The Competitive Consequences of Using a Category Captain

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Abstract

Many retailers these days designate a national brand manufacturer as a "category captain" to help them manage the entire category. The category captain is involved in decisions that affect not only its own brands, but also those of its rivals. We analyze a setting where two manufacturers supply to a single retailer, and examine the competitive consequences when the category captain is engaged in one of the following three activities: (1) provision of demand enhancing services (2) sharing of superior demand information, and (3) collaborating in pricing decisions.

Contrary to concerns raised in previous literature, we find that a category captain’s involvement in pricing decisions or providing demand enhancing services does not necessarily lead to undesirable outcomes: consumers benefit from pricing collaboration and, under some conditions, the rival manufacturer benefits from demand enhancing services even when these services favor the category captain’s brand at the expense of the rival’s. We also find that while sharing demand information hurts the category captain, the joint profits of the retailer and the category captain increase. Further, sharing information does not necessarily improve channel performance: consumers may be worse off and, under some conditions, channel profits decrease.

(Keywords: Retailing, Distribution Channels, Category Management.)
1 Introduction

Category management can be defined as "a process that involves managing product categories as business units, and customizing them on a store-by-store basis to satisfy customer needs" (Nielsen Marketing Research and American Marketing Association 1992). Since its conception in the early 90’s, category management has become an integral part of retail strategy both in the U.S. and Europe (e.g., Business 2.0 2003, Hofstetter 2006). In practice, since retailers carry hundreds or even thousands of categories, they do not find it practical to maintain dedicated resources or build specialized capabilities for each category. Instead, since national brand manufacturers already invest heavily in understanding the category and have better insights about overall market trends, demand drivers and consumer shopping behavior; retailers often partner with a leading national brand manufacturer in each category to help them manage the entire category (Blattberg and Fox 1995, FTC Report 2001). This is true not only for smaller retailers, but also for large and dominant ones such as Wal-Mart, Kroger, Target, Safeway and H-E-B. For instance, Wal-Mart partnered with General Mills in the dairy category (Progressive Grocer 2006), and with Diageo in the spirits category (Sunday Herald 2005). According to a recent survey, retailers attribute 19 percent growth in sales, while manufacturers attribute 12 percent growth in sales to such collaborative initiatives (Progressive Grocer 2007).

The partnering manufacturer, known as the "category captain", is responsible for reviewing the performance of the entire category, often providing information about category and brand level demand, and recommending a store-level sales strategy, including assortment, shelf-space assignments, promotion and pricing. For example, Kraft Foods demonstrated to retailers that changing the relative placement of pourable dressings and spoonable dressings can increase pourable category volume by 12.3% and spoonable dressing volume by 7.4% (SuperMarket News 2003). Similarly, Carrefour\(^2\) realized a 6-16% sales increase in the oral care category across retail markets based on Colgate’s recommendations on relative product placements and educating consumers in-store (ECR Conference 2004). Interestingly, the scope of such arrangements includes not only the category captain’s own brands but also those of its rivals.

\(^2\)A French global retail chain which is the second largest retail group in the world (by revenues) after Wal-mart.
While the category captain’s job typically does not involve any compensation from the retailer, nevertheless, it often requires that the category captain meet some pre-set objectives such as higher category sales or profits. Retailers often ask manufacturers to compete for this job, and replace existing category captains with new ones in case they are not satisfied with the outcomes. Industry benchmarking studies regularly rank manufacturers based on their performance as category captains (e.g., Cannondale Associates 2007), and top performers are recognized through industry awards (e.g., Progressive Grocer 2006, Retail Merchandiser 2004). Such accolades can be a matter of pride and prestige within the industry.

More importantly, becoming the category captain of choice is crucial to the success of many leading national brand manufacturers (e.g., Forbes 2002). Category captainship provides the manufacturer with some degree of decision-making authority over the retailer’s strategy. While the level of influence may vary across categories and retailers, the category captain occupies a unique position relative to its rivals (Desrochers, Gundlach and Foer 2003, Lindblom and Olkkonen 2008). Indeed, according to an A.C. Nielsen Survey (Progressive Grocer 2003), the most important reason for manufacturers to be involved in category management is to influence retailer category decisions. Consequently, even today, category captainship continues to be a top-management priority for many manufacturers. For instance, at a recent conference, P&G’s Chief Operating Officer identified increasing the number and scope of P&G’s category captain engagements as one of P&G’s top five challenges in 2007 (TRMM Workshop 2007).

As this practice has become widespread amongst retailers and is crucial for manufacturers, it is not without controversy. While the use of category captains per se is not considered illegal or anticompetitive (FTC Report 2001), researchers in marketing (Gruen and Shah 2000, Lindblom and Olkkonen 2008) as well as legal scholars (e.g., Wright 2006, Carameli 2004) have been concerned about the (lack of) objectivity of the category captain: the potential to harm retailer and rival manufacturers’ interests, hinder competition and ultimately hurt consumers. Moreover, even

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3In some cases, category captains pay the retailer for the opportunity to manage the category.
4There is no federal regulation on category captaincy. The FTC only recommends guidelines to minimize potential for anticompetitive conduct such as the retailer making the final category management decisions, limiting the competitive information that goes to the category captain and requiring category captains to establish managerial firewalls within their organizations.
if the overall benefits of this practice outweigh the costs, the question remains whether selectively restricting the range of responsibilities that go with category captainship can lead to a better outcome (FTC Report 2001, Desrochers, Gundlach and Foer 2003, Leary 2004). Thus, a related concern is what activities the category captain should be allowed to perform.

Our objective is to conduct a formal model-based examination about how specific category captain responsibilities impact the category captain, the retailer, the rival manufacturer, and the consumer. We consider the following three cases:

1. The category captain engages in demand enhancing activities such as better shelf management and enhancing the in-store environment.

2. The category captain shares superior demand information with the retailer.

3. The category captain and retailer collaborate in pricing decisions for the category.

To study these issues, we develop a parsimonious model that captures the essence of different category captain activities. While we are not able to examine all possible activities that a retailer might ask the category captain to perform, we believe that our research makes a useful start. We believe that our results are potentially useful to retailers, manufacturers and policy makers. We find that:

1. Demand enhancing activities benefit both the retailer and the category captain. The rival manufacturer may also benefit as long as the demand enhancing activities do not favor the category captain’s brand too much. Total market demand increases.

2. Sharing demand information increases the joint profits of the category captain and the retailer, but hurts the category captain. The rival manufacturer is never better off. Consumer surplus decreases.

3. Collaborating to make pricing decisions benefits both the category captain and the retailer. The rival manufacturer is worse off. Consumer surplus increases.

Prior research on category management has been primarily concerned with the transition from a brand focus to a category focus. Zenor (1994) examines the transition for individual
manufacturers with multi-brand product lines. Using a decision support framework for a single retailer, Chen et al. (1999) argue that category management must account for cross-category influences. Dhar, Hoch and Kumar (2001) find that the effectiveness of category management activities depend on the role of the category in the store’s portfolio. Basuroy, Mantrala and Walters (2001) analyze a two-retailer two-manufacturer setting to investigate the impact of the transition on retailers’ prices and performance. Consistent with their analytical results, they find evidence that retailer prices increased following the transition. Gajanan, Basuroy and Beldona (2007) consider the impact of the transition on manufacturers’ brand differentiation decisions.

In contrast to this prior research, we investigate the impact of engaging a category captain in various category management activities. In ongoing research, Wang (2003), Wang, Raju and Dhar (2003), Kurtulus and Toktay (2007) examine the consequences when a category captain and retailer collaborate on pricing under different sets of conditions. We examine a broader range of category captain activities than those considered in their work. Our work is also related to research on information sharing in a supply chain and on channel coordination. We discuss these and the aforementioned ongoing research when we discuss specific category captain activities.

Researchers have also examined the role and conduct of category captains using managerial surveys. Gruen and Shah (2000) investigate the determinants and outcomes of plan objectivity and implementation in a survey of supplier category managers in the U.S. retail industry. Lindbolm and Olkonnen (2008) conduct a survey amongst Finnish suppliers and find that category captains have higher influence than rivals on retailer strategies, and also benefit the most from category management. Morgan, Kaleka and Gooner (2007) survey category managers of U.K. retailers to investigate the impact of supplier opportunism. Interestingly, they find that the reported level of category captain opportunism is relatively low, as is the extent of discontent amongst non-category captain manufacturers.

In what follows, we consider the provision of demand enhancing activities in §2, sharing of superior demand information in §3 and collaboration in pricing decisions in §4. We summarize our findings and discuss avenues for future research in §5.
2 Provision of Demand Enhancing Services

We consider a market consisting of two national brands NB1 and NB2 sold by manufacturers M1 and M2, respectively. We consider a mature product category and assume that both brands are available to consumers in a retail outlet. We assume that the retailer’s objective is to maximize its combined profits from selling both brands. We focus on one product category and abstract away from substitution and complementarity effects across product categories. Competition among retailers is not modeled.

In the Absence of a Category Captain: This setting serves as our benchmark case. We assume the demand functions for NB1 and NB2 to be:

\[
q_1 = 1 + \theta (p_2 - p_1) - p_1, \quad (1)
\]

\[
q_2 = 1 + \theta (p_1 - p_2) - p_2, \quad (2)
\]

where \(q_1\) and \(q_2\) are unit sales and \(p_1\) and \(p_2\) are the prices of NB1 and NB2, respectively. \(\theta > 0\) represents the cross-price sensitivity and reflects the degree of competition in the market. Demand specified in (1) and (2) have their basis in utility theory and have been used in earlier research (e.g., Raju, Sethuraman and Dhar 1995) to arrive at predictions that are consistent with market data. Later, we discuss more general demand formulations. M1 and M2 supply NB1 and NB2 at wholesale prices \(w_1\) and \(w_2\), respectively.

Prices are set in a two-stage Stackelberg game: the manufacturers set their wholesale prices in the first stage, while the retailer sets its retail prices in the second stage. All parties are interested in maximizing their own profits.

In the Presence of a Category Captain: We now allow for the retailer to engage a category captain, say M1, to provide retailing services that potentially enhance demand. These services could include better shelf space management, designing end-of-aisle displays, stocking products that the customers desire, and superior inventory management so that demand does not go unfulfilled. While the Colgate and Kraft Foods examples suggest that some demand enhancing activities may benefit all brands in a category, a frequent concern raised by researchers and industry observers (e.g., Gruen and Shah 2000, Carameli 2004) is that a category captain may deploy
these services in a manner that benefits the category captain at the expense of the rival. For instance, a category captain may allocate lesser shelf space to rival brands or relegate them to less visible portions on the shelf.

We allow our model to be flexible enough to accommodate both possibilities. While M1’s retailing service, denoted by \( e_c > 0 \), always enhances NB1’s demand, the degree and direction of its impact on NB2’s demand depends on the nature of this service, denoted by \( \rho \in (-1, 1) \), as follows:

\[
q_1(e_c) = 1 + \theta (p_2 - p_1) - p_1 + \frac{1}{2} e_c, \tag{3}
\]

\[
q_2(e_c) = 1 + \theta (p_1 - p_2) - p_2 + \frac{1}{2} \rho e_c, \tag{4}
\]

A strictly positive \( \rho \) indicates that the category captain’s service also enhances NB2’s demand. For example, the category captain might convince the retailer to expand the shelf space for the entire category. If \( \rho \) is zero, then the category captain’s service increases only NB1’s demand and has no effect on NB2’s demand. A strictly negative \( \rho \) indicates that the category captain’s service depletes NB2’s demand in the process of enhancing NB1’s demand. For instance, the category captain may convince the retailer to install an end-of-aisle display for its own brand. However, in all cases, the demand for the category as a whole still increases. We assume that it costs \( \frac{1}{2} e_c^2 \) to provide a service of level \( e_c \). Later, we consider that the cost may also increase with \( \rho \).

We take the nature of the category captain’s services to be given so that \( \rho \) is common knowledge to all parties, and examine the consequences when the retailer makes use of the category captain’s services. We consider a two stage Stackelberg game. In the first stage, manufacturers set their wholesale prices. In addition, the category captain sets the level of demand enhancing services to maximize its profits. In the second stage, the retailer sets its retail prices based on the wholesale prices as well as the level of the demand enhancing service.

We solve for the sub-game perfect Nash equilibrium in the benchmark settings and in the setting where the retailer engages a category captain, and compare the outcomes. Table 1 provides the results of our analysis. We summarize our results in Proposition 1. The proofs for this and
for all remaining propositions are provided in the Technical Appendix5.

**Proposition 1** When the category captain provides demand enhancing services, the retailer and category captain always benefit. Total market demand always increases. The other manufacturer also benefits unless \( \rho < \hat{\rho} \), where \( \hat{\rho} = -\frac{\theta}{2(1+\theta)} \).

Proposition 1 suggests that even if the category captain’s demand enhancing activities favor its own brand, as long as this is not too much at the expense of the rival’s brand, it helps all parties. When \( \rho \) is positive, the intuition is quite straightforward. The reason why it works even when \( \rho \) is negative is as follows.

Demand enhancing activities allow M1 to increase its wholesale price. In particular, M1 sets a higher wholesale price than M2. The retailer follows suit, and in fact magnifies this difference when setting retail prices6. As NB1’s retail price is higher, this leads to demand switching from NB1 to NB2. Thus, demand enhancing activities also have an indirect effect on NB2’s demand through the price movements, and this counteracts the direct effect when \( \rho \) is negative. In fact, unless \( \rho \) is too negative (\( \rho < \hat{\rho} \)), the indirect effect more than offsets the direct effect. Further, M1’s higher wholesale price may also allow M2 to increase its wholesale price. We find that both M2’s demand and wholesale price are higher when M1 engages in demand enhancing activities as long as \( \rho \) is not too negative. We also find that, in all cases, the total market demand is higher7.

What is also interesting is that the critical value \( \hat{\rho} \) decreases with \( \theta \), implying that in more competitive markets, there is even more scope for the category captain to benefit all. A higher \( \theta \) leads to more demand switching, thereby extending the range for \( \rho \).

**Proposition 2** The more competitive the market, the greater the range of \( \rho \) where the use of a category captain can benefit all parties.

Researchers and industry observers often raise concerns that a lack of objectivity or opportunism on part of the category captain will harm the retailer and rival manufacturer (e.g., Gruen

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5Technical Appendix is available upon request from authors.
6Refer Eqn. (21) in Technical Appendix, Pg 2.
7We cannot comment on consumer welfare since we do not explicitly model how the category captain’s demand enhancing activities affect consumer preferences, especially when \( \rho < 0 \).
and Shah 2000, Leary 2004). We find that, in the context of providing demand enhancing activities, this is not a foregone conclusion. Even when the category captain places its own interest above that of the other parties, the other parties may still benefit. In fact, the scope for the rival manufacturer to benefit is higher when the market is more competitive. Our results may explain why in the survey of U.K. supermarket retailers by Morgan, Kaleka and Gooner (2007) the levels of category captain opportunism and discontent amongst rival manufacturers reported by the retailers are relatively low. If engaging a category captain for demand enhancing activities always benefits the retailer, and can benefit the rival manufacturer as long as the category captain’s service is not too biased, then there may be little reason to complain.

Table 1: Provision of Demand Enhancing Services

<table>
<thead>
<tr>
<th></th>
<th>Without a Category Captain</th>
<th>With a Category Captain</th>
</tr>
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<tbody>
<tr>
<td>M1’s Profits</td>
<td>(\frac{1+\theta}{2(2+\theta)^2})</td>
<td>(\frac{2(2+3\theta)^2(15+16\theta)}{(30+62\theta^2+24\theta^2-\theta_\rho)^2})</td>
</tr>
<tr>
<td>M2’s Profits</td>
<td>(\frac{1+\theta}{2(2+\theta)^2})</td>
<td>(\frac{(1+\theta)(15+24\theta+\theta_\rho)^2}{2(30+62\theta^2+24\theta^2-\theta_\rho)^2})</td>
</tr>
<tr>
<td>Retailer Profits</td>
<td>(\frac{(1+\theta)^2}{2(2+\theta)^2})</td>
<td>(\frac{(1+\theta)^2(2304\theta^3+96\theta^2(43+\rho)+(31+\rho)(79+\rho)+\rho(30+\rho)+481)}{4(1+2\theta)(30+62\theta^2+24\theta^2-\theta_\rho)^2})</td>
</tr>
<tr>
<td>Market Demand</td>
<td>(\frac{1+\theta}{2+\theta})</td>
<td>(\frac{1+\theta}{2+\theta} + \frac{2(2+3\theta)(1+\rho)}{4(2+\theta)(30+62\theta^2+24\theta^2-\theta_\rho)})</td>
</tr>
</tbody>
</table>

2.1 Model Extensions

We now discuss the impact of relaxing some of our assumptions. While we have taken the cost of providing retailing service to be independent of \(\rho\), one might argue that it should increase with \(\rho\). For instance, it is likely to be more difficult to increase demand for both NB1 and NB2 (i.e., \(\rho > 0\)) than only for NB1 (i.e., \(\rho \leq 0\)). But we note that the results of Propositions 1 and 2,\footnote{We recognize that the degree of market competitiveness has many facets, and our model captures just one. For example, the number of firms in a market also affects the degree of competitiveness. The specific market conduct also determines the degree of competitive rivalry. Our model does not include these aspects and we acknowledge these limitations.}
including the specific value of \( \hat{\rho} \), derive from the demand formulation\(^9\). Thus, allowing the cost function to increase with \( \rho \) would not impact our results\(^{10}\).

We expect that our results are relatively robust and would extend to more general formulations of the demand and the impact of retailing services. For instance, for M2 to benefit even when \( \rho < 0 \), all that we require is the following: when retailing service has no impact on NB2 (i.e., \( \rho = 0 \)), the provision of such service has to enable M1 to raise its wholesale price and this has to have a positive impact on NB2’s demand, so that M2’s profits strictly increase. Then, under mild regularity conditions, it follows that for arbitrarily small \( \rho < 0 \), M2’s profits would still increase. Further, as the extent to which M2 benefits from an increase in M1’s wholesale price would depend on the cross-price sensitivity in NB2’s demand, we can expect that all else being equal, a higher cross-price sensitivity would increase the scope for the rival to benefit when \( \rho < 0 \).

3 Sharing of Demand Information

One of the oft cited benefits of engaging a category captain is that, major national brands often know more about the market for a particular product category than do the retailers. For instance, Blattberg and Fox (1995) explain that, in comparison with retailers, manufacturers have broader information about the market and its trends, and have knowledge about factors that drive category sales which are often outside of retailers’ understanding. Sharing such superior information can help retailers in a number of key decisions, such as what prices to charge, or what assortments to carry. While information can be of different types, we consider a case where there is some uncertainty about the base level of category demand. More specifically, we assume that the demand for NB1 and NB2 to be given by, \(^{11}\)

\[
q_1(\phi) = (1 + \phi) + \theta(p_2 - p_1) - p_1, \tag{5}
\]

\[
q_2(\phi) = (1 + \phi) + \theta(p_1 - p_2) - p_2, \tag{6}
\]

where \( \phi \) is stochastic, drawn from a distribution \( g(\phi) \) with zero mean and finite variance \( \sigma^2 \).

\(^9\)Refer Eqn. (21) in Technical Appendix, Pg 2.

\(^{10}\)We do need to impose some restrictions on the cost function. For instance, allowing the cost function to be \( \frac{1}{2}(1 + k\rho)e^2 \), we require \( k \in \left[ 0, \frac{1}{2} \right] \), where the upper bound ensures that NB2’s demand is non-zero in equilibrium. In other words, the cost of service must increase sufficiently fast.
We initially consider the case where only the category captain has superior demand information. Later, we extend it to the case where the rival manufacturer possesses private information about the market.

3.1 Only the Category Captain has Demand Information

We assume that, based on its internal market research, the category captain (M1) receives an imperfect forecast \( f_1 \) of the realization of \( \phi \) such that,

\[
f_1 = \phi + \varepsilon_1,
\]

(7)

where \( \varepsilon_1 \) is the forecast error, drawn from a distribution \( h_1(\phi) \) with zero mean and finite variance \( \sigma^2_1 \), and distributed independent of \( \phi \). Lower the error variance, more precise the forecast.

We assume that \( g(\cdot) \) and \( h_1(\cdot) \) are distributed such that Bayesian updating using \( f_1 \) leads to posterior expectations for \( \phi \) that are linear in \( f_1 \), i.e.,

\[
E[\phi|f_1] = (1 - t_1) E[\phi] + t_1 f_1 = t_1 f_1,
\]

(8)

where \( t_1 \in [0, 1] \) may be interpreted as the weight accorded to the new information relative to the prior information\(^{11} \). Eqn. (8) is satisfied by the exponential family of conjugate distributions, which include the normal, beta-binomial and gamma-Poisson (Ericson 1969). The latter two are well-suited for ensuring that the non-negativity constraints for the demand are not violated. It can be shown that \( t_1 = \frac{\sigma^2}{\sigma^2 + \sigma^2_1} \) (Ericson 1969), so that the weight for the new information depends on the precision of the forecast relative the underlying uncertainty in demand.

Past researchers (e.g., Vives 1984, Gal Or 1985, Raju and Roy 2000) have extensively used the linear demand formulation with a normally distributed demand intercept and a normally distributed forecast error. Li (1985) shows that their formulation can be generalized and their results continue to hold for a wider set of distributions for the demand intercept and forecast error. Christen (2005) utilizes a similar formulation to model uncertainty about rival’s costs and cost forecasts in a linear demand system, and relies on the same analytical techniques. We compare two cases.

\(^{11}\)Li (1985) shows that if \( f_1 \) is an unbiased estimator of \( \phi \) and the posterior expectation is linear in \( f_1 \), then the posterior expectation is, in fact, in general given by \( E[\phi|f_1] = (1 - t_1) E[\phi] + t_1 f_1 \).
**Case 1:** M1 keeps its forecast private. This serves as our benchmark scenario.

**Case 2:** M1 shares its forecast with the retailer. This represents the scenario where M1 is engaged as the category captain.

Since we are interested in the impact of sharing M1’s superior information with the retailer, we assume that the retailer is not aware of the variability in demand, unless it is informed by M1. This is consistent with the description by Blattberg and Fox (1995) that manufacturers have information about factors that are outside of retailers’ understanding. So under Case 1, the retailer believes that the demand is in fact given by eqns. (1) and (2). Since $\phi$ has zero mean, the retailer’s beliefs are not biased. In particular, this assumption implies that the retailer does not infer the variation in demand from M1’s wholesale price when M1 does not share information. Lee, Padmanabhan and Whang (1997) make a similar assumption about the manufacturer to explain the bullwhip effect, when the manufacturer observes only the retailer’s orders but not actual sales. Gavirneni, Kapuscinski and Tayur (1999) and Lee, So and Tang (2000) also make this assumption when evaluating the impact of sharing information in a supply chain. This assumption can also be seen as an extreme form of the argument that there are multiple factors that cause a manufacturer’s wholesale price to change, some of which the retailer may not even be aware of, and hence the retailer is limited in its ability to fully infer the manufacturer’s knowledge about the state of the market. While our assumption that the retailer does not extract useful information from the wholesale price would tend to magnify the impact of sharing information, we believe that it does not impact the qualitative nature of the results.

We initially assume that M2 does not receive any forecast of its own, and is aware only of the distribution of $\phi$ and $f_1$. In both Case 1 and Case 2, M1 first obtains its forecast. In Case 2, it shares this forecast with the retailer. Wholesale and retail prices are then set as before. We solve for the perfect Bayesian equilibrium in cases 1 and 2 and compare the outcome when M1 shares information (Case 2) to the benchmark (Case 1). Table 2 summarizes the results of our analysis.

**Proposition 3** When the rival manufacturer does not have demand information and the category captain shares its information with the retailer, the combined profits of the category captain and
the retailer increase, but the profits of the category captain decrease. The profits of the rival manufacturer are not affected. Consumer surplus decreases.

While sharing information improves the combined performance of M1 and the retailer, from M1’s perspective it creates a double marginalization problem. In particular, when M1 expects an above average demand (i.e., \( f_1 > 0 \)), retail margins are also higher since this information is shared with the retailer. This limits the extent to which M1 can benefit from the demand upside. This more than offsets the benefit from the reverse scenario when demand is expected to be below average. Stated differently, when information is shared with the retailer, double marginalization dampens the variability in M1’s derived demand. This decrease in demand variability reduces the value of M1’s forecast information and hence leads to a decrease in profits (e.g., Raju and Roy 2000)\(^{12}\). The rival manufacturer, however, is not affected, as it faces the same average derived demand even when M1 shares information.

While the average equilibrium prices and demand are the same as in the benchmark case, we find that consumer surplus decreases since the loss in consumer surplus from higher prices when demand is forecast to be above average more than offsets the gain from lower prices when demand is forecast to be below average. Thus, increased variability in retail prices leads to lower consumer surplus. Overall, we find that sharing information harms the category captain, but the overall gain allows for the category captain to be compensated.

The absence of fees paid to category captains has been mentioned as a potential cause for concern (Leary 2004). However, according to Blattberg and Fox (1995), the typical process in category captain arrangements is for a manufacturer to provide information and resources in exchange for the opportunity to participate actively in planning the category with the retailer. As we already saw in §2, a category captain gains from providing demand enhancing activities. So one could argue that in return for sharing information, the retailer engages the category captain for other activities, such that, in total, category captainship is worthwhile.

\(^{12}\)The value of M1’s information is the increase in M1’s profits relative to the case when \( f_1 \) is non-informative (i.e. \( \sigma_f^2 \to \infty \)). Note that when \( f_1 \) is non-informative, M1’s profits are the same whether or not it shares its information. Consequently, the change in M1’s value of information fully describes how its profits change when it shares information with the retailer.
Table 2: Sharing Demand Information when Only Category Captain has Information

<table>
<thead>
<tr>
<th></th>
<th>Category Captain Does Not Share Information</th>
<th>Category Captain Shares Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1’s Profits</td>
<td>(\frac{1+\theta}{2(2+\theta)^2} + \frac{1}{2(1+\theta)} t_1 \sigma^2)</td>
<td>(\frac{1+\theta}{2(2+\theta)^2} + \frac{t_1 \sigma^2}{8(1+\theta)})</td>
</tr>
<tr>
<td>M2’s Profits</td>
<td>(\frac{1+\theta}{2(2+\theta)^2})</td>
<td>(\frac{1+\theta}{2(2+\theta)^2})</td>
</tr>
<tr>
<td>Retailer Profits</td>
<td>(\frac{(1+\theta)^2}{2(2+\theta)^2} - \frac{1}{4(1+\theta)} t_1 \sigma^2)</td>
<td>(\frac{(1+\theta)^2}{2(2+\theta)^2} + \frac{(5+8\theta) t_1 \sigma^2}{16(1+\theta)})</td>
</tr>
<tr>
<td>Consumer Surplus</td>
<td>(\frac{(1+\theta)^3}{4(2+\theta)^4(1+2\theta)} + \frac{(1+\theta) \sigma^2}{4(1+2\theta)})</td>
<td>(\frac{(1+\theta)^3}{4(2+\theta)^4(1+2\theta)} + \frac{(1+\theta) \sigma^2}{1+2\theta})</td>
</tr>
</tbody>
</table>

Proposition 3 indicates that the overall performance of the channel, in terms of profits, improves when the category captain shares information. But to what extent is this driven by the category captain’s own brand? To answer this question, we turn to the issue of channel performance with respect to NB1 alone.

**Proposition 4** When the rival manufacturer does not have any information about market demand, sharing of information by the category captain increases channel profits from the category captain’s brand only if the market is sufficiently competitive \((\theta \geq \frac{1}{2})\).

As discussed before, when M1 shares information, it is worse off since double marginalization dampens the variability in its derived demand. Accordingly, the variation in its wholesale price in response to market forecasts is lower. On the other hand, the retailer’s profits from NB1 always increase since it is now able to adapt its retail price based on the forecast. Thus, sharing information decreases the extent to which the manufacturer uses the information, but increases the extent to which the retailer uses it. The balance between these two aspects determines whether their combined performance for NB1, in terms of profits, improves. We find that in the extreme case when M1 does not face competition from M2 \((\theta = 0)\), sharing of information decreases the
combined performance for NB1. As the market becomes more competitive, the extent to which M1 is able to adapt its wholesale prices in response to market forecasts decreases. This is true whether or not it shares information with the retailer. On the other hand, the extent to which the retailer adapts its retail prices when it has access to market forecasts is relatively less sensitive to the degree of competition. Consequently, when the market is competitive enough, the gains from enabling the retailer to use the information more than offsets the loss from the decrease in the M1’s use of this information.

Thus, when the market is not sufficiently competitive ($\theta < \frac{1}{2}$), gain in the combined profits of the category captain and the retailer is in fact solely due to the improvement in performance with respect to the rival manufacturer’s brand.

### 3.2 Rival Manufacturer also has Demand Information

We consider that M2 obtains an independent, private forecast $f_2$ given by,

$$ f_2 = \phi + \varepsilon_2, \tag{9} $$

where $\varepsilon_2$ is the forecast error, drawn from a distribution $h_2(\phi)$ with zero mean and finite variance $\sigma_2^2$, and distributed independent of $\phi$ and $\varepsilon_1$. We assume that $g(\cdot)$ and $h_2(\cdot)$ are such that

$$ E[\phi|f_2] = (1 - t_2) E[\phi] + t_2 f_2 = t_2 f_2, \tag{10} $$

where $t_2 \in [0, 1]$. It can be shown that $t_2 = \frac{\sigma^2}{\sigma^2 + \sigma_2^2}$.

Again, we compare the outcomes before and after M1 shares information with the retailer. The analysis in this case is more involved. M1’s strategy will be a function of its forecast $f_1$, i.e. its strategy is contingent on its forecast. In equilibrium, this functional relation must be optimal given M2’s strategy, which in turn is a function of its forecast $f_2$. Further, since M2’s forecast is private, M1’s must consider the conditional expectation of M2’s strategy based on its own forecast.

However, as shown by Li (1985) and Li, Mckelvey and Page (1987), the linear demand - linear posterior expectation formulation facilitates our analysis. It can be shown that if one
manufacturer chooses a strategy that is linear in its own forecast, then the rival’s best response is linear in the rival’s own forecast (Refer Technical Appendix §B.3, pg 8). Next, we solve for the equilibrium in linear strategies. Uniqueness of linear strategies, as opposed to more general functional forms, follows as in Li (1985) and Li, Mckelvey and Page (1987)\(^\text{13}\). The results of our analysis are summarized in Table 3.

**Table 3: Sharing Demand Information when Category Captain and Rival have Information**

<table>
<thead>
<tr>
<th>Category Captain Does Not Share Information</th>
<th>Category Captain Shares Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M1’s Profits</strong></td>
<td></td>
</tr>
<tr>
<td>(\frac{1 + \theta}{2(2 + \theta)^2} + \frac{2(1 + \theta)(2 + 2\theta + \theta t_2) + t_1 \sigma^2}{(4(1 + \theta)^2 - \theta^2 t_1 t_2)})</td>
<td></td>
</tr>
<tr>
<td>(\frac{1 + \theta}{2(2 + \theta)^2} + \frac{1 + \theta(2(1 + \theta + \theta t_2) - \theta_1 t_1^2 t_2)^2 t_1 \sigma^2}{2(4(1 + \theta)^2 - \theta^2 t_1 t_2)})</td>
<td></td>
</tr>
<tr>
<td><strong>M2’s Profits</strong></td>
<td></td>
</tr>
<tr>
<td>(\frac{1 + \theta}{2(2 + \theta)^2} + \frac{2(1 + \theta)(2 + 2\theta + \theta t_1) + t_2 \sigma^2}{(4(1 + \theta)^2 - \theta^2 t_1 t_2)})</td>
<td></td>
</tr>
<tr>
<td>(\frac{1 + \theta}{2(2 + \theta)^2} + \frac{(1 + \theta)(4(1 + \theta) - (2 + \theta) t_1)^2 t_2 \sigma^2}{2(4(1 + \theta)^2 - \theta^2 t_1 t_2)})</td>
<td></td>
</tr>
<tr>
<td><strong>Retailer’s Profits</strong></td>
<td></td>
</tr>
<tr>
<td>(\frac{1 + \theta}{2(2 + \theta)^2} - \frac{(1 + \theta)(t_1 + t_2)(4(1 + \theta)^2 + \theta^2 t_1 t_2)}{(4(1 + \theta)^2 - \theta^2 t_1 t_2)})</td>
<td></td>
</tr>
<tr>
<td>(\frac{(1 + \theta)^2}{2(2 + \theta)^2} + \frac{2 + \gamma_{B1}^4 (1 + \theta) Y_{B1}^4 - 2}{4} t_1 \sigma^2)</td>
<td></td>
</tr>
<tr>
<td><strong>Consumer Surplus</strong></td>
<td></td>
</tr>
<tr>
<td>(-\frac{(1 + \theta) (t_1 Y_{B1}^3 + t_2 Y_{B2}^3 + \theta(1 + \theta) Y_1 Y_{B1}^3 Y_{B2} t_1 t_2)}{2(1 + 2\theta)})</td>
<td></td>
</tr>
<tr>
<td>(-\frac{(1 + \theta) (6t_1 + 2t_1 Y_{B1}^3 + 2(2 - t_1) t_2 Y_{B2}^3 + 4\theta(1 + \theta) Y_1 Y_{B1}^3 Y_{B2} t_1 t_2)}{8(1 + 2\theta)})</td>
<td></td>
</tr>
<tr>
<td><strong>Surplus</strong></td>
<td></td>
</tr>
<tr>
<td>(\frac{(1 + \theta)(1 + \theta^2 + 2\theta t_1)}{(1 + \theta)(1 + \theta^2 + 2\theta t_2)} + t_1 (Y_{B1}^3)^2 + t_2 (Y_{B2}^3)^2)</td>
<td></td>
</tr>
<tr>
<td>(\frac{(1 + \theta)(1 + \theta^2 + 2\theta t_1)}{(1 + \theta)(1 + \theta^2 + 2\theta t_2)} + t_1 (Y_{B1}^4)^2 + t_2 (Y_{B2}^4)^2)</td>
<td></td>
</tr>
</tbody>
</table>

where, \(Y_{B1}^3 = \frac{2(2 + 2\theta + \theta t_2)}{4(1 + \theta)^2 - \theta^2 t_1 t_2}\), \(Y_{B2}^3 = \frac{2(2 + 2\theta + \theta t_1)}{4(1 + \theta)^2 - \theta^2 t_1 t_2}\), \(Y_{B1}^4 = \frac{2(1 + \theta + \theta t_2) - \theta_1 t_1}{4(1 + \theta)^2 - \theta^2 t_1 t_2}\), \(Y_{B2}^4 = \frac{4(1 + \theta) - (2 + \theta) t_1}{4(1 + \theta)^2 - \theta^2 t_1 t_2}\).

**Proposition 5** When the rival manufacturer also has demand information and the category captain shares its information with the retailer, the combined profits of the category captain and the retailer increase, but the profits of the category captain decrease. The profits of the rival

\(^{13}\)An alternate proof for uniqueness emerges from Basar and Ho (1974). While they work with a linear demand - normal distribution formulation, as Li, Mckelvey and Page (1987) point out, their approach only requires that the posterior expectation be linear.
manufacturer decrease. Consumer surplus decreases.

We find that double marginalization now makes both manufacturers worse off even as it improves the joint profits of M1 and the retailer. Even though M2 has an independent and private forecast, still \( f_1 \) and \( f_2 \) are correlated because of their common dependence on \( \phi \). Therefore, the variability in each manufacturer’s derived demand is reduced when M1 shares information with the retailer, which lowers the value of their forecast information\(^{14}\). Again, consumer surplus decreases due to increased variability in retail prices.

We now consider the channel performance in terms of profits with respect to each brand.

**Proposition 6** When the rival manufacturer also conducts its own market research, sharing of information by the category captain increases channel profits from the category captain’s brand if the market is sufficiently competitive \((\theta > \hat{\theta}_1)^{15}\). It increases the channel profits from the rival manufacturer’s brand either if its forecast accuracy is not too high \( \left( \frac{1}{\sigma_1^2} < \frac{1}{\sigma_2^2} \right) \) or if the market is sufficiently competitive \((\theta > \frac{1 + \sqrt{5}}{2})\).

The channel performance with respect to a brand depends on how sharing information affects the overall usage of information. When the channel is more competitive, the decrease in the use of information by manufacturers is less important. Thus, channel performance improves if the market is sufficiently competitive. In addition, for NB2, if the accuracy of M2’s information is not high, then the decrease in its use by M2 when M1 shares its information is less important\(^{16}\). We also find that the overall channel performance across both brands increases either if M2’s forecast is not too accurate or if the market is sufficiently competitive.

Researchers in supply chain management have studied the sharing of demand information from the retailer to the manufacturer wherein this information is used to make production quantity decisions. Lee, Padmanabhan and Whang (1997), Gavirneni, Kapuscinski and Tayur (1999) and Lee, So and Tang (2000) find that such information sharing improves operational efficiency

---

\(^{14}\)From Proposition 3, if M2 did not have a forecast, it is unaffected by M1’s sharing of information. Therefore, when M2 has a forecast, the change in value of its information fully describes how M2’s profits change when M1 shares its own information with the retailer.

\(^{15}\)\( \hat{\theta} \) is defined implicitly in Eqn. (66) in the Technical Appendix, Pg 13.

\(^{16}\)The conditions in Proposition 6 for NB2 are sufficient but not necessary.
in different settings. Li (2002) considers a model with competing retailers and shows that such operational gains can be more than offset by the losses from this information inadvertently leaking to competing retailers. In contrast to this research stream, we consider information sharing from the manufacturer to the retailer in a context where this information is used to set prices. We find that such sharing improves channel profits with respect to the category captain’s brand only when the market is sufficiently competitive.

Our work is also related to that of Iyer, Narasimhan and Rakesh (2007) who consider a manufacturer’s trade-off between having a channel with better demand information and maintaining inventory to tackle demand uncertainty in the absence of such information. They find that better information leads to higher retail prices which limits the manufacturer’s ability to extract profits. As a result, the manufacturer may prefer to have a low-information channel and maintain inventory. While they examine changes in the information level of the channel as a whole, we consider the sharing of information within the channel. We also analyze how this impacts a rival manufacturer who also has private demand information.

We have limited our attention to one kind of information (category demand) and one kind of decision (pricing). Other types of information, such as price elasticity or cross-category influences are also potentially useful to the retailer, and these may be useful for making decisions other than price such as assortment or inventory levels. We have not considered these aspects in our analysis and acknowledge this as a limitation.

4 Collaboration in Pricing Decisions

The category captain’s influence on the retailer’s pricing decision has been one of the more controversial aspects of category captainship (e.g., Steiner 2001, Desrochers, Gundlach and Foer 2003, Carameli 2004). On the one hand, some worry that the category captain and the retailer may collude with each other, leading to higher retail prices. On the other hand, it also raises the concern that a category captain may use its position to harm rival manufacturers, say for instance, by influencing the retailer to raise the price of competing products and render them less attractive. We start by examining the "most collusive" scenario wherein the interests of the category captain
(M1) and the retailer are fully aligned when collaborating on pricing decisions, and then extend our analysis to allow for their interests to be misaligned.

4.1 Category Captain and Retailer Interests are Fully Aligned

We assume that the retail demand functions for NB1 and NB2 are as defined earlier in §2, eqns. (1) and (2). Also, the benchmark setting without pricing collaboration is the same as the benchmark setting in §2, when the retailer does not use a category captain.

Since the interests of the category captain (M1) and the retailer are perfectly aligned, we assume that, when they collaborate, retail prices are set so as to maximize their joint profits as follows:

\[
\begin{align*}
\max_{p_1, p_2} & \quad (p_1 - w_1) q_1 + (p_2 - w_2) q_2 + w_1 q_1 \\
& = \max_{p_1, p_2} p_1 q_1 + (p_2 - w_2) q_2.
\end{align*}
\]

(11)

As before, we consider a two-stage Stackelberg game, where wholesale prices are set in the first stage and retail prices are set in the second stage. Note that in eqn. (11) the category captain’s wholesale price \( w_1 \) does not play a role in how retail prices are set. Also, as a consequence, the rival manufacturer does not need to consider what \( w_1 \) may be when it sets its wholesale price. Thus, the only role for \( w_1 \) is to determine how the joint profits are shared between the category captain and the retailer. Therefore, we assume that as long as their joint profits increase, \( w_1 \) is set so as to share the joint gains in some pre-determined manner and do not explicitly consider it in our analysis.

We examine the impact of pricing collaboration by comparing it with the benchmark scenario when there is no pricing collaboration. We solve for the sub-game perfect Nash equilibrium in both cases. Table 4 summarizes the results of our analysis.

**Proposition 7** When the category captain and the retailer collaborate on pricing decisions and their interests are perfectly aligned, they are better off. The rival manufacturer is worse off and the consumers are better off.

When retail prices are set based on the joint interests of the category captain and the retailer,
it leads to a lower retail price for the category captain’s brand. This causes demand to shift from NB2 to NB1, which in turn forces the rival manufacturer to reduce its wholesale price, in order to stimulate demand for NB2. This leads to a lower retail price for NB2 as well, but not as low as that of NB1. Therefore under pricing collaboration, retail prices are lower for both brands, total output increases and consumers are better off.

We find that, in equilibrium, NB2 is indeed priced higher than NB1, but this is primarily because pricing collaboration leads to a lower price for NB1\textsuperscript{17}. We also find that NB2’s demand is lower than before since the increase in demand from a lower retail price is more than offset by demand switching from NB2 to NB1.

The rival manufacturer is worse off than before as both its demand and wholesale price are lower. The joint profits of the category captain and the retailer increase since the extent of double marginalization is reduced for both brands. It is fully eliminated for NB1 because of collaboration in pricing, and, consequently, it is reduced for NB2 because the rival manufacturer is forced to set a lower wholesale price. Some legal experts have argued that in evaluating the consequences of category captainship, the focus must be on how it affects the competitive process rather than competitors per se (e.g., Leary 2004). In this context, we find that collaboration in pricing decisions reduces the inefficiencies from double marginalization and leads to lower retail prices, even as it hurts the rival manufacturer.

<table>
<thead>
<tr>
<th>Table 4: Pricing Collaboration when Interests are Fully Aligned</th>
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</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Without Pricing Collaboration</strong></td>
</tr>
<tr>
<td>M1 + Retailer Profits</td>
</tr>
<tr>
<td>M2’s Profits</td>
</tr>
<tr>
<td>Consumer Surplus</td>
</tr>
</tbody>
</table>

\textsuperscript{17}Given the wholesale prices, the retailer’s best response for \(p_2\) is the same with and without pricing collaboration, while \(p_1\) is lower with pricing collaboration.
4.2 Category Captain and Retailer Interests are not Fully Aligned

Gruen and Shah (2000) and the FTC Report (2001) find that retailers differ in the extent to which they adopt the category captain’s recommendations when making their final decisions for the category, possibly because their interests are not fully aligned. Thus, we now allow for the interests of the category captain and the retailer to be less than perfectly aligned when they collaborate. We consider that when retail prices are set, the decisions are driven more by the retailer’s interests than by that of the category captain’s. Let \( \lambda \in [0, 1] \) represent the degree to which the category captain’s interests are considered, such that retail prices are set according to:

\[
\max_{p_1, p_2} (p_1 - w_1) q_1 + (p_2 - w_2) q_2 + \lambda w_1 q_1. \tag{12}
\]

If \( \lambda = 1 \), then we obtain the setting where interests are perfectly aligned. If \( \lambda = 0 \), then we obtain the setting where the retailer and the category captain do not collaborate on pricing. Thus, \( \lambda \) represents the extent to which interests are aligned when collaborating on pricing decisions.

In addition, we also consider that the category captain’s wholesale price is set so as to maximize its own profits, subject only to the constraint that the retailer earns at least as much profits as it did when it did not collaborate on pricing. Specifically, M1 sets \( w_1 \) as follows:

\[
\max_{w_1} w_1 q_1, \quad \text{s.t.} \quad \Pi_r \geq \Pi_0^r
\]

where, \( \Pi_r = (p_1 - w_1) q_1 + (p_2 - w_2) q_2 \) and \( \Pi_0^r = \frac{(1+\theta)^2}{2(2+\theta)^2} \).

Thus, the category captain’s wholesale price is set based more on the category captain’s interests, while retail prices are set based more on the retailer’s interests. Note that, when interests are not fully aligned, changes in the category captain’s wholesale price do impact retail prices.

We consider a two-stage Stackelberg game, with wholesale prices being set in the first stage and retail prices being set in the second stage. We compare the outcomes under pricing collaboration and in the benchmark scenario without pricing collaboration. Table 5 summarizes the results of our analysis.
Table 5: Pricing Collaboration when Interests are Imperfectly Aligned

<table>
<thead>
<tr>
<th>Without Pricing Collaboration</th>
<th>With Pricing Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1’s Profits</td>
<td>$\frac{1+\theta}{2(2+\theta)^2}$</td>
</tr>
<tr>
<td>M2’s Profits</td>
<td>$\frac{1+\theta}{2(2+\theta)^2}$</td>
</tr>
<tr>
<td>Retailer Profits</td>
<td>$\frac{(1+\theta)^2}{2(2+\theta)^2}$</td>
</tr>
<tr>
<td>Consumer Surplus</td>
<td>$\frac{(1+\theta)^3}{4(2+\theta)^2(1+2\theta)}$</td>
</tr>
</tbody>
</table>

where, $w_1^{c2^*} = \frac{(2+\theta)^2(4+7\theta-\theta) - 2\sqrt{(2+5\theta+3\theta^2) - 2\theta(4+14\theta+15\theta^2+5\theta^3) + \lambda(12+52\theta+79\theta^2+48\theta^3+10\theta^4)}}{(2+\theta)^2(1-\lambda)(4+8\theta+\theta^2+\lambda(4+8\theta+3\theta^2))}$. 

We find that the results of Proposition 7 continue to hold qualitatively, and are strengthened as the degree of alignment in interests increases\(^{18}\). The retailer earns only its minimum profits, while the category captain enjoys higher profits than in the benchmark. The rival manufacturer is always worse off, while consumers benefit from the lower retail prices. While category demand increases, sales of the rival manufacturer decline.

Interestingly, the category captain’s wholesale price follows an inverted-U relation with the degree of alignment in interests. The reason is as follows. Holding $w_1$ and $w_2$ constant, an increase in $\lambda$ leads to a lower retail price for NB1, and hence has a negative impact on the retailer’s profits. However, a lower retail price for NB1 forces M2 to decrease $w_2$, and this has a positive effect on the retailer’s profits. We find that when $\lambda$ is low, the latter effect offsets the former. This allows M1 to increase its wholesale price, even while ensuring that the retailer earns its minimum profits. We summarize this result in the following proposition.

**Proposition 8** When the category captain and the retailer collaborate on pricing decisions and

\(^{18}\)Refer Technical Appendix §C.2, Pg 14.
their interests are imperfectly aligned, the category captain's wholesale price follows an inverted-U relation with the degree of alignment.

In ongoing research, Kurtulus and Toktay (2007) have examined the consequences of category captainship under pricing collaboration when interests are fully aligned and the retailer is constrained in the total volume of stock it can carry (and therefore sell). They find that more of the category captain's brand will be stocked than that of the rival's. In the extreme case, the rival's brand is fully displaced or excluded. In this regard, our analysis shows that absent retail stocking constraints, while pricing collaboration leads to growth in category sales, sales of the rival manufacturer still decline. However, the rival manufacturer is never fully excluded. Wang (2003) and Wang, Raju and Dhar (2003) have also considered pricing collaboration when interests are perfectly aligned. They find that there is scope for all channel members to benefit if the scope of collaboration is limited to the category captain's brand, i.e. the price of NB2 continues to be the same as in the benchmark.

Prior research in the area of channel design and coordination has studied various means to align interests amongst channel members (e.g., McGuire and Staelin 1983, Shugan and Jeuland 1983, Coughlan 1985, Lal 1990, Desai 1997). Our work complements this research stream. We consider that the category captain and the retailer overtly collaborate on pricing in a setting where their interests may only be partially aligned. We find that such collaboration reduces double marginalization not only for the category captain's brand, but also for the rival manufacturer's brand, at the expense of the rival.

4.3 Model Extensions

We now discuss the impact of relaxing some of our assumptions. We have assumed that the category captain's wholesale price is set primarily based on its own interests. Alternately, one could consider the other extreme, where it is set so as to maximize the retailer's profits while ensuring a minimum level of profits for the category captain. This could reflect a scenario where the retailer is more dominant. We would expect that, in this case, M1's wholesale price would be lower than when it is set primarily based on M1's interests, thus reducing the degree of double
marginalization for NB1. This would lead to lower retail prices overall and, consequently, M2 would be further worse off.

Similarly, we have assumed that only the retailer’s interests can dominate when retail prices are set. This is in keeping with the observation that retailers have the final say in determining whether and to what extent the category captain’s recommendations are adopted. If, instead, we allow for the category captain’s interests to dominate, then we would expect that this would lead to an even lower retail price for the category captain’s brand and make the rival manufacturer further worse off.

We assumed that the wholesale price is the only means to allocate profits between the category captain and the retailer. This is in line with the observation that category captainship typically does not involve any fees, either from the retailer or the manufacturer. If we allowed for such fees, we would expect that $w_1$ would always be set to zero, since this maximizes the magnitude of joint profits, and M1 would be compensated through a captaincy fee. As double marginalization is eliminated with respect to NB1, it would result in an even lower wholesale price for NB2, making M2 further worse off.

We assumed that pricing collaboration does not change the sequence in which prices are set. Thus, our analysis focuses primarily on how the category captain’s ability to influence retail prices affects outcomes. One might argue that in the process of collaborating with the retailer, the category captain may set its wholesale price knowing the rival manufacturer’s wholesale price. In this case, M2 would be better off than when setting wholesale prices simultaneously and may even be better off than in the benchmark case if alignment in interests is low.

Lastly, while we have allowed for misalignment in interests, we do not explicitly consider issues related to observability of actions and moral hazard. This also leads to questions related to monitoring and incentive mechanisms. We have not considered such aspects and acknowledge this as a limitation.
5 Conclusions, Limitations and Future Research

Many retailers these days have come to rely on their category captains to manage entire categories. Consequently, as illustrated by the remarks of P&G’s Chief Operating Officer (TRMM Workshop 2007), many leading national manufacturers regard category captainship as an important part of their channel management strategy. At the same time, this practice raises eyebrows amongst some industry observers and researchers. As Carameli (2004) expresses it: "Intuitively, the category captain relationship is like the fox guarding the henhouse.". While some have voiced concerns about antitrust issues (e.g., Desrochers, Gundlach and Foer 2004), others worry about the impact of opportunism on business outcomes and the overall success of category management (e.g., Gruen and Shah 2000). But even as this practice has emerged as the dominant mode of retail category management (e.g., Business 2.0 2003, Hofstetter 2006), there has been limited formal analysis to examine its competitive consequences. Our research represents a step in this direction. We provide a model-based analysis of how specific category captain responsibilities impact the category captain, the retailer, the rival manufacturer and the consumer. Table 6 summarizes our findings.

<table>
<thead>
<tr>
<th>CC Responsibility</th>
<th>CC</th>
<th>R</th>
<th>CC + R</th>
<th>RM</th>
<th>Co</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Enhancing Services</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+/-</td>
<td>+*</td>
</tr>
<tr>
<td>Sharing Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only CC has Demand Information</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>=</td>
<td>-</td>
</tr>
<tr>
<td>CC and RM have Demand Information</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Collaboration in Pricing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC’s and R’s Interests are Perfectly Aligned</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>CC’s and R’s Interests are Imperfectly Aligned</td>
<td>+</td>
<td>=</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

+ : Positive impact, = : No impact, − : Negative impact.

CC = Category Captain, R = Retailer, RM = Rival Manufacturer, Co = Consumer.

* - Total market demand increases.

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Some of our findings allay concerns regarding the category captain opportunism and explain why these concerns may not be a serious threat to actual practice. Indeed, Morgan, Kaleka and Gooner (2007) find that such concerns are relatively low amongst U.K. supermarket retailers. We find that when a category captain and retailer collaborate on pricing decisions, it does not lead to a collusive outcome. Rather, this improves channel efficiency and leads to lower retail prices, thereby benefiting the consumer. Moreover, when a category captain is responsible for demand enhancing services, under some conditions, a rival manufacturer may benefit even when the category captain deploys these services in a manner that boosts its demand at the expense of the rival.

While the sharing of demand information within the channel is commonly thought of as an efficiency improving measure, we find that when such information is used to set prices, consumers are worse off and, under some conditions, channel profits decrease. We also find that sharing information per se is not worthwhile for the category captain. The retailer must either share some of its resulting gains, or "bundle" this responsibility along with some others so that, as a whole, they are worthwhile for the category captain.

We now briefly discuss some of the limitations of our work and potential avenues for future research. We have limited our attention to a setting with two symmetric manufacturers, with the choice of category captain taken to be exogenous. Future research, along the lines of Wang, Raju and Dhar (2003), could allow for asymmetry between manufacturers to examine what manufacturer characteristics may influence the choice of category captains. One could also study a setting with more than two manufacturers to examine the impact of an alternate dimension of industry competitiveness.

While we have focused on interactions at a single retailer, one could expand the scope to examine the influence of category captains across competing retailers. Often times, the same manufacturers vie for the category captain position at multiple retailers. One could examine the factors that may cause competing retailers to choose the same or different manufacturers as category captains.
When considering information sharing, we examined only the instance where the category captain has information about the level of category demand and this information is used for setting prices. It would be interesting to examine the outcomes when the category captain has information pertaining to price-sensitivity or other aspects of customer behavior, and this is used for decisions other than setting prices, such as assortment or inventory.

We have either considered that mechanisms that can align category captain and retailer interests are absent, or have specified the degree of alignment in their interests exogenously. Future research could explicitly model the incentive mechanisms or features of the institutional setting that may help align their interests. For instance, the arrangements may be analyzed from the perspective of agency theory. One could also explore measures that the retailer can adopt to limit the extent of undesirable outcomes (e.g., Kurtulus and Toktay 2007).

Lastly, we have studied the various responsibilities one at a time. Given that in some instances the category captain may have to be compensated by assigning multiple responsibilities, it may also be worthwhile to analyze the interaction between these responsibilities when they are assigned simultaneously.
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