A JOURNAL OF THE INSTITUTE FOR OPERATIONS RESEARCH AND THE MANAGEMENT SCIENCES

MARKETING SCIENCE

Volume: 17

Number: 2

Year: 1998

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Direct Estimation of Batsell and Polking's Model

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Abstract

Batsell and Polking (1985) developed one of the important choice models that address the problem of independence from irrelevant alternatives. In this note, we propose an estimation method that directly estimates Batsell and Polking's model. Compared to the indirect estimation method suggested by Batsell and Polking, the direct method is simpler, making the BP model more accessible to potential users.
(*Estimation*; *Choice Model*; *Competitive Structure*)

1. Introduction

Batsell and Polking (1985; hereafter BP) developed a model that explicitly incorporates interactions among competing products. The BP model is considered one of the important classes of choice models that address the problem of independence from irrelevant alternatives (Lilien, Kotler, and Moorthy 1992, p. 107; Roberts and Lilien 1993). To estimate the model, BP used an indirect method of calibrating the model parameters from OLS estimates of another equivalent model to the original BP model. The purpose of this note is to propose a direct OLS estimation method of the BP model. The proposed method is simpler than the indirect method, making the BP model more accessible to potential users of the model.

In §2, we introduce the BP model using a simple example. Also, the indirect estimation method used by BP is briefly described. In §3, we propose a direct method for estimating the BP model. Then, the direct method is applied to the snack data analyzed by BP to compare the resulting estimates with those obtained by the indirect method. We discuss strengths and limitations of the direct method in §4. Also suggested is a GLS method that addresses issues introduced by using OLS to the BP model that has the log ratio of choice shares for an ordered pair of products as its dependent variable.

2. BP Model and the Indirect Estimation Method

We describe the BP model using a simple example in Table 1. BP used the example to demonstrate their indirect estimation method. There is a set of four competing products, $S = \{1,2,3,4\}$. Products 1 and 2 and products 3 and 4 are supposed to be similar, respectively. Products in one group could be Coke and Pepsi, whereas those in the other group could be 7Up and Sprite.

Suppose a consumer chooses a product between Coke and 7Up. The ratio of Coke's share to 7Up's share shows how Coke does versus 7Up in a simple one-on-one context. BP calls the ratio a second-order effect because it involves only two products. When we consider the three-product set with products Coke, 7Up, and Sprite, the ratio of the Coke's share to 7Up's share may be different from that observed in the two-product set of Coke and 7Up because of the influence of Sprite. The ratio observed for the three-product set may be decomposed into a component purely due to the competition between Coke and 7Up, a second-order effect, and a component due to the existence of Sprite in the choice set, a third-order effect. If Coke, 7Up, Sprite, and Pepsi are in the choice set, the ratio of Coke's share to 7Up's share may be decomposed into a second-order effect, a third-order effect of Sprite, a third-order effect of Pepsi, and a fourth-order effect of 7Up and Pepsi. In

MARKETING SCIENCE/Vol. 17, No. 2, 1998
pp. 170–178
0732-2399/98/1702/0170$05.00