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Empirical models of manufacturer-retailer interaction: A review and agenda for future research

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Abstract The nature of the interaction between manufacturers and retailers has received a great deal of empirical attention in the last 15 years. One major line of empirical research examines the balance of power between them and ranges from reduced form models quantifying aggregate profit and other related trends for manufacturers and retailers to structural models that test alternative forms of manufacturer-retailer pricing interaction. A second line of research addresses the sources of leverage for each party, e.g., trade promotions and their pass-through, customer information from loyalty programs, manufacturer advertising, product

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assortment in general, and private label assortment in particular. The purpose of this article is to synthesize what has been learnt about the nature of the interaction between manufacturers and retailers and the effectiveness of each party's sources of leverage and to highlight gaps in our knowledge that future research should attempt to fill.

Keywords Channel power · Vertical strategic interaction · Channel profit · Trade promotions · Private label

1 Introduction

The nature of the interaction between manufacturers and retailers has received a great deal of attention in the last 15 years. One major line of empirical research focuses on the balance of power between them. Research in this area ranges from reduced form models quantifying aggregate profit and other related trends for manufacturers and retailers to structural models that test alternative forms of manufacturer-retailer pricing interaction or determine how total channel profit is split between the two parties. Another major line of research addresses the sources of leverage for each party, e.g., trade promotions and their pass-through, customer information from loyalty programs, manufacturer advertising, product assortment in general, and private label assortment in particular. The purpose of this article is to (a) synthesize what has been learnt about the nature of the interaction between manufacturers and retailers and the effectiveness of each party's sources of leverage, and (b) highlight gaps in our knowledge that future research should attempt to fill.

The framework that guides our discussion is provided in Fig. 1. The three concentric ovals in the figure represent three levels of knowledge we have accumulated about manufacturer-retailer interactions. The innermost oval represents what we know most about—the nature of pricing interaction, the leverage of private labels, and trade promotions by manufacturers and their pass-through by wholesalers and retailers. The middle oval represents areas where empirical insights are still limited and where more needs to be done—the role of advertising in the interaction

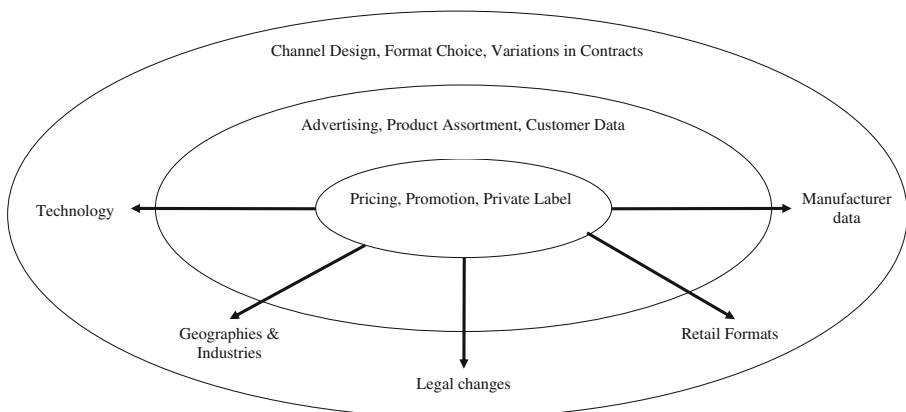


Fig. 1 Guiding framework

between manufacturers and retailers, how the nature of the interaction influences the retailer's product assortment decisions, and how the customer data that are increasingly captured through retailers' loyalty programs are being used to shift the power balance and/or create win-win opportunities for manufacturers and retailers. The outermost oval represents areas in which most of the work is theoretical and where much more empirical work is needed. The arrows emanating from the center of the figure represent changes in the environment and new opportunities for research that we believe will be instrumental in improving our understanding of the issues in the outer ovals. In the remainder of this article, we synthesize what we have learned in each area and provide an agenda for future research guided by the changes and opportunities noted in the figure.

2 The pricing interaction between manufacturers and retailers

In recent years, researchers have begun to explicitly capture the vertical strategic interaction between manufacturers and retailers using structural econometric models. Some researchers focus on inferring the nature of the manufacturer-retailer interaction, while others assume the nature of the interaction and use the estimated model to perform policy analyses.

Sudhir (2001) and Che et al. (2007) use non-nested model tests to select whether manufacturer Stackelberg (MS) or vertical Nash relationships (VN) better describe the manufacturer-retailer relationship. They find support for the MS relationship and also find that retailers maximize category profits not just brand profits. Kadiyali et al. (2000) analyze pricing in the channel using a conjectural variations (CV) approach, whereby a structure is not imposed on the interaction between manufacturers and retailers, but inferred from the estimated CV parameter. The CV model fits better than either VN or MS. Using a similar approach, Villas-Boas and Zhao (2005) find small but statistically significant deviations from MS. A flexible alternative approach to determine the nature of vertical interaction has been proposed by Draganska et al. (2010), who build on the theoretical work of Iyer and Villas-Boas (2003) and estimate a Nash bargaining model of manufacturer-retailer interactions. The model allows for a behavioral interpretation of the deviations from MS or VN by relating these deviations to bargaining power.

How does the manufacturer-retailer interaction affect retail and wholesale prices? What fraction of the overall channel margin goes to the manufacturer versus the retailer? How is this affected by their relative bargaining power? Kadiyali et al. (2000) find that retailers' share of channel profits are greater than those of manufacturers, varying from a low of 57% to a high of 72% for the categories they study. In contrast, Villas-Boas and Zhao (2005) report retail margin shares of 50% for the smaller brands and 40% for the dominant brand, suggesting evidence of manufacturer power.

Draganska et al. (2010) Nash bargaining model distinguishes between bargaining power and bargaining position—the net gain in profit relative to profit when bargaining fails. For single-product markets, bargaining power of an agent is shown to be the fraction of the channel profits that accrues to the agent—thus giving a structural interpretation to the channel profit share measure used in earlier research. Draganska et al. find that bargaining power largely favors manufacturers but depends

on the negotiation partner. The power split in the channel also varies by the size of the firms, store brand share, positioning, and the retailer's assortment.

These divergent findings need to be reconciled. Evidence of manufacturer power tends to be found in settings where wholesale price is unobserved (Villas-Boas and Zhao 2005; Draganska et al. 2010) and retailers are allowed to compete with each other (Draganska et al. 2010) while Kadiyali et al. (2000) find evidence of retailer power in a setting where wholesale price is observed and retailers are assumed to be local monopolists. The former is in line with Farris and Ailawadi (1992) and Ailawadi et al. (1995), who do not find support for increasing retailer profitability in aggregate industry trends. It would be helpful for future research to investigate bargaining power in a setting where wholesale price is observed for multiple competing retailers in different categories. Natural or field experiments could be used to calibrate model assumptions, as counterfactual bargaining outcomes are seldom observed.

Overall, even though there are some departures from the MS model, it is the workhorse for modeling manufacturer-retailer interactions. Many papers involving manufacturer-retailer interactions now *assume* MS to address a variety of issues such as optimal targeting (Besanko et al. 2003; Pancras and Sudhir 2007), slotting allowances (Israelevich 2004), value of distribution channel (Chu et al. 2007; channel mergers (Villas-Boas 2007), brand equity measurement (Goldfarb et al. 2009), and dynamic demand for durable tied goods (Hartmann and Nair 2007).

It is important, however, to note that much of this work has been done on a small number of grocery and general household product categories in the US grocery format. Many environmental trends are changing: retail formats have proliferated, consumer purchases can be tracked across stores and store formats, data have become available in new categories, new markets, and new formats. Future research should exploit the opportunities opened up by these new data to test existing findings and learn more about how manufacturers and retailers interact to determine format choice, prices, and contracts.

Changes in the legal system have also occurred that directly influence manufacturer-retailer interaction but have gone relatively unnoticed by academic researchers. Until 1997, resale price maintenance was per se illegal in the US. However, in 1997, the US Supreme Court ruled that maximum resale price maintenance was no longer per se illegal, and in 2007, it ruled that minimum resale price maintenance was no longer per se illegal. This ruling has important ramifications for how manufacturers set and influence retail prices and for the general level of pricing and retailer service across different industries, retail formats, and brands.

Finally, the interaction between manufacturers and retailers depends upon the information flow, information asymmetry, and information signaling between them. The advent of new channels like DTC selling for manufacturers and new data collection mechanisms like radio-frequency identification (RFID) technology (Larson et al. 2005; Hui et al. 2009a, b) have the potential to change the power structure in the channel by bringing the manufacturer "closer" to the consumer. The availability of longer time series of richer panel data should allow researchers to study the impact of these new channels and new data and also provide deeper insights into whether, how, and why bargaining power of retailers is changing over time. These data will also be key to bringing in phenomena such as variety-seeking and subsequent-assortment optimization (e.g., Rooderkerk et al. 2008), learning (e.g., Camerer and Ho 1999), state

dependence, and forward-looking behavior (e.g., Erdem and Keane 1996; Che et al. 2007) into models of manufacturer-retailer interactions.

3 The leverage of private label

In recent years, empirical researchers have presented convincing evidence about the role that private labels play in the interaction between manufacturers and retailers and the leverage they provide to the latter. One area of enquiry relates to retail margins on private labels versus national brands. That retail percentage margins are higher on private labels than on national brands can be stated as an empirical generalization (Hoch and Banerji 1993; Ailawadi and Harlam 2004; Pauwels and Srinivasan 2004). However, private labels are sold at retail prices that are 20-30% lower than national brands, so private labels do not always provide a dollar margin advantage to retailers (Ailawadi and Harlam 2004).

Another area relates to whether private label is an effective bargaining tool for retailers. Ailawadi and Harlam (2004) show, in a cross-category analysis, that a retailer's national brand margin increases with its private label share in a category, after controlling for the fact that retailers may push private label more in profitable categories. Pauwels and Srinivasan (2004) find that when a retailer introduces a private label, its unit margin on national brands increases. They also find that the entry hurts the performance of second tier national brands but may be beneficial for premium-priced national brands. Meza and Sudhir (2008) confirm that increased competition from a private label lowers national brand wholesale prices. They also find that national brands that are imitated by a private label, and thus face more intense competition, have prices lower than predicted by the MS model, while the wholesale prices of non-imitated national brand prices are consistent with the MS model, suggesting that the retailer gains bargaining power from the introduction of private labels.

A third area relates to whether private labels engender store loyalty among consumers. On the one hand, correlational and survey-based studies suggest a positive association between private label use and consumer loyalty to the retailer (Ailawadi et al. 2001; Corstjens and Lal 2000). Sudhir and Talukdar (2004) provide further, albeit indirect, support for this association. On the other hand, Hansen and Singh (2008) find that heavy store brand users are most likely to defect when a low-price retailer like Wal-Mart enters the market. Ailawadi et al. (2008) reconcile these findings, showing that, after controlling for endogeneity, there is an inverted U effect of private label share on share of wallet. Share of wallet initially increases with their private label purchases from a given retailer, but, the effect turns negative for very high private label share.

This work implies that private label is a strong weapon in a retailer's arsenal when it comes to negotiating with manufacturers. But, the margin advantage of private label is not a given. Retailers must keep their private label costs low but they must also improve quality and differentiate their offerings if they want to reduce the retail price gap with national brands. This balancing act between cost containment and quality improvement is even more important now as many retailers try to develop a multi-tier private label strategy with value and premium private label products (Geyskens et al. 2008). They have a similar tight rope to walk when it comes to

consumer loyalty—it is important to get consumers to buy some private label products, but, pushing it too far may hurt consumer loyalty. It is also in manufacturers' interest to understand the benefits and limitations of private label brands so that they can negotiate effectively with retailers and develop win-win strategies for co-existing with private labels.

With the improved information made possible by technological advances, it may be conjectured that private labels will gain greater strength. Improved targeting of private labels in categories and to consumers with the most promise may open up opportunities for manufacturers to extract greater profits in product categories where they have greatest power, while recognizing that the battle is difficult and becoming more so in other categories.

4 Pass-through of trade promotions

In the US consumer packaged goods (CPG) industry alone, companies spend more than \$75 billion on trade promotions annually (Drèze and Bell 2003), approximately 60% of their total marketing budget (Trade Promotion 2005). Pass-through is a key measure of trade-spending effectiveness. The American Marketing Association defines pass-through as “The number or percentage of sales promotion incentives offered to wholesalers or retailers by manufacturers that are extended to consumers by those channel members.” The last 5 years have seen substantial empirical research on the magnitude and drivers of pass-through. Besanko, Dubé, and Gupta (2005, hereafter, BDG) investigate own and cross-brand pass-through while Pauwels (2007) investigates the dynamics of these phenomena. Meza and Sudhir (2006) focus on pass-through timing and Ailawadi and Harlam (2009, hereafter, AH) and Nijs et al. (2009, hereafter NM) quantify the magnitude of pass-through and explain variation across manufacturers (AH) and across wholesalers and retailers (NM).

In all but one of these studies, pass-through is defined as the ratio of a change in price to a change in the cost of goods, i.e. dp/dc (Tyagi 1999), and *estimated* from a regression on time series data. This measure works well for off-invoice or scan/bill-back discounts that apply to specific items and weeks. In contrast, AH *compute* pass-through as the ratio of total retail promotion spending to total trade promotion funding provided by the manufacturer. This measure accounts not just for off-invoice and scan/bill-back discounts but also for lump sum payments and other forms of trade promotion funds that are not tied to individual items and/or weeks (McAlister 2007). It also separates regular from promotional price pass-through, an important distinction as shown by McAlister (2007) and Dubé and Gupta (2008).

Estimates of mean retailer pass-through rates using times-series data vary between 0.69 (NM) and 0.83 (BDG). Median calculated pass-through is 0.75 (AH) for manufacturers providing at least some trade funding. Thus, across a variety of data sources and measures, the empirical generalization that average retailer pass-through is less than 100% holds. Wholesaler pass-through rates to retailers average 1.06, suggesting wholesalers require a demand increase to break-even on trade deals offered by manufacturers (NM).

However, average pass-through estimates are of limited value for manufacturers evaluating their trade-promotion programs because of the high variation around the

average. NM report a standard deviation of 0.40 and AH report even greater variation across manufacturers, with 0 pass-through in 34% of the cases and pass-through greater than 250% in approximately 14% of the cases. Channel power can partially explain these variations: (1) large manufacturers get more pass-through from retailers (AH); (2) large retailers get more pass-through from wholesalers (NM); and (3) high market share products get more retailer pass-through (BDG, AH, NM, Pauwels 2007). Further, contrary to conventional wisdom, AH report that retailers promote as many as 15% of manufacturers' products without any direct manufacturer funding. They find that this is more likely for large share manufacturers in profitable and promotion-sensitive categories but more research is needed to understand retailer motivations to promote products.

NM show that manufacturers and wholesalers can avoid offering unprofitable trade deals by utilizing estimates of pass-through, price elasticity, and margins. Relative to a scenario where each retailer receives the same 10% off invoice cost cut, selective use of trade promotions could lead to a 56% reduction in the number of deals, an 86% improvement in deal profitability, and a 40% reduction in promotional costs. Future work should focus on establishing normative guidelines for trade spending and pass-through by both wholesalers and retailers.

Also, empirical work has focused on pass-through in the form of price promotions but non-price support in the form of displays, preferential shelf space, and other in-store merchandising is also important to manufacturers. While NM provide empirical evidence that the costs of channel flows and the level of feature and display support provided by the retailer influences pass-through more work is needed to understand how retailers make these decisions.

Meza and Sudhir (2006) document differences in pass-through over time. Since demand elasticities vary over time for seasonal products, dp/dc may reflect not only pass-through but also variation in demand elasticities. Using a structural approach, they estimate dynamic patterns in pass-through while controlling for changes in demand elasticities over time. In two categories, they find high-share items get very high pass-through, but the rest get virtually no pass-through during regular periods. In contrast, all items get roughly equal but smaller pass-through in high demand periods. In essence, pass-through is deep but narrow in regular periods and broad but shallow in high-demand periods.

More research is warranted on the timing and depth versus frequency of promotion pass-through. As technological advances facilitate the rapid implementation of changes in pricing and merchandising and improved data make it easier to monitor these changes through RFID, both the magnitude and timing of pass-through will become more transparent. Will this improve the effectiveness of trade promotions? Will it change the timing of pass-through such that money "in the door" goes more quickly "out the door"? Future research should address these questions.

Finally, the notion of cross-brand pass-through has generated some controversy in the literature. BDG report cases of both positive and negative cross-brand pass-through. McAlister (2007) refutes the existence of these effects and shows that their statistical significance in BDG's analysis is attributable at least partly to inadvertent overstatement of sample size due to regional pricing patterns. In a rejoinder, Dubé and Gupta (2008) recognize that the number of cases of significant cross-brand pass-

through is substantially lower than in BDG but find that overall model fit is improved when they allow for cross-brand pass-through effects and by using Bayesian methods. In their aggregate analysis, AH find evidence of substantial subsidization of promotions across categories and departments and from national brands to private label. They do not, however, find evidence of cross-brand pass-through across manufacturers within a category. Future research should consider in what forms, if at all, cross-brand pass-through occurs? What are its drivers? How do allocation rules for trade funds and accounting metrics influence estimates of these effects (NM, McAlister 2007)?

5 The understudied leverage of advertising, assortment, and loyalty programs

5.1 Advertising

The literature on manufacturer/retailer interactions reviewed earlier mainly studies pricing interactions. Multi-stage games with multiple strategic interactions (e.g., wholesale price and advertising) are difficult relative to simpler games (e.g., wholesale price alone). A more holistic picture of channel interactions would likely include the effects and determinants of advertising, product quality, and retail distribution. Of these factors, advertising is a natural choice to study first. Firms can adjust their advertising expenditures relatively easily, advertising varies substantially over time and space, and data on advertising expenditures are readily available and might well be correlated with pass-through and other aforementioned decisions.

The literature generally finds that advertising is relatively ineffective. Assmus et al. (1984) meta-analysis reports an average advertising elasticity of 0.15. Lodish et al. (1995) summarize a large number of field experiments across product categories, finding that the advertising elasticity is about 0.26 for new brands and 0.05 for established brands. Sethuraman and Tellis (1991) find, in their meta-analysis that price elasticity is about 20 times larger than advertising elasticity. This suggests that firms are over-advertising, since the elasticity ratio should be one at a profit maximizing combination of price and advertising (Dorfman and Steiner 1954).

The question arises, if advertising is so ineffective, why do firms do so much of it? Several potential explanations exist, but prominent among them is the potential effect of advertising on retailers. If advertising affects consumer demand, and retailers respond to changes in consumer demand, then advertising must affect retailers' actions. The fundamental idea that advertising pull increases channel push proposed by Farris and Reibstein (1984) and Olver and Farris (1989) is well known. There is also some work on the effect of advertising on manufacturer versus retailer prices and margins (e.g., Steiner 1973; Kaul and Wittink 1995). Yet very few papers on advertising effectiveness or channel interaction allow for or estimate such strategic interactions. Measuring the effect of advertising on sales without modeling the dependence of price and retail distribution on advertising, potentially under-estimates the full impact of advertising. Future research should develop a more holistic modeling framework that includes these intermediate effects of advertising on channel decisions.

5.2 Loyalty programs

Information gathered through loyalty programs (LPs) is playing an increasingly important role in retailers' decisions. The LP infrastructure not only provides detailed consumer insights, but also allows retailers to deliver a variety of targeted marketing activities to selected households via customized direct mail/e-mail, check-out coupons, or customized communications on the web (Zhang and Wedel 2009). These programs are reshaping the way manufacturers and retailers interact with each other. For example, the leading online grocer Peapod Inc. offered special promotion services to consumer product manufacturers through its Peapod Interactive division which implemented and monitored various customized promotions for each manufacturer sponsor (Holleran 1997). Drug store chain CVS routinely partners with manufacturers to deliver targeted promotions through its LP. The manufacturers pay a membership fee and provide monetary support for those promotions. In exchange, they receive detailed reports about the performance of their products with different segments of CVS customers, and can target selected households and take advantage of cross-selling opportunities.

There has been extensive research on the effect (or lack thereof) of LPs on consumer purchase behavior, customer retention, customer lifetime value, and the firm's sales/financial outcomes (e.g., Bolton et al. 2000; Lal and Bell 2003; Leenheer et al. 2007; Lewis 2004; Sharp and Sharp 1997; Taylor and Neslin 2005), but little is known about how LPs are changing the power balance between manufacturers and retailers. Collaboration through LPs can provide benefits for both parties (e.g., Pancras and Sudhir 2007). Manufacturers can achieve higher return on their trade promotion spending due to the enhanced targeting capability and be shielded from competitive reactions because customized promotions through LPs are not easily observed by competitors (Zhang and Wedel 2009). Retailers can piggy back on manufacturers' financial support to increase their store loyalty, shopping basket size, and customer retention. The fact that marketing offerings targeted through LPs are not easily observed by competitors can also relieve manufacturers and/or retailers from prisoner's dilemmas that may arise in perfectly competitive markets where a firm's action is (assumed to be) known to all competitors (see Chen et al. 2001; Shaffer and Zhang 1995).

While collaboration through LP is likely to increase the size of the pie, it is less certain how the division of the pie may be changed. Which party will gain power—retailers who own information or manufacturers who have financial resources? Many other important questions also remain. For example, what is the net gain for the retailer vs. manufacturer to collaborate in an LP? How does it change a retailer's bargaining power for other products not covered by the LP? How does it affect a retailer's private label performance? What types of LP designs are more conducive to creating win-win opportunities? With the increasing prevalence of retail loyalty programs, academic research needs to catch up in answering these pressing questions.

With the technological advances we are seeing in industry, some new questions also arise: what role will/should manufacturers and retailers play in each other's loyalty programs? What is the impact of loyalty in one channel (say offline) on loyalty in an online channel? How will improved measurement of loyalty and its

transparency affect the interaction between manufacturers and retailers? Large scale customer relationship programs (e.g., HomeMadeSimple.com by Procter & Gamble) that provide data on tens of millions of customers to CPG manufacturers may also alter the relative push-pull power structure between manufacturers and competing retailers.

5.3 Product assortment

In contrast with the vast amount of research on consumer response to product assortment (see Broniarczyk 2008 for a recent overview), there is scant research on how manufacturers and retailers interact to determine the composition of the assortment. With the proliferation of SKUs and product categories, retailers have found it difficult to directly manage every category and often outsource category management to a leading manufacturer, referred to as the category captain (Kurtuluş and Toktay 2004). The retailer shares information on sales, pricing, shelf space data, etc. with the captain. The captain designs a strategic plan for the category, encompassing recommendations on which products to include and how to allocate space among them. In this set-up, the retailer benefits from the knowledge and resources available to the category captain.

However, the objectives of both parties are not perfectly aligned. The captain may gain substantial power if its recommendations (1) increase the captain's presence on the shelf and (2) soften competition from rival manufacturers and the retailer's private label. Hence, blind trust could hurt the retailer's private label development, profit margins, and long-term profitability. To contain these potential adverse effects, retailers critically study the category plans provided by the captain and/or ask a rival manufacturer to draw up an alternative plan. Therefore, manufacturers walk a fine line between fulfilling their own objectives and those of the retailer.

With the recent advent of commercial software solutions for assortment planning, retailers are taking back control over the management of product categories (Gartner 2007; Mantrala et al. 2009). Consequently, retailers increasingly demand new products to add value over and above the existing assortment. In addition, they ask for consumer-driven innovations that provide value at the store level. New products cannot be expected to do well in every store region. Their success will depend on store characteristics, socio-demographics of the store region, and the nature of local competition within the category. As a result, leading manufacturers such as Unilever and P&G invest heavily in marketing intelligence to assist retailers with knowledge of their consumers and product categories.

Category captainship in assortment decisions raises a lot of interesting questions. First, what criteria do the captain and retailer use when assessing the attractiveness of a specific category configuration? Potential objectives include (growth of) profitability, sales, and market share. The answer will likely depend on the role of the category (Dhar et al. 2001). Second, how do captains balance their own and the retailer's objectives? In their study on assortment optimization in a grocery retail setting, Rooderkerk et al. (2008) assume a weighted objective function which balances the expected category profit of the retailer and the captain. The weight parameter is interpreted as an indicator of the relative power of the captain compared to the retailer.

Third, to what extent are the retailer and captain able to create win-win situations with product assortments? In new product categories, this may be possible by growing the total pie. In mature categories, the only possible way may be at the expense of other manufacturers. However, win-win situations in the short run could increase the dependence of the retailer on the category captain in the long run. Fourth, how does the retailer's desire to grow private label come into play? The retailer may wish to balance the category profit in the short run and the growth of the private label in the long run (Meza and Sudhir 2008). Fifth, what are the consequences for the consumer? Would a powerful category captain soften competition leading to reduced variety and higher prices? Finally, in response to the current trend of retailers taking back control over their assortment, future research could focus on what additional data manufacturers should gather to improve the quality of joint decision making. Consequently, an interesting challenge will be to determine how these different data sources can be combined to increase profitability of all channel partners.

6 Conclusion

This article has summarized the major insights revealed by empirical research on manufacturer-retailer interaction and identified areas where existing findings diverge and are in need of resolution or external validation. It has also highlighted major changes in the retail environment that may not only change the answers we think we already have, but that have opened up a whole host of new questions and a new realm of possibilities for capturing and using rich data to answer those questions. There are plenty of opportunities for studying new product categories, new markets, and new research questions, and for learning from the natural experiments that are occurring all around us. But they are most likely to bear fruit if practitioners and academic researchers collaborate to share data, ideas, and research methods. We hope the empirical insights and ideas summarized in this article will stimulate such collaboration.

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