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How supplier category management policy influences category sales performance

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Abstract

Purpose – The purpose of this paper is to examine how several aspects of supplier category management policy might affect category sales performance at Korean supermarkets.

Design/methodology/approach – Aggregated (market-level) Nielsen time-series category management and sales data for several variety enhancer categories in the Korean supermarket industry are analyzed.

Findings – Across both small and large supermarkets, both the number of brands and the forward inventory level had positive effects on sales while days of supply of a product had a significant negative effect. For large supermarkets, the out-of-stock rate also had a significant negative effect, while for small supermarkets the retail distribution rate had a significant positive effect.

Research limitations/implications – Using data for the Korean supermarket industry, this study demonstrates which policies for product assortment, pricing, stocking, and product replenishment can affect category sales and how these effects may vary between large and small stores. However, the findings rest on market-level aggregated data and may be limited in scope to variety enhancer (i.e. low purchase frequency and high penetration) categories. Future research could try to relax these limitations.

Originality/value – The value of this study lies in confirming findings such as how category sales are higher in categories with a relatively larger number of brands (as has been observed in the US supermarket industry), as well as in the surprising finding that category pricing policies do not have a significant effect on category sales even though variety enhancer categories are generally considered price sensitive.

Keywords Brand management, Distribution, Pricing, Supermarkets, South Korea, Suppliers

Paper type Research paper

Introduction

In general, manufacturers and wholesale suppliers of consumer products focus on brand performance, while retailers focus on categories consisting of general classes of stock keeping units (SKUs) rather than on brands or brand SKUs. Retailers seek growth in overall category sales rather than growth in brand sales or share. In principle, category management (CM) can reduce such divergence in sales objectives between suppliers and retailers. CM is a joint retailer/supplier process of managing categories in terms of pricing, merchandising, promotion, and product mix in light of category-specific objectives, competitive environments, and consumer behaviour (GMA, 1995; Blattberg, 1996).

In the Korean market, the government has played a significant role in introducing CM. Under the Ministry of Commerce, Industry, and Energy, the Efficient Consumer Response/Supply Chain Management Board introduced CM in 1999. Since 2000, major Korean retailers have been jointly implementing CM in experimental stores together with

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partner suppliers. For example, LG Distribution and Lotte Mart play a role as category captains and Yoohan Kumberly and DongSuh Foods participate as partner suppliers.

In CM, the category captain role sometimes goes to the retailer (e.g. Basuroy *et al.*, 2001; Dhar *et al.*, 2001) and sometimes to the supplier (e.g. Gruen and Shah, 2000). This study considers effects of CM policies on category sales performance from the viewpoint of the *supplier* by utilising aggregated market-level A.C. Nielsen data for health and beauty products manufacturers who are implementing CM. In principle, if suppliers provide more attractive product assortments, place more stock on shelves, sell products at lower prices, and use more aggressive promotions than competitors, they will achieve higher sales performance. Suppliers set the priority for specific CM policies for assortments, stock levels, and pricing, the effectiveness of which could vary depending upon category roles, such as, for example, staple and variety enhancer categories (Dhar *et al.*, 2001) or destination and convenience categories (Blattberg, 1996). In addition, suppliers might plan different out-of-stock rates or product availability levels for large retailers than for small retailers.

The objective of this study is to examine which CM policies contribute most to category sales performance and how these effects might depend on store size. These policies include those for assortments of brands, pricing, stock levels, distribution coverage, and product replenishment. The study analyses market-level Nielsen data that represents 2,859 large supermarkets and 15,565 small supermarkets in Korea for the time period of 1997-2002. The data set consists of a time-series of observations for each store size type for both a number of CM policy variables and for category sales across four product categories: shampoo, toothpaste, laundry detergent, and dish detergent.

Development of hypotheses about CM policies and category performance

Product assortments and performance

Assortment policies within product categories involve:

- setting the variety of SKUs offered; and
- setting guidelines for maintaining, adding, or deleting SKUs.

Category breadth (e.g. number of brands) and depth (the number of SKUs) helps cater to heterogeneous customers. Variety attracts shoppers and induces them to buy (Bergen *et al.*, 1996; Dhar *et al.*, 2001). However, in an on-line grocer context, Boatwright and Nunes (2001) found that *decreasing* the number of SKUs tended to increase sales, although at a decreasing rate. Yet, further analysis of a more complete set of categories from this same on-line grocer data set found conflicting if not opposing results, suggesting that larger assortments in fact did have positive performance effects (Borle *et al.*, 2005). A fairly general principle follows from Van Ryzin and Mahajan (1999) who show that larger assortments have positive performance effects under conditions of item demand rigidity. Arguably, variety-seeking/enhancing categories approximate such conditions more so than conditions of close inter-item substitutability. In a cross-sectional study of secondary data which is particularly relevant to the present study, Cadeaux (1999) offers industry-level evidence that category sales revenue is positively related to both the number of SKUs and the number of brands in a category (using aggregated US market-level (Nielsen) data for 304 supermarket sub-categories). In light of the general arguments and evidence for a positive effect of assortment on sales, and particularly in light of market-level evidence about the sales effects of the number of brands in a category (e.g. Cadeaux, 1999), we present the following basic hypothesis:

H1. The number of brands in a category will have a positive effect on category sales.

Pricing and performance

CM policies set the standard retail prices for SKUs. Basuroy *et al.* (2001) reported that when a retailer implements CM, average prices increase although sales decrease at the outset. Under generally elastic demand, low prices increase category sales because brand-loyal consumers buy more and price-conscious consumers switch brands. Allenby and Rossi (1991) show that if prices fall within the latitude of price acceptance, price-sensitive consumers are willing to purchase more expensive (presumably higher quality) brands. This behaviour results in increased aggregate sales revenue from a price reduction. However, such consumers discontinue purchasing expensive brands when prices return to normal levels.

Price effects could depend on category roles (Dhar *et al.*, 2001). In a variety enhancer category such as shampoo (i.e. one of low purchase frequency/high penetration), relatively low regular prices lead to higher sales performance as measured by unit Category Development Index (CDI). However, in such categories, price discounts lead to significantly lower sales performance as measured by dollar CDI, indicating that variety enhancer categories may not be sufficiently price elastic to justify low regular prices. On the other hand, temporary price reductions can increase category sales in the case of a staple category such as cereal but not affect either dollar or unit CDIs in a variety enhancer category (Dhar *et al.*, 2001).

The focal categories for the present study – shampoo, toothpaste, laundry detergent, and dish detergent – are arguably variety enhancer categories rather than staple categories. Thus, following Dhar *et al.* (2001), we argue that price reductions lead to higher sales performance and arrive at the following hypotheses:

H2. When regular prices in a category are lower, category sales will be higher.

H3. When rates of price reduction in a category are higher, category sales will be higher.

Stock, space allocation, and performance

Many categories encounter diminishing returns from adding new products, brands, and SKUs on shelves. Shelf space allocation and position strongly influence consumer buying (Dreze *et al.*, 1994). In CM, shelf space policies determine which products to stock and their space allocations. In general, two views exist about the causal relationship between shelf space allocation and sales performance. One is that sales are proportional to space. According to this view, the more space allocated to the product category, the lower the out-of-stock rate and the higher the sales performance (Borin *et al.*, 1994). Another view is that *expected* sales indirectly affects space. For, say, seasonal goods, a forecasted demand increase could lead to an increase in planned stock levels and therefore an increase in allocated space (Cadeaux, 1994).

This study assumes that sales performance increases in proportion to allocated space at a constant rate. Borin *et al.* (1994) demonstrate that when more space is allocated to a product category, at first, out-of stock rates of SKUs in a category decrease but then category sales eventually increase. In particular, Desmet and Renaudin (1998) demonstrate a positive space elasticity in impulse buying categories such as jewelry and fruit. This study measures space in terms of forward inventory, that is, the size of the category displayed on the shelves. The forward inventory reflects

the competitive structure among product categories, product preferences of consumers, and the extent of consumers' purchases. Thus, the following hypothesis expresses the relation between space area as measured by forward inventory and category sales:

H4. The forward inventory level for a category will have a positive effect on category sales.

Product replenishment and performance

Product replenishment in CM concerns product availability, out-of-stocks, and the days of supply of product items or SKUs. Suppliers generally attempt to facilitate product availability to reduce out-of-stocks and to reduce inventory levels. In particular, pre-planning agreements between suppliers and retailers can support product replenishment (Gruen and Shah, 2000). If the distribution (coverage) rate in terms of the number of stores that sell the product increases, product availability increases and hence sales performance improves (Farris *et al.*, 1989). As an empirical generalisation, Farris *et al.* (1989) discuss how a brand's market share is a convex function of its retail distribution, increasing at an increasing rate up to 100 per cent distribution. Another basic objective of CM product replenishment policies is to reduce out-of-stocks (Blattberg and Fox, 1995). Stock-outs reduce supplier selling opportunities, decrease the actual distribution (availability) rate, increase the penetration of competitors' products, and increase stock-out rectification costs.

The final dimension of product replenishment is the days of supply of products, an indicator of the ratio of sales volume to inventory. The days of supply of products indicates the number of days that the inventory in the store is sold out in comparison to the selling speed during a specific time period. If inventories are not sold out and remain on shelves for a long time, stock turnover will decrease and sales will drop (Levy and Weitz, 2007).

The following hypotheses depict the effects on category sales performance of:

- the distribution rate of the product category;
- the out-of-stock rate; and
- the days of supply of the product:

H5. The distribution rate for a category will have a positive effect on category sales.

H6. The out-of-stock rate for a category will have a negative effect on category sales.

H7. When the days of supply of products for a category are relatively shorter, category sales will be relatively higher.

Empirical model

The major objective of this study is to examine how CM policies affect category performance. In addition, it examines how these effects may vary across stores of different sizes (that is, large vs small supermarkets). Since consumers' perceptions about category roles arguably depend on store size, CM policies should also differ by store size. For example, in a large supermarket, shampoo and toothpaste categories should play a routine role for consumers who visit the store to purchase them as part of a larger shopping experience across a number of categories; however, in a small

supermarket, those categories should play a destination or convenience role for consumers who visit the store specifically to buy those categories. Thus, since the different size stores require different shelf stocking policies, product replenishment policies, and the like, suppliers should use different CM policies depending upon the store size. In light of these store size effects and the previous discussion of CM polices and category performance, we propose the empirical model shown in Figure 1.

Data, measures, and analysis

Data

The data used are A.C. Nielsen data obtained from the beauty and health manufacturer who is implementing CM as the representative in the industry in Korea. The Nielsen data represent *aggregated* nation-wide (i.e. market-level) data for 2,859 large supermarkets and 15,565 small supermarkets, with observations made at two-month intervals. In this market, a large supermarket is one that has two or more checkouts and a small supermarket is one that has only one checkout. This study, in the Nielsen database, utilised retail trade indices which included forward inventory, the level of the average regular price, the number of brands in a category, the retail distribution rate, the out-of-stock rate, the days of supply of a product, and category sales. The categories were shampoo, toothpaste, washer (laundry) detergent, and kitchen (dish) detergent. The sample was comprised of a total of 109 (aggregated) cases. Each case represents data for all variables in one category observed at one two-month interval. In this data set, 31 shampoo cases (observations) were collected from the January/February period in 1997 to the November/December period in 2002, 30 toothpaste cases from the January/February period in 1997 to the January/February period in 2001, and 24 washer (laundry) detergent and 24 kitchen (dish) detergent cases each were from the January/February period in 1998 to the November/December period in 2001. Thus each observation represents one two-month period observation for each category. The categories are pooled in the subsequent analysis, yielding the 109 potential observations.

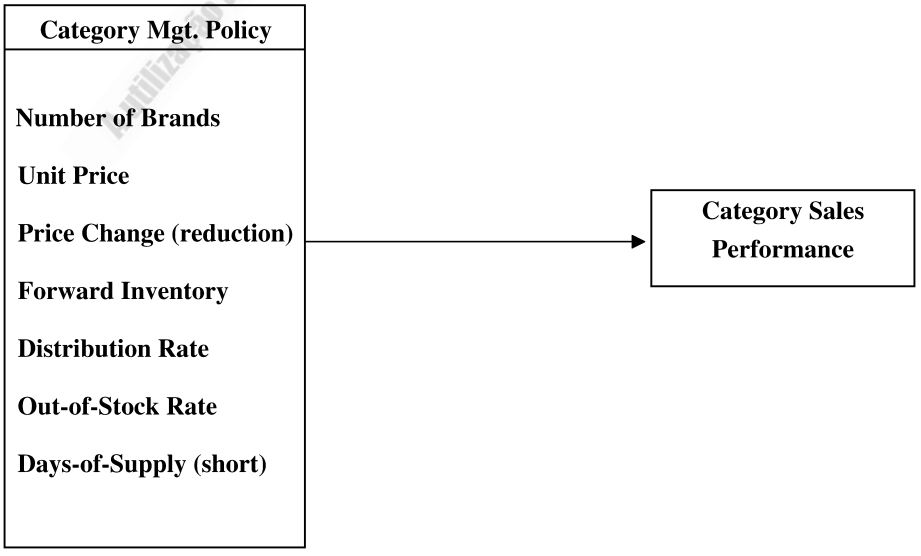

Figure 1.
Empirical model

Measures

The variables used in this study do not include all the CM policies and practices that could possibly explain category performance. Such variables as in-store promotion and merchandising, shelf location, and advertising were excluded from the analysis because they were not available. All measurements were standardised using *z*-scores, category by category, so as to increase compatibility and eliminate errors due to scale effects. Specific measures follow.

The first variable, number of brands, is a basic measure of the variety of assortment, although the number of SKUs for each brand was not available. Unit price and price change capture different aspects of the supplier pricing policy. Unit price is the regular unit price level for the category and price change is the rate of unit price changes (reductions) between the periods. Forward inventory partially captures supplier stocking and shelf management policy and is simply the forward inventory that is displayed on the shelves, an indicator of the size of the category. Distribution rate, out-of-stock rate, and days-of-supply capture different aspects of supplier product replenishment policy. Distribution rate is the all commodity value weighted distribution rate or the proportion of stores that distribute the product of interest weighted by the all commodity volume sold by each store (Little, 1998). Here distribution is counted when more than one occasion of stock, purchase, or selling happens during the two-month period. Out-of-stock rate is defined as the per cent of stores that do not hold the product on shelves or in the warehouse when surveyed in spite of having a record of purchasing the product category. Days-of-supply is the number of days of sales represented by the category stock in the stores, a measure of the relative selling speed during the period. Finally, the dependent variable, category sales, captures category performance in terms of sales revenue earned from the product category during each period.

Results

To simultaneously test the hypotheses discussed above, we estimate the following multiple regression model:

$$\begin{aligned}\text{category sales} = \alpha &+ \beta_1 \text{ number of Brands } + \beta_2 \text{ unit price } + \beta_3 \text{ price change} \\ &+ \beta_4 \text{ forward inventory} + \beta_5 \text{ distribution rate} \\ &+ \beta_6 \text{ out-of-stock rate } + \beta_7 \text{ days-of-supply } + \varepsilon_i\end{aligned}$$

where α is the constant term, the β's are parameters to be estimated, and ε_i is a random error term. The regression analysis was conducted separately for each store size grouping. Table I presents the results of the analysis. R^2 in the regression model is moderately high at 0.717 in large supermarkets and 0.770 in small supermarkets. This shows that the CM policy variables explain a large portion of the variation in category sales performance.

A Durbin-Watson (D-W) test was conducted to check serial correlation of residuals because the data were collected at two-month intervals. When the sample size is 109 and independent variables are eight, low bound (dL) and upper bound (dU) in D-W test is 1.378 and 1.717, respectively, at $\alpha = 0.01$ level (Savin and White, 1977). In the case of large supermarkets, since the D-W statistic (1.895) is greater than dU (1.717), we can conclude that serial correlation does not exist at the $\alpha = 0.01$ level. In the case of small supermarkets, the D-W statistic between dL (1.378) and dU (1.717) is inconclusive (Greene, 1997).

Variables[a]	Large supermarket Standardized coefficients	*t*-statistic	Small supermarket Standardized coefficients	*t*-statistic
(Constant)	0.036		0.074	
Number of brands	0.272	2.565*	0.282	3.930**
Unit price	0.024	0.223	−0.116	−1.567
Price change	−0.069	−0.689	0.070	1.14
Forward inventory	0.787	7.991**	0.148	2.549*
Distribution rate	0.087	1.033	0.126	2.118*
Out-of-stock rate	−0.241	−2.845**	−0.049	−0.889
Days of supply	−0.632	−6.522**	−0.635	−8.564**
R^2	0.717		0.770	
Durbin-Watson statistic	1.895		1.381	

Notes: [a]Dependent variable is category sales; $^{*}p < 0.05$ $^{**}p < 0.01$

Table I.
Regression results

The variance inflation factor (VIF) was used to assess multicollinearity among independent variables. VIFs were distributed with the ranges of 1.001-1.817 for large supermarkets and 1.001-2.061 for small supermarkets. Thus, we can conclude that multicollinearity does not exist in both cases since the VIFs are far smaller than the criterion of 5.3 suggested by Hair *et al.* (1995).

To be concise, we present the results of the hypothesis testing for large and small supermarkets simultaneously. *H1* hypothesised that the number of brands in a category will have a positive effect on sales in a category. As can be seen in Table I, number of brands had a significant *positive* effect on sales for both large supermarkets ($\beta = 0.272$, $p < 0.05$) and small supermarkets ($\beta = 0.282$, $p < 0.01$). *H2* hypothesised that when the level of regular prices of products in a category is relatively lower, the level of category sales will be relatively higher while *H3* hypothesised that when rates of price change (that is, price reductions) for products in a category are relatively higher, category sales will be relatively higher. However, unit price did not have a significant effect for either large supermarkets ($\beta = 0.024, p > 0.05$) or small supermarkets ($\beta = -0.116, p > 0.05$). Price change also did not have a significant effect for either large supermarkets ($\beta = -0.069$, $p > 0.05$) or small supermarkets ($\beta = 0.070$, $p > 0.05$). Thus, the results do not support either *H2* or *H3* ($\alpha = 0.05$). *H4* hypothesised that the forward inventory level for a category will have a positive effect on category sales. Forward inventory did have a significant positive effect for both large supermarkets ($\beta = 0.787$, $p < 0.01$) and small supermarkets ($\beta = 0.148, p < 0.05$). Thus, the results support *H4* ($\alpha = 0.05$).

Finally, *H5*, *H6*, and *H7* hypothesised that relatively high distribution rates, low out-of-stock rates, and short days-of-supply would have positive effects on category sales. Distribution rate did not have a significant effect in large supermarkets ($\beta = 0.087$, $p > 0.05$) but had a significant positive effect on sales in small supermarkets ($\beta = 0.126$, $p < 0.05$). On the other hand, out-of-stock rate had a significant negative effect in large supermarkets ($\beta = -0.241$, $p < 0.01$) but was not significant in small supermarkets($\beta = -0.049$, $p > 0.05$). Thus, the results partially support *H5* and *H6* ($\alpha = 0.05$). Days-of-supply had a significant negative effect at both large supermarkets ($\beta = -0.632$, $p < 0.01$) and small supermarkets ($\beta = -0.635$, $p < 0.01$). Thus, the results support *H7* ($\alpha = 0.05$), that shorter days-of-supply (faster selling speed of stock on hand) will have a positive effect on category sales.

Conclusions

Summary and discussion

This study investigated how different CM policies, as developed and implemented by suppliers in the Korean supermarket industry, might vary in effectiveness in generating category sales at the retail level. The analysis helps to determine how specific policy levels for product assortments, pricing, shelf stocking, distribution coverage, and product replenishment might increase category sales. Empirical results varied depending on store size. In large supermarkets, the significant factors influencing category sales were the out-of-stock rate, the number of brands, the forward inventory, and the days-of-supply of a product. On the other hand, in small supermarkets, the significant factors influencing category sales were the retail distribution rate, the number of brands, the forward inventory, and the days-of-supply of a product. Regardless of store size, larger assortments of brands in a category and short days-of-supply of a product had a positive effect on category sales. The out-of-stock rate acted as a key negative factor only for large supermarkets while the retail distribution rate was a key positive factor only for small supermarkets.

These results yield several implications. First, the number of brands in a category, an indicator of the breadth of product assortment, did have significant positive effect on category sales even though suppliers in the Korean market do not add or delete brands to any great extent. This basic finding, although limited to four fairly broad categories, is a step towards empirically generalising within a longitudinal context in Korea previous market-level but cross-sectional US findings which show that, across a large number of supermarket sub-categories, the number of brands in a category is positively related to category sales (Cadeaux, 1999).

Since variety enhancer categories such as shampoo, toothpaste, or detergent are generally thought to be price sensitive, a surprising finding was that category pricing policies did not have a significant effect on category sales. One reason for this result could be that, as shown in Table I, the absolute effects of the regular unit price are too small to compensate for the price changes. Another explanation could be that while at the brand level the price change rate may influence brand shares, category sales may not reflect the aggregation of (unobserved) compensatory effects on brand shares. Other researchers have found that upon initial implementation of a CM programme, average category prices increase and sales decrease, but when a supplier subsequently reduces wholesale prices to meet reduced demand, *retailer* performance eventually improves (Basuroy *et al.*, 2001).

Shelf stock levels as measured by forward inventory had a significant effect on category sales for both classes of retailers. Perhaps, in some sense, a larger forward inventory displayed on the shelves is indicative of competitive advantage of the particular *category* against competing product categories in the store.

Several distribution and product replenishment policies had, overall, the most significant effects on category sales. Yet, notably, the retail distribution rate did not explain much variation in category sales for large supermarkets. Large supermarkets usually sell relatively large volumes of merchandise and generally stock wide assortments, hence suppliers focus more on developing total sales volume per store rather than increasing market coverage by trying to add to the number of (larger) stores selling their product category since the latter practice might simply encounter diminishing sales returns in a population of larger stores. A general implication might be that, for larger supermarkets, suppliers should emphasise attractive assortments or fewer out-of-stocks per store rather than increasing the retail distribution rate. On the

other hand, consistent with the observations of Farris *et al.* (1989), the retail distribution rate did have significant effects on category sales in small supermarkets. Small supermarkets stock mostly popular high share brands because of limited shelf space. Thus, suppliers implementing CM could benefit from increasing the number of smaller supermarkets who sell their popular brands in a category.

In contrast to the retail distribution rate, the out-of-stock rate did have a significant effect on increasing category sales in the case of large supermarkets, but not in the case of small supermarkets. A direct implication would be that supplier CM policies should try to focus on replenishing stocks in large supermarkets but give less emphasis to small supermarkets. One conjecture for why small supermarkets did not significantly experience reductions in category sales due to out-of-stock conditions might be that customers in small supermarkets are relatively more store-loyal and will purchase alternative SKUs or brands in a category or defer the purchase but not leave the store if an out-of-stock occurs.

The days-of-supply of a product category had a large effect on category sales in both large and small supermarkets. If the days to replenish products are delayed, or, in other words, if the inventory remains on shelves relatively long compared to the selling speed, suppliers' category sales will decrease rapidly. Thus, suppliers might benefit by generally focusing on rapid stock turnover through co-marketing activities with retailers.

Limitations and future research

This study examines the effects of several CM policies on category sales in the Korean supermarket industry. Its findings suggest some guidelines for how suppliers might allocate limited resources across the various CM policy variables as well as across stores of different sizes. It has several limitations. Although the data cover a number of key CM policies, they do not provide complete information about all marketing actions on a category-by-category basis within stores. Its findings may be limited in scope to variety enhancer (i.e. low purchase frequency and high penetration) categories such as shampoo, toothpaste, or detergent. Although its analysis focused specifically on the category sales performance effects of CM policies for distribution, stocking, assortments, and pricing, it ignores other CM processes such as category definition and category performance assessment.

There are several promising topics for future research in this area. It might be worthwhile to develop a cross-category analysis of how CM policies and category sales performance depend on category role. Although this study focuses only on national brands in a category, a direct extension would be to analyse private brands as a way of building store traffic. Finally, a further direction would be to examine the reciprocal effects of retailer introduction of CM on supplier policies and supplier performance and vice versa. For example, a comparison of supplier performance before and after the implementation of CM programmes by retailers could help suppliers discover whether and how suppliers benefit from CM.

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