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Benefits of Shelf-Space Management in Dairy Cases of Grocery Retailers

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U.S. farmers are assessed over $750 million annually through commodity checkoffs to fund various generic commodity promotion programs such as generic advertising, consumer education, and product research. Historically, major commodity groups (e.g., dairy, beef, and pork) have invested majority shares of their checkoff budgets in generic advertising. In recent years, however, relatively slow growth of checkoff revenues combined with strong increases in media advertising costs has prompted a shift in producer checkoff dollars away from advertising activities to other non-advertising demand-enhancing activities such as in-store shelf space management programs, in the hope of better utilizing scarce checkoff dollars to achieve higher benefits to producers.

The objectives of this study are to develop a general framework that can be used for the analysis of economic impacts of in-store space management programs in retail stores and to provide economic evaluation of a retail-level dairy case management program operated in the Northwestern Hudson Valley Market, New York.

Recently, the American Dairy Association and Dairy Council implemented the Dairy Case Management Program (DCMP) in over 600 grocery stores in the New York State milk marketing area. The dairy case is the primary merchandising instrument available for grocery retailers to promote dairy and other refrigerated products. Since the space of dairy case is limited, retailers continuously face the problem as to how much space they should allocate to various products and how to determine the location of each product within the dairy case. Before the DCMP was implemented, store auditors were sent to stores to evaluate current conditions of the dairy case and planograms were produced for the pre-program period. Then, based on the evaluation of existing planograms and pre-program audit reports, new planograms were developed and provided to each store for the in-program period. The new planograms were designed to achieve three objectives : (*i*) increase the per capita consumption of fluid milk, (*ii*) improve the position of milk as a high-profile beverage and fluid milk category, and (*iii*) improve the management of milk ordering and handling.

In general, planogram design procedures followed the following protocols: (*i*) whole, reduced fat, and skim milk were vertically aligned with each product in its own section; (*ii*) the store's fastest selling items were placed on the side with the highest traffic area at eye level; and (*iii*) all size options were arranged next to each other. In addition, lactose reduced and organic milk products were integrated into the fat content sections and beverage milk products (i.e., flavored and single serve unflavored) were positioned next to other non-milk juices when applicable. After the DCMP was implemented, dairy cases were audited each week for eight consecutive weeks and scored in terms of planogram adherence, hygiene, temperature control, and inventory, ordering, and rotation scheduling.

To assess the effect of reallocation and rearrangement of product space in the dairy case, it is important to generate numeric variables that reflect these changes. Retailers often believe that eye-level is the best option vertically while the middle position is the best horizontally. Alternatively, some prefer the edges in order to be the first or last from consumers' attention. Since no complete theory exists on this issue, we adopt a flexible specification in modeling numeric variables of location and space of each product. To generate the location variables, we measure coordinates of the center of product facings on the planogram, and integrate these coordinates using a quadratic function. The quadratic function is chosen to insure the model flexibility, where the optimal position can be in the middle of the shelf or on one or both edges both horizontally and vertically. For the space variable, we measure the amount of actual space allocated to

each product SKU. For example, if there are three facings of a product whose package dimensions are 3 inches by 8 inches, then the product takes a total space of 72 square inches. The number of facings could have been used because of its convenience. However, the number of facings does not control for the size of each facing. One facing for a large product will not have the same effect as one facing for a small product. If other conditions are held constant, large-sized products are likely to get much more visual attention than small ones.

A double logarithmic functional form is adopted, where the natural logarithm of sales for each SKU is a function of the natural logarithm of price, location, space, and other control variables such as audit score, grocery chain, package size, and month of sales, respectively. The grocery chain indicator variable is included to account for differences in marketing and promotion activities across retail chains assuming that each retail chain runs consistent marketing and promotion programs across its stores. The package size variable is added to account for differences in consumer purchasing behavior by package size. Monthly dummy variables are included to control for monthly or seasonal variations in sales.

Data were collected from retail grocery stores in the Northwestern Hudson Valley Market, New York that participated in the DCMP. The data include 770 SKUs from 6 grocery retail chains with 28 stores that participated in DCMP between July and August, 2002. In order to compare pre- and in-program performance, data were also collected for the preceding two months. By pooling four months of data for each of 770 unique SKUs, our data set has 3,080 observations in which 520 observations are from convenience stores and 2,560 observations are from supermarkets.

The Maximum Likelihood Estimation (MLE) method was used to estimate the double-log sales model for three samples: convenience stores, supermarkets, and all stores. Overall, the models fit the data reasonably well, with estimated R-square values ranging from 0.38 to 0.41. Coefficients of the price variable showed expected negative signs and all were statistically significant at the 5 percent level. The space variables also showed expected signs and are statistically significant at the 5 percent level. The elasticities of space variables were 0.63, 1.62, and 1.55 for convenience stores, supermarkets, and all stores, respectively. The space elasticity from the supermarket model indicates a 1.62 percent increase in product sales per one percent increase in product space. The lower convenience store results (0.63) is likely due, in part, to a higher proportion of smaller package-size products relative to supermarkets. Improving overall store conditions (e.g., cleanliness, ordering, stocking), as identified through store audit scores, appears important in supermarkets, while the effect was not significantly different from zero in convenience stores. This may be due, in part to the relatively larger volume and variety of products in supermarkets, combined with the fact that planogram effects are accounted for via the location and space variables. The majority of retail chain and size dummy variables were statistically significant, indicating that sales performance per SKU differ significantly across retail chains and package sizes. All monthly dummy variables were significant from the analysis of convenience stores, but only *May* and *June* were significant from supermarkets at the 10 percent level.

Effects of horizontal and vertical movements were examined through simulation of the estimated store sales models. Specifically, we computed expected sales in response to changing x- and y-coordinates for horizontal and vertical movement, respectively, while maintaining values of other variables at sample means. The graphs in Figure 1 show the effects of product movement in the dairy case, both horizontally and vertically. For the horizontal movement, mixed results were observed from convenience stores and supermarkets. For convenience stores, the preferred product location was approximately centrally located (18 inches from the left), while the preferred product location in supermarkets was the right edge. There is no unifying theory that can justify this result, but the mixed result may be attributed to the relative differences in the size of the dairy cases. The mean horizontal case dimension in convenience stores was around 44 inches, while it was 219 inches in supermarkets. When the case is relatively narrow, the midpoint may be a good location, but it may not be an ideal location to attract consumers when the case is substantially wide with a large number of products on either side. Thus, when the case is wide, the good location may be the edges, the first or last in the case.

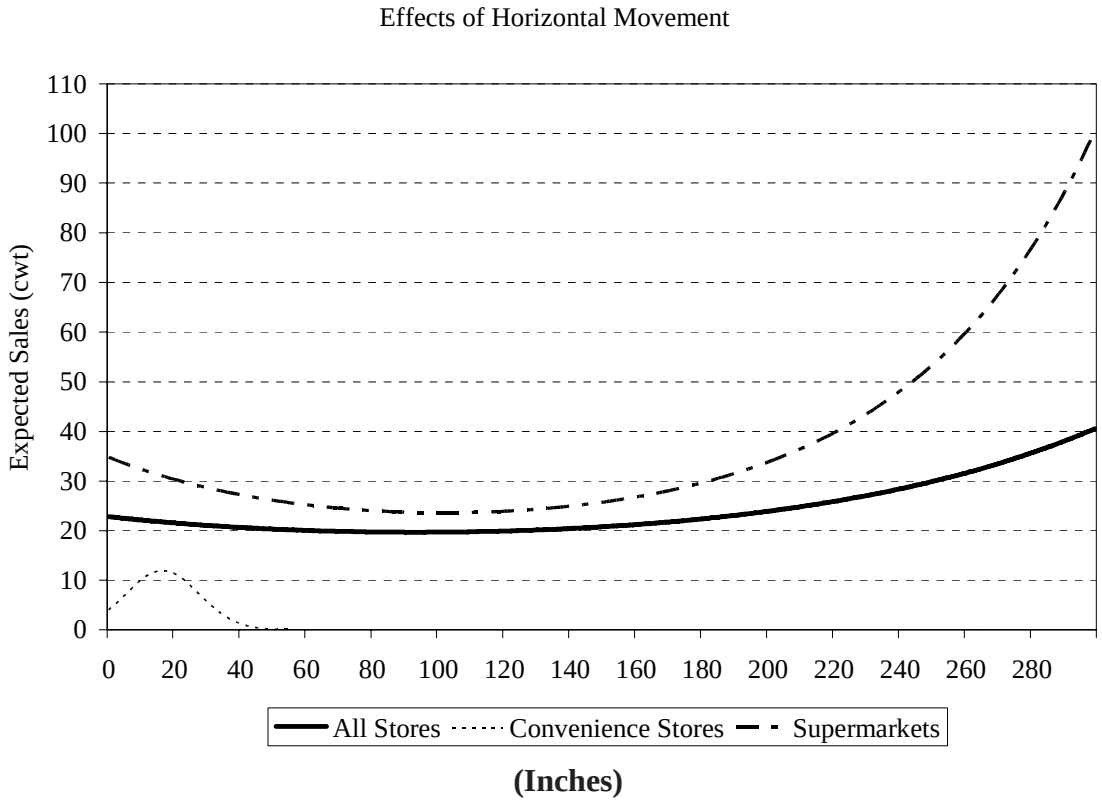
For the vertical movement, we have consistent results from both convenience stores and supermarkets. Across all store types, the expected sales reached the

highest point when the product is located around 60 inches (5 feet) high (Figure 1). Previous studies in the literature also found no consistent results from horizontal movement, but suggested that an eye-level location was most desirable (above the knees but below 6.5 feet) from the vertical arrangement. Supplemental model estimation results with linear functional forms on the location variables were generally consistent with these results.

A final simulation of the estimated models was conducted to determine the sales impact of implementing the DCMP in participating stores. To do so, the sample was divided into two parts representing the pre- and in-program time periods and then the estimated models were simulated for each period. For this simulation, only the corresponding DCMP variables on location, space, and exit scores were changed between the two distinct periods, while all other variables were held constant at their overall sample means. Simulation results indicated that the DCMP resulted in a 7.05% increase in average product milk sales at the retailer level across all stores (Table 1). Disaggregated by store type, DCMP effects indicated sales enhancement of 5.89% and 10.37% for supermarkets and convenience stores, respectively. Estimated 95% confidence intervals indicate our results are statistically greater than zero.

The evaluation results presented here should be viewed with caution as a case-study application to a relatively small market in New York State. Further exploration with additional market areas may permit the generalization of findings presented here. Given data availability, future research in this area is warranted to consider the cross-product effects of shelf-space management programs. Changing location (or space) of a product may not only affect own sales but also sales of adjacent products, and will be influenced by the level of complementary or substitute product relationships.

Figure 1. Effects of Horizontal and Vertical Movement in Dairy Case



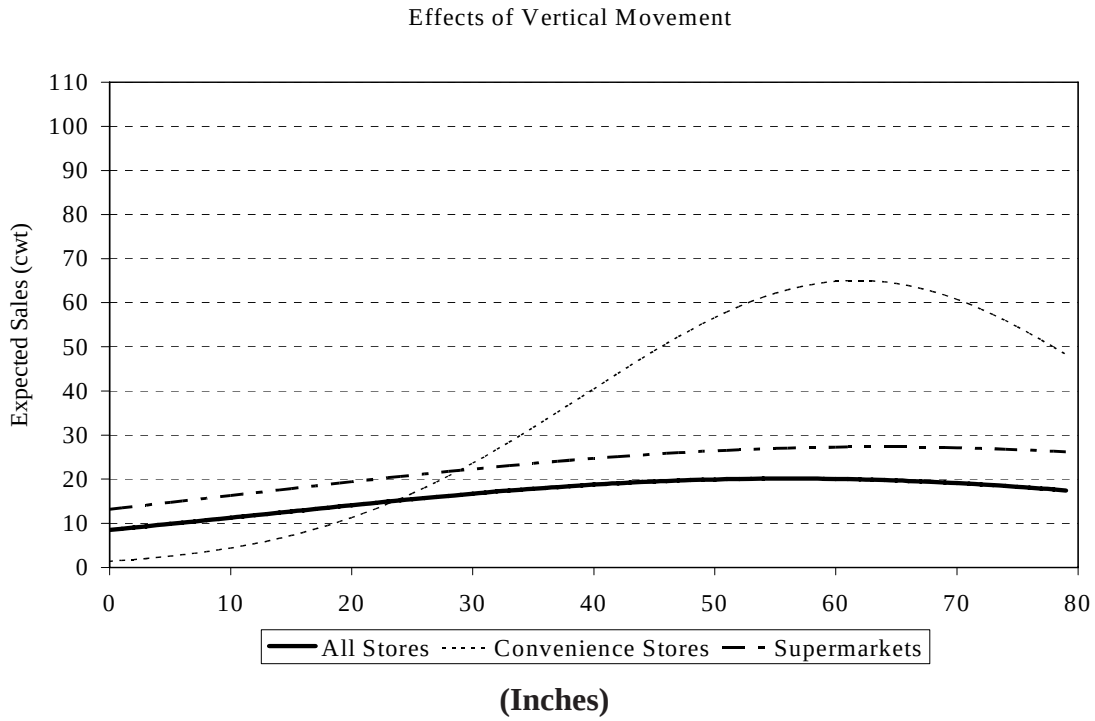


Table 1. Effects of DCMP in Increasing Store Sales

	All Stores	Convenience Stores	Supermarkets
Sales Increase (%)	7.05	10.37	5.89
95 (%) Confidence Interval	[4.76, 11.22]	[5.36, 16.15]	[3.88, 9.07]

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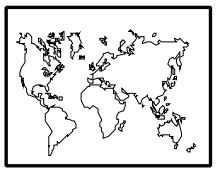

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