

**SLOTING ALLOWANCES, FAILURE FEES AND ASYMMETRIC
INFORMATION IN THE GROCERY SUPPLY CHAIN**

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Slotting Allowances, Failure Fees and Asymmetric Information in the Grocery Supply Chain

Introduction and Background

Trade allowances in the grocery industry are important but hotly debated practices, receiving attention from Congress, Federal Trade Commission and United States Department of Agriculture. Two such allowances are slotting and failure fees. Slotting allowances are fixed fee transfers from manufacturers to retailers. These transfers are paid by manufacturers to have their products included in the retail grocery store's product mix. This payment is made at the time of product introduction, with the original concept to reimburse retailers for handling costs of new products.

Slotting allowances are joined in lesser frequency by failure fees. Failure fees are exit fees imposed only when a product fails to meet an ex ante contracted sales target. Exit is defined as when a product is taken off the shelf or is removed from the portfolio of products stocked on a grocer's shelves. The manufacturer/retailer relationship does not necessarily end because of the exit of one product.

While estimates vary on the magnitude of grocery industry slotting allowances and failure fees, they clearly represent a significant percentage of manufacturer costs. The competitive environment surrounding the food industry heightens slotting allowance and failure fee importance. There are conflicting views regarding the role of slotting allowances and failure fees in the grocery supply chain. Manufacturers contend that slotting allowances and other fees are a direct way for retailers to increase their profits, by extracting manufacturers' profits. Retailers, on the other hand, argue that the need for slotting transfers grew from costs associated with stocking

new products.

In the presence of scarce shelf space, the retail grocer faces the proliferation of new products and high new product failure rates. Accurately predicting the demand for a new product becomes increasingly difficult for the retailer as the number of new product offerings increase. Grocers have a high opportunity cost of shelf space. Each square foot of space occupied by a product that fails is lost profit for the retailer. Loss occurs when products are purchased from manufacturers and not re-sold (or re-sold at a large discount to clear the shelves).

When dealing with perceptions or expectations between players in economic markets, including the grocery industry, the topic of asymmetric information becomes important. The retailer/manufacturer relationship surrounding slotting allowances (or even without slotting allowances) does not satisfy the complete information assumption. Manufacturers often have information about the product and its demand², but they may have competing incentives to misinform or not credibly relay that information to retailers (DeVuyst, 2000). Retailers may then lack reliable demand estimates when determining if they want to purchase the new product and pricing for retail sales.

Manufacturers having more information about the distribution of a new product's demand confronts the retailer with adverse selection problems when stocking decisions are made. Chu suggests that retailers can alleviate adverse selection problems and screen potentially high-demand products from low-demand products by offering terms of trade that include a slotting allowance. The logic is that only manufacturers of potentially successful, high demand products will find it economically feasible to pay a slotting fee. If slotting allowances alone allowed retailers to screen

²Test market, market analysis and research and development information controlled by the manufacturer will likely increase the reliability of the subjective probability distribution of the manufacturer.

high-demand from low-demand products, new product failures would be eliminated (or at least greatly reduced). Product failure rates continue to be high, even with slotting allowances.

Additionally, McLaughlin and Rao find that slotting allowances may be correlated with low-demand products. They suggest that manufacturers may offer a slotting allowance as a financial incentive for products they fear may have a marginal economic return. These products paying a slotting allowance may make non-negative profits to pass the screening criteria and be shelved, but have lower expected consumer demand than other products.

In studying slotting allowances and their effects on the food chain, Sullivan suggests that the equilibrium slotting allowance will increase as the supply of products increases and store sales do not comparably increase. In her model, slotting allowances represent a risk-sharing mechanism where all products pay a slotting allowance and the successful products subsidize the unsuccessful. This notion spreads risk of failure over the whole store's portfolio of products but does not separate products into high and low consumer demand categories (successful and unsuccessful products). Separating products into categories imparts more demand distribution information to the retailer about new products and may increase efficiency in new product introductions.

Learning more about the demand distribution of new products in the grocery industry parallels a lender's quest to learn more about new borrowers in finance and credit industries. Learning more about prospective borrowers is part of managing credit risk for lenders. Use of loan pricing models may be part of a lender's risk-management strategy. In loan pricing literature, when average pricing of loans occurs, low-risk borrowers in effect subsidize high-risk borrowers. Low-risk borrowers pay an interest rate too high for the risk inherent in their loan while the high-risk borrowers pay a rate too low for their corresponding risk level. As low-risk borrowers find

more competitively-priced loan funds, the lender will potentially have a portfolio of high-risk loans that are not priced to cover their portfolio risk (Miller *et al*). By offering a menu of contract terms, borrowers reveal their true risk positions by choosing an incentive-compatible price and non-price contract (Bester).

If we apply the same logic as used in loan pricing literature, charging an average slotting fee will not separate products by their demand distributions. Profits from successful products will need to subsidize the losses on unsuccessful products. Otherwise, by offering a menu of contract terms, including slotting fees and failure fees, retailers will constrain manufacturers to reveal a product's demand distribution.

To date, literature has not included fees other than slotting in the modeling of the manufacturer/retailer relationship. The economic rationale and understanding of industry practice is furthered by studying the impact that slotting allowances and failure fees have on asymmetric information in the food industry. There is a need to investigate the use of a menu of trade allowances as a tool for alleviating asymmetric information in the food retailer/manufacture relationship. Specifically, can combinations of slotting allowances and failure fees be used by retailers to reliably extract demand distribution information from manufacturers? If so, this menu of contracting terms could be effectively used as a tool to sort products by their demand distributions. This study employs a model of the manufacturer/retailer relationship with asymmetric information to simulate the role of slotting allowances and failure fees in credibly relaying demand information and partially shifting risk of new product introductions from retailer to manufacturer.

Theoretical Model and Implementation

Lariviere and Padmanabhan (LP) and Chu use mechanism design to investigate slotting

allowances in the grocery industry. This study builds upon their work by analyzing slotting allowances and failure fees in the presence of both uncertainty and asymmetric information. Mechanisms or contracts including only slotting allowances (as modeled by Chu and LP) reveal the “type” exhibited through the expected demand of the new product. By including failure fees in the incentive contracts (as this study does), more information about the demand distribution is revealed. Generally, more information is needed to characterize a demand distribution when the uninformed principal or retailer is assumed to be risk averse.

Risk-averse economic agents prefer less variability to more variability for a given expected return. Variance of the demand distribution characterizes demand variability. Risk or variability is included in the study when retailers make stocking decisions under asymmetric information about new product demand. So, markets are assumed to be not perfectly competitive. Also, as shown by DeVuyst (2000), the actions of manufacturers affect the value of the retailer’s firm, and vice versa. Strategy decisions and asymmetric information affect both retailers and manufacturers in the grocery product market. Following the logic of Hansen and Lott, portfolio diversification with risk reduction is employed to reflect the retailer’s decision process in this study’s modeling of the retailer/manufacturer relationship.

Risk-averse retailers are concerned with the variability of product demand. Mean and variance of product demand is crucial in the screening process. Past slotting allowance studies rely on a single slotting allowance to reveal information. Retailers are assumed to be risk-neutral profit maximizers in those studies. In this study, the retailer is assumed to be risk averse and so, variability matters. One slotting allowance will not screen adequately. Mathematically, it is evident that one slotting allowance will not screen for variability when trying to solve two equations (mean and variance) with one unknown (slotting allowance). Two policy levers,

slotting allowance and failure fee, are needed to reveal mean and variance information.

This study models a risk-averse retailer choosing between new products to shelve in a single period. The retailer is offered four products with differing demand distributions. Shelf space is limited to two slots, so a maximum of two products can be accepted and shelved. Modeling is from the retailer perspective³.

Means and variances of the price sensitivity parameter for new products characterize the first two moments of the products' demand distributions. The first two moments of the demand distribution provide information about the expected level and variability of product consumer demand at the retail level. Table 1 illustrates the mean and variance characteristics of the four products.

Table 1.1 Products' Mean and Variance Characteristics

Product	Mean	Variance
A	low	low
B	low	moderate
C	high	moderate
D	high	high

A risk-averse retailer prefers high mean and low variance. Two of the products will always be mean-variance dominated, i.e., B and D in Table 1. Product B is dominated by product A because A has an equally low mean, but lower variance than B. Product D is dominated by product C because C has an equally high mean but has a moderate variance compared to D's high variance. Products A and C are non-dominated.

³Full model is available in DeVuyst 1999.

With limited shelf space, the risk-averse retailer first eliminates (and does not shelve) the dominated products. Then, the retailer employs fundamentals of portfolio theory through mean-variance analysis to construct a portfolio of non-dominated products. Therefore, the portfolio which is chosen by computer algorithm is not a mean-variance frontier of all products but of only non-dominated products.

The mechanism design forces the manufacturer to reveal all demand information to the retailer. Therefore, all the rents that would accrue due to asymmetric information are passed to the retailer. The model could be designed to have an alternative sharing rule for economic rents.

Model design requires that first, wholesale cost and marginal cost of each product are given. Retail price, slotting allowance, failure fee and corresponding sales target are determined through nonlinear optimization of retailer mean-variance profit objective. Then, wholesale cost is modified iteratively to try to improve manufacturer expected profit while still maximizing retailer expected profit.

Shrink costs are borne by the retailer in this study. Admittedly, shrink is shared in some grocery arrangements. But following the study's objectives, the model explores a two-party agreement, with ownership of the product transferring when the stocking decision is made⁴.

A mechanism design approach derives slotting allowances, failure fees and sales targets to credibly relay characteristics of a product's demand distribution. The approach follows Chu's analytic model for slotting as a way for retailers to screen high-demand from low-demand products, instead of relying on advertising effort of manufacturers as a signal of product expected

⁴A two-party relationship between manufacturer and retailer is analyzed without inclusion of a dealer broker whom may take title to the goods between the manufacturer and the retailer. As noted in *Supermarket Business*, the trend is for less dealer brokers, especially with larger retailers wanting to deal directly with manufacturers. Additionally, the convention in slotting literature is to model a two-party relationship.

demand structure.

The model builds on Chu's work by using slotting allowances, failure fees and associated sales targets as screens. Failure fees facilitate screening of products where variability of product demand is important. Manufacturers of higher variability products will choose a different contract combination than manufacturers of lower variability products.

A menu of incentive contracts is determined for each new product stocking decision. Incentive contracts include variables similar to the price and non-price terms available in loan decision making and credit delivery. Retail grocery incentive contracts include retail price and associated trade allowances (including slotting allowances and failure fees).

Of the four products represented, two will always be mean-variance dominated. Because of space constraints, the retailer is limited to shelving only two products. The model first eliminates dominated products. Then, manufacturers reveal demand information by choosing incentive contracts for non-dominated products. To accomplish these tasks, this study models a risk-averse retailer subject to a set of constraints. These constraints insure that under each of the offered contracts:

- expected profit of the mean-variance dominated products is less than or equal to zero (individual rationality);
- expected profit of the non-dominated products is greater than or equal to zero (individual rationality); and
- the manufacturer of each non-dominated product chooses the contract which credibly reveals its demand distribution (incentive compatibility).

The mechanism design model utilizes individual rationality constraints to screen or eliminate dominated products. The constraints prohibit manufacturers from offering products that

will not return positive profit. Then model constraints are used to determine incentive contracts for manufacturers of non-dominated products to choose that will reveal information their demand information. Therefore, the portfolio of products consists of only mean-variance non-dominated products, not the universe of products.

Simultaneous optimizations create difficulties in solving the model. So here, wholesale cost is fixed at an initial level and the retailer's problem is maximized. Wholesale cost is then iteratively increased and model resolved. Through this process the model creates a menu of contract terms for various wholesale costs that could be chosen by a manufacturer.

The sequence of steps that this model represents is:

- Step 1. A manufacturer introduces a new product to the retailer;
- Step 2. The retailer designs a menu of contracts including retail price, slotting allowance, sales target and failure fee (tied to levels of wholesale cost) that maximizes its profit, eliminates mean-variance dominated products and screens demand distribution characteristics of non-dominated products;
- Step 3. A manufacturer either accepts or rejects a specified contract (including the choice of a wholesale cost level); and
- Step 4. The accepted contract specifications will be “played” by shelving the product and revealing true demand.

For modeling purposes, an initial wholesale cost is assumed to aide in retailer contract design. In terms of the true manufacturer/retailer contract negotiation game sequence, the manufacturer chooses wholesale cost after the retailer designs the menu of contracts. This follows Chu where the manufacturer chooses wholesale cost after the retailer's first move. In this study, each menu of contracts includes a range of wholesale costs corresponding to relevant

slotting allowance, failure fee, sales target and retail price combinations. The model proceeds this way due to problems of simultaneous optimizations by five actors, where optimal choice variables of one optimization materially affect the optimizations of other actors.

Results

Results from this study find whether combinations of slotting allowances and failure fees can be used by retailers to reliably extract demand distribution information from manufacturers. These combinations are embedded in a menu of contracting terms. If the model is feasible, the menu of contracting terms can be used effectively to screen products by their demand distributions. Because of modeling assumptions, generalized policy statements are not made. Model results impart qualitative information about direction of change and the ability to use trade allowance contracts to extract demand information. Exact variable values or magnitudes of allowances and fees are not the substantive outcome.

Initial parameter values are used to demonstrate model feasibility. For the model to be feasible, the constraints must eliminate mean-variance dominated products B and D and separate non-dominated products A and C by their demand distributions. Separation of the product types is accomplished through the retailer specifying a menu of contract terms, including retail price, slotting allowance, sales target and failure fee for each product demand distribution type.

Model feasibility is obtained with the initial parameter values. Results of the initial model run are given in Table 2. All results (except sales target) are given in dollars. Sales target is discussed later. The table includes an array of wholesale costs at which a manufacturer could choose for his product. Retail price, slotting allowance, failure fee and sales target ($P_{i,j}$, $S_{i,j}$, $f_{i,j}$ and $T_{i,j}$) are embedded in the contracts designed by the retailer to separate products A and C by

their demand distributions. When A and C pick the optimal contract for their demand distribution, credible mean and variance information is received by the retailer.

Product A has a higher mean demand (lower mean price sensitivity) and a moderate variance of demand. Product C has a lower mean demand (higher mean price sensitivity) and a lower variance of demand. Contract 1, consisting of $P_{A,1}$, $S_{A,1}$, $f_{A,1}$ and $T_{A,1}$, is the appropriate contract designed for product A. Contract 2, consisting of $P_{C,2}$, $S_{C,2}$, $f_{C,2}$, and $T_{C,2}$, is the appropriate contract designed for product C. Wholesale costs for products A and C are given by W_A and W_C . W_A equal to 1.2 represents a twenty percent markup over marginal cost, K_A , whereby W_A equal to 2.1 represents a 110 percent markup over marginal cost.

Results from Table 2 show that accurately designed contracts, including levels of retail price, slotting allowance, failure fee and sales target separate non-dominated products by their demand distributions. Retailer mean and variance of profit decline as wholesale cost increases. Product A has a retail price ranging from 5.50 to 5.62 as wholesale cost increases. Retail price for product C ranges from 5.54 to 5.96 as wholesale cost increases. Sales targets are 8.48 and 10.47 from products A and C, respectively. Sales targets report a specific value of price sensitivity, ζ_i . So, a higher ζ_i or price sensitivity level corresponds to a lower target demand level.

Table 2 Initial Case Results

W_A	W_B	W_C	W_D	S_{A1}	S_{C2}	f_{A1}	f_{C2}	P_{A1}	P_{C2}	T_{A1}	T_{C2}	obj. [^]	μ_δ	σ_δ^2
1.2	1.2	1.2	1.2	11.747	1000.000	0.000	-110.228	5.50	5.54	8.48	10.47	1312.661	1354.267	8325.016
1.3	1.3	1.3	1.3	17.592	1000.000	0.000	-109.875	5.51	5.59	8.48	10.47	1309.124	1351.410	8236.392
1.4	1.4	1.4	1.4	23.416	1000.000	0.000	-109.534	5.53	5.63	8.48	10.47	1305.632	1348.610	8148.344
1.5	1.5	1.5	1.5	29.221	1000.000	0.000	-109.206	5.54	5.68	8.48	10.47	1302.187	1345.850	8060.886
1.6	1.6	1.6	1.6	35.006	1000.000	0.000	-108.890	5.55	5.73	8.48	10.47	1298.788	1343.140	7974.030
1.7	1.7	1.7	1.7	40.772	1000.000	0.000	-108.587	5.57	5.77	8.48	10.47	1295.435	1340.480	7887.790
1.8	1.8	1.8	1.8	46.518	1000.000	0.000	-108.297	5.58	5.82	8.48	10.47	1292.127	1337.870	7802.180
1.9	1.9	1.9	1.9	52.245	1000.000	0.000	-108.019	5.59	5.87	8.48	10.47	1288.866	1335.300	7717.213
2.0	2.0	2.0	2.0	57.952	1000.000	0.000	-107.754	5.61	5.92	8.48	10.47	1285.651	1332.790	7632.903
2.1	2.1	2.1	2.1	63.640	1000.000	0.000	-107.502	5.62	5.96	8.48	10.47	1282.482	1330.320	7549.260

obj is the retailer's mean-variance objective value

[^]values in this case are figured using actual means and variances to determine efficiency losses for the asymmetry of information section

μ_δ is the retailer's average profit

σ_δ^2 is the retailer's variance of profit

Sales targets are given in terms of units squared per dollar. All other results are in dollars.

Corresponding to product A's higher mean demand, its contract has a lower slotting allowance. The logic follows that higher mean demand will cover stocking and other costs so a slotting allowance is either lower or not necessary. As wholesale cost increases, the slotting allowance for product A increases from 11.747 to 63.640. Alternatively, product C's contract includes a 1,000 (maximum level allowed) slotting allowance for all levels of wholesale cost. Product C has a lower mean demand. The retailer requests higher slotting up-front to cover costs that lower average demand may not cover.

Product A produces a higher mean demand for the retailer, but also has a higher variance. The higher variance allows the demand level to deviate (negatively and positively) in a wider range than a product with lower variance. If the higher variance level of product A causes it to not reach the contracted sales target, a failure fee may be paid. In this base case, a failure fee is not included for product A.

Product C, with a lower variance of demand, has the possibility of receiving a success rebate if the contracted sales target is exceeded. Success rebates (negative failure fees) for product C range from -110.228 to -107.502 as wholesale cost increases. The retailer extracts a slotting allowance to cover the lower mean demand and then pays some of the allowance back through a success rebate if the sales target is exceeded. It is important to note that the retail price for product C is larger in magnitude than for product A. A high retail price negatively effects sales and the chance of reaching a sales target. While product C has the chance of receiving a success rebate, the retailer designs a contract that may be difficult for product C to achieve.

Concluding Comments

This study offers an explanation for the use of slotting allowances and failure fees in the retail grocery industry. An understanding is gained of slotting allowances and failure fees and the

relationship they have with asymmetric information and credible relay of demand distribution information. Mechanism design modeling concepts are employed to solve adverse selection problems by aligning retailer and manufacturer incentives. This study shows that a menu of contract terms can induce manufacturers to reveal product demand distribution information.

The mechanism design framework and two moments of the product demand distribution are utilized to eliminate mean-variance dominated products and separate non-dominated products by their demand distributions. Model results suggest that accurately designed menus of contracts including retail prices, slotting allowances, failure fees (or success rebates) and sales targets can separate products by their demand distributions and alleviate asymmetric information problems. Adverse selection problems can be reduced by utilizing such mechanisms to align incentives for retailers and manufacturers when shelving new product introductions.

This study validates McLaughlin and Rao's hypothesis that slotting allowances may be correlated with lower mean demand products. The products paying a slotting allowance may make non-negative profits to pass the screening criteria and be shelved, but have lower expected consumer demand than other products. Retailers request slotting allowances relative to the lower mean demand, but may offer a possible success rebate if the sales target is exceeded.

The impact of this research is further reaching than in pure theoretical modeling contexts. While the research is important for academic researchers to gain a greater understanding of slotting allowances and failure fees and their impact on information in the grocery supply chain, others benefit from such research. All actors in the food supply chain gain from slotting allowance and failure fee research. Retailers, manufacturers, policymakers and ultimately consumers benefit from such research. Grocery retailers capitalize from understanding how to construct a menu of contracts allowing manufacturers to credibly reveal demand distributions of

new products. They are able to eliminate dominated products and separate non-dominated products by their demand distributions. Manufacturers can choose between contracts of slotting allowances, failure fees and sales targets that best fit the new product demand distribution. The incentive compatibility and individual rationality constraints require that manufacturers choose contracts that are optimal for them. Policymakers are able to use this study's results about the manufacturer/retailer relationship and asymmetric information in the supply chain to add more information about the impact of these payment systems on competitiveness. And possible welfare implications will benefit consumers from the implementation of properly constructed slotting allowance, failure fee and success rebate contracts.

References

- Bester, H. 1985. "Screening vs. Rationing in Credit Markets with Imperfect Information." *American Economic Review*, v.75: 850-855.
- Chu, W. 1992. "Demand Signaling and Screening in Channels of Distribution." *Marketing Science*, v. 11, n. 4 (Fall): 327-347.
- DeVuyst, C. S. 2000. "Non-Credible Information Flows in the Retail Food Chain: The Behavioral Roots of Asymmetric Information" submitted to *Marketing Science*.
- DeVuyst, C. S. 1999. *Slotting Allowances, Failure Fees and Asymmetric Information in the Grocery Supply Chain*. Unpublished doctoral dissertation.
- Lariviere, M. and V. Padmanabhan. 1997. "Slotting Allowances and New Product Introductions." *Marketing Science*, v. 16, n. 2: 112-128.
- McLaughlin, E. W. and V. R. Rao. 1990. "The Strategic Role of Supermarket Buyer Intermediaries in New Product Selection: Implications for Systemwide Efficiency." *American Journal of Agricultural Economics*, v. 72, n. 2 (May): 358-370.
- Miller, L. H., P.N. Ellinger, P. J. Barry and K. Lajili. 1994. "Price and Nonprice Management of Agricultural Credit Risk." *Agricultural Finance Review*, v. 54: 28-41.
- Sullivan, M. 1997. "Slotting Allowances and the Market for New Products." *Journal of Law and Economics*, v. XL, n. 2 (October): 461-494.