WP 2009-28
September 2009

Working Paper

Department of Applied Economics and Management
Cornell University, Ithaca, New York 14853-7801 USA

A Market Experiment on Trade Promotion Budget and Allocation

Miguel I. Gómez
Vithala R. Rao
Hong Yuan

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September, 2009

* Miguel I. Gómez is Assis agement,
Cornell University (mig7@ of
Management and Professor School of
Management, Cornell Univ essor,
Department of Business Ac . All
authors contributed equally

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Abstract

We design a market experiment to examine how firm size and ability to choose trade promotion types influence trade promotion budget, its allocation and channel profits. Our experimental results show that larger manufacturers offer smaller trade promotion budgets. Manufacturers with ability to influence the allocation decision favor scan-backs while retailers favor off-invoices. Trade promotion decisions affect profit sharing within the channel but not total channel profit. We validate these findings with an econometric analysis of survey data from supermarket executives. Overall, our results suggest that market experiments can shed light on trade promotion outcomes for which industry data are sparse.

INTRODUCTION

Trade promotions comprise a growing category of manufacturer incentives directed to retailers rather than to end consumers. These promotions are designed to influence retailers' sales and prices by providing various inducements. Manufacturers of consumer-packaged goods (CPGs) are increasing their trade promotions worldwide. For example, in the US, CPG manufacturers have increased their trade promotions to retailers eight-fold between 1996 and 2004 (Joyce 2005) and reached a near all-time high (over 80 billion dollars) in 2007. Trade promotion spending of U.S. manufacturers accounted for an unprecedented 53 percent of their average marketing budget in 2006 (versus 25 percent two decades ago) and was their second largest expense after the cost of goods (Cannondale 2007). In Europe, trade promotion budgets were over fourteen percent of CPG manufacturers' gross sales in 2003 and the largest fifty firms allocated about €100 billion on trade promotions that year (Lawrie 2004). Moreover, trade promotions are also growing in emerging economies, hand in hand with the globalization of supply chains (Reardon, Henson and Berdague, 2007).

In spite of their growth, trade promotions often generate conflict in the distribution channel (Ailawadi et al. 2009). Trade promotion budgets impact directly the effective wholesale price paid by retailers and profit sharing among members of the distribution channel. Moreover, manufacturers and retailers decide on the budget allocation between two broad promotion types: discount- and performance-based. A manufacturer may offer a retailer discount-based trade promotions, in which a per-case discount is given for all retailer purchases of a given brand during a limited period of time (e.g. off-invoices). Or, a manufacturer may negotiate with a retailer performance-based trade promotions, in which a discount per case is given after a pre-specified level of retail sales performance (e.g. target sales volume per week) has been attained and verified by retail sales scanning data (e.g. scan-backs). There are many other trade promotion types such as cooperative advertising, market development funds and bill-backs, among other, but this study focuses on the two most popular types of scan-backs and off-invoices.

The economics and marketing literatures have addressed factors that affect trade promotions between manufacturers and retailers. A strain of research primarily from industrial organization economics suggests that channel relationships influence the negotiation of trade promotions (Cotterill 2001; Sullivan 2002; Scheffman 2002; Hamilton 2003). Likewise, marketing researchers develop conceptual and analytical models to understand the links between trade promotion decisions and channel performance (Ailawadi, Farris, and Shames 1999; Cui, Raju and Zhang 2008; Drèze and Bell 2003); examine the extent of own and cross-category pass through (Ailawadi and Harlam 2009; Besanko, Dubé and Gupta 2008; Pauwels 2007); and use survey data[1] to examine the impact of manufacturer/retailer characteristics on trade promotion decisions (Gómez, Rao, and McLaughlin 2007).

In spite of the recent increase in trade promotion studies data availability is still a limitation for marketing researchers. A common problem encountered in the literature is the difficulty in obtaining data on trade promotions because they are part of a firm's marketing strategy and because they are inconsistently reported in financial statements by firms (Ailawadi et al. 2009; Skibo 2007; Drèze and Bell 2003). Moreover, a recent assessment by Brown and Dant (2008) finds that only a small number of retailing studies have employed market experiments to distribution channel problems. We believe that experimental economics methods can shed light on the consequences of the behavior of a manufacturer and a retailer dyad making

[1] These data were collected under unique circumstances, and linked to a retailer scholarship to a nationally recognized food executive program.

trade promotion budget and allocation decisions. Experimental economics employs laboratory methods to the analysis of motivated human decision behavior in contexts governed by specific rules (Davis and Holt 1993; Smith 1990). In particular, the experimental economics literature applies and encourages the application of heuristic, exploratory methods that provide empirical probes to new topics and novel experimental methods (e.g. Smith 2009; Holt and Anderson 1996). These methods can provide data on manufacturer and retailer trade promotion decisions that may be hard to obtain otherwise.

In this study we design a market experiment that allows us to examine the impact of manufacturer-retailer dyad characteristics on trade promotion outcomes (budget and allocation) and channel performance. In particular, we focus on three aspects of the manufacturer-retailer dyad relationship: 1) manufacturer size (large and small); 2) retailer size (large and small); and 3) firm's ability to select the trade promotion type between off-invoices and scan-backs. In our experiment, we specify that a larger manufacturer (retailer) has the ability to sell (buy) products outside the dyad, but small firms cannot. We employ concepts rooted in the distribution channel literature (Bucklin 1973, 1986; El-Ansary and Stern 1973) and develop testable hypotheses. Our results suggest that 1) a large manufacturer offers a smaller trade promotion budget (as percentage of wholesale price); 2) the allocation to off-invoices (scan-backs) decreases (increases) when the manufacturer makes the allocation decision and increases (decreases) when the retailer makes the allocation decision; and 3) trade promotion decisions affect profit sharing between the manufacturer and the retailer but have no effect on total channel profits. In addition, we validate our findings in the market experiment using data from a food retailing survey on trade promotions negotiated with their suppliers.

The rest of this paper is organized as follows. We first describe our market experiment and state our hypotheses. Next, we describe the implementation of the experimental design and discuss our findings from the market experiment. Subsequently, we assess the validity of our experimental findings using industry data. In a concluding section we discuss managerial and policy implications, and propose topics for future research.

MARKET EXPERIMENT

Using networked computers, we simulate markets with different characteristics and observe how manufacturers and retailers behave in an interactive setting. In our experiment, manufacturers earn experimental dollars (EDs) by selling to the retailers while retailers earn EDs by selling to the consumers. Manufacturers and retailers make decisions to maximize their ED earnings. In our market experiment we assume that a manufacturer selects the budget and, subsequently, either the manufacturer or the retailer makes the allocation decision to either off-invoices or scan-backs. [2]

We experimentally manipulate three factors each at two levels. These are: the size of the manufacturer (large or small), the size of the retailer (large or small), and the ability of a channel member to influence allocation. A "large" manufacturer produces more units (i.e., commands a larger market size) than its "small" counterparts; and this "large" manufacturer also has the ability to sell excess production outside the dyad in an external market. Similarly, a "large" retailer enjoys a larger potential consumer demand than a "small" retailer and has the ability to procure units outside the dyad when consumer demand exceeds the quantity ordered from the

[2] This sequence of decisions is supported in our interviews among a convenience sample of retail buyers from fifteen supermarket companies. The respondents reported that in 70 percent of the cases, the manufacturer determines an annual promotion budget for each retail brand account; next, the retailer and the manufacturer decide how promotional funds can best be allocated, depending on their ability to influence decisions in the channel.

manufacturer in the dyad. A "small" manufacturer (retailer) cannot sell (buy) outside the dyad. These three features are combined to yield six experimental conditions (Table 1). However, we could use only six cells of the planned 2x2x2 design because two of the cells became redundant. These two cells are the conditions involving a small manufacturer making the allocation decision and a small retailer making the allocation decision.

[Insert Table 1 here]

HYPOTHESES

With the setup of our market experiment, we now discuss specific hypotheses which address the links between 1) channel member size (large or small) and trade promotion budget; 2) channel member size (large or small) and allocation between off-invoices and scan-backs; and 3) channel member ability to influence the allocation decision and the allocation between off-invoices and scan-backs. We do not consider the link between ability to influence the allocation and trade promotion budget because normally the allocation decision takes place after the manufacturer selects its trade promotion budget. This is also consistent with our experimental design (See Table 2 for Stages of experiments).

Size of channel members and trade promotion budget: A stream of research primarily from industrial organization economics examines the causes and consequences of trade promotions in the context of distribution channel relationships (Cotterill 2001; Sullivan 2002; Scheffman 2002; Hamilton 2003). This literature shows that trade promotions may produce demand distortions and move prices away from the competitive equilibrium. The most studied causal relationship in this stream of literature is how the size of market participants and the corresponding market structure affects prices in the channel (Bresnahan 1989). Since trade promotion budgets affect the effective wholesale price, industrial organization theory implies that large manufacturers may allocate smaller trade promotion budgets than small manufacturers. Conversely, large retailers may receive greater trade promotion budgets because they have the leverage to command a higher percentage and lowering the effective price paid to manufacturers.

The marketing literature also offers evidence of the links between channel member size and trade promotion budget. Mela, Gupta and Jedidi (1998) show that the dramatic shift of marketing expenditures from direct consumer advertising to trade promotions have increased concentration in the retail sector. More recently, Gómez, Rao and McLaughlin (2007) find that manufacturer variables such as brand price premium as well as annual retailer sales (or retailer size) determine trade promotion budgets. Finally, Cui, Raju and Zhang (2008) develop a game theoretical model to show that manufacturers have incentives to price discriminate between large and small retailers. These authors show that it is optimal for manufacturers to offer the same list price to all retailers, but they can implement price discrimination through trade promotions.

Therefore, based on both the industrial organization and the marketing literatures, we suggest the following hypothesis:

H1: Trade promotion budget measured as a percentage of wholesale price is smaller (larger) for a large manufacturer (retailer) than that for a small manufacturer (retailer).

Ability to influence the allocation decision and allocation to off-invoices versus scan-backs: The economics and marketing literatures have addressed the allocation between performance- and discount-based trade promotions in the context of channel relationships. Ailawadi, Farris and Shames (1999) demonstrate that performance-based trade promotions linking manufacturer and retail prices, such as scan-backs, may enhance the ability of manufacturers to coordinate distribution channels by ensuring that trade promotions are reflected in lower retail prices. This is contrary to the impact of off-invoice allowances, which enable retailers to engage in forward buying or partial pass-through. Theoretical and empirical work by Bell and Drèze (2002) and Drèze and Bell (2003) compare retailer pricing and profitability between off-invoices and scan-backs. Drèze and Bell (2003) formalize the findings of Ailawadi, Farris and Shames (1999) and show theoretically that, ceteris paribus, retailers prefer off-invoices over scan-backs while manufacturers prefer scan-backs over off-invoices. Retailers prefer off-invoices because of the flexibility offered in their use (e.g., allowing the retailer to forward buy, and even engaging in diverting) and the possibility of not having to pass-through all discounts to the consumer. However, this greater retailer flexibility comes at a cost to the manufacturers: they lose control over their marketing mix. They also argue that manufacturers can design scan-back trade promotions that provide the same benefits to retailers as off-invoice promotions. More recently, Kurata and Yue (2008) develop a model focusing on scan-backs, and show that manufacturers and other members of the supply chain always benefit from scan-backs. In contrast, retailers benefit from scan-backs only when they are offered together with buy-backs, in which the manufacturer agrees to buy back some or all of the products that are not profitable to the retailer.

These results imply that, with ability to influence the allocation decision, a manufacturer would prefer scan-backs over off-invoices. Conversely, a retailer with ability to select the trade promotion type would choose off-invoices over scan-backs. Therefore, we offer the following hypothesis:

H2: The allocation to off-invoices (scan-backs) increases (decreases) with retailer's ability to influence the allocation decision and decreases (increases) with manufacturer's ability to influence the allocation decision.

Size of channel members and allocation to off-invoices and scan-backs: Kasulis et al. (1999) argue from a theoretical perspective that a large manufacturer should maximize allocation to scan-backs. Gómez, Maratou and Just (2006) use supermarket data to provide empirical evidence that large retailers can increase the allocation of funds to off-invoice trade promotions by achieving higher market share for their private labels, while manufacturers decrease the allocation of funds to off-invoice trade promotions by establishing formal policies of negotiation and influence the allocation in favor to scan-back types. Gómez, Rao and McLaughlin (2007) show that retail companies with larger annual sales, stronger brand positioning, and formal policies are able to increase the allocation to off-invoices and to decrease allocation to performance-based trade promotions. Therefore, we posit the following hypothesis:

H3: A large manufacturer (retailer) decreases the allocation to off-invoices (scan-backs).

Profit Implications of Trade Promotion Decisions: Due to the difficulty of collecting trade promotion data, there has been little empirical research in the literature about the effects of trade promotion decisions on channel profits. Many researchers and practitioners argue that retailers increase profits by demanding larger trade promotions from suppliers (Farris and Ailawadi 1992). Because in our controlled experimental setting trade promotion budget acts as a cost for the manufacturer and a benefit for the retailer, we expect the amount of trade promotion budget to have a positive effect on manufacturer profit and a negative one on retailer profit. What's more interesting is the impact of alternative trade promotion allocation strategies on profits of channel members. Ailawadi, Farris and Shames (1999) use a series of numerical simulations to show that performance-based trade promotions such as scan-backs may increase the share of a manufacturer's profits. In the same spirit, Nelsin, Powell and Stone (1995) develop a dynamic optimization model of manufacturers, retailers, and consumers. The authors show that allocation to types that eliminate forward-buying behavior (e.g. scan-backs) may result in higher manufacturer profits. Based on these studies, we hypothesize that:

H4: A manufacturer (retailer) profits decrease (increase) with trade promotion budget; and a manufacturer (retailer) profits decrease when trade promotion budget is allocated to off-invoices (scan-backs).

IMPLIMENTATION OF MARKET EXPERIMENT

We ran this experiment in two sessions (symmetric versus asymmetric) and for each session we recruited forty MBA students with an average work experience of forty three months and an average age of thirty. Most of the subjects had previous work experience on issues related to relationships in the distribution channels of goods and services. The selection of subjects for the study provides face validity to our results. Each subject was paid $10-$15 privately at the end of the experiment, depending on performance. In addition, the subject with the highest accumulated profit at the end of the experiment received a $200 gift certificate from a netional chain of electronic stores. Half of the subjects were randomly assigned to the symmetric condition and half to the asymmetric condition. At the beginning of each session, ten subjects were randomly assigned as manufacturers and ten as retailers and they remained in the same roles throughout the experiment. In about 90 minutes, the subjects traded as manufacturer-retailer dyads using experimental dollars (EDs) in a series of market periods. A market period consists of manufacturers and retailers making decisions in the distribution channel (described in detail below) that lead to channel member profits at the end of each period.

The experiment was programmed using Z-tree[3] and all the transactions were completed through networked computers. In each period, the computer system first randomly selects a manufacturer (M) and a retailer (R) to form a dyad. In symmetric markets (when manufacturer and retailer are both large or both small), five of the ten dyads have large manufacturers selling to large retailers and the other five dyads have small manufacturers selling to small retailers. In asymmetric markets (when one of the members of the dyad is large and the other small), five of the ten dyads have large manufacturers selling to small retailers and the other five dyads have small manufacturers selling to large retailers. Then five markets were randomly formed, each having two different types of manufacturer-retailer dyads. In other words, each market in symmetric channel consists of a M(large)-R(large) pair and a M(small)-R(small) pair whereas each market in the asymmetric condition consists of a M(large)-R(small) pair and a M(small)-R(large) pair. Because there were five markets in a given period, the subjects did not know in advance which markets they belonged to and who they were trading with.

For each market, the computers simulate 100 robot consumers, each potentially demanding one unit of a hypothetical product. Each robot consumer has a value for the product which represents the reservation price (defined as the highest price this consumer is willing to pay). The value for any consumer is a random draw from a uniform distribution between 0 and 10 EDs. The large manufacturer (retailer) in the market produces (has the potential to sell) 80 units whereas the small manufacturer (retailer) produces (has the potential to sell) only 20 units.

At the beginning of the experiment, instructions were read and questions were answered publicly, followed by a practice period to familiarize subjects with the experimental environment. During the practice period, the experimenter explained information on each screen

[3] Zurich Toolbox for Readymade Economic Experiments (Fischbacher 2007).

and answered questions as the practice experiment progressed. This procedure ensured that all subjects understood the details of the experiment.

Within each market period there are five stages shown in Table 2. In the first stage, given wholesale price P_M = 2 EDs and the information about manufacturer and retailer size within the dyad, the manufacturer decides on the trade promotion budget (*TP %*) as a percentage discount of P_M. In the second stage, retailers decide the number of units to order from the manufacturer (Q_M) knowing the trade promotion budget offered by the manufacturer (*TP %*). In the third stage one of the channel members within a dyad make the allocation decision between off-invoices and scan-backs. In the asymmetric markets, only the large manufacturers and large retailers make the allocation decisions whereas in the symmetric markets the computers randomly select a member within a dyad. If the trade promotion budget is allocated to off-invoices, the units used to determine the total amount of trade promotion (Q_{TP}) will be the same as the quantity **ordered** by the retailer (Q_M). However, if the trade promotion budget is allocated to scan-backs, then the units considered in trade promotion (Q_{TP}) is equal to the quantity **sold** by retailer to the end consumers (Q_R). Thus, if *off-invoices* are selected the total amount of trade promotion paid to the retailer $B_{off\text{-}invoices} = TP\% * P_M * Q_M$ (and $B_{scanbacks} = 0$). If scan-backs are chosen, then the trade promotion allowance $B_{scanbakcs} = TP\% * P_M * Q_R$ (and $B_{off\text{-}invoices} = 0$). In the fourth stage, given the trade promotion allowance and type selected, retailers make decisions on the retail price (P_R) as a value between 0 and the maximum consumer value 10EDs. In the fifth stage**,** transactions were completed by computer-simulated robot buyers. If a consumer's value is higher than or equal to the retail price, he/she will purchase one unit of the product from the retailer. Otherwise, the consumer will not purchase. For the unsold units (Q_M - Q_R), there is a per inventory cost of I = 0.10EDs for the retailer.

[Insert Table 2 here]

Subjects were informed of the transaction outcomes (including units sold, inventory left, the amount and type of trade promotion and profits) in the current period before they moved on to the next period. Manufacturer's profits depend on (1) revenue; (2) trade promotion budget and its allocation; and (3) its ability to sell excess production elsewhere. A small manufacturer cannot sell its excess production outside the dyad whereas a large manufacturer can sell its excess production elsewhere with a profit margin that is 50% of the profit margin it gets by selling the product to the retailer in the dyad[4]. Therefore, profits for small manufacturers in period *t* were calculated as:

(1) $$PROFIT_{small\_manufacturer,t} = (Q_{M,t} * P_{M,t}) - (TP\% * Q_{TP,t} * P_{M,t}),$$

where the first term in parenthesis is manufacturer revenues and the second is trade promotion. Likewise, the profits for large manufacturers in period *t* are:

(2) $$PROFIT_{large\_manufacturer,t} = (Q_{M,t} * P_{M,t}) - (TP\% * Q_{TP,t} * P_{M,t}) + [(80 - Q_{M,t})) * 0.5 * P_{M,t}],$$

where the first two terms are the same as in equation (1) and the third term in parenthesis represents manufacturer profits accruing to units sold outside the dyad.

Retailer profits depend on (1) revenue; (2) trade promotion budget and its allocation; (3) inventory costs for unsold units; and (4) its ability to procure shortages from elsewhere.

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[4] In order for the subjects to focus on within-dyad trade promotion decisions, we made sure that profit margin outside the dyad was lower (50% here) than the profit margin within the dyad.

A small retailer cannot procure units from elsewhere outside the dyad. Therefore, the quantity sold to consumers (Q_R) cannot exceed the quantity ordered from the manufacturer (Q_M). If consumer demand exceeds the units ordered from the manufacturer in the dyad ($Q_R > Q_M$), a large retailer procures the shortage ($Q_{outside}$) from elsewhere with a profit margin that is 50% of the profit margin it gets by selling the units ordered from the manufacturer in the dyad. Therefore, profits for small retailers in period t are:

$$PROFIT_{small\_retailer,t} = (Q_{R,t} * P_{R,t}) - (Q_{M,t} * P_{M,t}) + (TP\%_t * Q_{TP,t} * P_{M,t}) + [(Q_{M,t} - Q_{R,t}) * I_t], \quad (3)$$

where the first term is retailer revenues; the second term is the cost of goods sold; the third term is the trade promotion income; and the fourth term is the inventory cost corresponding to unsold units (when $Q_M > Q_R$). Analogously, the profits for a large retailer in period t are:

$$\begin{aligned} PROFIT_{large\_retailer,t} &= (Q_{R,t} * P_{R,t}) - (Q_{M,t} * P_{M,t}) + (TP\%_t * Q_{TP,t} * P_{M,t}) + [(Q_{M,t} - Q_{R,t}) * I_t] \\ &+ [(P_{R,t} - P_{M,t}) * 0.5 * Q_{outside,t}] \end{aligned} . \quad (4)$$

In equation (4), the first four expressions in brackets are the same as in equation (3) and the fifth term represents the profits accrued to units procured outside the dyad. Total profits for manufacturers and retailers were accumulated throughout the periods. The experimental profits in EDs accumulated throughout the periods were then converted into real dollars.

STATISTICAL PROCEDURES AND OPERATIONALIZATION OF VARIABLES

On average, subjects played thirty six periods in each ninety-minute session. Our unit of observation is the manufacturer-retailer dyad. We employ three dichotomous variables to measure size in a given retailer manufacturer dyad: $LARGE\_M_{i,t}$ equals 1 if the manufacturer *i* in period *t* in the dyad is large, zero otherwise; $LARGE\_R_{j,t}$ equals 1 if the retailer *j* in period *t* in the dyad is large, zero otherwise; and an interaction term $LARGE\_DYAD_{i,j,t}$, which equals $LARGE\_M_{i,t}$ times $LARGE\_R_{j,t}$. We also create a dummy variable $M\_DECIDES_t$ to account for the ability of manufacturers and retailers to select the trade promotion types; this variable is equal to one if the manufacturer makes the allocation decision in the dyad in period *t*, zero otherwise.

We test the first three hypotheses by creating two dependent variables: (i) the trade promotion budget offered by manufacturer *i* to retailer *j* in period *t* ($TP\_BUDGET_{i,j,t}$), expressed as a percent of experimental dollars allocated to the wholesale price and (ii) a dummy variable for allocation type ($OFFINVOICES_{i,j,t}$), which equals one if the budget offered by manufacturer *i* to retailer *j* in period *t* is allocated to off-invoices and zero otherwise. We estimated the following models to test Hypotheses 1-3:

Model 1: $TP\_BUDGET_{i,j,t} = F_1(LARGE\_M_{i,t}, LARGE\_R_{j,t}, LARGE\_DYAD_{i,j,t})$ *to test the hypothesis H1 on channel member size and trade promotion budget*

Model 2: $OFFINVOICES_{i,j,t} = F_2(LARGE\_M_{i,t}, LARGE\_R_{j,t}, LARGE\_DYAD_{i,j,t},$

$M\_DECIDES_t)$ *to test H2 andH3 on the allocation to off-invoices.*

We employ *fractional logit* (Papke and Wooldridge, 1996) and maximum-likelihood estimation methods using the logistic distribution as the link function to estimate Model 1 because $TP\_BUDGET_{i,j,t}$ varies from 0 to 1 (given our data collection procedure). This approach employs Generalized Linear Models with the Bernoulli log-likelihood function defined as

$$l_i(\mathbf{b}) = y_i \log [G(\mathbf{x}_i\mathbf{b})] + (1-y_i) \log [1 - G(\mathbf{x}_i\mathbf{b})], \tag{5}$$

where $G(.)$ is the logistic function $G(x_ib) = 1/[1+exp(-x_ib)]$, y_i is the fractional variable, $\mathbf{x}_i$ is a vector of exogenous variables, and $\mathbf{b}$ is the vector of parameters to be estimated.

We employ a standard Logit model for estimating Model 2 because the dependent variable $OFFINVOICES_{i,j,t}$ is dichotomous.

To investigate the profit implications of trade promotion decisions, we use manufacturer and retailer profit measures in period t from equations (1)-(4) depending on the size of the channel member. In addition, channel profits in period t are defined as the sum of manufacturer and retailer profits in period t. We employed single-equation Ordinary Least Squares (OLS) using the White correction for heteroskedasticity.

RESULTS

Our analysis sample comprises 380 observations. The mean percent trade promotion budget was 19.8 percent; subjects selected off-invoices on 46.0 percent of the times; and the mean unit retailer margin was 3.4. In Table 3 we present results corresponding to each of the three main hypotheses.

Trade promotion budget - Columns 1 and 2 address the impact of manufacturer and retailer size on trade promotion percent budget. Our results provide evidence that a large manufacturer allocates a smaller percent trade promotion budget than a small manufacturer (five percent level of significance) and a large retailer receives a larger percent trade promotion budget than a small retailer (ten percent level of significance). The coefficients in Table 3 are obtained from nonlinear models because they do not represent marginal effects of the focal relationships and they must be computed.[5] The marginal effect indicates that a large manufacturer has a percent trade promotion budget that is 3.2 percent points smaller than a small manufacturer. On the other hand, a large retailer receives a percent trade promotion budget that is 1.8 percent points larger than a small retailer. These results support hypothesis H1. The coefficient of *LARGE_DYAD* suggests that there is no difference in the percent trade promotion budget between large manufacturer – large retailer and small manufacturer – small retailer dyads; this indicates that there is no interaction between sizes of manufacturer and retailer.

[Insert Table 3 here]

Allocation of trade promotions - In Columns 3 and 4, we present maximum likelihood estimates and their corresponding odd ratios for the coefficients of the measures of channel member size and ability to make the allocation decision to test hypotheses H2 and H3.The Likelihood Ratio (LR) statistic is significant, which suggests that the model explains the variability of the allocation to off-invoices. The coefficient for *M_DECIDES* is negative and significant, indicating that when a manufacturer makes the allocation decision, it tends to select scan-backs relative to off-invoices. In terms of relative probabilities, the odds ratio of choosing scan-backs is nearly twice that when the manufacturer makes the decision in the dyad. Conversely, retailers with ability to decide on the allocation tend to prefer off-invoices and reflect these preferences in their choices. These results provide support to H2.

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[5] The marginal effect of a given explanatory variable x on $E(y / \mathbf{X})$ is given by $\partial E(y \mid \mathbf{X}) / \partial x$, or, for specification (3), $g(\mathbf{X}\boldsymbol{\beta})\, \beta_x$, where y is the dependent variable, $\mathbf{X}$ is the vector of explanatory variables, $\boldsymbol{\beta}$ is the vector of parameters, β_x is the coefficient corresponding to variable x, $g(z) \equiv dG(z)/dz = exp(z)/[1+exp(z)]^2$.

The estimated coefficients of manufacturer and retailer size exhibit the expected signs (i.e. a large manufacturer has higher allocation to scan-backs and a large retailer has higher allocation to off-invoices) but are statistically insignificant. Therefore, our results do not provide qualified support to H3.

Further, we assessed the internal validity of our results by predicting the trade promotion budget and the allocation to off-invoices for the last two periods using estimates obtained for the previous periods. The root mean square forecast error (RMSE) and the mean absolute forecast error (MAE) for the trade promotion budget are respectively 0.06 and 0.08. Likewise, for the allocation to off-invoices equation the model predicted correctly 71 percent of the time. These results provide high predictive validity for our model. It is gratifying to see that our subject pool is appropriate for this experiment.

Profit Implications - The results shown in Table 4 suggest that trade promotion decisions have important implications for profit sharing in the distribution channel. Manufacturer profits tend to decrease with trade promotion budget: a one percent point increase in trade promotion budget is associated with a lower manufacturer profit of 0.23 EDs. The implications of trade promotion budget decisions for retailers are the opposite: a one percent point increase in trade promotion budget is associated with a higher retailer profit of 0.26 EDs. We also find that manufacturer-retailer dyads that allocate the budget to off-invoices exhibit manufacturer profits that are 2.99 EDs lower than dyads that allocate the budget to scan-backs whereas retailer profits are 6.87 EDs higher when the budget is allocated to off-invoices than to scan-backs. These findings support H4. Interestingly, we find that channel profits are not affected by the trade promotion budget nor by the specific type of trade promotion employed (both *TP_BUDGET* and *OFFINVOICES* are statistically insignificant in Column 3 of Table 4). Therefore, our results suggest that the net effect of trade promotion budget and its allocation is transfer of profits between the retailer and the manufacturer, without altering total channel profits: retailers (manufacturers) tend to increase their share of profits with larger (smaller) trade promotion budgets and with allocation to off-invoices (scan-backs). This may explain why it is very hard to employ trade promotions for channel coordination.

[Insert Table 4 here]

FURTHER SUPPORT USING SURVEY DATA

In this section, we provide additional support to our experimental results using survey data on trade promotions from 36 supermarket companies. These data are based a survey conducted by Gómez, Rao and McLaughlin (2007) and supplemented with data from secondary sources akin to our experimental measures. This analysis is based on 174 usable observations covering five product categories and over thirty brands. The unit of observation is a particular brand and not the individual trade promotion contract. The dataset contains information on the total amount of trade promotion dollars received from manufacturers and the percent allocation of these funds to off-invoices and to performance-based types. We supplemented the survey with secondary data to measure channel member size and ability to select the trade promotion type, so that these data are comparable to those from the market experiment. Specifically, to measure size of channel members we collected data on brand market share in the national market (*M_SHARE*) and data on supermarket market share in the main metropolitan areas in which they operate (*R_SHARE*). To measure ability to select the trade promotion type, we employ the following question from the survey: "what percent of the times do you select the trade promotion type" (*R_SELECTS*).

The dependent variables are the percent trade promotion budget and its percent allocation to off-invoices. Note that the allocation equation here is a continuous-censored while in the market experiment the allocation variable is dichotomous (the budget is all allocated to either scan-backs or off-invoices). The vectors of explanatory variables include measures of firm size and ability to influence allocation constructs described above and $\boldsymbol{Z_j}$ is vector of other control variables, including product category dummies and price differences across brands in the same product category. We estimate each equation separately to be consistent with the sequence followed in the market experiment. Given that the dependent variables vary from zero to one, we employ maximum-likelihood estimation methods using the logistic distribution as the link function, following the *fractional logit* model (Papke and Wooldridge, 1996).

Table 5 shows all parameter estimates and standard errors for the parameter estimates for the budget and allocation equations. Consider the trade promotion budget equation first. The estimated coefficient for the manufacturer's brand market share is negative and significant at the one percent level. The marginal effect indicates that a manufacturer with a brand market share ten percent points above the sample mean has a percent trade promotion budget five percent points smaller. In addition, the estimated coefficient for the market share of the retailer is positive and significant at ten percent level. The marginal effect suggests that a retailer with market share ten percent points above the sample mean has a percent trade promotion budget two percent points larger. These results provide support for H1 and are consistent with the findings in the experimental design.

[Insert Table 5 here]

Regarding the allocation of trade promotion budget, Table 5 shows that increased retailer ability to select the trade promotion type (*R_SELECTS*) is positively related to the allocation of trade promotion budget to off-invoices at the ten percent significance level. The marginal effect indicates that retailers that are able to select the trade promotion type ten percent above the sample mean can increase allocation to off-invoices by two percent. Conversely, manufacturers with increased ability to select the trade promotion type tend to reduce allocation to off-invoices. This result provides support to H2. The coefficient of corresponding to the market share of the retailer is positive and significant at the one percent level and the marginal effect indicates that a retailer with a market share ten percent above the sample mean exhibits an allocation to off-invoices that is nine percent higher. The coefficient of the manufacturer's brand market share is negative but insignificant. These results provide moderate support for H3. [6]

Overall, the survey data analysis provides further evidence supporting our major results regarding trade promotion decisions. It not only serves as a validation for our market experiments but also highlights the need for experimental approach when industry data are hard to obtain.

CONCLUSIONS, LIMITATIONS, AND FUTURE RESEARCH

In this paper, we report the results from a market experiment designed to study the influence of manufacturer size, retailer size and channel member's ability to influence the trade promotion type, on trade promotion decisions made by manufacturers and retailers and their implications for profit sharing in the distribution channel. Overall, we are able to find support for three of our four hypotheses and validate our market experiment with survey data.

Our results indicate that large manufacturers with ability to sell outside the dyad tend to have smaller trade promotion budgets and to increase allocation to scan-backs, relative to their small counterparts. In contrast, large retailers with ability to buy outside the dyad tend to receive

[6] We are not able to test H4 using the survey data because we do not have profit information.

bigger trade promotion budgets and are able to increase allocation to off-invoices than smaller retailers. These trade promotion decisions also have profit implications such that manufacturers benefit more from scan-backs whereas retailers benefit more from off-invoices.

Another interesting finding from our study is that trade promotion decisions affect profit sharing between manufacturers and retailers but not total channel profit. This suggests that trade promotions will continue to be a contentious issue between manufacturers and retailers due to their different objectives. Trade promotion outcomes are influenced by such dyad characteristics as size of the channel members and ability to influence allocation decisions. These findings are valuable to practitioners and public policy makers.

In addition to the empirical results, the experimental approach allows us to examine the effects of key variables in a context-free environment; the experimental economics methods are particularly valuable in situations where data are not available. This is the case with the problem of trade promotions because they are not systematically reported by firms in certain industries and countries. We believe this paper provided evidence to show that market experiments may be a useful approach to examine trade promotion decisions in the supply chain, taking into account that companies are often reluctant to share data on their trade promotion practices. We hope that our approach will be adopted by other researchers on this important managerial problem, where data are sparse.

Future research should be conducted to show the robustness of experimental results by using different sets of parameter values. While our market experiment was limited to examining the effects of only two characteristics of the channel relationship, the approach can be extended to study relationships between trade promotion and other important channel characteristics such as brand, access to market intelligence as well as institutional and legal contexts. Further, we did not allow negotiations between manufacturers and retailers when trade promotion budget and allocation decisions were made in order to simplify the experimental procedures and to manipulate channel relationships. Future research can examine further how retailers and manufacturers behave during the negotiation process. Finally, we hope that our experimental research will inspire other researchers in examining optimal strategies for manufacturers and retailers in a game-theoretic analysis.

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Table 1: Experimental Conditions

Experimental Conditions[a]	Dyad Type (Large or Small)		Who makes the Trade Promotion Allocation Decision
	Manufac-turer	Retailer	
1	Large	Large	Manufacturer
2	Large	Large	Retailer
3	Small	Small	Manufacturer
4	Small	Small	Retailer
5	Large	Small	Manufacturer
6	Small	Large	Retailer

[a] A "large" manufacturer (retailer) has a large market size and has the ability to sell its products to an alternative buyer (from an alternative supplier) outside the dyad; a "small" manufacturer (retailer) has a small market share and cannot sell (buy) its products to (from) alternative channel members.

Table 2: Stages of Market Experiment within each Market Period

Stage	Description
I	Given wholesale price P_M = 2 EDs and the information about manufacturer and retailer size within the dyad, the manufacturer selects trade promotion budget (*TP %*) as a percentage discount of P_M.
II	The retailer observes the trade promotion budget *(TP %)* set by the manufacturer in the dyad and decides the number of units to order from the manufacturer (Q_M) knowing the trade promotion budget offered by the manufacturer.
III	The computer program assigns the allocation decision between off-invoices and scan-backs to either the manufacturer or the retailer. In the asymmetric markets, only the large manufacturers and large retailers make the allocation decisions whereas in the symmetric markets the computers randomly select a member within a dyad. If the budget is allocated to off-invoices, the units used to determine the total amount of trade promotion (Q_{TP}) will be the same as the quantity ordered by the retailer (Q_M). If the budget is allocated to scan-backs, then the units considered in trade promotion (Q_{TP}) is equal to the quantity sold by retailer (Q_R).
IV	The retailer selects retailer price (P_R) as a value between 0 and the maximum consumer value 10EDs after observing the trade promotion allowance and the allocation type (off-invoices and scan-backs)
V	Transactions were completed by computer-simulated robot buyers. Consumers buy one unit of product from the retailer if her value is greater than or equal to the retail price; otherwise, the consumer will not purchase. For unsold units (Q_M - Q_R), there is a per inventory cost of I = 0.10EDs for the retailer.

Table 3: Parameter Estimates of Market Experiment[a]

	Column 1	Column 2	Column 3	Column 4
Dependent Variable:	**TP_BUDGET**		**OFFINVOICES**	
Estimation Method:	Fractional Logit		Logit	
Experimental Conditions	Parameter Estimates	Marginal Effects	Parameter Estimates	Odds Ratio
LARGE_M	-0.195** (0.095)	-0.032	-0.174 (0.295)	0.840
LARGE_R	0.154* (0.089)	0.018	0.196 (0.294)	1.217
LARGE_DYAD	-0.014 (0.133)	0.005	-0.214 (0.417)	0.806
M_DECIDES	--	--	-0.582*** (0.211)	0.558
Constant	-1.282** (0.066)	--	0.206 (0.244)	--
Number of Observations	380	--	380	--
Pseudo R-Squared	0.07	--	0.05	--
Log Likelihood	-138.9	--	-257.1	--
Likelihood Ratio Statistic	--	--	21.62**	--
Hypothesis Tested	Hypothesis 1		Hypotheses 2 and 3	

[a] Standard errors in parenthesis; *** significant at the 1 percent level; ** significant at the 5 percent level; * significant at the 10 percent level.

Table 4: Trade Promotion Decisions and Profit Implications

	Column 1	Column 2	Column 3
Dependent Variable:	Manufacturer Profits	Retailer Profits	Channel Profits
TP_BUDGET	-23.59*** (5.29)	26.03** (11.09)	2.43 (11.01)
OFFINVOICES	-2.99*** (0.97)	6.87*** (2.36)	3.88 (3.31)
LARGE_M	70.34*** (0.89)	-6.99*** (1.65)	63.35*** (1.27)
LARGE_R	9.73*** (1.31)	49.54*** (2.96)	59.27*** (3.46)
LARGE_DYAD	10.19*** (1.91)	36.19*** (4.73)	46.38*** (4.60)
M_DECIDES	-0.68 (1.00)	-0.15 (2.42)	-0.84 (2.32)
Constant	26.04*** (1.67)	18.40*** (3.30)	44.44*** (3.09)
Number of Observations	380	380	380
R-Squared	0.95	0.71	0.88

*** Significant at the 1 percent level; ** significant at the 5 percent level.

Table 5: Parameter Estimates from Industry Survey Data: Determinants of Trade Promotion Budget and its Allocation

Dependent Variable:	Budget		Allocation to Off-Invoices	
Explanatory Variables	**Coefficient**	**Marginal Effect**	**Coefficient**	**Marginal Effect**
Manufacturer Brand Market Share *(M_SHARE)*	-0.021*** (0.006)[a]	-0.005	-0.019 (0.012)	-0.004
Retailer Market Share *(M_SHARE)*	0.009* (0.005)	0.002	0.044*** (0.015)	0.009
Retailer ability to select the trade promotion type (*R_SELECTS*)	--	--	0.910* (0.509)	0.002
Intercept	-1.864*** (0.197)	--	-2.470*** (0.684)	--
Control Variables				
Price Differences	-2.61*** (0.682)	--	-0.749 (1.435)	--
Coffee	0.779*** (0.244)	--	0.612 (0.520)	--
Ready-to-Eat Cereal	0.867*** (0.198)	--	0.978** (0.535)	--
Laundry Detergent	0.154 (0.204)	--	0.400 (0.493)	--
Frozen Dinners	0.253 (0.195)	--	0.814 (0.496)	--
Number of Observations	172	--	172	--
Log Likelihood	-51.04	--	-78.82	--
Pseudo R-squared	0.19	--	0.36	--

[a] Robust Standard Errors;

*** Significant at the 1 percent level; ** significant at the 5 percent level; * significant at the 10 percent level.

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