Fader et al.,2009). Reduction in the cost of acquiring survey data will result in increased interest in stochastic mode (Rossi and Allenby,2000). Thus the data –base methodology can provide a macroscopic view to predict the probability of customers' behavior with numerical analysis. This paper bases on this view of point, to make the theory of expectation disconfirmation becoming a concrete model which can be actual calculating and estimation. This proposed stochastic model enables managers to generalize their customer expectation and performance.

Expectation disconfirmation theory(Boulding 1993; Cadotte, Woodruff, and Jenkins 1987; Churchill and Suprenant 1982; Oliver 1980, 1997; Oliver and DeSarbo 1988; Tse and Wilton 1988; Yi 1990; Zeithaml, Berry, and Para- suraman 1988) is to predict that customers make in advance of consumption act as a standard against which customers measure the firm's performance(Oliver 1980, 1997). It plays an important role in customer satisfaction process and can also be extend to discuss the relationship satisfaction between businesses to business. The higher the expectation in the relation to actual performance, the greater the degree of

disconfirmation and the lower the satisfaction. This model considers satisfaction is a function which includes the difference between observed outcome (product) performance and prior expectations about the outcome's (product's) performance (Kopalle and Lehmann, 2001).

Thus we base on the stochastic concept to propose the probability density function to explore the dynamic process that the satisfaction is constructed with company's expectation before partnership and the perceived performance after partnership.

The paper is organized as following: first we review the previous literature of expectation disconfirmation theory and its application of other researches. Secondly, we propose our model and describe its assumption. Thirdly, the empirical data will be conduct to estimate the parameters of the model. The results of model calibration will also be demonstrated. Finally, the conclusion will be made.

## **LITERATURE REVIEW**

### **EXPECTATION DISCONFIRMATION THEORY**

Disconfirmation of expectations paradigm is conceptualized by Oliver (1980, 1997). It came from a subject of study for antecedents of satisfaction (Anderson and Sullivan, 1993). The standard approach to study the satisfaction involves comparison of prior expectations with observed performance. Thus in this theory, the customer's perception of overall satisfaction results from a comparison between expectation and outcome performance. Therefore, expectation and outcome performance are two important variables which can influence the judgment of satisfaction measure. Because customers' satisfaction is one of the curial factor to predict the customer purchase tendency. To investigate satisfaction toward the products is also a main topic in customer behavior research. Based on expectation disconfirmation theory, firm can increase satisfaction by increasing perceived product performance or decreasing expectation.

In the process of satisfaction judgments, first buyers may experience from expectations of the specific product or service prior to purchase. Second, consumption reveals a perceive performance level of product which is influence by expectations if difference between actual performance and expectations is perceived as being small. Hence, perceived performance may increase or decrease directly with expectations as indicated by the arrow drawn from expectations to perceived performance. Third, perceived performance may either confirm or disconfirm prepurchase expectation (Anderson and Sullivan, 1993). Fourth, satisfaction is positively affected by expectations and the perceived level of disconfirmation. When the outcome performance is object, it is difficult to increase the perceived performance. Thus, to decrease expectations is a viable alternative for the firm (Kopalle and Lehmann, 2001).

To sum up expectation disconfirmation theory, expectations provide a baseline or anchor level of satisfaction. It also be considered as belief probabilities of what the consequence of

an event will be (Oliver,1980). In this research, we develop our stochastic model by this view of point.

### **OTHER RELATED RESEARCH**

Anderson and Sullivan(1993)investigate the linkage between the antecedents and consequences of satisfaction. They find that the perceived performance which falls short of expectations has greater impact on satisfaction and repurchase intentions than performance which exceeds expectations. And disconfirmation is more likely to occur when performance is easy to evaluate.

Kopalle and Lehmann(2001) explore the role of disconfirmation sensitivity and perfectionism. The results show that customers who are more disconfirmation sensitivity or more satisfied when a product performs better than expected, are hypothesized to have lower expectations. In contrast, customers who are perfectionist well have higher expectations than those who are not.

Huang and Liu(2014) based on dynamical percept of customer satisfaction to explore the disconfirmation between expectation of pre-purchase and perceived actual performance of pos-purchase. According the stimulation of word of mouth in internet on different time points, they conduct the experiment in which expectation, perceive performance and reference point effect are manipulated. The results show that the anchoring effect and disconfirmation effect are exited. This study also finds the cognition inconsistency among three stages in the experiment. The perceive performance-satisfaction is less variance in the last stage when paired with high-disconfirmation in the first stage, whereas perceive performance-satisfaction is more variance when paired with low-disconfirmation.

### **THE MODEL**

#### **THE EXPECTATION**

Based on Oliver(1980),we consider the expectation is a stochastic concept as a random variable  $x$ .  $X$  follows log normal distribution with the parameters  $\mu_x$  and  $\sigma_x^2$ . Its probability density function (pdf) is

$$f_X(x) = \frac{1}{x\sigma_\alpha\sqrt{2\pi}} \exp\left[-\frac{(\log x - \mu_\alpha)^2}{2\sigma_\alpha^2}\right], \quad x > 0 \quad (1)$$

We also consider  $\alpha = \log x$  is the normal distribution with parameter  $\mu_\alpha$  and  $\sigma_\alpha^2$ .

The cumulative distribution function(cdf) of  $X$  is

$$F_X(x) = \Phi\left[\frac{(\log x - \mu_\alpha)}{\sigma_\alpha}\right], \quad X > 0 \quad (2)$$

In equation(2),  $\Phi$  is the cumulative distribution function of the standard normal distribution.

#### **THE OUTCOME PERFORMANCE**

We also consider the outcome performance is a random variable  $y$ .  $Y$  follows another log

normal distribution with the parameters  $\mu_y$  and  $\sigma_y^2$ . Its probability density function (pdf) is

$$f_Y(y) = \frac{1}{y\sigma_\beta\sqrt{2\pi}} \exp\left[-\frac{(\log y - \mu_\beta)^2}{2\sigma_\beta^2}\right], \quad y > 0 \quad (3)$$

We also consider  $\beta = \log y$  is the normal distribution with parameter  $\mu_\beta$  and  $\sigma_\beta^2$ . The cumulative distribution function(cdf) of  $Y$  is

$$F_Y(y) = \Phi\left[\frac{(\log y - \mu_\beta)}{\sigma_\beta}\right], \quad Y > 0 \quad (4)$$

In equation(4),  $\Phi$  is the cumulative distribution function of the standard normal distribution.

### THE JOINT DISTRIBUTION

We consider the joint distribution of expectation( $X$ ) and outcome performance( $Y$ ) is

$$f_{XY}(x, y) = \frac{1}{2\pi xy\sigma_\alpha\sigma_\beta\sqrt{1-\rho^2}} \times \left\{ \exp\left[-\frac{1}{2(1-\rho^2)}\right] \times \left[ \left(\frac{\log x - \mu_\alpha}{2\sigma_\alpha}\right)^2 - 2\rho\left(\frac{\log x - \mu_\alpha}{2\sigma_\alpha}\right)\left(\frac{\log y - \mu_\beta}{2\sigma_\beta}\right) + \left(\frac{\log y - \mu_\beta}{2\sigma_\beta}\right)^2 \right] \right\} \quad (5)$$

In equation(5),  $\rho$  is the correlation coefficient of  $\alpha$  and  $\beta$  and is estimate by

$$\rho = \frac{E[(\alpha - \mu_\alpha)(\beta - \mu_\beta)]}{\sigma_\alpha\sigma_\beta} \quad (6)$$

For conditional probability density function of  $Y$  given by  $X$  is

$$f_{Y|X}(y|x) = \frac{1}{y\sigma_{\beta|\alpha}\sqrt{2\pi}} \exp\left[-\frac{(\log y - \mu_{\beta|\alpha})^2}{2\sigma_{\beta|\alpha}^2}\right] \quad (7)$$

In equation(7),

$$\mu_{\beta|\alpha} = \mu_\beta - \left[ \rho \frac{\sigma_\beta}{\sigma_\alpha} (\log x - \mu_\alpha) \right] \quad (8)$$

$$\sigma_{\beta|\alpha} = \sigma_\beta \sqrt{(1-\rho)^2} \quad (9)$$

Where  $\mu_{\beta|\alpha}$  and  $\sigma_{\beta|\alpha}$  are the mean and standard deviation of  $Y$  given by  $X$ . They can be calculated by(8) and (9).

The equation(7), demonstrate the concept of expectation disconfirmation theory in which the outcome performance(we consider as random variable  $y$ ) is influenced by the prior

expectation (we consider as random variable  $x$ ). Then according to the conditional probability (equation (7)), we can calculate the different level of disconfirmation as satisfaction or dissatisfaction and finally predict the overall satisfaction. The detail of the description is in the next section and the real data will be also demonstrated to test this model.

### THE MODEL OF EXPECTATION DISCONFIRMATION THEORY

According to expectation disconfirmation theory (Oliver, 1977, 1980), if the outcome performance (we denote as  $Y$ ) is larger than expectation (we denote as  $X$  which is considered as a constant quantity  $x_0$ ), then the customer will feel satisfy. Thus, it can be present in equation (10).

$$\begin{aligned}
 & P(Y > x_0 | X = x_0) \\
 &= 1 - \int_0^{x_0} f_Y(y | x_0) dy \\
 &= 1 - \int_0^{x_0} \frac{1}{y \sigma_{\beta|\alpha} \sqrt{2\pi}} \exp\left[-\frac{(\log y - \mu_{\beta|\alpha})^2}{2\sigma_{\beta|\alpha}^2}\right] dy
 \end{aligned} \tag{10}$$

On the other hand, if the outcome performance (we denote as  $Y$ ) is smaller than expectation (we denote as  $X$  which is considered as a constant quantity  $x_0$ ), then the customer will feel dissatisfy. Thus, it can be present in equation (11).

$$\begin{aligned}
 & P(Y < x_0 | X = x_0) \\
 &= \int_0^{x_0} f_Y(y | x_0) dy \\
 &= \int_0^{x_0} \frac{1}{y \sigma_{\beta|\alpha} \sqrt{2\pi}} \exp\left[-\frac{(\log y - \mu_{\beta|\alpha})^2}{2\sigma_{\beta|\alpha}^2}\right] dy
 \end{aligned} \tag{11}$$

## THE EMPIRICAL DATA ANALYSIS

### THE DATA BASE

We use the B-to-B data from the consulting results for an advertiser to its advertising agency. The data we use includes the measurement of the expectation, the outcome performance evaluation and the overall satisfaction. The total sample size is 4012. Then we use half of this data to estimate the parameters of the model and another half to test the predictive validity.

### THE PARAMETERS ESTIMATION

We use MLE (maximum likelihood estimate) to estimate the parameters in our model. Let  $L$  denote the total likelihood and  $n$  is the sample size. Then

$$\begin{aligned}
& L(\mu_\alpha, \mu_\beta, \sigma_\alpha^2, \sigma_\beta^2, \rho) \\
&= \prod_{i=1}^n f_{XY}(\mu_\alpha, \mu_\beta, \sigma_\alpha^2, \sigma_\beta^2, \rho) \\
&= \left( \frac{1}{2\pi\sigma_\alpha\sigma_\beta\sqrt{1-\rho^2}} \right)^n \times \\
& \left\{ \exp n \left[ -\frac{1}{2(1-\rho^2)} \right] \times \left[ \left( \frac{\log x - \mu_\alpha}{2\sigma_\alpha} \right)^2 - 2n\rho \left( \frac{\log x - \mu_\alpha}{2\sigma_\alpha} \right) \left( \frac{\log y - \mu_\beta}{2\sigma_\beta} \right) + \left( \frac{\log y - \mu_\beta}{2\sigma_\beta} \right)^2 \right] \right\}
\end{aligned} \tag{12}$$

We differentiate  $L(\mu_\alpha, \mu_\beta, \sigma_\alpha^2, \sigma_\beta^2, \rho)$  respectively regarding  $\mu_\alpha, \sigma_\alpha^2, \mu_\beta, \sigma_\beta^2$  and  $\rho$  set them equal to zero. That is,

$$\begin{cases}
\frac{\partial \mu_\alpha}{\partial} L(\mu_\alpha, \mu_\beta, \sigma_\alpha^2, \sigma_\beta^2, \rho) = 0 \\
\frac{\partial \mu_\beta}{\partial} L(\mu_\alpha, \mu_\beta, \sigma_\alpha^2, \sigma_\beta^2, \rho) = 0 \\
\frac{\partial \sigma_\alpha^2}{\partial} L(\mu_\alpha, \mu_\beta, \sigma_\alpha^2, \sigma_\beta^2, \rho) = 0 \\
\frac{\partial \sigma_\beta^2}{\partial} L(\mu_\alpha, \mu_\beta, \sigma_\alpha^2, \sigma_\beta^2, \rho) = 0 \\
\frac{\partial \rho}{\partial} L(\mu_\alpha, \mu_\beta, \sigma_\alpha^2, \sigma_\beta^2, \rho) = 0
\end{cases} \tag{13}$$

We take the solutions of (13) as MLE for  $\mu_\alpha, \sigma_\alpha^2, \mu_\beta, \sigma_\beta^2$  and  $\rho$ .

Finally, we use our empirical data which has been described in previous section to estimate these five parameters. The results are in table 1.

Table 1 The Parameters Estimate

$\mu_\alpha$	$\sigma_\alpha^2$	$\mu_\beta$	$\sigma_\beta^2$	$\rho$
30.51	0.188	50.82	0.423	0.359

#### THE PREDICTIVE VALIDITY

To test the fitness of real overall satisfaction and the calculation results of probability, we use the 0.5 as threshold level of probability. Then we calculate the rate of rule fitting of all samples and conduct the chi-square testing to test the results which are shown in table 2.

Table 2 The results of chi-square testing

	satisfaction	dissatisfaction
Fitness rate	95.53%	95.69%
$X^2=215379$ (p<.00)		

The rate of fitness is higher than 95% in all scenarios and the chi-square testing are

significant. Then prediction analysis shows good fitness between the model and the real data.

### CONCLUSION

The contribution of this research is to propose a stochastic model and use mathematical formula to demonstrate the expectation disconfirmation theory. We also use the real data to test our model and show good fitness. This model provides practical application of expectation disconfirmation theory. In the future, other industrial data can also be conduct in this model to predict their customer's partnership satisfaction.

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