Optimal promotional strategy for intra-category cross-selling

An application to culinary products in Taiwan

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Abstract

Purpose – The aim of this paper is to investigate an optimal promotional strategy of intra-category cross-selling on culinary products for the fiercely competitive, fast-moving consumer goods (FMCG) industry.

Design/methodology/approach – A linear regression model and a Markov switching autoregressive model is used, that incorporates a retailing demand process to capture a nonlinear structure among promotional budget allocation, and evaluate promotional performance, and optimal promotional frequency within a given time span. Three product categories are applied with 39 months of time-series data from a multinational packaged food company in Taiwan.

Findings – The result shows that most previous decisions on promotional budget allocation are non-optimal – most promotional investments were either extended too long or allocated too low in stimulating sales.

Research limitations/implications – This study suggests implications for the brand or category manager in removing such non-optimal promotional policies.

Originality/value – Previous promotional investment is evaluated by comparing the changes in promotional budget allocation. Markov's switching feedback rules are then applied to determine the proper length of equilibrium state with and/or without promotion. Finally, effective decision rules on magnitude, duration, and frequency of intra-category promotional strategy are induced.

Keywords Budget allocation, Fast-moving consumer goods, Promotional strategy

Paper type Research paper

Introduction

Fundamental changes are continuing to take place in the "fast-moving consumer goods" (FMCG) industry, as both retailers and manufacturers begin to embrace the current "category management" approach to product assortment processing (Basuroy *et al.*, 2001; Du *et al.*, 2007). Pondering the wide variety of shopping options, and recognizing extreme price competition amongst retailers, today's shopper is increasingly likely to discriminately seek out products amongst various sources, and amongst various products and brand extensions. Furthermore, with the natural maturing and lapsing of the market towards the declining stage of the life cycle of any product, manufacturers and retailers are faced with the need to improve revenue levels, when at the same time, they also need to invest heavily in pricing, promotion and merchandising activities.

Taking Tesco as an example; as a result of the creation in 2002 of its everyday low price (EDLP) scheme, it can now claim to be Britain's cheapest supermarket. Furthermore, with initiatives such as the EDLP scheme having been introduced

throughout the industry, there has been an increase in both the general awareness of consumers and their willingness to seek out the lowest possible prices. Up to the present, Tesco is the grocery market leader in the UK with a market share of around 30 percent and is the 15th-largest company on the London Stock Exchange.

Promotions and pricing have long been amongst the most widely discussed topics by both marketing practitioners and researchers alike (e.g. Alford and Biswas, 2002; Chandon, 2000; Kurata and Liu, 2006; Mulhern and Leone, 1991; Palazon and Elena, 2009), with such strategies having been clearly demonstrated to have long-run profitability (Kopalle *et al.*, 1999; Pauwels *et al.*, 2002; Tsiros and Hardesty, 2010). When they have to simultaneously contend with a large number of different product categories, both manufacturers and retailers refer to the effective execution of promotional activities as "intermingling".

Promotional activities include cents-off coupons, direct mail, on-pack policies, business-to-business (B2B) and business-to-customer (B2C) sales promotions, as well as promotional events. In general, such promotional activities involve three main aspects:
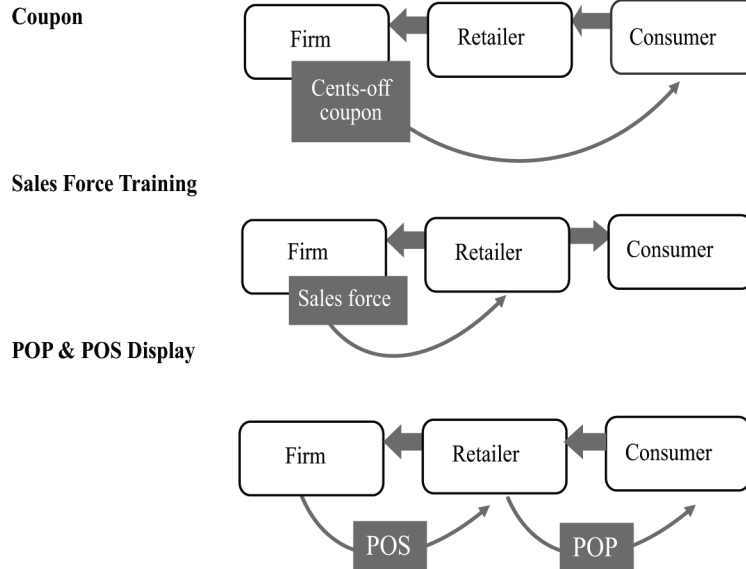
(1) promotional depth (the amount of money which a business should be prepared to invest);

(2) promotional frequency (how often stores should offer discounted prices); and

(3) promotional extent (the total number of products within a particular category which should be promoted).

In reality, however, the tendency amongst most manufacturers and retailers has been to continue to rely upon price-based promotions as their primary means of achieving their volume targets, an approach which raises the question of whether such reliance on price-based activities may actually damage the ability of the company to enhance efficiency in the long term.

It is clear that at each decision-making point, brand managers need to allocate their limited resources and budgets to the various categories, and these decisions will clearly be heavily dependent not only upon their experience in budget allocation, but also upon the expected responsiveness to the promotions in each category. For many industries, sales promotions represent a significant proportion of a firm's marketing budget, with non-durable goods manufacturers actually spending more on short-term sales promotions than long-term advertising (Walters, 1991). The effectiveness of a sales promotion can be examined by decomposing the sales bump during each promotional period (cycle) into sales increases attributable to brand switching, purchase time acceleration and stockpiling (Gupta, 1988). In the present study, we classify sales promotion tools according to the data collected (Figure 1).

Cents-off coupons
Cents-off coupons are already well recognized within the marketing literature for their immediate influence on sales. Most cents-off coupons are short-term promotions, a strategy which is aimed not only at accelerating consumer purchases, but also at maximizing total sales, with the prior studies having clearly demonstrated an increase in brand sales soon after such coupons are distributed (Neslin *et al.*, 1985).

Coupon

Sales Force Training

POP & POS Display

Figure 1.
Differences in sales
promotion tool channels

Sales force training expenditure
Sales force training expenditure represents the training expenses incurred by salesmen
or market promoters. Although these players can deliver the latest information from
the market to the manufacturers, they do not normally have such information on the
marketplace readily available; thus, the training workshop is a very powerful and
worthwhile tool for manufacturers, in terms of retaining sales force productivity. The
higher the expenditure on salesmen or promoters, the higher the sales level they can
generate; thus, "excellent" promoters exhibit greater perception of the importance of
promotions than "sub-standard" promoting retailers, and will invariably reveal a
tendency to follow up on such perception by spending more on their total promotional
budget (Friestad and Wright, 1994).

POP & POS display expenditure
POP & POS display expenditure refers mainly to promotional events, shelf displays
and road shows set up in retail stores, with such displays and associated expenditure
strongly affecting the sales items. Many academic studies have confirmed the
effectiveness of display expenditure, with each of these sales promotion tools having
its own way of attracting consumers (Bemmaor and Mouchoux, 1991; Bolton, 1989;
Kumar and Leone, 1988; Woodside and Waddle, 1975). Coupons, which go directly to
the consumer, stimulate retail sales. Training expenditure applies directly to the
trading sales force so that the company can retain its sales productivity, thereby
enhancing consumer purchases. Expenditure on shelf space, displays or road shows
within a retail store provides producers with greater exposure of their products and
effective enhancement of consumer purchases. The sales promotions explored in this
study refer primarily to cents-off coupons and on-pack policies.

Apart for the three promotion tools described above, other studies have indicated the importance of promotional frequency, with regard to changes in the reference price for consumers. Their findings provide clear explanations of the potential loss of brand equity when brands are heavily promoted, since a lower consumer reference price reduces the premium that can be charged for a brand in the marketplace, thereby resulting in lower equity.

The effect of deal frequency on the reference price of consumers is discussed in several of the prior studies in which it is demonstrated that the higher the deal frequency, the lower the height of the deal spikes (Kalwani and Yim, 1992; Lattin and Bucklin, 1989; Mayhew and Winer, 1992). Such a result is likely to be attributable to consumer expectations on the frequency of deals and subsequent changes in the consumer reference price. Both Bolton (1989) and Raju (1992) reported similar empirical results, as did Winer (1985), albeit indirectly through a preceding generalization linking the reference price to purchasing behavior.

We subsequently go on to develop a framework aimed at providing an understanding of the different types of promotions under distinct categories, and then use this framework to generate our hypotheses. We follow Kurata and Liu (2006) to use the Markov switching time series model which captures the dynamics of promotional activities, and subsequently go on to describe the method of measurement, demonstrate our analytical methodology and present the results. The panel dataset obtained from a leading global packaged food company includes categories of milk, chocolate, confectionery, bottled water, coffee, ice cream, food seasonings and pet foods.

The dataset, covering the period from January 2004 to March 2007, refers to numerous innovative promotional activities, with bouillons and seasonings being the two categories targeted for specific analysis; this analysis is based upon three different package sizes which effectively convey the various sales and promotional activities. Finally, our study concludes with a discussion on the managerial implications and opportunities for further research.

Why using Markov switching times-series model?

Occasionally, the effects of a promotion may be extended into the next period (Narasimhan *et al.*, 1996). Although a Markov switching time-series model is invariably used in econometrics to describe time-series data (Hamilton, 1996), Kurata and Liu (2006) went on to use this model to describe the ways in which promotions influence retail sales. Bronnenberg (1998) studied optimal advertising planning decisions under budget constraints, noting that a sudden surge in sales may often be observed on the day of a special promotion. Marketing researchers have similarly reported spikes in the time-series plot of actual sales attributable to sales promotions.

Although the traditional market response models, such as the linear or multiplicative methods, have difficulty in explaining any impulsive increase in demand potentially attributable to promotions, the Markov switching model is capable of capturing such impulses. This model can be used to analyze the optimal promotion depth and frequency under a supply chain framework in cases where retailers wish to maximize their expected revenue whilst suppliers strive to minimize their expected inventory costs. The Markov switching model can also be used to examine the optimal

promotion depth and frequency in different scenarios of various package sizes, product categories, retail channels and promotion types.

Methodology
Data collections and sample
The panel dataset used in the present study includes three different retailing outlets. The first is PX Mart, which, having previously served only the army and government-sponsored convenience stores, was recently expanded to over 700 retail stores with over 6,000 brands being made available to the public. PX Mart previously required government employee membership and offered deep discounts (20 percent) on all items, resulting in its image of the cheapest store around. PX Mart is currently the most widely distributive retail store in the FMCG industry in Taiwan.

The second is the hypermarket sector, which includes the global player Carrefour and the Taiwanese corporation RT-MART (established in 1996). The third is a wholesaler-sponsored distributor providing manufacturers' products to retailers; this distributor often carries its own private labels. The sales promotion tools used by these different outlets are presented in Table I.

The two categories of "bouillons" and "seasonings" provide the main focus for our examination in the present study, based upon 39 months of sales data covering the period from January 2004 to March 2007. The total promotional expenditure on bouillons was US\$109,210, whilst that on seasonings was US\$72,580. The average sales of bottle packages were US\$7,470 per month, while sales of jar packages amounted to US\$5,200. Each outlet has its own promotional tools, including online e-commerce, CI, trade promotions, POSM, samples, events and coupons.

Modeling
We begin by using a linear regression model to test the influence of promotions on sales and the interactive impacts of retail outlets, package sizes and product categories. Most sales response models tend to follow the autoregressive process:

$$Y_{t_{ijk}} = \beta_0 + \beta_1 Y_{t-1_{ijk}} + \beta_2 X_{1_i} + \varepsilon_{i_1} \varepsilon_{i_1} \sim iid$$

where $Y_{t_{ijk}}$ represents the sales revenue in period t; $Y_{t-1_{ijk}}$ refers to the sales revenue in period $t-1$; and X_{1_i} is the total amount of promotional expenditure (see Appendix, Table AI).

Brand	Category	Package	Outlet	Sales promotion
One brand	Bouillon	Jar	PX Mart	Coupon
			KA Mart	Training expenditure
			GT (distributors)	Display expenditure
		Cube	PX Mart	Coupon
			KA Mart	Training expenditure
			GT (distributors)	Display expenditure
	Seasoning	Bottle	PX Mart	Coupon
			KA Mart	Training expenditure
			GT (distributors)	Display expenditure

Table I.
Sales promotion tools used by different outlets

The i variable refers to the different promotional vehicles, where $i = 1$ indicates sales promotion, $i = 2$ refers to coupons, $i = 3$ indicates training expenditure, and $i = 4$ refers to display expenditure. The j variable refers to the different package types, where $j = 1$ indicates jars; $j = 2$ refers to cubes; and $j = 3$ indicates bottles. The k variable represents the different outlets, where $k = 1$ indicates PX Mart, $k = 2$ indicates the superstores; and $k = 3$ refers to the general distributor. The moderating effects of the categories, packages and outlets can be modeled as follows:

$$Y_{t_{ijk}} = \beta_0 + \beta_1 Y_{t-1_{ijk}} + \beta_2 X_{1_i} + \beta_3 X_{2_j} \beta_4 X_{1_i} X_{2_i} + \varepsilon_{i_2} \varepsilon_{i_2} \sim iid,$$

where X_{2_j} represents the packages (see Appendix, Table AII); and:

$$Y_{t_{ijk}} = \beta_0 + \beta_1 Y_{t-1_{ijk}} + \beta_2 X_{1_i} + \beta_3 X_{3_k} + \beta_4 X_{1_i} X_{3_k} + \varepsilon_{i_3} \varepsilon_{i_3} \sim iid,$$

where X_{3_k} represents the outlets (see Appendix, Table AIII).

The regression estimates indicate that promotions have no significant influence on sales; thus, if the effects of sales promotions are uncertain, a company may have some difficulty investing the required expenditure based purely on personal experience.

We now go on to use the Markov Switching model to determine the optimal promotional strategy. We follow Hamilton (1996) and Kurata and Liu (2006) and assume two different regimes exist in the market behavior of promotion activities characterized by different underlying processes,

$$y_t - \mu_{s_t} = \varphi(y_{t-1} - \mu_{s_{t-1}}) + \varepsilon_t, \tag{1}$$

where y_t presents the primary market demand at time t, μ_{s_t} represents the expected market demand (from promotional activities) at time t, and $\varepsilon_t \sim iid(0, \sigma^2)$. The switching mechanism is assumed to be governed by the sales promotion function s_t that follows a Markov switching AR(1) process with two separate demand states, the non-promoted base regime ($s_t = 1$)) and the promoted spike regime ($s_t = 2$)). For a stationary Markovian, we assume the incremental expected demand μ are independent of auto-correlation coefficient μ and error ε_t. The transition matrix **P** contains the probabilities P_{ij} of switching from regime i at time t to regime j at time $t + 1$: function can then be expressed as the probabilistic form:

$$P = (P_{ij}) = \begin{pmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{pmatrix} = \begin{pmatrix} p_{11} & 1 - p_{11} \\ 1 - p_{22} & p_{22} \end{pmatrix}$$

where P_{11} represents the manufacturers' having continual non-promotional activities, and P_{22} represents having continual promotional activities in two states; P_{12} represents the manufacturers who do not have a promotion in Period 1 but do have one in Period 2, and P_{21} represents the reverse. The transition probability of state i transferred to state j; with the transition probabilities satisfy two constraints, $0 \leq p_{11}, p_{12}, p_{21}, p_{22} \leq 1$ $0 \leq p_{11}, p_{12}, p_{21}, p_{22} \leq 1$ and $p_{11} + p_{12} = 1$ and $P_{21} + P_{22} = 1$. In marketing literature, for example Holak and Tang (1990) found that most products such as the cigarette sold at retailers have positively-correlated demands. The interpretation of transition probability is consumers' brand loyalty where a prior state is contingent on the post state (Nijs *et al.*, 2001).

Following Cosslett and Lee (1985), Hamilton (1996) has developed a general non-liner transfer function. Starting from the unconditional probability of state 1 at time $t = 1$, given by the well-known formula:

$$\theta = \theta(P_{11}, P_{22}) = \frac{(1 - P_{11})}{(2 - P_{11} - P_{22})}$$

The ergodic Markov switching regime model has two features. First, it allows the promotion activities to switch across regimes following a first order Markov chain. The unconditional probability for state 1, θ can be referred to as the frequency of promotional activities a firm apply. Second, the autoregressive parameters are also allowed to change as the expected demand shift, and hence the promoted demands are regime-varying. We set the expected revenue, R, for the manufacturer as the product of the expected demand from customers, μ_1 or μ_2, and the discounted price, or promotional depth $\bar{p}$ as:

$$R = R(\theta) = (1 - \theta)\bar{p}\mu_1 + \theta(\bar{p} - k\theta)\mu_2 \qquad (2)$$

Where the promotional cost is proportional to the promotional frequency θ, and k is a linear promotional cost fraction. Take the first and second order derivatives with respect to the promotional frequency, and doing so yields the following optimal promotion strategy in maximizing revenue:

$$\theta^* = \frac{\overline{P}}{2k\mu_2}\left(\mu_2 - \mu_1\right) \qquad (3)$$

Although the transitional probability θ_{ij} is used to determine the optimal promotion frequency in a given period, it can be treated as a standard to allocate the budget. The higher the value of θ is, the higher the promotional frequency will be. Therefore, promotional frequency can be viewed as a measure of promotional performance, which involves maximizing the revenue and the profit.

Results
The results of this study on promotional frequency, with regard to different sales promotion vehicles and packages, are summarized in Table II. If $= 0$, then this would imply that the previous promotional investment strategy had led to virtually no increase in sales revenue.

Amongst the three promotional vehicles, display expenditure is found to have the highest impact on sales of cube packages ($\theta = 0.33$), whilst coupons are found to have an effect only on bottle ($\theta = 0.14$) and jar ($\theta = 0.09$) packages. Training expenditure is

Sales promotion	Bouillons		Seasonings	Sum of θ
	Jar	Cube	Bottle	
Coupon	0.09	0.00[a]	0.14	0.23
Training expenditure	0.05	0.00[a]	0.20	0.25
Display expenditure	0.00[a]	0.33	0.00[a]	0.33

Note: [a]Where the value of θ was found to be less than 0, it was counted as 0

Table II.
Summary of promotional frequency on various packages and categories

found to have a greater impact on bottle packages ($\theta = 0.20$), but less impact on jar and cube packages. Overall, sales promotions are found to have greater impacts on the category of bouillons ($\theta^* = 0.47$) than on the category of seasonings ($\theta = 0.34$).

In seeking to establish their optimal promotional budget allocation, we would suggest that manufacturers should allocate most of their budget to the cube packaging of bouillons, essentially because the response rate for such sales promotions is far higher than that for the other two types of packaging. However, in the present study, we also note that for certain items, the promotional frequency impact is zero ($\theta^* = 0$), a result which would seem to suggest that manufacturers should not assign any of their sales promotion budgets to coupons, to training expenditure on cube packages, or to display expenditure on jar and bottle packages.

Based upon the assumption of Markov switching stationary distribution, we can calculate the possible transition probabilities constrained by: $\theta \leq P_{11}$, $P_{22} \leq 1$ and $0 \leq P_{11} + P_{22} \leq 1$. However, given that θ is not uniquely decided by probabilities P11 and P22, the question arises as to how a brand manager can apply the results of stochastic promotions to real promotional planning. For example, as shown in Table III, the impact of coupons on jar packages was found to be $\theta 21 = 0.09$; thus, one possible transition probability combination could be P11 = 0.9 and P22 = 0.00, resulting in $\theta^* = 0.09$.

In the two-state Markov chain, the average period of time that a manufacturer remains in the promotional state (or in the non-promotional state) is described as:

$$\frac{1}{1 - P_{22}} \left(\text{or} \frac{1}{1 - P_{11}} \right).$$

Thus, the appropriate period of time for remaining in the non-promotional (promotional) state can be interpreted as $P_{11} = 0.9$ ($P_{22} = 0.00$); that is, ten months (one month). Hence, in our case, the optimal promotion strategy would involve the offering of coupons every other ten-month period.

Conclusion

In the fiercely competitive fast-moving consumer goods (FMCG) market, the effects of sales promotions are far too complex to explain, and indeed, such promotions can no longer guarantee stimulation of sales. Furthermore, manufacturers have difficulties making promotional decisions, a challenge which leads to the effects of promotions appearing uncertain, yet promotional activities continue to receive a considerable share of promotional budgets. We have analyzed the optimal sales promotional strategy for intra-category cross-selling, which includes budget allocation, promotional frequency and the evaluation of promotional performance. Interestingly, our results reveal that neither sales promotions nor the moderating effect exhibit any real measure of success.

In order to capture the actual demand response to promotions, we follow Kurata and Liu (2006) to apply the Markov switching autoregressive process, with the results

Category	Total promotional expenditure	θ	
Bouillons	NT\$ 3,276,220	0.15	
Seasonings	NT\$ 2,177,470	0.24	

Table III.
Comparison between promotional expenditure and θ

indicating that the promotional frequency, θ^*, is quite low; thus, the optimal frequency should be at least every ten months, or longer. Since there are numerous promoted products available in the market, consumers tend to be overloaded with information, and if investment is not large enough to counter the campaigns of competitors, promotions may be totally ineffective, and thus, a waste of money.

In reality, higher promotional investment does not necessarily generate higher revenue. The optimal promotion strategy should be less frequent promotion of the bouillon product category ($\theta = 0.15$), whereas seasonings ought to be regularly promoted ($\theta = 0.24$); however, our sample firms tended to spend heavily on bouillons (US$109,210) and less on seasonings (US$ 72,580). The reasons for this may include consumer price sensitivity, brand awareness, substitutes or consumer preference, all of which are beyond the scope of the present study.

Finally, there are two research limitations of this study which must be taken into consideration. First, since we treated the market price as given, the price discount effect is not taken into account. Second, we have considered neither the changes in brand awareness and brand image nor the impact on the customer decision processes. These limitations clearly provide important topics for future study.

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Further reading

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Appendix. Linear regression result

Parameter	t-value	p	Conclusion
Sum of all sales promotion	0.22	0.8304	Reject the hypothesis
Coupon	−0.01	0.9918	Reject the hypothesis
Training expenditure	−0.88	0.3834	Reject the hypothesis
Display expenditure	0.73	0.4680	Reject the hypothesis

Table AI.

Interaction	F-value	p	Conclusion
Sum of all sales promotion*packages	1.22	0.2269	Reject the hypothesis
	0.61	0.5412	Reject the hypothesis
Coupon*packages	0.23	0.8192	Reject the hypothesis
	0.07	0.9479	Reject the hypothesis
Training expenditure*packages	0.54	0.5925	Reject the hypothesis
	0.87	0.3843	Reject the hypothesis
Display expenditure*packages	1.43	0.1565	Reject the hypothesis
	0.48	0.6322	Reject the hypothesis

Table AII.

Interaction	Fvalue	p	Conclusion
Sum of all sales promotion*outlets	1.32	0.1904	Reject the hypothesis
	−1.30	0.1955	Reject the hypothesis
Coupon*outlets	0.24	0.8138	Reject the hypothesis
	−0.83	0.4089	Reject the hypothesis
Training expenditure*outlets	−0.45	0.6562	Reject the hypothesis
	−0.03	0.9750	Reject the hypothesis
Display expenditure*outlets	2.11	0.0374*	Significant
	−1.00	0.3205	Reject the hypothesis

Table AIII.

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