Effects of Horizontal and Vertical Market Power on Trade Promotion Budget and Allocation in the US Supermarket Industry: An Experimental and Empirical Analysis

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Introduction

Trade promotions comprise a growing category of manufacturer incentives directed to distribution channel members, such as wholesalers and retailers, rather than to consumers. These promotions are generally designed to influence resellers' sales and prices by providing various, sometimes complex, inducements. For example, a manufacturer may offer a retailer a per-case discount for all purchases of a given brand during a limited period of time. Or, a manufacturer may negotiate with a retailer a discount per case after a pre-specified level of retail sales performance (e.g. target sales volume per week) has been completed and verified by retail sales scanning data from companies such as AC Nielsen or Information Resources, Inc.

Trade promotions offered by US manufacturers of consumer-packaged goods to their distributors have increased eight-fold since 1996 and in 2004 totaled about 80 billion dollars (Joyce 2005). Trade promotion spending accounts for about 52 percent of a manufacturer's marketing budget in 2002 compared to 25 percent two decades ago. Further, it the second largest manufacturer expense after the cost of goods, representing in average 17.4 percent of gross sales versus 13.5 percent in 1997 (Cannondale 2003).

In spite of their popularity, trade promotion negotiations often generate conflict in the distribution channel (Kasulis et al. 1999; Dreze and Bell 2003). In particular, such conflict is reflected in two major decisions that are tied to the negotiation of trade promotions between manufacturers and retailers: the budget and its allocation to various types. Recently, a strain of research primarily from industrial organization economics and marketing suggests that market power structure influences the negotiation of trade promotions (Cotterill 2001; Patterson and Richards; Sullivan; Scheffman; Young and Hobbs; Hamilton). Despite the magnitude of these promotional funds, little empirical research has examined the structure of TPs (budget and

allocation) or the market power-relater factors influencing this structure. The difficulty in gaining access to data from confidential supplier-retailer negotiations is central to dearth of research in this area (Kasulis et al; Drèze and Bell). This paper is an attempt to fill in that gap.

We employ data collected in two studies to examine the impacts of market power structure between manufacturers and retailers on the decisions on size and allocation of trade promotion budget. Study 1 is a market experiment where subjects represent manufacturers and retailers making trade promotion decisions. Study 2 is an econometric analysis of a brand-level budget and allocation data on trade promotions collected from thirty six US supermarket companies. In our study, market power is the firm's ability to attract consumers relative to its competitors through product differentiation and it applies equally well to manufacturers and retailers. The market power structure between manufacturers and retailers also impacts the ability of manufacturers and retailers to influence the share of total channel profit via allocation of trade promotions.

In our experimental data, we find that (1) a manufacturer with higher market power offers a larger trade promotion budget; (2) a manufacturer (retailer) with higher market power relative to a retailer (manufacturer) in the dyad increases allocation to performance-based (discount-based) trade promotions; and (3) discount-based trade promotions appear to increase pass through rates (i.e., the extent to which retailers pass on the price discount to their consumers). Our econometric analysis of survey data corroborates the experimental results. The manuscript is organized as follows. The next section discussed relevant literature on trade promotions in the context of market power. The third section describes our conceptual model and states our hypotheses. The fourth section describes the experimental design and discusses the findings. The fifth section describes the data, explains the econometric model and discusses the results of our

empirical study using trade promotion data from supermarket companies. The last section concludes and proposes topics for future research.

Literature Review

Trade promotions have been one focus of attention from both marketing and economics literature. The marketing literature focuses mostly the explanation of the growth of trade promotions, the extent of pass-through. However, recent studies address the allocation budget of trade promotion funds as well the influence of market power on trade promotion outcomes. The economics literature addresses primarily the impacts of trade promotions in terms of strategic behavior of firms and their consequences.

Trade promotions are part of the promotional mix of most manufacturers of consumer packaged goods. Consequently, the marketing literature focuses primarily on profitability and pass-through (i.e., the extent to which a reseller passes trade promotions on to consumers in the form of retail promotions). First, marketing researchers have examined the rapid growth of trade promotions and determined their return on investments (Ailawadi, Farris and Shames 1999; Curhan and Kopp 1988; Drèze and Bell 2003; Srinivasan et al. 2004; Tyagi 1999). In general, these studies indicate that current trade promotional practices cannot be shown to be efficient for the distribution channel, often suggesting improved TP designs. Sudhir and Rao is an exception. The study uses data from a supermarket company to show that slotting allowances (or payments for shelf space paid by manufacturers to retailers for the introduction of new products) increase efficiency of the food distribution system.

The most studied topic on trade promotions is, by far, the extent of pass-through. The marketing literature has developed theoretical models and conducted empirical research

describing the extent to which retailers actually pass on trade promotions to consumers in the form of retail promotions rather than retain some portion of the promotional funds to enhance profits (Tyagi; Kumar, Rajiv and Jeuland; Besanko, Dube and Gupta; Neslin, Powell and Stone 1995). These studies show that bargaining power, product category characteristics, frequency of trade promotions as well as the budget (i.e., price elasticity of demand at the retail level) influence pass-through rates. Yet, this literature has not explored the impact of the selection of trade promotion types (discount-based versus performance-based) on pass through rate, an issue explored here in the experimental design in Study 1.

More recently, a third stream of studies has addressed the trade promotion budget and its allocation across trade promotion types in the context of market power structure (Kasulis et al.; Gomez, Rao and McLaughlin; Gomez, Moratou and Just; Dreze and Bell; Bruce, Desai and Staelin; Ailawadi, Farris and Shames). Kasulis et al. develop a descriptive strategic framework to argue that bargaining power of channel participants explains why different trade promotions can produce dissimilar channel performance and consumer impacts. Ailawadi, Farris and Shames demonstrate that performance-based trade promotions linking manufacturer and retail prices may enhance the ability of manufacturers to coordinate distribution channels. This is contrary to off-invoice allowances, which allow resellers to make discretionary use of such funds via forward buying (using trade promotions to build stocks for future sales) or simply not completely passing their cost savings on to their customers. Drèze and Bell employ economic theory to formalize Ailawadi, Farris and Shames' findings and show that manufacturers can design pay-for-performance trade promotions that provide the same benefits to the retailer as off-invoice promotions, thus reducing the manufacturer risk of retailer's misuse of trade promotion funds. In the same spirit, Gomez, Moratou and Just use supermarket data to show that retailer bargaining

power increases the allocation of funds to off-invoice trade promotions through higher share of private label and retailer size, while manufacturer bargaining power decreases the allocation of funds to off-invoice trade promotions by establishing formal policies of negotiation.

More recently, Gomez, Rao and McLaughlin find that manufacturer variables such as brand position in retailer product category and brand price premium as well as annual retailer sales determine trade promotion budgets. In addition, the authors show that retail companies with larger share of private label in product category sales, larger annual sales and stronger brand positioning are able to increase the allocation of promotional funds to off-invoices and decrease allocation to performance-based trade promotions such as scan-backs, accruals and bill-backs. Bruce, Desai and Staelin (2007) develop a theoretical model of consumer, retailer, and manufacturer behavior and provide insights about the inter-temporal effects of trade promotions. The authors show that manufacturers benefit by offering larger trade promotion budgets.

A strain of research primarily from industrial organization economics examines the causes and consequences of trade promotions in the context of relative retail-supplier bargaining power in the distribution channel (Cotterill 2001; Patterson and Richards; Sullivan; Scheffman; Young and Hobbs; Hamilton). The economics literature has focused on issues arising from industry structure, system performance, and public policy consequences. Much of this literature finds demand distortions that may result from TPs and non-optimal allocation of resources leading to inefficiency in the distribution channels. Paterson and Richards, however, challenge this view, focusing on the rise of trade promotions in produce distributed through the supermarket channel. They point out that it is not clear whether this trend is the result of increased retail concentration or the outcome of a competitive market confronted with a large number of new products and an extremely small success rate. Further, Hamilton concludes that

certain promotion funds, particularly slotting allowances, may actually be motivated by suppliers, not retailers. He notes that suppliers may employ these allowances to better coordinate channel activity, ending in greater supplier sales and improvements in consumer welfare.

Contribution to Literature

Our study makes three contributions to extant literature. It is the first attempt to design a marketing experiment to explore the impacts of market power structure on trade promotion outcomes in terms of budget and allocation. Second, it addresses the influence of the choice of trade promotion type (discount-based versus performance-based) on pass-through rates. Finally, it uses empirical data to further explore how market power structure of retailers and manufacturers jointly affect trade promotion outcomes.

Conceptual Model and Hypotheses

In our conceptual model the manufacturer sets the trade promotion budget first. The budget set by the manufacturer is influenced by the market power of the manufacturer. Next, depending on the relative power of the manufacturer and retailer in the dyad, the trade promotion budget is allocated across performance-based and discount-based trade promotion types. Either the manufacturer or the retailer selects the trade promotion type, depending on the relative market power structure of the dyad. We define "trade promotion budget" as the total trade promotion dollars received by the retailer from a manufacturer and "trade promotion allocation" as the percent of these dollars allocated discount-based and performance-based trade promotions.

[Insert Figure 1 here]

Hypotheses

Manufacturer market power and trade promotion budget - We posit that manufacturer market power is likely to affect trade promotion budget. A manufacturer with market power may have incentives to offer a larger budget (relative to a manufacturer with no market power) because trade promotion funds may be more effective in affecting consumer choices (e.g., increasing consumer demand). For example, Neslin and Shoemaker (1989) and Gedenk and Neslin (1999) show that, for stronger brands, the resultant post-promotion probabilities of choice of a brand are higher than if no promotion had occurred at all. Furthermore, Seetharaman (2004) employs choice models to show that lagged promotions have a carryover effect on habit persistence.

Recent empirical evidence provides support to a positive relationship between manufacturer market power and trade promotion budget. Kruger (2007) notes that trade promotions budgets vary across geographical regions depending on the manufacturer market position. The author argues that the same manufacturer off-invoice promotion provides more benefits in areas where the manufacturer holds high market share relative to their low-share counterparts. The reason is that the manufacturer will receive better retailer support in high market share areas because the retailer in those areas anticipates more sales. In addition, Bruce, Desai and Staelin (2007) develop a theoretical model supported with empirical analysis and show that manufacturers benefit by offering larger trade promotion budgets. Therefore, we offer the following hypothesis:

H1: Trade promotion budget increases with manufacturer horizontal power.

Vertical manufacturer power, vertical retailer power, and allocation of trade promotions- Trade promotions can be divided into two broad groups: discount-based and performance-based (Kasulis et al.). Discount-based promotions, primarily off-invoice allowances, tend to enhance the ability of retailers to make discretionary use of these funds, increasing the probability of opportunistic behavior from retailers. The mechanism for off-invoice allowances is simple: suppliers provide merchandise to retailers at a price discount, usually for a brief, specified period—two to three weeks is standard. Because of the greater freedom it affords them, retailers generally favor off-invoice promotions over performance-based promotions while the opposite is true of manufacturers (Drèze and Bell). On the other hand, performance-based contracts increase retail incentives to push the manufacturer's product and are tied to a measure of retailer performance (e.g., units sold or displayed or price discounts in effect during a given period). Essentially, manufacturers agree to reimburse the retailer a specified amount for each unit sold to consumers. Performance-based promotions include scan-backs, bill-backs and accrual programs.

In this work, vertical power refers to the ability of a manufacturer and a retailer in a given dyad to influence the allocation decision. Following theoretical and empirical evidence in the literature (Dreze and Bell 2003; Gomez, Maratou and Just 2007; Gomez, Rao and McLaughlin 2007), we posit the following hypothesis:

H2: The allocation to off-invoices (scan-backs) increases (decreases) with retailer vertical power and decreases (increases) with manufacturer vertical power.

Manufacturer market power and allocation of trade promotions - 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. Their theory shows 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). However, this greater retailer flexibility comes at a cost to the manufacturers: they lose control over their marketing mix. Kasulis et al. (1999) develop a conceptual framework to show that a manufacturer with horizontal market power should maximize allocation to performance-based trade promotions. In addition, Gomez, Rao and McLaughlin provide empirical evidence that manufacturer characteristics associated with market power influence the allocation in favor to performance-based types. Therefore, we posit the following hypothesis:

H3: Holding vertical power constant, the allocation to off-invoices (scan-backs) decreases (increases) with manufacturer horizontal power.

Pass-through and trade promotion allocation - Although pass-though has received considerable attention from marketing researchers, no empirical work has provided evidence the relationship between pass-trough and allocation. Based primarily on previous work by Dreze and Bell (2003), and given that manufacturers have more control over the use of trade promotion funds by retailers, we offer the following hypothesis:

H4: Pass-through rates are higher when trade promotion funds are allocated to performance-based (scan-backs) types relative to discount-based (off-invoices) types.

Study 1: Market Experiment

Experimental Design and Procedure

In the laboratory experiment, we examine the effects of horizontal and vertical power on trade promotion budget and allocation decisions using a 2 (Symmetric versus Asymmetric – between subjects) X 2 (Manufacturer-dominant or Retailer-dominant – within subject) X 3

(replications) design. The conditions of horizontal power are: 'symmetric' (retailer and manufacturer are both strong or both weak) and 'asymmetric' (either manufacturer is stronger than retailer or vice-versa). Although the manufacturers make the trade promotion budget decisions, the dominant firm chooses allocation between scan-backs and off-invoices. The experimental conditions are shown below (M=manufacturer; R=Retailer).

Experimental Conditions	Horizontal Power in the M-R Dyad (strong/weak)	Who decides on the TP Budget?	Who decides on the TP Allocation
Manufacturer Dominant-Symmetric	M(Strong), R(Strong); or M(Weak), R(Weak)	M	M
Retailer Dominant-Symmetric	M(Strong), R(Strong); or M(Weak), R(Weak)	M	R
Manufacturer Dominant-Asymmetric	M(Strong), R(Weak)	M	M
Retailer Dominant-Asymmetric	M(Weak), R(Strong)	M	R

Note that for the asymmetric markets, we only focus on the conditions where the stronger firm dominants. We ran a total of six experimental sessions with three symmetric and three asymmetric markets. Twenty undergraduate students at a large Midwestern university were recruited for each experimental session. At the beginning of the experiments, **10** subjects were randomly assigned as manufacturers and **10** as retailers and they remained the same roles throughout the experiment. In about 90 minutes, the subjects traded in manufacturer-retailer dyads using experimental dollars (EDs) in a series of market periods. We manipulated manufacturer and retailer horizontal power through market share and outside options. Compared to a weak manufacturer, a strong manufacturer not only produces more units but also has the power to sells excess production outside the dyad. Similarly, a strong retailer not only enjoys a

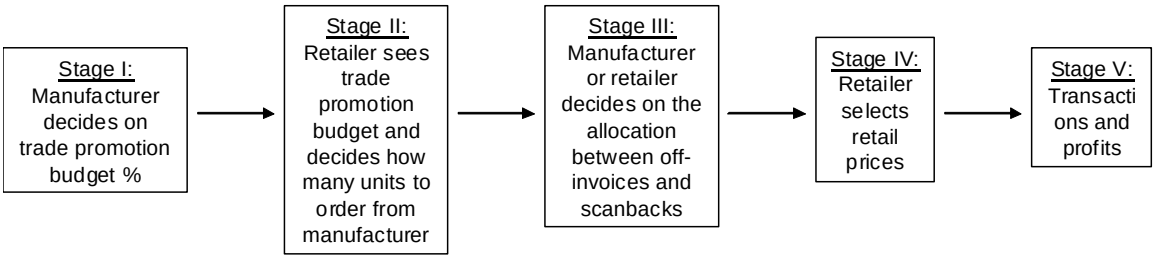
larger potential consumer demand than a weak retailer but also has the power to procure units outside the dyad.

In each period, we first randomly select a manufacturer and a retailer to from a dyad. In symmetric (asymmetric) markets, 5 of the 10 dyads have strong manufacturers selling to strong (weak) retailers and the other 5 dyads have weak manufacturers selling to weak (strong) retailers. We then randomly form 5 markets, each having two different types of manufacturer-retailer dyads. In other words, each market in the symmetric condition consists of a M(strong)-R(strong) pair and a M(weak)-R(weak) pair whereas each market in the asymmetric condition consists of a M(strong)-(R)weak pair and a (M)weak-(R)strong pair. Since there were 5 markets in a given period, the subjects did not know in advance which market they belonged to and who they were playing with. Random Matching Protocol is used a lot in experimental economics. This procedure retains the one-shot nature of the theoretical model as it has been used by many experimental researchers (e.g., Ho et al 2007; Amaldoss and Rapoport 2005).

For each market, the computers simulate 100 robot consumers, each demanding one unit of the product. Each robot consumer has a value for the product which represents 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 strong manufacturer (retailer) in the market produces (has the potential to sell) 80 units whereas the weak 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

and answered questions as the experiment progressed. Within each market period, there are essentially five stages. For each period, the sequence of the experiment is the following:



In the first stage, given wholesale price P_M = 2 EDs and the information about the manufacturer and retailer power 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 amount of units ordered from the manufacturer (Q_M) knowing the trade promotion budget offered by the manufacturer (TP%). In the third stage, the dominant firm (manufacturer or retailer) within a dyad makes the allocation decision between off-invoices and scanbacks. 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 scanbacks, then the units considered in trade promotion (Q_{TP}) is equal to the quantity **sold** by retailer to the end consumer (Q_R). Thus, the total amount of trade promotion paid to the retailer $B_{off\text{-}invoices} = TP\% * P_M * Q_M$ (and $B_{scanbacks} = 0$) if *off-invoices* are selected. If *scanbacks* are chosen, then the TP 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 by the dominant firm, retailers make decisions on the retailer price (P_R) as a value between 0 and maximum consumer value 10EDs. In the fifth stage**,** the transactions were completed by computers to avoid human errors. 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 assigned manufacturer and

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. Finally, the subjects were informed of the outcomes of the transactions (including units sold, inventory left, the amount and type of trade promotion and the profits) in the current period before they move on to the next period. Profits for retailers and manufacturers are calculated as follows:

Manufacturer profit depends on (1) revenue; (2) trade promotion budget and its allocation; and (3) its ability to sell excess production elsewhere. Although a *weak* manufacturer **cannot** sell its excess production outside the dyad, a *strong* manufacturer sells 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.

Profits for weak manufacturers are:

$$\underbrace{(Q_M * P_M)}_{\text{Revenue}} - \underbrace{(TP\% * Q_{TP} * P_M)}_{\text{Trade Promotion}}$$

whereas profits for strong manufacturers are:

$$\underbrace{(Q_M * P_M)}_{\text{Revenue}} - \underbrace{(TP\% * Q_{TP} * P_M)}_{\text{Trade Promotion}} + \underbrace{[(80 - Q_M)*0.5*P_M]}_{\text{Units Sold Elsewhere}}$$

Retailer profit depends 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.

A weak 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 strong 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 weak retailers are:

$$\underbrace{(P_R * Q_R)}_{\text{Revenue}} - \underbrace{(P_M * Q_M)}_{\text{Cost of Order}} + \underbrace{(TP\% * Q_{TP} * P_M)}_{\text{Trade Promotion}} - \underbrace{[(Q_M - Q_R)*I]}_{\text{Inventory Cost (if } Q_M > Q_R)}$$

The profits for strong retailers are:

$$\underbrace{(P_R * Q_R)}_{\text{Revenue}} - \underbrace{(P_M * Q_M)}_{\text{Cost of Order}} + \underbrace{(TP\% * Q_{TP} * P_M)}_{\text{Trade Promotion}} - \underbrace{[(Q_M - Q_R)*I]}_{\text{Inventory Cost (if } Q_M > Q_R)} + \underbrace{[(P_R - P_M)*0.5*Q_{outside}]}_{\text{Units Procured elsewhere (if } Q_M < Q_R)}$$

These profits were shown to each subject at the end of each period and then earnings in EDs were accumulated and then translated into real dollars. Each subject was paid $5-$10 privately at the end of the experiment depending on performance.

Statistical procedures and operationalization of variables

We employ a sub-sample consisting of the last fifteen periods of the experiment in each session to conduct statistical analysis. The unit of observation for the statistical analysis is the manufacturer-retailer dyad. We develop three measures of manufacturer market power. The first is a dummy variable (*M_STRONG*) which equals 1 if the manufacturer is strong; zero otherwise. The second variable to measure manufacturer exercised power is defined as follows:

(1) $M\_POWER_t = (Actual\ Profits_t + TP\_Budget_t) / (Manufacturer\ Maximum\ Possible\ Profit)$,

where *t* indicates the period. In numerator of equation (1) the trade promotion budget is subtracted from actual profits in order to control for the effect that the trade promotion budget on profits. This is done to avoid possible endogeneity of *M_POWER* in the statistical analysis that follows. Therefore, M_POWER is a variable in the range between zero and one and the greater its value, the greater the market power exercised by the manufacturer. In the same spirit, the third

measure of manufacturer exercised power is constructed relative to the market power of retailer in the dyad:

(2) $M\_REL\_POWER_t = Log ((M\_POWER_t) / (R\_POWER_t))$,

where R_POWER_t, the market power of retailer is defined as

(3) $R\_POWER_t = (Actual\ Profits_t - TP\_Budget_t) / (Retailer\ Maximum\ Possible\ Profit)$.

In our experiment, vertical power is accounted for by the ability of manufacturers and retailers to select the trade promotion types. Therefore we define a dummy variable (M_DOMINANT) equal to one if the manufacturer makes the allocation decision in the dyad; zero otherwise.

The dependent variables are the trade promotion budget, its allocation and the retail price. The trade promotion budget is *TP%* as defined in the previous section. Given that this is a variable in the interval between zero and one, we calculate the logit transformation as TP_LOGIT = log (*TP%/(1- TP%))* to facilitate interpretation of results. The allocation variable is a dummy variable (SCAN_BACKS), which equals one if the budget is allocated to scan-backs and zero otherwise. The retail price (P_r) is chosen by the retailers in the experiment. Therefore, the models to test Hypotheses 1-4 are the following:

(4) TP_LOGIT = F1(manufacturer power)

(5) SCAN_BACKS = F2(M_DOMINANT)

(6) SCAN_BACKS = F3(M_DOMINANT, manufacturer power)

(7) $P_r = F4(TP\%, SCAN\_BACKS)$,

where *t* is period and *manufacturer power* takes values M_STRONG, M_POWER, or M_REL_POWER. Equations (5) and (6) ere estimated using maximum likelihood methods on the logistic distribution while equations (4) and (7) are estimated employing ordinary least squares.

Findings

In Table 1 we present results corresponding to equation (4) employing the three measures of manufacturer power. The results provide evidence that a manufacturer with market power selects higher trade promotion budgets than manufacturers without market power. For example, using the dummy variable in the experiment design (M_STRONG) indicate that a strong manufacturer selects a trade promotion budget thirteen percent higher than a manufacturer with no market power, as defined in the experiment. These results provide evidence in support to Hypothesis 1.

[Insert Table 1 here]

In Table 2 we present maximum likelihood coefficients corresponding to equations (5) and (6). Coefficients in Table 2 indicate that when the manufacturer has vertical power (i.e. the manufacturer chooses the trade promotion type), the odds ratio of choosing scan-backs relative to off-invoices is nearly three to one in all regression models. These results provide strong support to Hypothesis 2. The estimated impact of manufacturer horizontal power on the allocation is represented by the coefficients of M_STRONG, M_POWER and M_REL_POWER in columns 2-4 of Table 2. The estimated coefficients of M_STRONG and M_POWER are positive but insignificant. In contrast, the coefficient of M_REL_POWER is positive and significant, suggesting that a manufacturer with horizontal power has the ability to increase the allocation to scan-backs. These results provide only partial evidence of Hypothesis 3.

[Insert Table 2 here]

We show results of the impact of allocation on pass-through rates in Table 3. Column 1 shows the impact of budget and type on the price set by retailers and Column 2 shows the same variables and their interaction. The results show that a 10 percent trade promotion budget

allocated to off-invoices leads to a reduction of 0.19 experimental dollars in the price set by retailers. However, if the same 10 percent trade promotion budget is allocated to scan-backs, then the retail price is reduced by 0.37 experimental dollars. That is, scan-backs are associated with pass-though rates that are as twice as large as those associated with off-invoices. The interaction term between the budget and its allocation is positive, indicating that pass-through rates tend to increase as the budget allocated to scan-backs increases. Results in Table 3 provide evidence of Hypothesis 4.

[Insert Table 3 here]

Study 2: Empirical Analysis of Supermarket Trade Promotion Data

Survey Instrument and operationalization of market power structure

We employ the dataset on trade promotion budget and allocation used by Gomez, Rao and McLaughlin (2007). These data was collected from 36 US supermarket companies, accounting for approximately $200 billion of annual revenues, about 40 percent of total US supermarket sales. Employing brand as the unit of observation, the authors construct a survey instrument that elicits detailed information regarding the trade promotions negotiated between supermarket companies and their suppliers during calendar year 2002. Each retail company provided data for two product categories randomly selected from a total of five: ready-to-eat cereal, frozen dinners/entrees, coffee, laundry detergent and pet food. These five product categories represented about 20 percent of the top twenty five product category sales in the US supermarket sector in 2002 (Grocery Headquarters 2003). At the brand level, the dataset has 216 observations (36 supermarket companies, times 2 product categories, times 3 brands), of which 164 are useable.

Our unit of analysis is a particular brand during 2002, not the individual trade promotion contract. Our data set contains information on the total amount of trade promotion dollars received from manufacturers and the percent allocation of these funds to off-invoices, accruals/scan-backs, bill-backs and others at the brand level for the five categories under study. In order to make an analysis that is comparable to our experimental design, we supplemented the survey data with secondary data akin to measure horizontal and vertical power for retailers and manufacturers in the sample corresponding to 2002. Specifically, we collected data on brand market share in the national market (M_SHARE) to measure manufacturer power; data on supermarket market share in the main metropolitan areas (R_SHARE) in which they operate to measure supermarket market power; and to measure vertical power we employ the following question elicited from retailers: "what percent of the times do you select the trade promotion type" (R_SELECTS). We note that the supermarket data does not have information to examine pass-through rates. Therefore we cannot examine Hypothesis 4 in our empirical procedures.

Empirical Model

We follow the empirical model developed by Gomez, Rao and Mclaughlin (2007) and estimate the following equation system:

$$
\begin{aligned}
y_{1,ijk} &= \beta_0 + \mathbf{R\_POWER_{ijk}}\boldsymbol{\beta}_1 + \mathbf{M\_POWER_{ljk}}\boldsymbol{\alpha_1} + \partial_1\mathbf{Z_j} + \varepsilon_{1,ij} + \varepsilon_{1,ijk} \\
y^*_{2,ijk} &= \alpha_0 + \mathbf{R\_POWER_{ijk}}\boldsymbol{\beta}_2 + \mathbf{M\_POWER_{ljk}}\boldsymbol{\alpha_2} + \mathbf{R\_SELECTS_{ljk}}\boldsymbol{\lambda_3} + \partial_2\mathbf{Z_j} + \varepsilon_{2,ij} + \varepsilon_{2,ijk} \\
y^*_{3,ijk} &= \partial_0 + \mathbf{R\_POWER_{ijk}}\boldsymbol{\beta}_3 + \mathbf{M\_POWER_{ljk}}\boldsymbol{\alpha_3} + \mathbf{R\_SELECTS_{ljk}}\boldsymbol{\lambda_3} + \partial_3\mathbf{Z_j} + \varepsilon_{3,ij} + \varepsilon_{3,ijk}
\end{aligned} \tag{8}
$$

$$
y_n = y_{n,ijk} \; if \; y^*_{n,ijk} \geq 0 \quad and \quad y_n = 0 \; if \; y^*_{n,ijk} < 0 \quad for \; n = 2,3
$$

where *i, l, j, k* represent retailer, manufacturer, product category and brand, respectively. The endogenous variables are the natural logarithm of trade promotion budget (y_1), and its percent allocation to off-invoices (y^*_2) and to accruals/scan-backs (y^*_3). The allocation variables are

censored at zero and are identified with an asterisk. The vectors of explanatory variables include the vertical and horizontal market power constructs described above and a vector of product category dummy variables ($\mathbf{Z_j}$).

Following Gomez, Rao and Mclaughlin (2007), in equation (8) the three endogenous variables are inter-related. Therefore, we assume that the error structure takes the form $\varepsilon_{n,\,ij} + \varepsilon_{n,ijk}$ (n = 1, 2, 3). The vector of error terms ($\varepsilon_{1,ijk}$, $\varepsilon_{2,ijk}$, $\varepsilon_{3,ijk}$) has multivariate normal distribution with mean 0 and variance-covariance matrix Σ, which needs to be estimated. On the other hand, since each retail firm provided responses for three brands in two of the five product categories, we allow for heteroscedasticty of the regression disturbance and model it as a function of retailer and product category variables. Therefore, in each equation we include the random error component $\varepsilon_{n,ij}$ (n = 1, 2, 3) to reflect the possible heteroscedastic nature of our data and express the variance of these error terms, $\varepsilon_{n,ij}$ (n = 1,…,5) as an exponential function of the natural logarithm of annual retailer market share and the vector of product category dummies ($\boldsymbol{Z_j}$).

Because the endogenous variables include continuous and limited constructas, we employ the joint estimation procedure QLIM in SAS (SAS version 9.01, 2005). The QLIM algorithm follows Genz (1992) and employs Monte Carlo integration procedures to compute the multivariate normal integrations of the system of equations (8) and he parameter estimates are obtained by a method of simulated scores (MSS) developed by Hajivassiliou and McFadden (1998).

Results

Table 4 shows all parameter estimates and standard errors of the joint model of budget and allocation of trade promotions and related statistics from the QLIM procedure. Consider the trade promotion budget equation first. The estimated coefficients for manufacturer power exhibit

the expected sign and are significant at 1 percent level. The marginal effects indicate that a manufacturer with a bran market share 10 percent points above the sample mean has a the trade promotion budget 3.9 percent higher than the mean. In contrast, the sign of the coefficient for the retailer market power is not significant. These estimates provide support for Hypothesis 1 and are consistent with the experimental design in Study 1, because the manufacturer decides on the trade promotion budget.

[Insert Table 4 here]

Regarding the trade promotion allocation equations estimates (off-invoices and accruals/scan-backs), the variable R_SELECT exhibit the expected signs, although the coefficients are statistically insignificant. That is, retailers with vertical power allocate a larger proportion of the trade promotion budget to off-invoices and a smaller proportion to accruals/scan-backs. Given the lack of significance of these coefficients, these results fail to provide support to Hypothesis 2.

The coefficients of retailer and manufacturer market share assess the impact of retailer and manufacturer horizontal market power on allocation. The only significant coefficient is retailer market share on the allocations to off-invoices. A retailer with higher market share has the ability to allocate a larger proportion of the trade promotion budget to off-invoices, as argued in Hypothesis 3. The coefficients of the manufacturer market share in both allocation equations and the coefficient of retailer market share in the accruals/scan-backs equations have the signs predicted by the theory but are statistically insignificant. Overall, these results provide partial support to Hypothesis 3.

Concluding Remarks

Our study provides evidence that both vertical and horizontal market power of manufacturers and retailers affect trade promotion outcomes. In particular, we find that (1) a manufacturer with higher market power offers larger trade promotion budgets; (2) a manufacturer (retailer) with higher market power relative to a retailer (manufacturer) in the dyad increases allocation to performance-based (discount-based) trade promotions; and (3) discount-based trade promotions appear to increase pass through rates (i.e., the extent to which retailers pass on the price discount to their consumers). An important contribution of our study is to bring the negotiation of trade promotions between manufacturers and retailers to an experimental setting.

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Table 1: Market Experiment, Manufacturer market Power and Trade Promotion Budget

	Dependent Variable: log(TP%/(1-TP%))		
	(1)	(2)	(3)
Constant	-1.611*** (0.025)[a]	-1.787*** (0.103)	-1.495*** (0.025)
M_STRONG	0.130*** (0.036)	--	--
M_POWER	--	0.375*** (0.126)	--
M_REL_POWER	--	--	0.200*** (0.035)
Observations	840	840	836
Adjusted R-square	0.04	0.04	0.05

[a] Standard Errors; * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.

Table 2: Market Experiment, Manufacturer Market Power, Vertical Power and Allocation of Trade Promotions

	Dependent Variable: SCAN_BACKS			
	(1)	(2)	(3)	(4)
Constant	-0.320*** (0.116)[a]	-0.347*** (0.129)	-0.765** (0.324)	-0.383*** (0.125)
M_DOMINANT	1.192*** (0.166)	1.245*** (0.172)	1.211*** (0.165)	1.165*** (0.167)
M_STRONG	--	-0.052 (0.172)	--	--
M_POWER	--	--	0.538 (0.408)	--
M_REL_POWER	--	--	--	0.214* (0.123)
Observations	640	640	640	637
Pseudo R-square	0.06	0.06	0.06	0.07

[a] Standard Errors; * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.

Table 3: Market Experiment, Allocation of Trade Promotions and Pass-through

Dependent Variable: Retail Price		
	(1)	(2)
Constant	5.481*** (0.118)	5.599*** (0.156)
Trade Promotion Budget (%)	-1.931*** (0.444)	-2.542*** (0.677)
SCAN_BACKS	-0.182* (0.109)	-0.405* (0.222)
Trade Promotion Budget(%)*SCAN_BACKS	--	1.088 (0.901)
Observations	641	641
Adjusted R-square	0.03	0.03

[a] Robust Standard Errors; * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.

Table 4: Joint Model Parameter Estimates: Determinants of Trade Promotion Budget and its Allocation

Dependent Variable:	Budget	Allocation to Off-Invoices		Allocation to Accruals And Scan-Backs	
Explanatory Variables	**Coefficient**	**Coefficient**	**Marginal Effect**	**Coefficient**	**Marginal Effect**
Intercept	12.919*** (0.548)	-0.368** (0.174)	--	0.253* (0.174)	--
Manufacturer Market Share	0.041*** (0.012)	-0.002 (0.003)	-0.001	0.004 (0.004)	0.003
Retailer Market Share	-0.017 (0.015)	0.012*** (0.004)	0.010	-0.003 (0.004)	-0.002
Retailer Vertical Power	--	0.157 (0.143)	0.113	-0.162 (0.178)	-0.154
Coffee	-0.166 (0.774)	0.141 (0.182)	0.050	-0.153 (0.132)	-0.164
Ready-to-Eat Cereal	0.716 (0.575)	0.227 (0.252)	0.163	-0.060 (0.114)	-0.052
Laundry Detergent	-1.332* (0.738)	0.307 (0.241)	0.238	-0.262** (0.129)	-0.261
Frozen Dinners	0.670 (0.529)	0.460* (0.265)	0.345	-0.235** (0.119)	-0.230
Standard Error	1.101*** (0.393)	0.246** (0.152)	--	0.236*** (0.046)	--
Pseudo R-squared	0.17	0.35	--	0.14	--
Model Fit Summary	No. of observations = 166 Pseudo R-squared = 0.22 Log likelihood = -535.31 Akaike Information Criterion = 1,129				

[a] Robust Standard Errors; * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.

Figure 1: Conceptual Framework