Overview and Recent Advances in Conjoint Analysis
for Customer Satisfaction Measures

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Abstract
In the customer satisfaction evaluation a great importance is assumed by Conjoint Analysis. It can be applied in any area of business and science, in which it is important to measure people's perceptions or judgments. It allows the individualization of a possible combinations subset for product features to be used in order to determine the relative importance of each feature in the purchasing decision. Purpose of this paper is to furnish an overview on recent advances in Conjoint Analysis for customer satisfaction evaluation, with reference to two methodological approaches, such as permutation tests and textual analysis. In particular, permutation tests represent a robust method because they don't imply distributive hypothesis on the examined variables and, consequently, are very flexible and adequate to real applicative context. Moreover, in the analysis of the preference structure, recent contributes concerning the Conjoint Analysis aim to improve the description of preferences and behaviors by means of textual information.

Keywords: Conjoint Analysis, Customer Satisfaction, Permutation Test, Individual Preferences, GAT Procedure, Textual Analysis.

1. Introduction

The present paper exposes the Conjoint Analysis method (CA) for the customer satisfaction evaluation in quality services context. CA points out a whole of statistical techniques, that are finalized to the study of the choice models of the consumers, beginning from judgments of preference expressed in reference to different profiles of products or services (Gustafsson et al., 2001). It is based on the assumption that the consumers evaluate the utility of a real or hypothetical product or service, combining the utilities that they associate to each single characteristic of the product or service.

CA allows the individualization of a subset of the possible combinations of product features to be used to determine the relative importance of each feature in the purchasing decision. CA is based on the following consideration: the relative values of attributes jointly considered can be better measured than they are singly considered. Determining the relative importance of service attributes is one of the most important objectives of customer satisfaction measurement. Its typical application is in marketing research to evaluate customers' preferences (or utility) for a product or service not yet implemented, i.e., in situations where the actual customer experience is very low. Typically, these preferences concern a future product or a service. However, CA can be applied in any area of

business and science, in which it is important to measure people's perceptions or judgments. In order to synthesize different attributions in a multivariate measure of customer satisfaction some popular methods currently used are the "gap analysis", based on the difference between expectations and performance and the "linear regression" of the overall satisfaction rating on the ratings for the attributes.

The traditional Conjoint Analysis or Full Profile Conjoint Analysis foresees to ask to the consumer to express his own preference on all the attributes (complete factorial plain) or on some combinations of attributes (fractioned factorial plain). The procedure consists of introducing some "plancards" to the consumer and to ask to evaluate them. After the answers collection, they must be analyzed. When the answer-variable is metric and the preference is expressed by a linear model with additive fixed effects, the OLS estimator can be used (De Luca, 2002). Full Profile Conjoint Analysis requires only that the respondent provide preference ratings of each item in a set of full profile product description. Once this data is collected, metric conjoint analysis uses dummy variable regression analysis to derive the respondent's preference utilities. The respondent's preference ratings for the product descriptors (full profile descriptors of the service or other item) are used as the dependent (criterion) variable in the analysis. The independent (predictor) variables are the various factorial levels making up each stimulus. In the non-metric conjoint analysis, the dependent (criterion) variable represents a ranking of the alternative profiles and is only ordinal-scaled.

Purpose of this paper is to furnish an overview on recent advances in CA for customer satisfaction evaluation, in the optic of two new approaches, such as permutation tests and textual analysis.

2. Conjoint Analysis through permutation test approach

Permutation tests approach (Pesarin, 2001) represents a particularly robust method because it doesn't implies distributive hypothesis on the examined variables.

In Arboretti, Giancristofaro et al. (2005) is carried on the Full Profile Conjoint Analysis by means of permutation tests. Recent studies have shown that, for metric CA, a robust alternative to the traditional parametric F test is furnished by the permutation tests, conditioned to the observations. Such tests introduce a power comparable to the parametric F test in case of normality, but they better involve in case of heavy tails distributions.

Arboretti, Giancristofaro et al. (2006) furnishes the application of permutation tests in the CA, in order to support the planning of a new structure of sanitary assistance. CA can furnish to the managers some reliable information on the real preferences of the consumers in relationship to various multi-attribute alternatives; so the mentioned paper aims to evaluate the Customer Satisfaction, to predispose accordingly the supply formalities of a new poli-ambulatorial service and, through permutation test, it provide to measure the preferences system of the involved consumers in the fruition of this new sanitary service. The author underline that the application of the NPC Test (Pesarin, 2001) offers the advantage to conduct a multivariate verification of hypothesis. In general, the NPC Test methodology frees the researcher from urgent and often not realistic assumptions of the traditional multivariate parametric methods (the multivariate normality and the linearity of the relationships among variables) and it allows a more flexible analysis in terms of the specification of multivariate hypotheses and in terms of the variables typology involved in the analysis (Corain and Salmaso, 2004). Moreover, the NPC Test doesn't need the modeling of the dependence structure among variables.

Some extensions and applications of the nonparametric combination of dependent rankings (Pesarin and Lago, 2000) are proposed in Arboretti and Giancristofaro (2007) with applications to the quality assessment of industrial products. This methodology is applied to Conjoint Analysis in order to aggregate (ex ante) preferences from a group of individuals. Furthermore, a new global

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association test (GAT) is introduced in order to test for the association of the global ranking with all attributes of interest. The GAT procedure allows the experimenter to have clear indications on significant attributes by considering the intensity of the optimal weights given by the procedure itself. This may help the experimenter in interpreting the usual analysis, involving the normal plot for detecting active effects.

3. The interest for Conjoint Analysis in textual data analysis

In recent statistical literature the CA represents a source of interest for studies of textual analysis (Bolasco, 1999; Lebart and Salem, 1994). In such approach we have to mention Giordano and Infante (2004), that aims to realize a review of the scientific publications referred to C.A. The starting point of the investigation is, in fact, the search of the publications concerning conjoint analysis. The temporal domain concerns the period of the first publications officially recognized on the C.A. (beginnings of the '70 years), until the first semester of 2004. In the paper the attention is focused to the Marketing, traditionally tied up to the C.A. With the employment of the textual data analysis the authors face the search of common forms employed in different disciplinary fields in which the C.A. is used.

More recently, Balbi et al. (2008) propose a procedure aimed at integrating Conjoint Analysis with textual information achieved by answers to open-ended questions. In order to obtain a better specification of Conjoint Analysis results, the authors propose an integrated strategy based on C.A. together with textual data analysis. The proposed procedure improves the understanding of the preference structure and the ideal product definition. All survey data, structured (i.e. numerical data) and not structured (i.e. textual data), are jointly analyzed. Therefore, the interpretation of classical conjoint analysis results is enriched by the verbal description of the ideal product. An empirical analysis on the watch market shows the effectiveness of the proposal.

The methodological innovative element is given by the use of textual information, contextually collected to the preferences, in the background of the numerical data analysis. This allows a validation of the "ideal" combinations obtained by the Conjoint Analysis, as well as further interpretative elements.

4. Final remarks

Conjoint analysis is used to evaluate consumer preference. If products are composed of attributes, C.A. determines which combination of attribute levels are most preferred by consumers. Consumers indicate their preferences by ranking a number of different combinations of attribute levels. C.A. assumes that consumers make purchases by simultaneously considering several attributes of a product.

The ability to analyze several attributes at once distinguishes conjoint analysis from traditional market research methods where each attribute is studied separately. It allows to discover how consumers make trade-offs between the various possible attribute combinations available. Usually, C.A. consists of a main-effects analysis of variance with ordinally scaled dependent variables. Consumer preferences are the dependent variables, and product attributes are the independent variables. It is a powerful tool for businesses in the process of designing new products or services that meet customers' needs and has many potential applications in agribusiness economics.

On the bases of the examined contributes, we can affirm that the use of permutation tests in C.A. introduces a power comparable to the parametric F test in case of normality. Permutation tests offer the advantage to conduct a multivariate verification of hypothesis. They don't need the modeling of the dependence structure among variables and, so, result very flexible and applicable.

In market research we often need statistical methods able to jointly deal with numerical and textual variables. Particularly in market segmentation, we have revisited several tools that have been proposed in literature in order to better understand the individual preferences and to improve the segmentation process by means of textual analysis.

The C.A. is still a methodology that introduces some critic elements. First of all the system of preferences of the consumer is intrinsically a measurement object with a complex nature, also confirmed by the presence in literature of different behavioural models (Bagozzi et al, 2002); the possible existence of remarkable interactions among some attributes and the intrinsic multidimensionality of products or services have to be taken in account, for the complete evaluation of the individuals' preferences system.

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