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DRIVERS OF THE SYNERGY BETWEEN PRICE CUTS AND STORE FLYER ADVERTISING AT SUPERMARKETS AND DISCOUNTERS

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Abstract

Despite retailers' intense use of both price cuts and store flyer advertising, it is still unclear whether and when it is beneficial for retailers to *combine* the two promotion tools at the same time as opposed to using them *separately*. We systematically investigate synergies between price cuts and store flyers for a broad set of 488 brands from 44 consumer packaged goods categories across six leading German retailers. We find that a clear majority of the brands benefit from positive synergies and hence, combining price cuts and store flyer advertising is recommended, especially at supermarkets. This synergy can be strong. For instance, a 15% price cut without store flyer support at a supermarket, on average, increases sales by 11%, and medium spending on store flyers for the brand at its regular (non-promoted) price results in a sales lift of 8%. The combined use of both tools, however, increases sales by 52%, much more than the sum of their separate effects (11% + 8% = 19%). Yet, there is also substantial variance in the synergy, which we explain with retailer format (supermarkets versus discounters) as well as various brand and category characteristics. Our findings have important implications for the coordination of promotion activities by retailers.

Keywords: *price cuts, store flyers, synergy, discounters, supermarkets*

1. Introduction

In grocery retailing, sales promotions are a key element of the marketing mix, and the most frequently used promotion tools are price cuts and store flyer advertising. In Germany, for instance, about one fourth of grocery sales volume was sold on price promotion in 2017 (Nielsen 2018), and store flyers accounted for one third of retailers' advertising budgets (EHI Retail Institute 2016). These two tools play different roles in the promotion mix: price cuts provide an incentive to buy the brand, and store flyers draw attention to it (Zhang 2006). Both instruments generate large lifts in sales of the promoted brands and may even grow product categories at the retailer, as previous research has shown (e.g., Ailawadi et al. 2006; Gedenk 2018).

However, it is less clear whether and when it is beneficial for retailers to *combine* price cuts and store flyer advertising for a brand in the same week as opposed to using them in *separate* weeks. This decision depends on the presence and nature of synergy effects between price cuts and store flyers (Zhang 2006). The synergy is positive, if the sales impact of the joint use of the two tools is larger than the sum of the sales impacts when the tools are used separately (for a visualization, see Figure 1, Panel A: a&b > a+b). In this situation, it is beneficial for retailers to combine price cuts and store flyer advertising in the same week. In contrast, a negative synergy occurs when the sales increase from the joint use of both instruments is smaller than the sum of their separate effects (Figure 1, Panel B: a&b < a+b), so that retailers are better off using both tools in separate weeks.

--- Insert Figure 1 about here ---

In addition to the *timing* decision on whether to use price cuts and store flyer advertising in the same or in different weeks, the synergy is also relevant for the retailer's decision on *promotion scope* for a brand. In a given week, retailers cut prices only on part of their assortment, and space in the store flyer is limited. When choosing which brands to promote, retailers should consider not only the main effects of price cuts and store flyers, but also the sign and the size of the

synergy between these promotion tools. For a brand with a positive synergy, an ad in the store flyer not only generates a direct effect on sales through more attention for the brand, but it also affects sales indirectly by making price cuts more visible and hence more effective. Thus, a more favorable, i.e., a stronger positive synergy effect makes a brand a more attractive candidate for promotions with both price cuts and store flyers (Lemon and Nowlis 2002).

Thus, to coordinate their promotion efforts, it is important for retailers to know the sign and size of the synergy between price cuts and store flyer advertising, and to have insights into what retailer, brand, and product category characteristics drive this synergy. The synergy may differ, for example, between private labels and national brands, and between utilitarian and hedonic categories. Given the vastly different assortments and promotion policies of supermarkets versus discounters (van Lin and Gijsbrechts 2016; Zenor, Bronnenberg, and McAlister 1998), we not only expect the synergy between price cuts and store flyers to differ between these retailer formats, but the influence of various brand and category characteristics on the synergy may also differ between discounters and supermarkets.

Previous literature offers limited guidance on the direction and size of the synergy between price cuts and store flyer advertising. Theoretically, its direction could go either way (Zhang 2006). If price cuts without feature support barely get noticed, and if store flyers on their own do not provide a sufficient incentive to visit a retailer and purchase the brand, both instruments will reinforce each other and the synergy will be positive. Alternatively, if consumers interpret a store flyer ad as a proxy for a price cut, combining both will not generate much incremental sales for the brand beyond the response to a store flyer alone, and the synergy will be negative. Empirical evidence is also mixed, with some studies reporting a positive synergy (e.g., Moriarty 1983; van Heerde, Leeflang, and Wittink 2004; Xu et al. 2004), while others find a negative synergy (e.g., van Heerde, Leeflang, and Wittink 2001; Papatla and Krishnamurthi 1996) or no effect (e.g., Wilkinson, Mason, and Paksoy 1982; Kumar and Leone

1988). This ambiguous picture calls for a systematic investigation into the synergy between price cuts and store flyer advertising and its drivers. Therefore, in this study, we aim to answer the following research questions:

1) Is the synergy between price cuts and store flyer advertising, on average, positive or negative?
2) How does the synergy differ between supermarkets and discounters?
3) Which brand and category characteristics drive the synergy between price cuts and store flyer advertising?

We study these questions with two years of panel data on 488 brands across 44 consumer packaged goods (CPG) categories at six leading retailers in Germany. To model the response to both marketing instruments, we rely on a hierarchical linear model (HLM) where at level 1, brand sales are a function of price cuts, store flyer advertising, their interaction, and a set of control variables, and at level 2, the response to price cuts and store flyers, as well as their interaction effect are driven by brand and category characteristics. We estimate the HLM separately for supermarkets versus discounters.

Our paper makes two key contributions. First, while previous research has studied only one or few product categories, our comprehensive dataset allows us to provide generalizable findings on the average synergy between price cuts and store flyer advertising in grocery retailing. Second, we formally study a set of drivers of the synergy. Previous research has only compared the effect for national brands versus private labels (Lemon and Nowlis 2002). We add insights by analyzing three additional brand characteristics and six product category characteristics and by comparing the effects between supermarkets and discounters. Our findings have important implications not only for the coordination of promotion activities by retailers, but also manufacturers should consider them when negotiating trade promotions and brand support with retailers.

We proceed with a brief review of the literature in section 2, after which we present our research framework and derive expectations about the drivers of the synergy between price cuts and store flyer advertising in section 3. We present the data in section 4, and provide model-free evidence in section 5. In section 6, we introduce the model, and we report the results in section 7, before closing in section 8 with implications for managers and researchers.

2. Literature

Previous research has extensively studied synergy effects between price and various types of advertising. It covers manufacturer advertising (e.g., Eskin and Baron 1977; Sethuraman and Tellis 2002; Keller, Deleersnyder and Gedenk 2019) and retailer advertising in different media like direct mail, email, or TV (e.g., Pauwels et al. 2016; Xu et al. 2014), as well as feature advertising, including ads in store flyers and newspapers (e.g., Wilkinson, Mason, and Paksoy 1982; van Heerde, Leeflang, and Wittink 2001; Zhang 2006). Findings are mixed, and researchers have tried to explain this with the notion that the direction of the synergy between price and advertising might depend on the type of advertising (Popkowski-Leszczyc and Rao 1989; Kaul and Wittink 1995; Sethuraman and Tellis 2002): the synergy tends to be negative for image-oriented, brand-building advertising and positive for price advertising aimed at immediate sales response. The researchers argue that image advertising builds loyalty, making consumers less price sensitive, while price advertising draws attention to prices and thus, consumers become more responsive to prices. Given that advertising in store flyers typically communicates brand prices, this would suggest a positive synergy for this type of advertising.

Yet, also research on the synergy between price cuts and feature advertising produces mixed results: it finds positive synergies (e.g., Moriarty 1983, van Heerde et al. 2004; Zhang 2006; Xu et al. 2014), negative synergies (e.g., van Heerde, Leeflang, and Wittink 2001; Zhang 2006), or no effect (e.g., Wilkinson, Mason, and Paksoy 1982; Kumar and Leone 1988; Bolton

1989). However, these studies analyze only a single or a few product categories, so that results may not generalize and we do not know what the synergy between price cuts and store flyer advertising is, on average.

Furthermore, previous literature does not shed much light on what drives the synergy between price cuts and feature advertising. So far, only two studies have explicitly considered variance in this synergy. Zhang (2006) shows that the synergy differs across consumer segments. She speculates that this might be the case because consumers with a higher need for cognition are less likely to use features as a proxy for a price cut (Inman, McAlister, and Hoyer 1990). To the best of our knowledge, only Lemon and Nowlis (2002) study a single moderator. They show for the cracker category, that the synergy between price cuts and feature advertising is less favorable for national brands than for private labels. While research has shown that various brand, category, and retailer characteristics have an effect on both price and advertising effectiveness (e.g., Ailawadi et al. 2006; Pauwels et al. 2016; van Lin and Gijsbrechts 2016; Jindal et al. 2020), no study has systematically considered how they affect the synergy between price cuts and store flyers.

We fill these gaps in the literature by conducting a comprehensive study that generates insights on the average synergy between price cuts and store flyers (research question 1), on how this synergy differs between retailer formats (research question 2), as well as on the influence of various brand- and category-related drivers of the synergy (research question 3).

3. Research Framework

Zhang (2006) presents arguments for both positive and negative synergies between price cuts and store flyer advertising by outlining two behavioral mechanisms that underlie consumers' purchase decisions. We briefly review these two mechanisms in section 3.1 and use them in 3.2 to derive expectations about how retailer format (i.e., supermarket vs. discounter), as well as

several common brand and product category characteristics drive the synergy (see Figure 2 and left side of Table 1). Note that many of these drivers have been found in earlier research (e.g., Bolton 1989; Ailawadi et al. 2006) to also affect the main effects of price cuts and store flyers (and we will control for that in our models), but our focus here is on their impact on the synergy between both promotion tools.

--- Insert Figure 2 and Table 1 about here ---

3.1 Behavioral mechanisms

On the one hand, the *consideration set formation* mechanism can explain a positive synergy between price cuts and store flyers (Zhang 2006). In many purchase situations, consumers first form a consideration set of brands, and then engage in a more detailed evaluation of the brands in this set (e.g., Payne 1976, Hauser and Wernerfelt 1990, Roberts and Lattin 1991). Store flyers can make a brand more salient, thereby increasing the chance that it becomes part of the consideration set (e.g., Fader and McAllister 1990, Andrews and Srinivasan 1995, Mehta, Rajiv, and Srinivasan 2003). But store flyers alone do not provide a sufficient incentive to purchase a brand. At the same time, price cuts alone may not get noticed. By combining both, the store flyer can bring the brand into the consideration set through more attention, while the price cut provides consumers a clear reason to buy it on their shopping trip. In other words, the consideration set formation mechanism suggests that the sales impact of a price cut and a store flyer together exceeds the sum of the effects when the two marketing tools are used separately.

On the other hand, the *price cut proxy* mechanism can explain negative synergy effects (Zhang 2006). For CPG purchases, consumers often do not engage in detailed or elaborate information processing before making a purchase decision. Price messages like store flyer ads are associated with price cuts in consumers' learning history, and the mere presence of a feature ad might already lead consumers to associate it with a price discount – so they interpret the store flyer ad as a proxy for a price cut (Inman, McAlister, and Hoyer 1990). This is more likely when

consumers have little price knowledge and when they use the peripheral (rather than the central) route for processing information (Petty and Cacioppo 1986), i.e., when consumers change their behavior due to the store flyer without reviewing the true merits of the information presented to them. Hence, adding a price cut to a store flyer ad will not add much new information to consumers who use the ad as a promotion signal. Accordingly, the price cut proxy mechanism suggests that the sales impact of a price cut and a store flyer ad together is smaller than the sum of the effects when the two instruments are used separately.

3.2 Expectations about drivers of the synergy

Retailer format (discounters versus supermarkets). We expect that consumers rely less on the *consideration set formation* mechanism at discounters than at supermarkets. Discounter assortments are smaller, so each brand is more likely to be in the consideration set of discount shoppers anyway. Thus, price cuts will get noticed more easily in smaller assortments, and there is less need and opportunity for store flyer advertising to draw attention to them. This should result in a less favorable synergy between price cuts and store flyers at discounters.

Brand type (private labels versus national brands). Prior research has shown that private labels have smaller marketing budgets and offer fewer price discounts (Lamey et al. 2012). With less communication, their price cuts more often go unnoticed while the likelihood to be part of the consideration set will be smaller compared to more heavily advertised national brands. Therefore, private labels benefit more from store flyer support for their price cuts and the *consideration set formation* mechanism should be stronger than for national brands. Lemon and Nowlis (2002) show with scanner data and an experiment that private labels exhibit a more favorable synergy than national brands. Based on the consideration set formation mechanism and previous empirical findings, we expect that the synergy between price cuts and store flyer advertising is more favorable for private labels than for national brands.

Brand price premium. Premium brands with higher prices are typically more distinct

from other offerings in the same category (Ailawadi, Lehmann, and Neslin 2003; Blattberg and Wisniewski 1989) and receive more attention. Even without a store flyer, most consumers will notice a price cut for a premium offering more easily than for lower-tier brands. We therefore expect the *consideration set formation* mechanism to play less of a role for premium brands. However, when stakes are higher, consumers engage more in central route processing, i.e., careful and thoughtful consideration of the true merits of the information presented (Petty and Cacioppo 1986), which may result in a weaker *price cut proxy* mechanism (hence the "+" in Table 1). Given the prediction of a less favorable synergy by the weaker consideration set mechanism and a more favorable synergy by the weaker price cut proxy mechanism for premium priced brands, we do not formulate a directional expectation, but leave it as an empirical question.

Brand price volatility. If a brand's price volatility is higher due to more frequent promotions, consumers may be less likely to buy at regular price, but rather more inclined to wait and search for a deal. In this situation, store flyer advertising can help consumers identify deals easily and make the brand part of the consideration set. This stronger *consideration set formation* mechanism suggests a more favorable synergy with higher price volatility. At the same time, the *price cut proxy* mechanism could become stronger, suggesting a less favorable synergy. Consumer price knowledge is higher for brands whose prices are relatively stable over time, as benchmark prices for these brands are more readily accessible from memory than for brands with frequent price changes (Briesch et al. 1997; Vanhuele and Drèze 2002). Thus, with higher brand price volatility, consumers will depend more on external marketing signals to infer a good deal. Given that the two mechanisms suggest opposing effects of brand price volatility on the synergy between price cuts and store flyer advertising, we leave this as an empirical question.

Brand market share. Market-leading brands are typically more salient in consumers' memory than smaller brands (Briesch et al. 1997), and even without a store flyer, consumers will

notice a price cut more easily. Thus, store flyers will not contribute much to the price response, as such brands are more likely to be part of consumers' consideration sets anyway. We hence expect the *consideration set formation* mechanism to be weaker for brands with a higher market share. We also expect a brand's market share to be positively associated to consumer price knowledge so that the *price cut proxy* mechanism becomes weaker (Anderson et al. 2009; Grewal, Marmorstein, and Sharma 1996). Given that the mechanisms work in opposite directions, we leave the effect of market share on the synergy as an empirical question.

Category price level. Consumers generally have little knowledge about the actual size of price cuts (Krishna, Currim, and Shoemaker 1991; Vanhuele and Drèze 2002). Thus, if they use store flyer advertising as a proxy for a price cut, they may infer larger absolute savings for more expensive product categories. This would make the *price cut proxy* mechanism more important in higher-priced categories, so that we expect a less favorable synergy.

Number of brands in the category. In a crowded category, consumers will be less likely to pay attention to and to detect price cuts for each individual brand (Lamey et al. 2018). Thus, we expect the *consideration set formation* mechanism to be more important, and hence, the synergy between price cuts and store flyer advertising to be more favorable in categories with a larger number of brands.

Category advertising intensity. Manufacturers typically run image advertising to activate consumers' emotions and to differentiate their brand in the minds of consumers (Kaul and Wittink 1995). Consequently, more manufacturer advertising in a category creates non-price reasons to purchase brands. Consumers' dependence on prices in their shopping decisions will diminish as consumers only process this information through the peripheral route. This is in favor of the *price cut proxy* mechanism. As a result, categories with a higher advertising intensity should have less favorable synergy effects.

Category impulsivity. Impulse purchases are associated with peripheral processing of

information (Rook and Fisher 1995, Hausman 2000). Thus, we expect that in categories where consumers more often buy on impulse, the *price cut proxy* mechanism is stronger, and the synergy between price cuts and store flyer advertising becomes less favorable.

Category involvement. Consumers are more likely to actively gather information about products in categories with higher involvement (Zaichkowsky 1985). With higher category knowledge, consumers engage less in information (price) search and a store flyer is not required to bring a brand or good deal to shoppers' attention, resulting in a weaker *consideration set formation mechanism* and a less favorable synergy. At the same time, price knowledge should be higher in categories with higher involvement, and consumers more often process information through the central route. Therefore, we expect a weaker *price cut proxy* mechanism, and a more favorable synergy with higher category involvement. We leave it as an empirical issue which of these mechanisms dominates.

Category hedonism. Utilitarian products are functional, necessary, and practical, whereas hedonic products are fun, exciting, and enjoyable (Dhar and Wertenbroch, 2000; Voss, Spangenberg, and Grohmann 2003). Unlike utilitarian goods, which consumers only buy when needed, purchases of hedonic products are often unplanned. Thus, price cuts alone for hedonic products likely go unnoticed in the store. When presented in a store flyer, however, they attract more attention so that the *consideration set formation* mechanism should be stronger. Hence, we expect a positive effect of category hedonism on the synergy between price cuts and store flyer advertising.

In this study, our interest in the role of retailer format is not restricted to its effect on the synergy between price cuts and store flyer advertising (see Table 1). Given the substantial differences in assortment and pricing policy between discounters and supermarkets, retailer format may also moderate the effects of the proposed brand and category characteristics on the synergy. By estimating separate models for supermarkets versus discounters, we allow for

differences in the synergy between them as well as for subsample-specific effects of the brand- and category-related drivers.

4. Data

We study the effect of price cuts and store flyer advertising in the German CPG sector with data from January 2016 to December 2017 from various sources. First, we use *consumer panel data* collected by GfK to measure prices and sales. Our data contains purchase records from 36,809 household panel members at six dominant retailers in Germany. These retailers include three discounters (Lidl, Netto, Penny) and three supermarket chains (Edeka, Rewe, Kaufland).[1] Together, these retailers covered 46.6% of total grocery value sales in Germany in 2017 (LZ Retailytics 2018). The use of weekly price cuts and store flyer advertising not only varies across brands and retailers, but also across regions. Therefore, we aggregate the SKU-level data to the brand level within each retailer, region, and week, and analyze the data at the brand-retailer-region-week level, with Germany divided into four regions (North, South, West, and East).[2]

We examine 44 CPG product categories that include various food and non-food products (see Table 2). Within these categories, we retain brand-retailer-region combinations with a sufficient number of weeks with non-zero sales and where the retailer engages in price cuts and / or store flyer advertising. In particular, we rely on the following criteria: among the national brands, we select those whose category (volume) share in each region (across retailers) during the data period exceeds 1%.[3] For these national brands and the private labels, we select brand-retailer-region combinations with (1) at least 52 weeks of consecutive (non-zero) sales (e.g., Datta, Ailawadi, and van Heerde 2017), and (2) at least one week with store flyer support and/or

[1] Note that the discounter Aldi is not part of our set of retailers due to its limited use of price cuts, especially in combination with store flyer ads.
[2] We aggregate sales from the SKU to the brand level within each retailer-region-week combination, by summing them up. When we aggregate the price variables, we compute weighted averages, using as weights each SKU's share in total brand sales at the respective retailer-region in a rolling window of the most recent quarter.
[3] The share is determined based on national brands only.

a price cut.[4] We classify an observation as a price cut if the actual price in a week is at least 5% below the regular (non-promoted) price (see Nijs, Srinivasan, and Pauwels 2007, or Keller, Deleersnyder, and Gedenk 2019 for a similar approach; see Table 5 and Web Appendix 1 for details). This selection results in 488 brands with 2,754 brand-retailer-region combinations and 285,375 brand-retailer-region-week observations. We augment this data with key information from several other sources that cover the same brands and retailers over the 2016-2017 data period.

--- Insert Table 2 about here ---

A second key data input for this study is *information on store flyers* collected by FOCUS Marketing Research. FOCUS uses a panel of households to collect store flyers distributed by retailers across Germany. The panel provides store flyer information at the regional level, including gross advertising value (GAV), which reflects the cost (in €) associated with the production and distribution of store flyers. GAV will be larger for front page ads, for larger ads, and for store flyers distributed to a larger audience, for instance. When investigating the distribution of our variables, we find that the store flyer variable SF (for details see Table 5 and Web Appendix 1) includes some excessive GAVs. In order to avoid that outliers influence our findings, we delete observations in each subsample where the SF value is higher than the (subsample) mean plus five times the standard deviation. This reduces the total sample by only .6% to 283,554 observations.[5]

Third, we acquired weekly *data on TV advertising* by manufacturers and retailers from Nielsen in Germany for each brand and retailer in our sample over the two-year data period. This allows us to control for the effect of this national advertising in our model.

Fourth, to measure relevant category characteristics that are potential drivers of the synergy between price cuts and store flyer advertising, we ran an *online survey*. 671 participants

[4] In section 7.6, we show that our results are robust to stricter requirements for the use of promotions.
[5] In section 7.6, we show that our results are robust to removing outliers from our samples.

completed it in January 2019. The mean age of the respondents was 34.1 years, and 64% were women. Respondent evaluated three randomly chosen product categories, in which they had made at least one purchase over the previous six months. We received between 21 and 46 responses per category.

We provide more details on all variables in our analysis in section 6 (see Table 5) and in Web Appendix 1.

5. Model-Free Evidence

First, we provide insights into how retailers schedule their price cuts and store flyer support. Out of the 283,554 brand-retailer-region-week combinations in our dataset, 94,294 (or 33.3%) evince at least one type of promotion support for the brand (i.e., a price cut of at least 5% below the regular price and/or store flyer GAV > 0, see before). Table 3 splits out these supported brand-retailer-region-week combinations based on whether the two promotion tools are used separately versus together.

--- Insert Table 3 about here ---

Table 3 shows that a higher percentage of price cuts is supported by store flyer advertising at supermarkets than at discounters. Interestingly, there is no single promotion scenario (a, b, or a&b) that dominates: all scenarios occur sufficiently often to reliably estimate the synergy effects.[6]

Second, Table 4 provides first insights into the sign and size of the synergy between price cuts and store flyer advertising. We compare the average sales lift of a brand when retailers use price cuts and store flyers in the same versus in different weeks. For this analysis, we only include brand-retailer-region combinations that have at least one week with (1) only a price cut, (2) only a store flyer ad, and (3) a price cut and a store flyer ad combined. For these 1,633 brand-

[6] This also holds for each individual retail chain, as we show in Web Appendix 2.

retailer-region combinations (out of 2,754 in our main analysis), we compare the size of the average sales lift when retailers use both instruments in the same week with the sum of the average sales lifts when the instruments are used alone (see Figure 1).

To determine the sales lift for each brand-retailer-region combination and each promotion scenario, we divide mean weekly sales volume across weeks with a price cut and/or store flyer ad by mean weekly sales volume across all weeks without any promotion support, and subtract 1 to express it as a percentage increase relative to the brand's sales in non-promotion weeks. In Table 4, we report the means (and standard deviations) across the 1,633 brand-retailer-region combinations.

--- Insert Table 4 about here ---

Table 4 shows that, on average, price cuts and store flyers alone effectively boost brand sales. For example, when supermarkets offer price cuts (but do not advertise them in store flyers), on average, the promoted brand's sales are 51% higher than in weeks without any promotion (row "a"). Likewise, if supermarkets advertise brands in store flyers (but do not offer a price cut), sales are 63% higher (row "b"). Not surprisingly, the sales lift is highest when both marketing tools are used together (row "a&b"): if supermarkets use the two instruments in combination, sales are 364% higher than in weeks without any promotion.

But is the combination also more effective than the sum of the isolated effects (row a+b)? Yes: on average, the synergy is positive (last row in Table 4). At supermarkets, for instance, the lift from using price cuts and store flyer advertising together (364%) is larger than the sum of the isolated effects (51% + 63% = 114%). This pattern is consistent at discounters: the combined sales lift clearly exceeds the sum of the individual effects, where the difference approximates the synergy. But we also observe a difference between the two subsamples: the positive synergy, i.e., the incremental lift from using the two marketing tools together, is larger for supermarkets than for discounters, in line with our expectation (see Table 1).

Table 4 also shows substantial heterogeneity across brand-retailer-region combinations, as indicated by large standard deviations for the sales lifts as well as for the synergy. E.g., at supermarkets, we find a mean incremental sales lift of 250 percentage points ((a&b) – (a+b)), and a standard deviation of 362 percentage points. This indicates that the synergy is not always positive and varies substantially in size. Thus, it is important to study the drivers of the synergy to determine when it is larger versus smaller, or even turns negative as we observe in 22% of our cases (16% in the supermarket subsample, and 33% at discounters).

The sales lifts in Table 4 consider neither the size of the promotion efforts (i.e., discount size and GAV) nor other effects on sales (i.e., competition or TV advertising), and these averages cover a diverse set of brands and categories. To formally compare sales effects of the separate versus joint use of price cuts and store flyer advertising, while controlling for other drivers of sales, we build a hierarchical linear model (HLM) (Bryk and Raudenbush 1992). In this model, promotion response – including the interaction between price cuts and store flyer advertising – is a function of brand and category characteristics.

6. Model

6.1 Model specification

We conduct separate analyses for supermarkets versus discounters. In both subsamples, we pool observations across brands, retailers, regions, and weeks, and estimate a HLM with two levels. [7] At *level 1*, we model sales of a brand-retailer-region-week combination as a multiplicative function of price cuts, store flyer advertising, the interaction between the two, and a set of control variables. The multiplicative model allows us to interpret the coefficients as elasticities (Macé and Neslin 2004; van Heerde, Leeflang, and Wittink 2004). Our key interest is in the

[7] We have also estimated separate models for each of the six retailers, to test for differences across the three supermarkets and across the three discounters. Similarly, we checked for regional differences in synergy effects through region-specific models for supermarkets and discounters. We find that results are quite similar across retailer formats and across regions. Details are available upon request.

interaction between price cuts and store flyer advertising.[8] At *level 2* of the HLM, we add independent variables that are constant over retailers, regions, and time but vary across brands to explain the variance in the key parameters in level 1 of the HLM, especially the interaction between price cuts and store flyers.

For expositional clarity, we present the model in separate equations for each level before integrating them into a single estimation equation (Raudenbush and Bryk 2002). We provide details on all variables in the model in Table 5 and Web Appendix 1. Following Raudenbush and Bryk (2002), we group-mean-center all continuous level 1 predictors (with brand-retailer-region combinations as groups) and grand-mean-center all level 2 predictors.

--- Insert Table 5 about here ---

Level 1 includes predictors varying across brands, retailers, regions, and time:

$$
\begin{aligned}
(1a)\ S_{irat} = {} & \beta_0 \cdot PI_{irat}^{\beta_{1,i}} \cdot SF_{irat}^{\beta_{2,i}} \cdot PI_{irat}^{\left[\beta_{3,i} \cdot \ln(SF_{irat})\right]} \cdot Preg_{irat}^{\beta_4} \cdot cbPI_{irat}^{\beta_5} \cdot crPI_{irat}^{\beta_6} \cdot \\
& cbSF_{irat}^{\beta_7} \cdot crSF_{irat}^{\beta_8} \cdot AdvM_{it}^{\beta_9} \cdot AdvR_{rt}^{\beta_{10}} \cdot INV_{irat}^{\beta_{11}} \cdot \beta_{12}^{D.xmas_t} \cdot \beta_{13}^{D.easter_t} \cdot \\
& trend_t^{\beta_{14}} \cdot \prod_q \left(\beta_{15,q}^{D.quart_{qt}}\right) \cdot \prod_i \left(\beta_{16,i}^{D.bra_i}\right) \cdot \prod_r \left(\beta_{17,r}^{D.ret_r}\right) \cdot \prod_a \left(\beta_{18,a}^{D.reg_a}\right) \cdot \prod_c Cop_{cirat}^{\beta_{19,c}} \cdot \\
& e^{u_{irat}}.
\end{aligned}
$$

where the indices *i*, *r*, *a,* and *t* represent brands, retailers, regions, and weeks, respectively. The random error term u_{irat} is assumed to be normally distributed with zero mean and variance σ^2. To linearize this model, we take the natural logarithm on both sides of the equation (Andrews et al. 2008; van Heerde, Leeflang, and Wittink 2000)[9]:

[8] Note that the multiplicative function contains an inherent interaction in the sense that marginal returns of sales with respect to a price cut are a function of the level of store flyer advertising (and vice versa). Yet, this inherent interaction is restricted in sign and small in magnitude (Zhang 2006). For the full absolute sales impact of the interaction between price cuts and store flyer advertising when both instruments are used at the same versus at different times, we refer to the simulations in Figures 3 and 5 as well as in Web Appendix 3, which account for the full interaction (implicit and explicit).

[9] For all continuous level 1 variables where zero is part of the observed data range, we add a small constant to each observation before the transformation. For instance, we add 1 to all (rescaled) store flyer values. In section 7.6, we show that results are very similar when we use an alternative value. For each mean-centered level 1 variable X, we compute ln(X) – ln(mean[X]), so that the elasticity of another independent variable Z in Equation 1 (e.g., PI), is the effect of Z at the mean value of X (e.g., SF).

$$
\begin{aligned}
(1b)\quad \ln(S_{irat}) = {} & \ln(\beta_0) + \beta_{1,i} \cdot \ln(PI_{irat}) + \beta_{2,i} \cdot \ln(SF_{irat}) + \beta_{3,i} \cdot \ln(SF_{irat}) \cdot \ln(PI) + \\
& \beta_4 \cdot \ln(Preg_{irat}) + \beta_5 \cdot \ln(cbPI_{irat}) + \beta_6 \cdot \ln(crPI_{irat}) + \beta_7 \cdot \ln(cbSF_{irat}) + \\
& \beta_8 \cdot \ln(crSF_{irat}) + \beta_9 \cdot \ln(AdvM_{it}) + \beta_{10} \cdot \ln(AdvR_{rt}) + \beta_{11} \cdot \ln(INV_{irat}) + \ln(\beta_{12}) \cdot \\
& D.xmas_t + \ln(\beta_{13}) \cdot D.easter_t + \beta_{14} \cdot \ln(trend_t) + \sum_q [\ln(\beta_{15,q}) \cdot D.quart_{qt}] + \\
& \sum_i [\ln(\beta_{16,i}) \cdot D.bra_i] + \sum_r [\ln(\beta_{17,r}) \cdot D.ret_r] + \sum_a [\ln(\beta_{18,a}) \cdot D.reg_a] + \\
& \sum_c [\beta_{19,c} \cdot \ln(Cop_{cirat})] + u_{irat}
\end{aligned}
$$

Promotion response. The first focal independent variable in the level 1 equation is the price index (PI). To determine PI, we divide a brand's actual price in a given week by its regular (baseline) price at the respective retailer in the respective region. A PI of .9, for instance, corresponds to a 10% price cut in that week relative to the brand's regular price. This ratio approach makes price cuts comparable across brands, retailers, and regions. It captures price cuts and not price differences across brands (e.g., Datta, Ailawadi, and van Heerde 2017), as we control for changes in the brand's regular price (Jedidi, Mela, and Gupta 1999). In a multiplicative model, the coefficient $\beta_{1,i}$ is the short-term promotional price elasticity for brand i when store flyer advertising is at its mean (i.e., zero, given mean-centering). $\beta_{1,i}$ should be negative, reflecting that price cuts (i.e., lower PI) increase brand sales.

The other focal independent variable in the level 1 equation is gross advertising spending on store flyers (SF) for a brand by a retailer in a region. We use weekly spending (rather than an adstock variable), since advertising in store flyers typically focuses on communicating prices and increases brand sales immediately. We rescale the store flyer variable to make it comparable across the four regions which differ in size (see Table 5 and Web Appendix 1). The coefficient $\beta_{2,i}$ represents the store flyer advertising elasticity for brand i when PI is at its mean (given mean-centering). We expect $\beta_{2,i}$ to be positive, indicating that an ad in the store flyer increases brand sales that week.

Our main interest in this study is in the interaction between the price index and store flyer advertising which captures the synergy between the promotion tools. If the interaction coefficient

$\beta_{3,i}$ is negative (positive), the sales impact of a price cut and a store flyer ad together is larger (smaller) than the sum of the effects of price cuts and store flyers used separately. Note that a *positive* synergy as discussed in the conceptual part of the paper and the model-free evidence, translates into a *negative* interaction coefficient in the HLM. A negative price elasticity β_1 will be amplified when the interaction coefficient β_3 is also negative (consistent with a stronger response to price cuts).

Control variables. We control for the impact of the regular price of a brand at a retailer and region through Preg, which is derived over a four week rolling window to account for gradual changes over time (Datta, Ailawadi, and van Heerde 2017). We account for price cuts and store flyer advertising by *competing brands within the retailer* through cbPI and cbSF, and similarly, for promotions for the *focal brand at competing retailers* through crPI and crSF (Kopalle, Mela, and Marsh 1999; van Heerde, Leeflang, and Wittink 2004). Further, we control for retailers' and manufacturers' TV advertising through AdvR and AdvM, using stock variables to capture their long-term impact (Sethuraman, Tellis, and Briesch 2011).

We include the inventory variable INV in our models, to take into account that price cuts and store flyer advertising lead to purchase acceleration so that consumers' inventories increase during the promotion week, which can decrease sales in subsequent weeks. In line with Kopalle, Mela, and Marsh (1999), this variable takes the form: $INV_{irat} = INV_{irat-1} + (S_{irat-1} - \overline{S}_{ira})$, where $\overline{S}_{ira}$ is the mean sales level of brand *i* at retailer *r* in region *a* over the data period. Furthermore, dummy variables account for the major holidays Christmas and Easter (D.xmas, D.easter) as well as quarterly differences (Dquart), and we add a trend variable (trend) to accommodate brand growth patterns. Finally, differences in sales across brands, retailers, and regions are captured by fixed effects (D.bra, D.ret, D.reg), and Gaussian copulas terms (Cop) control for potential endogeneity in the price index, the store flyer variable and regular price (see subsection 6.2).

Level 2 of the HLM makes the promotion response in Equation 1 a function of predictors that vary across brands.

$$(2)\ \beta_{k,i} = \gamma_{k,0} + \gamma_{k,1} \cdot \text{B.PRIVATE}_i + \gamma_{k,2}\ \text{B.PRIPREM}_i + \gamma_{k,3} \cdot \text{B.PRIVOL}_i + \gamma_{k,4} \cdot \text{B.MS}_i + \gamma_{k,5} \cdot \text{C.PRILEV}_i + \gamma_{k,6} \cdot \text{C.NBRDS}_i + \gamma_{k,7} \cdot \text{C.ADV}_i + \gamma_{k,8} \cdot \text{C.IMPULS}_i + \gamma_{k,9} \cdot \text{C.INVOLV}_i + \gamma_{k,10} \cdot \text{C.HEDON}_i + v_{k,i}$$

A level 2 equation is estimated for each of the three focal promotion effects in the level 1 model, as indicated by the index k: the main effect of price cuts $\beta_{1,i}$ (k = 1), the main effect of store flyer advertising $\beta_{2,i}$ (k = 2), and the interaction effect $\beta_{3,i}$ (k = 3). As introduced in the framework, we account for the following brand- and category-related drivers of promotion response: brand type (B.PRIVATE: private label versus national brand), brand price premium (B.PRIPREM), brand price volatility (B.PRIVOL), brand market share (B.MS), category price level (C.PRILEV), number of brands in a category (C.NBRDS), intensity of manufacturer advertising in a category (C.ADV), impulse buying of products in a category (C.IMPULS), category involvement (C.INVOLV), and the hedonic (vs. utilitarian) nature of a category (C.HEDON). For details on these variables, see Table 5, Panel B, and Web Appendix 1. The constants $\gamma_{k,0}$ in the level 2 models capture the mean effects of price cuts ($\gamma_{1,0}$) and store flyers ($\gamma_{2,0}$) as well as mean interaction ($\gamma_{3,0}$), when all drivers are at their means (i.e., zero, given mean-centering).

6.2 Model estimation

By substituting the level 2 equations into Equation 1b, we arrive at a single estimation equation. We then estimate the HLM with an OLS approach as implemented in the R software package 'lfe'. We estimate separate models for supermarkets versus discounters.

Retailer prices and store flyer decisions might be endogenous if managers strategically take them based on expected demand. To formally address endogeneity concerns for the variables PI, SF, and Preg, we implement the instrument-free Gaussian copula approach where

we directly model the joint distribution of these endogenous regressors and the error term through control function terms (see Park and Gupta 2012; Datta, Ailawadi, and van Heerde 2017; Becker, Proksch, and Ringle 2022). We augment the HLM specification with three Gaussian copulas terms for the three potentially endogenous variables. This instrument-free approach requires that the variables are non-normally distributed. This is the case for all three variables in both subsamples, as indicated by an Anderson-Darling test. The coefficients for the copula terms are statistically significant ($p < .01$), with the exception of the copula term for the SF variable in the discounter subsample ($p > .10$), which we therefore remove from the respective model.

6.3 Model validity

Model fit. To evaluate the explanatory power of our focal predictors, we build our models by successively adding blocks of predictors and comparing model fit. We start with a base model (Model 0) that includes only control variables and the main effects of price cuts and store flyer advertising and their drivers (Equations 2 for k = 1 and k = 2 only). We set the interaction between price cuts and store flyer advertising ($\beta_{3,i}$ in Equation 1, i.e., all coefficients in Equation 2 for k = 3) to zero. Next, in Model 1, we add the average interaction effect between PI and SF ($\gamma_{3,0}$ in Equation 2, k = 3). Finally, to arrive at our full model (Model 2), we also introduce the effects of the potential drivers of the interaction, i.e., $\gamma_{3,1}$ to $\gamma_{3,10}$ in Equation 2 for k = 3. Likelihood ratio tests show that model fit improves significantly when we add the blocks of predictors and move from Model 0 to Model 1 ($p < .01$ for supermarkets and $p < .10$ for discounters), and from Model 1 to Model 2 ($p < .01$ for both subsamples) (see Table 6). This means that, on average, the interaction between price cuts and store flyer advertising is not zero, and that our drivers make a significant contribution to explaining the variance in the interaction across brands.

--- Insert Table 6 about here ---

Multicollinearity. VIF values are below 2.5 for all variables in Equations 1 and 2 in both subsamples, suggesting no severe multicollinearity problems.

7. Model Results

We present the estimates for the level 1 equations for supermarkets and discounters in Table 7, and for the level 2 equations in Table 8. In the final column of both tables, we test for the joint significance of the coefficients across the subsamples using the meta-analytic Z statistic (Rosenthal, 1991).

--- Insert Tables 7 & 8 about here ---

7.1 Control variables

Our results for the control variables in level 1 of the HLM are plausible (see Table 7). We find a negative effect of a brands' regular price in both models and in the meta-analysis (β_4). Competition generally hurts: cross-brand price elasticities (β_5) and cross-retailer price elasticities (β_6) are positive, and store flyer advertising for competing brands at the focal retailer (β_7) has a negative effect on sales. Only at supermarkets, store flyer ads for the focal brand by competing retailers reinforce sales (β_8). Apparently, they remind consumers to purchase the focal brand at their customary supermarket.

TV advertising by the manufacturer (β_9) and the retailer (β_{10}) has a positive effect on sales. The inventory variable has the expected negative effect in both subsamples (β_{11}), indicating that weeks with higher sales are followed by weeks with lower sales. This is consistent with the well-known stockpiling effect. The Christmas dummy has a negative effect (β_{12}), reflecting lower sales during weeks when retailers have extra closing days due to holidays. During the Easter weeks, sales decrease at discounters, but increase at supermarkets (β_{13}), probably because shoppers want to take advantage of larger assortments and/or are willing to spend more money for the holiday. Finally, sales at discounters in Germany grow over our data period, while this is not the case for supermarkets (β_{14}).

7.2 Main effects of price cuts and store flyer advertising

Price cuts. The constant $\gamma_{1,0}$ in Equation 2 for k = 1 captures the main effect of price promotions. It is the price cut elasticity for mean spending on store flyer advertising and mean values of the brand and category characteristics in the level 2 equation for k = 1 (given mean-centering). $\gamma_{1,0}$ is significant and negative in both models, as price cuts boost sales of national brands (see Table 8). Specifically, the mean price cut elasticities are -1.53 at supermarkets and -.63 at discounters.

The effects of brand and category characteristics on the main effect of price cuts in Equation 2, k = 1, are plausible. For instance, a higher category price level is associated with a stronger response to price cuts, probably because absolute savings during a price cut are larger than for lower-priced categories (Bolton 1989).

Store flyer advertising. The average main effect of store flyer advertising on sales is captured by $\gamma_{2,0}$ in Equation 2, k = 2. It is significant and positive (see Table 8). The mean elasticity is .11 at supermarkets and .66 at discounters. The elasticity for the discounter subsample is higher than typical advertising elasticities (Sethuraman, Tellis, and Briesch 2011), probably for two reasons. First, store flyers of German discounters often advertise very attractive deals for durable products that are not part of the retailer's usual assortment. These deals draw more attention to the discounter store flyer in general, and the other featured brands may benefit from this. Second, the mean advertising elasticity is mainly driven by national brands, while for private labels it is much smaller. German discounters have traditionally offered mostly private labels, but recently added more national brands. These national brands are often not yet part of the consideration sets of discount shoppers, and therefore benefit strongly from store flyer advertising.

The effects of brand and category characteristics on the main effect of store flyer advertising in Equation 2, k = 2, are plausible. For example, store flyers have a weaker effect for brands with a larger market share, indicating that these strong brands require less support

through retailer advertising.

7.3 Synergy between price cuts and store flyer advertising

The coefficient $\beta_{3,i}$ in Equation 1 captures the interaction between price cuts and store flyer advertising. Again, this coefficient is split out in Equation 2, k = 3, where $\gamma_{3,0}$ captures the average interaction for mean values of the drivers in Equation 2. The interaction coefficient $\gamma_{3,0}$ is significant and negative in both sub-samples (see Table 8): it is -2.66 at supermarkets and -.62 at discounters. Hence, the negative price elasticity will become stronger in combination with a store flyer ad, after controlling for the main effect of the ad. Thus, the answer to our research question 1 is that, on average, the effect on brand sales of using price cuts and store flyer advertising together in the same week (a&b in Figure 1) is larger than the sum of the effects when both tools are used separately (a+b). This finding is consistent with the positive synergy effects reported in the model-free evidence (see Table 4).

The difference in the mean interaction coefficient between supermarkets and discounters is significant (Wald-test, $p < .01$)[10], in line with our expectation of a less favorable synergy at discounters (see Table 1), and with the model-free evidence (see Table 4), where synergy effects at supermarkets (250%) are also larger than at discounters (137%). Thus, the answer to our research question 2 is that the synergy between price cuts and store flyer advertising is more favorable at supermarkets than at discounters.

To illustrate the size of the interaction effect, we simulate sales as a function of the price index for different levels of store flyer support and plot it in Figure 3.[11] It shows that the synergy is very strong. E.g. at supermarkets, a 15% price cut (PI of .85) without store flyer support increases sales by 11%, and medium spending on store flyers (median GAV) without a price cut

[10] The Wald-test is done in a pooled model which is estimated with the data from both supermarkets and discounters, and which includes interactions of all variables with a retailer format dummy.

[11] We compute the sales index for each brand-retailer-region combination, using actual values of the drivers for each brand. We then compute the weighted mean across these combinations, using the number of observations in each brand-retailer-region combination as weights. The index is 1 when there are no promotions. We vary PI and SF systematically.

results in a sales lift of 8%. The combined use of a 15% price cut and medium store flyer spending increases sales by 52%, much more than the sum of the separate effects (11% + 8% = 19%). At discounters, a 15% price cut alone increases sales by 9%, medium spending on store flyers (median SF) without a price cut results in a lift of 74%, and the joint use of the two marketing tools increases sales by 107%, which again is more than 9% + 74% = 83%, even though the synergy is smaller than at supermarkets.[12]

--- Insert Figures 3 & 4 about here ---

Apart from the mean interaction effects, we also find considerable variance. Figure 4 presents the distributions of the interaction coefficients across brands at the two retailer formats. At supermarkets, .3% of the brands exhibit a positive interaction, i.e., a negative synergy. Negative interactions (i.e., positive synergies) can become very strong with values up to -5.4 especially for private labels, which dominate the left "bump" in the distribution. As in the model-free evidence, the percentage of positive interactions (i.e., negative synergies) is larger at discounters, accounting for 32.6% of the brands. Standard deviations are large in both subsamples (1.41 for supermarkets and 1.57 for discounters). In the following, we discuss how our drivers help explain this variance in the synergy.

7.4 Brand- and category-related drivers of the synergy

To test our expectations about how brand and category characteristics drive the synergy between price cuts and store flyer advertising (research question 3, see Table 1), we now turn to the results for Equation 2, k = 3, in Table 8. The respective coefficients indicate how the interaction changes when the drivers increase by one. When comparing results to expectations, note that a *more favorable* synergy for larger values of the driver (corresponding to a "+" in Table 1), would

[12] Since we use a multiplicative model to estimate interaction effects, one could argue that we should determine effect sizes by multiplying percentage changes in sales when price cuts and store flyer advertising are used alone rather than by summing them up. However, also with this approach, the product of the separate effects (for supermarkets 1.11*1.08 would yield a 20% increase in sales, and for discounters 1.09*1.74 would represent a 90% increase) would be smaller than the effect of the joint use of price cuts and store flyers.

be reflected by a *negative* coefficient for the driver of the interaction in Table 8, and vice versa.

Brand type (private labels versus national brands). The coefficient $\gamma_{3,1}$ in Equation 2 for k = 3 captures the effect of brand type on the synergy between price cuts and store flyer ads. It is significant and negative at both supermarkets and discounters, in support of our expectation that the synergy is more favorable for private labels than for national brands (see Table 1). This finding is also in line with the results of Lemon and Nowlis (2002).

Brand price premium. The coefficient $\gamma_{3,2}$ is significant and positive at both retailer formats, i.e., the synergy between price cuts and store flyer advertising is less favorable for higher-priced brands. We presented conflicting arguments in section 3 and refrained from formulating an expectation (see Table 1). Our findings suggest that the consideration set formation mechanism dominates the price cut proxy mechanism, such that premium-priced brands are very distinct and more likely part of the consideration set anyway, even without store flyer advertising. Note that the effect of brand price premium on the interaction is stronger at discounters than at supermarkets (Wald-test, $p = .02$), maybe because price differences across brands are larger at discounters with their cheap private-labels.

Brand price volatility. The effect of brand price volatility on the interaction ($\gamma_{3,3}$) is weakly significant and positive at supermarkets ($p < .10$) and not significant at discounters ($p > .10$). We presented opposing arguments in section 3 (see Table 1). Apparently, the price cut proxy mechanism slightly dominates the consideration set formation mechanism at supermarkets, while the two mechanisms cancel each other out at discounters.

Brand market share. Market share has no significant effect on the interaction between price cuts and store flyer advertising ($p > .10$ for $\gamma_{3,4}$). Probably, opposing effects based on the two mechanisms cancel each other out (see Table 1).

Category price level. The coefficient for the effect of category price level on the interaction ($\gamma_{3,5}$) is significant and positive for both retailer formats, in line with our expectation

of a less favorable synergy for more expensive product categories.

Number of brands in the category. We find no significant effect of the number of brands on the interaction ($p > .10$ for $\gamma_{3,6}$). Maybe the expected positive effect on the synergy based on the consideration set formation mechanism is cancelled out by an opposing effect. In categories with a larger number of brands, price comparisons become harder, so consumers may rely more on the peripheral route of decision making, resulting in a stronger price cut proxy mechanism.

Category advertising intensity. The coefficient for the effect of TV advertising efforts by manufactures in the category on the interaction between price cuts and store flyer advertising ($\gamma_{3,7}$) is positive at supermarkets ($p < .01$), in line with our expectation of a less favorable synergy with higher advertising intensity. However, the effect on the interaction coefficient is negative at discounters ($p < .01$). This may be driven by national brands: the consideration set formation mechanism may get stronger with more advertising by manufacturers for national brands. Consumers typically focus on private labels when shopping at discounters, since many national brands have only recently been added to the discounters' assortments. Thus, an ad in the store flyer makes consumers realize that national brands are also available at the discounter.

Category impulsivity. At discounters, we find the expected positive effect of impulse buying in the category on the coefficient for the interaction (i.e., a negative effect on the synergy, see Table 1) ($p = .02$ for $\gamma_{3,8}$). At supermarkets, the effect is not significant ($p > .10$), maybe because the price cut proxy mechanism plays less of a role for this retailer format, as explained in section 3.

Category involvement. Consumer involvement with the category has no significant effect on the interaction between price cuts and store flyer advertising ($p > .10$ for $\gamma_{3,9}$). The price cut proxy mechanism and the consideration set formation mechanism seem to cancel each other out (see Table 1).

Category hedonism. The coefficient for hedonism ($\gamma_{3,9}$) is significant and negative at both

retailer formats, i.e., the synergy is more favorable in more hedonic categories, in line with our expectation (see Table 1). The effect of hedonism on the interaction is stronger at discounters than at supermarkets (p = .02). Maybe, because the shopping atmosphere at discounters is very utilitarian and consumers make fewer unplanned purchases, hedonic categories at discounters benefit more from the consideration set formation mechanism.

Effect sizes. To illustrate the relevance of the drivers, we extend our simulation of the sales impacts of price cuts and store flyer advertising (separately and together, see Figure 3) to compare them at different levels of our drivers. In Figure 5, we present effects for high and low values (mean +/- one standard deviation) of one category-level driver, i.e., category advertising intensity, and one brand-level driver, i.e., brand price premium.[13] Within each panel, parallel lines indicate that there is no synergy, while steeper (less steep) price curves with store flyer advertising than without indicate favorable (unfavorable) synergy effects. The effect of the drivers can be seen by comparing panels. E.g., the positive synergy between price cuts and store flyer advertising at supermarkets (as indicated by a stronger price response with than without store flyer advertising) is quite a bit smaller with high TV advertising in the category (Panel a) than with low advertising intensity (Panel b). For both drivers at both retailer formats, the impact of the drivers is substantial. The same holds for the other significant drivers of the synergy, as we show in Web Appendix 3.

--- Insert Figure 5 about here ---

7.5 Category sales

Retailers are not only interested in brand sales, but also in category sales. The synergy between price cuts and store flyer advertising and the effects of its drivers are not necessarily the same at the category level, since part of the bump in brand sales stems from in-store brand switching (which is not incremental for the category), and the extent of store switching may differ across

[13] We use the same approach as in Figure 3, except that we vary the focal driver.

different promotion scenarios. We therefore also estimate two category models where we link category sales at a supermarket/discounter in a region-week to the same brand-level variables as in the brand sales models (price cuts, store flyer advertising, the interaction between them, controls, and the drivers).

--- Insert Table 9 about here ---

The results, summarized in Table 9, are very similar to those in the brand sales model. A notable difference at level 1 of the HLM is that store flyer advertising for competing brands by the focal retailer has a negative effect on brand sales (see β_7 in Table 7), but a positive effect on category sales (see Table 9). This is plausible since ads for competing brands cause brand switching within the store, but they also grow the category at the focal retailer.

The average effects of price cuts and store flyer advertising are significant ($p < .01$) and show the same sign in the category as in the brand model. Yet, the size of the sales effects differs in some cases. The effects are weaker at the category than at the brand level for price cuts at supermarkets (price cut elasticity at the mean level of store flyer advertising $\gamma_{1,0}$ of -.87 versus -1.53), and for store flyer advertising at discounters (store flyer elasticity at the mean level of price cuts $\gamma_{2,0}$ of .30 versus .66), in line with substantial instore brand switching. In contrast, the category sales impact of a store flyer ad at the mean price cut level at supermarkets ($\gamma_{2,0} = .33$) is larger than the brand sales impact (.11), suggesting that consumers will not only buy more of focal brand, but also of competing brands. Obviously, for supermarkets with their large assortments, store flyers are an important tool for growing a product category by drawing attention to it.

The synergy between price cuts and store flyer advertising remains positive and significant ($p < .05$) at the category level, at both supermarkets ($\gamma_{3,0} = -1.25$) and discounters ($\gamma_{3,0} = -.29$). It is smaller at the category than at the brand level due to brand switching. Importantly, the effects of the drivers of the synergy are very similar to the brand-level results. In the category

model, the synergy is again more favorable at supermarkets than at discounters ($p < .01$), and the effects in level 2 of the HLM are consistent with the brand-level models, with two exceptions. First, at discounters, the more favorable synergy effect for private labels at the brand level reverses in the category model: combining store flyer ads with price cuts contributes more to category sales for national brands than for private labels. Second, for supermarkets, the synergy is less favorable for higher-priced categories at the brand level, but more favorable at the category level.

7.6 Robustness checks

We perform four robustness tests to ensure the stability of our brand-level results. First, we re-estimate our models on a dataset in which we do not remove any outliers. Second, we reduce this dataset to contain only brands for which we observe all relevant promotion scenarios, i.e., (1) only price cuts, (2) only store flyer advertising, (3) price cuts and store flyer advertising together, and (4) no promotion. This sample covers 313 (rather than 488) brands. Third, instead of adding 1 to the continuous level 1 variables where zero is part of the data range before taking their log, we add a value of .1. Fourth, we use an alternative coding for price cuts and store flyer advertising based on dummy variables: a price cut only dummy (d1), a store flyer only dummy (d2), and a dummy for price cut x store flyer combined (d3). Given the dummy coding, the estimates represent the lift in brand sales from each marketing strategy, and hence, the estimates are expected to be positive for all 3 dummies.

Our results are stable (see Web Appendix 4). This is especially noteworthy for the second robustness check, given the much smaller number of brands. For instance, we lose 35% of the observations in the discounter subsample.

8. Discussion

Based on an extensive analysis of 488 brands from 44 CPG categories, we find that the synergy between price cuts and store flyer advertising is positive, on average, i.e., the effect of using price cuts and store flyer advertising together is greater than the sum of the effects when the two tools are used separately. A positive synergy is in line with the consideration set formation mechanism (Zhang 2006): price cuts alone are often not noticed, while store flyer advertising alone does not provide a sufficient incentive to buy at the retailer. Only when both tools are used together, the price cut provides a reason to buy, and the store flyer makes it salient to shoppers.

The synergy between price cuts and store flyer advertising can be strong. For instance, on average at supermarkets, a 15% price cut (PI of .85) without store flyer support increases sales by 11%, and medium spending on store flyers (median GAV) without a price cut results in a sales lift of 8%. The combined use of a 15% price cut and medium store flyer spending increases sales by 52%, much more than the sum of the separate effects (11% + 8% = 19%). We also find substantial variation in the synergy between price cuts and store flyers, which we can link to a set of retailer, brand, and category characteristics (for a summary of our findings, see right side of Table 1).

With respect to category characteristics, we find that products with lower prices benefit more from the joint use of price cuts and store flyer advertising, probably because the price cut proxy mechanism is weaker for them (see left side of Table 1). Also, more hedonic products benefit especially from synergies, likely because the consideration set formation mechanism is stronger for them. For instance, our estimates suggest very strong positive synergies, on average, for beer, with mean values for β_3 of -3.04 at supermarkets and -3.13 at discounters. Beer scores second-highest among our 44 product categories on hedonism and below average on category price level.

With respect to brand characteristics, we find that private labels benefit more from combining price cuts and store flyer advertising, as do brands with a lower price premium. Both of these effects are likely driven by the consideration set formation mechanism (see Table 1): national brands and premium-priced brands have a better chance of being considered anyway. For instance, within the beer category at supermarkets, the two private label brands, which also have the lowest prices, have β_3 coefficients of -5.30 and -5.16, signaling much more favorable synergies than for the national brands in the category. In addition, at discounters, consumers very strongly respond to store flyer advertising alone for national brands, so no additional price cut is needed.

As to retailer type, the synergy is more favorable at supermarkets than at discounters, on average. We find several negative synergy effects at discounters, e.g., a β_3 coefficient of 1.08 for toothpaste. Also, for some brand and category drivers, we find different effects between supermarkets versus discounters. Brands with lower price volatility have more favorable synergies only at supermarkets, and lower category impulsivity makes the synergy more favorable only at discounters. Most notably, the effect of category advertising intensity has opposite signs at the two retailer formats. Categories with less manufacturer advertising benefit more from the joint use of price cuts and store flyer advertising at supermarkets, in line with a stronger price cut proxy mechanism (see Table 1). However, at discounters, categories with more manufacturer advertising benefit more, probably because store flyer advertising is needed to alert consumers to price cuts for national brands, which have only recently been listed at discounters. For instance, for yogurt, the category with the lowest advertising intensity, we find a positive synergy at supermarkets, but a negative synergy at discounters, on average.

Overall, we find the framework by Zhang (2006) to be very helpful in explaining the synergy between price cuts and store flyer advertising. For four potential drivers, the consideration set formation and the price proxy mechanism predict opposing effects, and it is not obvious how they net out (see the question marks in Table 1). For two of these drivers, we find

no significant effect in either subsample, indicating that the two mechanisms cancel out. Specifically, retailers do not need to worry about brand market share and category involvement when deciding about the joint versus separate use of price cuts and store flyer advertising.

The positive synergy between price cuts and store flyer advertising, on average, does not only benefit the promoted brand, but spills over to category sales. The average effect is smaller at the category level since some of the lift in brands sales stems from instore brand switching. Yet, the synergy remains positive on average, suggesting that combining price cuts with store flyers in the same week can attract more shoppers to the store or cause purchase acceleration.

8.1 Managerial implications

Overall, *retailers* are better off using price cuts and store flyer advertising for a brand in the same week, rather than employing them at different times. This recommendation virtually always holds for supermarkets, i.e., for 99.7% of the brands studied (see Figure 4). In contrast, we find some negative synergies at discounters: they should use price cuts and store flyer advertising separately rather than together for 32.6% of the brands. In practice, managers seem to be aware of this difference between retailer formats: in our data, discounters less often support price cuts with store flyer advertising than supermarkets (see model-free evidence in Table 3).

Our results also have implications for *manufacturers*. With positive synergies at both the brand and category level, manufacturers should encourage the retailer to advertise price cuts for their brand(s) in its store flyer and bring our findings to the negotiation table. They may even want to tie their trade promotion payments not only to the number of retailer promotions offered in the store, but also to their co-occurrence.

Our results provide guidance on what brands and categories benefit most from using both instruments at the same time. Discounters need to be careful not to combine price cuts with store flyer advertising when the synergy is negative. And supermarkets need to pay attention to the *size* of the positive synergy. Even if most brands benefit from the joint use of price cuts and store

flyer advertising, this will not be possible for all of them, as space in the store flyer is limited. When selecting brands for (joint) promotions, retailers should not only consider the main effects of price cuts and store flyer advertising, but also the synergy between them.

8.2 Future research directions

Our study has some limitations which suggest opportunities for future research. First, we focus on price cuts and store flyer advertising as the two most frequently used promotion tools. It would be interesting to extend the systematic analysis of synergies to other types of price and non-price promotions. For example, the synergy may be less favorable for bundle promotions because they are more salient than regular price cuts, and may therefore benefit less from the consideration set formation mechanism. Also, the synergy might be different for displays than for store flyers, given that displays draw attention to a price cut only when consumers are already in the store, not before the store visit.

Second, advertising support for price cuts appears not only in store flyers, but also in other advertising media like newspapers, radio, and online media. It might be interesting to compare these media, or even study synergies between them. For instance, newspaper advertising often catches consumers earlier in their purchase funnel, and TV advertising uses more emotional appeals than ads in store flyers, so the synergies with price cuts may differ.

Third, we use data from the CPG market in Germany, which is known for its strong and well-developed discounters. Future research may want to extend the analysis to other markets where different retailer formats like hypermarkets or drugstores flourish. To broaden the results even further, we also recommend future research to study the frequent use of price cuts and store flyers in non-CPG settings like consumer durables. For instance, large assortments with products that differ on many features as well as long interpurchase times may make the consideration set formation mechanism particularly important in the consumer electronics market.

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Table 1: Expected Effects of the Drivers on the Synergy between Price Cuts and Store Flyer Advertising

Drivers		Expectations			Findings	
		Considera-tion set formation mechanism	**Price cut proxy mechanism**	**Net synergy effect**	**Super-markets**	**Discounters**
Retailer	Format: discounters (vs. supermarkets)	–		–	–	
Brand	Type: private labels (vs. national brands)	+		+	+	+
	Price premium	–	+	?	–	–
	Price volatility	+	–	?	–	n.s.
	Market share	–	+	?	n.s.	n.s.
Category	Price level		–	–	–	–
	Number of brands	+		+	n.s.	n.s.
	Advertising intensity		–	–	–	+
	Impulsivity		–	–	n.s.	–
	Involvement	–	+	?	n.s.	n.s.
	Hedonism	+		+	+	+

Notes: + (–) indicates that the driver makes the synergy between price cuts and store flyers more (less) favorable. At discounters, for example, we expect the consideration set formation mechanism to be weaker, and the price cut proxy mechanism to be stronger than at supermarkets. Both suggest a less favorable synergy at discounters. Findings: n.s. = not significant.

Table 2: Overview Categories

Product Group	Product Categories
Food	Bean and Ground Coffee, Butter, Candy Bars, Chocolate Spread, Chocolate Tablets and Blocks, Cooking Fats and Oils, Cooking Sauces, Frozen Dinners and Entrees, Frozen Fish, Frozen Pizza, Cheese, Ice Cream, Jam, Ketchups, Margarine and Spreads, Mayonnaise, Olive Oil, Packet Soup, Pasta, Potato Crisps, Soup and Bouillons, Sweet Biscuits, Yoghurt
Beverages	Beer, Fruit Juice, Instant Coffee, Instant Drinking Chocolate, Milk, Mineral Water, Soft Drinks
Household care	Detergent (Powder), Household Cleaners, Lavatory Cleaners, Washing Up Liquids
Personal care	Body Creams and Skin Care, Dentifrice and Toothpaste, Deodorants, Hair Conditioning Products, Hairsprays, Liquid Soap, Shampoo, Shower and Bath Additives, Toilet Tissues, Toothbrushes

Table 3: Retailer Promotion Activity

	Promotion type	Supermarkets	Discounters
a	Price cut only	14,514	10,755
		(22%)	(39%)
b	Store flyer only	27,499	9,910
		(41%)	(36%)
a&b	Price cut & store flyer	24,554	7,062
		(37%)	(25%)

Notes: Number of brand-retailer-region-week combinations (share of the total number of observations for the respective retailer format). Based on brand-retailer-region combinations with at least one form of marketing support (price cut only, store flyer only, or both).

Table 4: Sales Lift Due to Price Cuts and/or Store Flyer Advertising

		Supermarkets	Discounters
a	Price cut only	51	51
		(91)	(73)
b	Store flyer only	63	198
		(124)	(223)
a&b	Price cut & store flyer	364	386
		(418)	(403)
a+b	Price cut + store flyer	114	249
		(162)	(245)
(a&b)-(a+b)	Synergy	250	137
		(362)	(324)

Notes: Mean sales lift in % across brand-retailer-region combinations (standard deviation in percentage points). The sales lift for each brand-retailer-region combination is determined by dividing mean weekly sales volume across weeks with the respective promotion support by mean weekly sales volume across all weeks without any promotion support, and subtracting 1 to express it as a percentage increase relative to the brand's sales in non-supported weeks. Based on brand-retailer region combinations with all forms of marketing support (price cut only, store flyer only, and both).

Table 5: Measures

Panel A: Variables in Level 1 Model

Variable	Description	Mean (SD)	
		Supermarkets	**Discounters**
S_{irat}	Volume sales of brand *i* at retailer *r* in region *a* in week *t*		
$Preg_{irat}$	Regular (or 'baseline') price per volume equivalent of brand *i* at retailer *r* in region *a* in week *t* is derived as the highest price of brand *i* at retailer *r* in region *a* in a rolling window over the most recent four weeks	1.39 (7.57)	.93 (3.42)
PI_{irat}	Price index of brand *i* at retailer *r* in region *a* in week *t* expressed as the actual price of brand *i* observed at retailer *r* in region *a* in week *t* divided by its regular price ($Preg_{irt}$)	.96 (.06)	.98 (.05)
$cbPI_{irat}$	Cross-brand competitive price index of brand *i* at retailer *r* in region *a* in week *t* expressed as the average of the price indices (PI) across all brands that compete with brand *i* at retailer *r* in region *a* in week *t*	.92 (.21)	.92 (.22)
$crPI_{irat}$	Cross-retailer competitive price index of brand *i* at retailer *r* in region *a* in week *t* expressed as the average PI of brand *i* in region *a* in week *t* across retailers that compete with retailer *r* and offer brand *i* in region *a* in week *t*	.96 (.05)	.97 (.05)
SF_{irat}	Gross advertising value (GAV) in Euros for store flyers for brand *i* at retailer *r* in region *a* in week *t*, divided by the median GAV for store flyers in region *a* across all brand-retailer-week combinations (source: FOCUS Marketing Research)	.52 (1.45)	.23 (.71)
$cbSF_{irat}$	Cross-brand competitive GAV in Euros in store flyers for brand *i* at retailer *r* in region *a* in week *t* expressed as the sum of GAVs for store flyers at retailer *r* in region *a* in week *t* across all brands competing with brand *i* at retailer *r* in region *a* in week *t*, divided by the median cross-brand competitive GAV for store flyers in region *a* across all brand-retailer-week combinations (source: FOCUS Marketing Research)	1.88 (2.94)	.63 (.98)
$crSF_{irat}$	Cross-retailer competitive GAV in Euros in store flyers for brand *i* at retailer *r* in region *a* expressed as the sum of GAVs for store flyers for brand *i* in region *a* in week *t* across all retailers competing with retailer *r* that advertise brand *i* in region *a* in week *t,* divided by the median cross-retailer competitive GAV for store flyers in region *a* across all brand-retailer-week combinations (source: FOCUS Marketing Research)	.58 (1.48)	.66 (1.69)
$AdvM_{it}$	Manufacturer (national) TV advertising stock for brand *i* in week *t* (in €1,000) (source: Nielsen)	27,292 (71,981)	22,651 (64,029)
$AdvR_{rt}$	Retailer (national) TV advertising stock in Euros by retailer *r* in week *t* (in €1,000) (source: Nielsen)	267,431 (191,236)	319,739 (341,724)

INV_{irat}	Inventory of brand *i* at retailer *r* in region *a* in week *t* (= $INV_{irat-1} + (S_{irat-1} - \overline{S}_{ira}$), where $\overline{S}_{ira}$ is the mean sales level of brand *i* at retailer *r* in region *a* over the data period (Kopalle, Mela and Marsh 1999)	103,411 (364,439)	150,383 (588,043)
Cop_{cirat}	Gaussian copula (control function term) for variables *c* (PI, Preg, and SF) of brand *i* at retailer *r* in region *a* in week *t* to control for potential endogeneity		
$D.xmas_t$	= 1 if Christmas is in week *t*, 0 else	4%	4%
$D.easter_t$	= 1 if Easter is in week *t*, 0 else	4%	4%
$Trend_t$	Trend variable for observations in week *t* (with weeks consecutively numbered from 1 to 104)		
$D.quart_{qt}$	= 1 if week *t* is in quarter *q* (with *q* = 2, 3 or 4), 0 else	$Q_{1...4}$: 25%	$Q_{1...4}$: 25%
$D.ret_r$	1 if observation is from retailer r (with r = 1, …, 5), 0 else	Rewe: 33% Edeka: 38% Kaufland: 29% Netto: 0% Lidl: 0% Penny: 0%	Rewe: 0% Edeka: 0% Kaufland: 0% Netto: 42% Lidl: 35% Penny: 23%
$D.reg_a$	1 if observation is from region a (with a = 1, 2, 3), 0 else	South: 27% East: 28% North: 17% West: 28%	South: 25% East: 28% North: 20% West: 27%
$D.bra_i$	1 if observation is from brand i (with i = 1, …., 487), 0 else		

Panel B: Variables in Level 2 Model (Brand and Category Characteristics)

Variable	Description	Mean (SD)	
		Supermarkets	Discounters
B.PRIVATE	Brand type of brand i (1 if private label, 0 if national brand)	28%	50%
$B.PRIPREM_i$	Price premium of brand *i* over the private label price (Ailawadi, Lehmann, and Neslin 2003)	1.92 (1.13)	1.57 (.93)
$B.PRIVOL_i$	Price volatility of brand *i* over time	.09 (.05)	.09 (.06)
$B.MS_i$	Market share of brand *i*	.11 (.14)	.13 (.15)
$C.PRILEV_i$	Price level of category of brand *i*	1.35 (.80)	1.41 (.86)
$C.NBRDS_i$	Number of brands in category of brand *i*	17.62 (8.68)	17.98 (9.05)
$C.ADV_i$	Manufacturer advertising intensity in category of brand *i* (source: Nielsen)	.04 (.04)	.04 (.05)
$C.IMPULS_i$	Impulse buying in category of brand *i* (source: survey; scale by Rook and Fisher 1995)	3.24 (.69)	3.27 (.72)
$C.INVOLV_i$	Involvement in category of brand *i* (source: survey; scale by Zaichkowsky 1985)	3.69 (.49)	3.71 (.51)
$C.HEDON_i$	Hedonic (vs. utilitarian) nature of category of brand *i.* (source: survey; scale by Voss, Spangenberg, and Grohmann 2003)	4.03 (1.45)	4.02 (1.48)

Notes: Unless the source is explicitly mentioned, all measures are derived from the GfK consumer panel data. Observations are brand-retailer-region-week combinations ($N_{Supermarket}$ = 163,060, $N_{Discounter}$ = 120,494). Means and standard deviations (SD) are before ln-transformation and mean-centering. For dummy variables, we report the percentage of observations with a value of 1 instead of the mean and SD. More details on the construction of these variables are provided in Web Appendix 1.

Table 6: Model Fit

		Supermarkets	Discounters
Model 0	Controls, main effects of PC and SF, and drivers of PC and SF	434,328.6	323,975.6
Model 1	Model 0 + Interaction between PC and SF	433,582.0 ***	323,972.7 *
Model 2	Model 1 + Drivers of the interaction between PC and SF	433,490.5 ***	323,868.9 ***

Notes: Numbers represent -2 Loglikelihood for each model. Likelihood-ratio-tests indicate that Model 1 has a better fit than Model 0, and Model 2 has a better fit than Model 1 in all four subsamples (* $p < .10$, ** $p < .05$, *** $p < .01$).

Table 7: Model Results Level 1 (Equation 1)

	Super-markets	Discounters	Meta-analytic Z
Regular price (β_4)	-.34 ***	-1.87 ***	- ***
Cross-brand competitive PI (β_5)	.03 ***	.02 ***	+ ***
Cross-retailer competitive PI (β_6)	.09 **	.15 **	+ ***
Cross-brand competitive SF (β_7)	-.06 ***	-.02 *	- ***
Cross-retailer competitive SF (β_8)	.04 ***	-.00	+ ***
Manufacturer TV advertising (β_9)	.01 ***	.01 ***	+ ***
Retailer TV advertising (β_{10})	.03 ***	.01 ***	+ ***
Inventory (β_{11})	-.06 ***	-.07 ***	- ***
Christmas (β_{12})	-.06 ***	-.12 ***	- ***
Easter (β_{13})	.03 **	-.03 *	+
Trend (β_{14})	.00	.01 ***	+
Quarterly dummies	Yes	Yes	
Fixed effects for brands, retailers, regions	Yes	Yes	
Copula terms for PI, Preg	Yes	Yes	
Copula term for SF	Yes	No	
Number of observations	163,060	120,494	

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Unstandardized coefficients.

Table 8: Model Results Level 2 (Equations 2 for k = 1,…,3)

	Super-markets		Discounters		Meta-analytic Z	
PI ($\gamma_{1,0}$)	-1.53	***	-.63	***	-	***
PI x Private label ($\gamma_{1,1}$)	2.36	***	2.33	***	+	***
PI x Brand price premium ($\gamma_{1,2}$)	-.10	***	-.16	***	-	***
PI x Brand price volatility ($\gamma_{1,3}$)	2.37	**	-3.10	**	+	
PI x Brand market share ($\gamma_{1,4}$)	.02		-3.04	***	-	***
PI x Cat. price level ($\gamma_{1,5}$)	-.91	***	-.24	**	-	***
PI x Cat. no. of brands ($\gamma_{1,6}$)	.00		-.06	***	-	***
PI x Cat. advertising intensity ($\gamma_{1,7}$)	-1.78	*	-.92		-	
PI x Cat. impulse buying ($\gamma_{1,8}$)	-1.10	***	-.35	***	-	***
PI x Cat. involvement ($\gamma_{1,9}$)	-1.04	***	-.99	***	-	***
PI x Cat. hedonism ($\gamma_{1,10}$)	.25	***	.19	***	+	***
SF ($\gamma_{2,0}$)	.11	***	.66	***	+	***
SF x Private label ($\gamma_{2,1}$)	-.23	***	-.56	***	-	***
SF x Brand price premium ($\gamma_{2,2}$)	-.03	***	.13	***	+	**
SF x Brand price volatility ($\gamma_{2,3}$)	3.34	***	1.69	***	+	***
SF x Brand market share ($\gamma_{2,4}$)	-.26	***	-.47	***	-	***
SF x Cat. price level ($\gamma_{2,5}$)	.07	***	.10	***	+	***
SF x Cat. no. of brands ($\gamma_{2,6}$)	.00		-.004	**	-	*
SF x Cat. advertising intensity ($\gamma_{2,7}$)	-.65	***	-2.50	***	-	***
SF x Cat. impulse buying ($\gamma_{2,8}$)	-.02	*	.02		-	
SF x Cat. involvement ($\gamma_{2,9}$)	-.03	***	.10	***	+	
SF x Cat. hedonism ($\gamma_{2,10}$)	.05	***	-.01		+	***
PI x SF ($\gamma_{3,0}$)	-2.66	***	-.62	**	-	***
PI x SF x Private label ($\gamma_{3,1}$)	-2.20	***	-1.47	**	-	***
PI x SF x Brand price premium ($\gamma_{3,2}$)	.27	***	.80	***	+	***
PI x SF x Brand price volatility ($\gamma_{3,3}$)	2.99	*	-4.70		+	
PI x SF x Brand market share ($\gamma_{3,4}$)	.78		-1.18		+	
PI x SF x Cat. price level ($\gamma_{3,5}$)	.42	***	.70	***	+	***
PI x SF x Cat. no. of brands ($\gamma_{3,6}$)	-.01		-.00		+	
PI x SF x Cat. advertising int. ($\gamma_{3,7}$)	8.67	***	-19.56	***	-	
PI x SF x Cat. impulse buying ($\gamma_{3,8}$)	.12		.67	**	+	
PI x SF x Cat. involvement ($\gamma_{3,9}$)	-.02		.17		+	
PI x SF x Cat. hedonism ($\gamma_{3,10}$)	-.12	**	-.45	***	-	***

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Unstandardized coefficients.

Table 9: Results Category Sales Model

	Super-markets	Discounters	Meta-analytic Z
Level 1			
Regular price (β_4)	-.02	-1.38 ***	- ***
Cross-brand competitive PI (β_5)	.04 ***	.12 ***	+ ***
Cross-retailer competitive PI (β_6)	.00	-.10 ***	-
Cross-brand competitive SF (β_7)	.19 ***	.19 ***	+ ***
Cross-retailer competitive SF (β_8)	.05 ***	.00	+ ***
Manufacturer TV advertising (β_9)	.00 **	.00 ***	+ ***
Retailer TV advertising (β_{10})	.01 ***	.01 ***	+ ***
Inventory (β_{11})	-.02 ***	-.02 ***	- ***
Christmas (β_{12})	-.07 ***	-.12 ***	- ***
Easter (β_{13})	.05 ***	.01	+ ***
Trend (β_{14})	-.01 ***	.01 ***	+
Level 2, k = 1			
PI ($\gamma_{1,0}$)	-.87 ***	-.62 ***	- ***
….			
Level 2, k = 2			
SF ($\gamma_{2,0}$)	.33 ***	.30 ***	+ ***
….			
Level 2, k = 3			
PI x SF ($\gamma_{3,0}$)	-1.25 ***	-.29 **	- ***
PI x SF x Private label ($\gamma_{3,1}$)	-1.37 ***	.99 ***	-
PI x SF x Brand price premium ($\gamma_{3,2}$)	.18 ***	.38 ***	+ ***
PI x SF x Brand price volatility ($\gamma_{3,3}$)	-.40	5.46 **	+
PI x SF x Brand market share ($\gamma_{3,4}$)	-3.26 ***	.77	- ***
PI x SF x Cat. price level ($\gamma_{3,5}$)	-.26 ***	.57 ***	+
PI x SF x Cat. no. of brands ($\gamma_{3,6}$)	-.04 ***	.01	- ***
PI x SF x Cat. advertising int. ($\gamma_{3,7}$)	4.31 ***	-8.76 ***	-
PI x SF x Cat. impulse buying ($\gamma_{3,8}$)	-.13	.40 **	+
PI x SF x Cat. involvement ($\gamma_{3,9}$)	.10	.05	+
PI x SF x Cat. hedonism ($\gamma_{3,10}$)	-.18 **	-.19 ***	- ***
Number of observations	163,060	120,494	

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Unstandardized coefficients.
Full results are available upon request.

Figure 1: Synergies between Price Cuts (PC) and Store Flyer Advertising (SF)

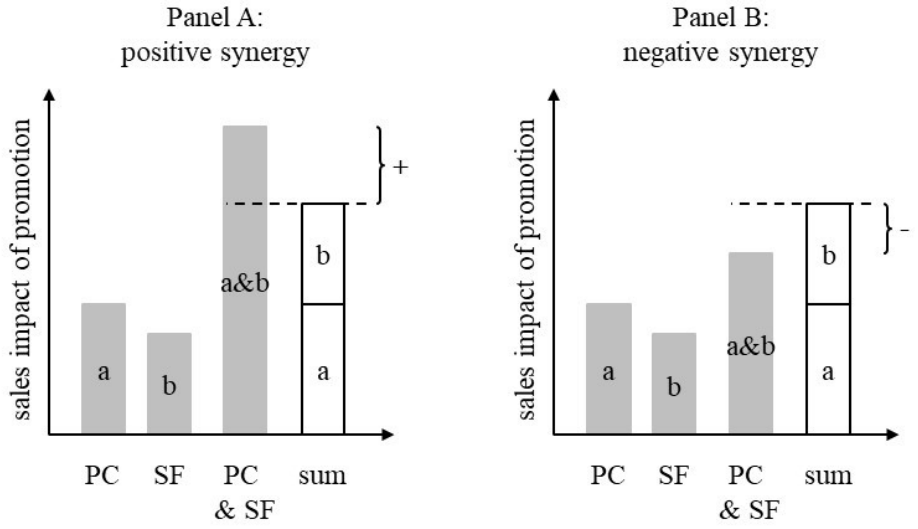


Figure 2: Research Framework

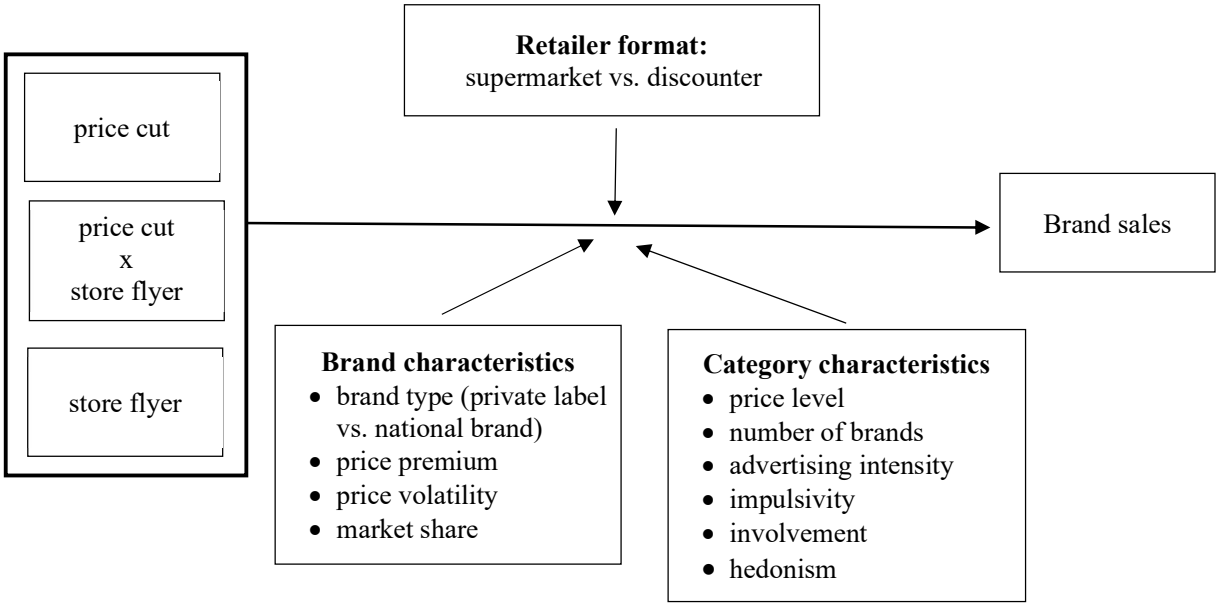
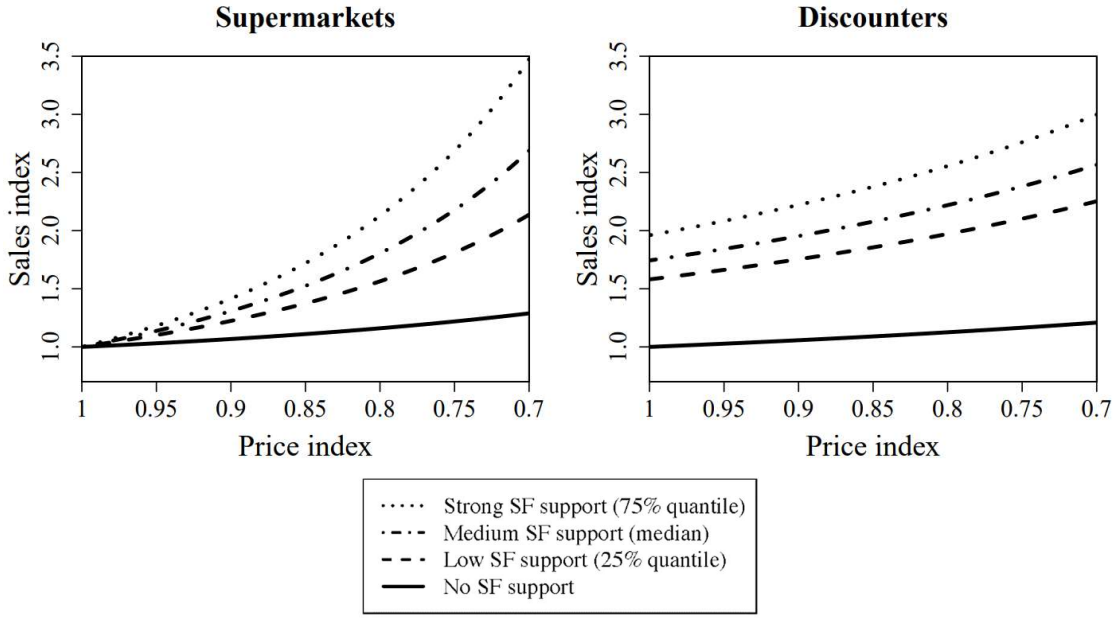
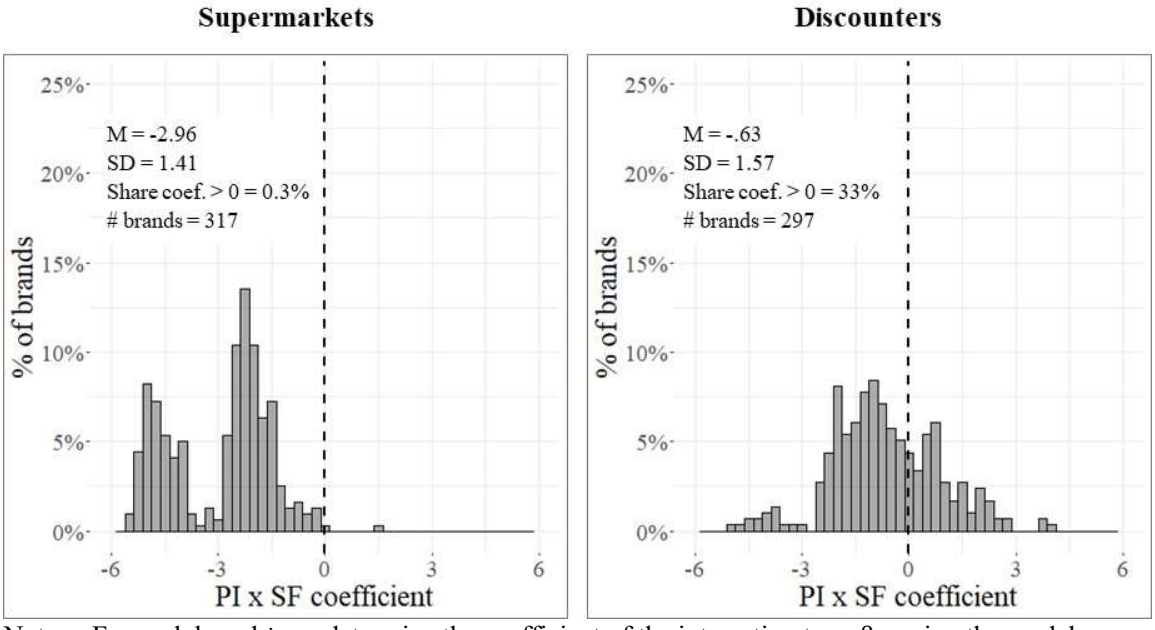


Figure 3: Effect of Price Cuts for Different Levels of Store Flyer Support



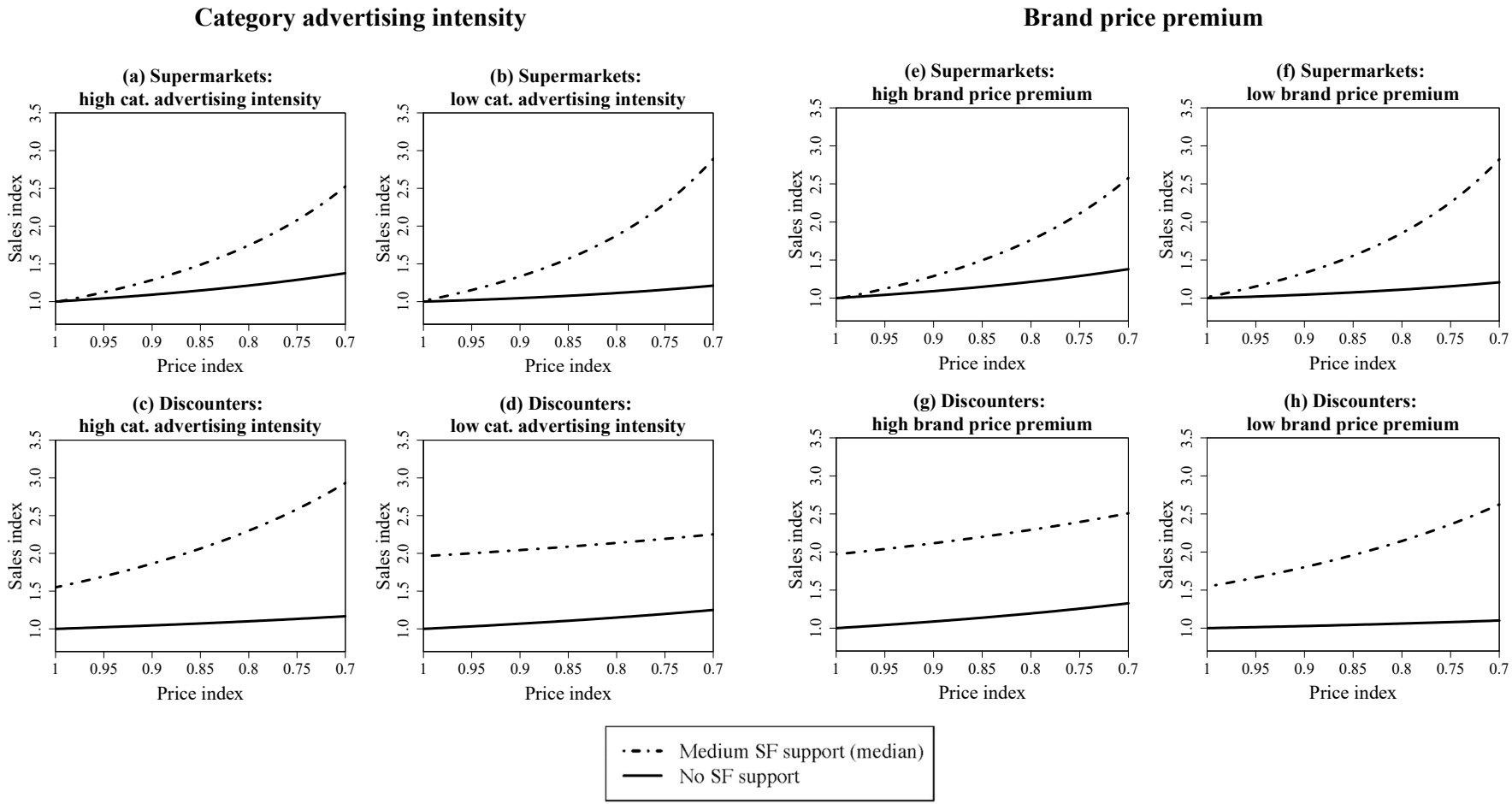
Notes: Sales indexed to 1 for a case without price cut (price index = 1) and without store flyer advertising. Quantiles for SF support are based on observations with GAV > 0.

Figure 4: Distribution of the Interaction between Price Cuts and Store Flyer Advertising



Notes: For each brand *i*, we determine the coefficient of the interaction term $\beta_{3,i}$ using the model estimates in Table 8, Equation 2, k = 3, and each brand's values for the drivers in Equation 2, k = 3. Since several national brands are sold by both supermarkets and discounters, the number of brands across the two subgroups (N=614) exceeds the total number of brands in our analyses (N=488).

Figure 5: Synergy at Different Levels of Drivers



Notes: Sales indexed to 1 for a case without price cut (price index = 1) and without store flyer advertising. Median SF support based on observations with GAV > 0.

Web Appendix

WEB APPENDIX 1: OPERATIONALIZATION OF VARIABLES

We use German consumer panel data from GfK to determine our sales and price variables, and data from FOCUS Marketing Research to determine the store flyer variables. Our **unit of analysis** is combinations of brands, retailers, regions, and brands. We define four geographic regions to cater for local differences in retailers' marketing. The regions (North, South, West, and East) are combinations of states, and have between ~13m and ~29m inhabitants.

GfK consumer panel

Our data contains detailed records of the purchases made by all households in the panel at the six largest retailers in Germany between January 1, 2016 and December 31, 2017.

Since products within a product category often vary in their package size, we express volume sales in a **volume equivalent** for each category (e.g., in kilogram or liter) as a standard unit. Similarly, we express all price variables as a price per volume equivalent to make products with varying package sizes comparable.

We first **aggregate the data** for each SKU to the level of retailer-region-week combinations. We obtain weekly revenues and sales for each SKU at retailer *r* in region *a* in week *t* by summing up all revenues and sales (in volume equivalents) of that SKU at retailer *r* in region *a* in week *t*. We compute the **actual price** for each SKU at retailer *r* in region *a* in week *t* by dividing revenues of that SKU at retailer *r* in region *a* in week *t* by volume sales of that SKU at retailer *r* in region *a* in week *t*.

FOCUS Marketing Research

We use data from FOCUS Marketing Research on store flyers. It contains detailed information on all store flyers by the six retailers during our observation period. Since retailers' store flyer advertising is to a great extent organized locally, data is provided on the level of retailer-specific areas, and we aggregate it to our four regions.

Advertising is operationalized as **gross advertising value** (GAV). The GAV captures all printing and distribution costs. It reflects the store flyers' reach and the size of the ads.

In addition, we use data from Nielsen and a consumer survey, as described in section 4.

We explain the operationalization of all variables in our model in Table W1:

Table W1: Variable Operationalization and Example Calculations

Panel A – Variables in Level 1 Model

Variable (source)	Symbol	Operationalization	Example calculation
Sales (GfK)	S_{irat}	Volume sales of brand *i* at retailer *r* in region *a* in week *t* = sum of sales (in volume equivalents) across all SKUs of brand *i* at retailer *r* in region *a* in week *t*	*Volume sales of all SKUs of brand i at retailer r in region a* in week *t:* SKU1 = 300 liters SKU2 = 900 liters **S_{irat}** = 300 + 900 = 1,200 liters
Regular price (GfK)	$Preg_{irat}$	Regular (or 'baseline') price of brand *i* at retailer *r* in region *a* in week *t* We compute the regular price for each SKU of brand *i* at retailer *r* in region *a* in week *t* as the highest actual price (per volume equivalent) of the SKU at retailer *r* in region *a* in the most recent four weeks *(t, t-1, t-2, t-3*). For each retailer-region-week combination, we then take the mean across the SKUs of brand *i*, using as weights each SKU's share in total brand volume sales at that retailer-region in a rolling window of the most recent quarter (13 weeks).	*Highest actual price of SKUs of brand i at retailer r in region a in most recent 4 weeks:* SKU1 = 1.5 €/l SKU2 = 1 €/l *Weights:* SKU1 = 1,000 l/4,000 l = .25 SKU2 = 3,000 l/4,000 l = .75 **$Preg_{irat}$** = (.25·1.5) + (.75·1) = 1.125 €/l
Price index (GfK)	PI_{irat}	Price index of brand *i* at retailer *r* in region *a* in week *t* We compute the price index for each SKU of brand *i* at retailer *r* in region *a* in week *t* as the ratio of the actual price of the SKU (per volume equivalent) to the regular price of the SKU (per volume equivalent) at retailer *r* in region *a* in week *t*.	*Actual price of SKUs of brand i at retailer r in region a in week t:* SKU1 = 1.5 €/l SKU2 = .80 €/l *Regular price of SKUs of brand i at retailer r in region a in week t:* SKU1 = 1.5 €/l

		For each retailer-region-week combination, we then take the mean across the SKUs of brand *i*, using as weights each SKU's share in total brand volume sales at that retailer-region in a rolling window of the most recent quarter (13 weeks).	SKU2 = 1 €/l *Price index (PI) of SKUs of brand i at retailer r in region a in week t:* SKU1 = 1.5/1.5 = 1 (no promotion) SKU2 = .80/1 = .80 (20% price discount) *Weights):* SKU1 = 1,000 l/4,000 l = .25 SKU2 = 3,000 l/4,000 l = .75 **PI_{irat}** = (.25·1) + (.75·.80) = .85
Cross-brand competitive price index (GfK)	$cbPI_{irat}$	Price index for brands that compete with brand *i* at retailer *r* in region *a* in week *t* For each retailer-region-week combination, we take the mean of the brand-specific PIs across all brands that compete with brand *i* at retailer *r* in region *a* in week *t* (i.e., the other brands in the category of brand *i*), using as weights each competing brand's share in total volume sales at retailer *r* in region *a* across all competing brands in a rolling window of the most recent quarter (13 weeks).	*Price index (PI) for brands that compete with brand i = 1 at retailer r in region a in week t:* BRAND2 = 1 (no promotion) BRAND3 = .75 (25% price discount) BRAND4 = .90 (10% price discount) *Weights:* BRAND2 = 100 l/400 l = .25 BRAND3 = 200 l/400 l = .50 BRAND4 = 100 l/400 l = .25 **$cbPI_{irat}$** = (.25·1.00) + (.50·.75) + (.25·.90) = .85
Cross-retailer competitive price index (GfK)	$crPI_{irat}$	Price index for brand *i* at retailers that compete with retailer *r* in region *a* in week *t* For each region-week combination, we take the mean of the PIs of brand *i* across all retailers that compete with retailer *r* and offer brand *i* in region *a* in week *t*, using as weights each competing retailer's share in total volume sales of brand *i* in region *a* across all competing retailers in a rolling window of the most recent quarter (13 weeks).	*Price index (PI) for brand i at retailers that compete with retailer r = 1 in region a in week t:* RETAILER2 = 1 (no promotion) RETAILER3 = .75 (25% price discount) RETAILER4 = .90 (10% price discount) *Weights:* RETAILER2 = 5,00 l/2,000 l = .25 RETAILER3 = 1,000 l/2,000 l = .50 RETAILER4 = 5,00 l/2,000 l = .25

			crPI$_{irat}$ = (.25·1.00) + (.50·.75) + (.25·.90) = .85
Store flyers (FOCUS)	SF$_{irat}$	Gross advertising value (GAV) for store flyers of brand *i* at retailer *r* in region *a* in week *t* We rescale the store flyer variable to make it comparable across the four regions by dividing it by the median GAV for store flyers in region *a* across all brand-retailer-week combinations with GAV > 0.	*GAV for store flyers of brand i at retailer r in region a:* WEEK 1 = €12,000 WEEK 2 = €7,000 Median across all brand-retailer-week combinations in region *a* = €10,000 **SF$_{ira,1}$** = €12,000 / €10,000 = 1.2 **SF$_{ira,2}$** = €7,000 / €10,000 = .7
Cross-brand competitive store flyers (FOCUS)	cbSF$_{irat}$	Gross advertising value (GAV) for store flyers at retailer *r* in region *a* in week *t* across all brands that compete with brand *i* at retailer *r* in region *a* in week *t* (i.e., the other brands in the category of brand *i*). We rescale the store flyer variable to make it comparable across the four regions by dividing it by the median GAV for cross-brand competitive store flyers in region *a* across all brand-retailer-week combinations with GAV > 0.	*GAV for store flyers of brands that compete with brand i = 1 at retailer r in region a in week t:* BRAND2 = €10,000 BRAND3 = €10,000 Sum of cross-brand GAV for store flyers = €10,000 + €10,000 = €20,000 Median of cross-brand GAV for store flyers across all brand-retailer-week combinations in region *a* = €25,000 **cbSF$_{irat}$** = €20,000 / €25,000 = .8
Cross-retailer competitive store flyers (FOCUS)	crSF$_{irat}$	Gross advertising value (GAV) for store flyers of brand *i* in region *a* in week *t* across all retailers that compete with retailer *r* in region *a* in week *t.* We rescale the store flyer variable to make it comparable across the four regions by dividing it by the median GAV for cross-retailer competitive store flyers in region *a* across all brand-retailer-week combinations with GAV > 0.	*GAV for store flyers of brand i at retailers that compete with retailer r = 1 in region a in week t:* RETAILER2 = €10,000 RETAILER3 = €10,000 Sum of cross-retailer GAV for store flyers across all brand-retailer-week combinations in region *a* = €10,000 +

			€10,000 = €20,000 Median of cross-retailer GAV for store flyers across all brand-retailer-week combinations in region 1 = €25,000 **crSF$_{irat}$** = €20,000 / €25,000 = .8
Manufacturer TV advertising stock (Nielsen)	AdvM$_{it}$	Manufacturer (national) TV advertising expenditures for brand *i* in week *t* (in €1,000) (source: Nielsen) We transform expenditures into a stock variable, using an exponential smoothing parameter of .7. We initialize the variable with the mean weekly expenditure of brand *i* across the first 26 weeks.	*Manufacturer TV advertising expenditures for brand i:* Mean advertising expenditure in first 26 weeks = T€9,500 WEEK2 = T€8,000 WEEK3 = T€12,000 *Computation of stock variable:* **AdvM$_{i,1}$** = T€9,500 **AdvM$_{i,2}$** = T€9,500*.7 + T€8,000 * (1-.7) = €9,050 **AdvM$_{i,3}$** = T€9,050*.7 + T€12,000 * (1-.7) = T€9,935
Retailer TV advertising stock (Nielsen)	AdvR$_{rt}$	Retailer (national) TV advertising expenditures of retailer *r* in week *t* (in €1,000) (source: Nielsen) We transform expenditures into a stock variable, using an exponential smoothing parameter of .7. We initialize the variable with the mean expenditure of retailer r across the first 26 weeks.	*Retailer TV advertising expenditures of retailer r:* Mean advertising expenditure in first 26 weeks = T€9,500 WEEK2 = T€8,000 WEEK3 = T€12,000 *Computation of stock variable:* **AdvR$_{r,1}$** = T€9,500 **AdvR$_{r,2}$** = T€9,500*.7 + T€8,000 * (1-.7) = €9,050 **AdvR$_{r,3}$** = T€9,050*.7 + T€12,000 * (1-.7) = T€9,935
Inventory (GfK)	INV$_{irat}$	Inventory for brand *i* at retailer *r* in region *a* in week *t* (Kopalle, Mela and Marsh 1999)	*Volume sales of brand i at retailer r in region a:*

		= $INV_{irat-1} + (S_{irat-1} - \overline{S}_{ira})$, where $\overline{S}_{ira}$ is mean weekly sales of brand *i* at retailer *r* in region *a* across all weeks We initialize the variable with the mean weekly sales of brand *i* at retailer *r* in region *a* across the first 26 weeks. In order to prevent negative inventory levels and to be able to log-transform the variable, we add the minimum inventory level for brand *i* at retailer *r* in region *a*.	Min. volume sales of brand i at retailer r in region a in first 26 weeks = 2 liter Mean volume sales of brand i at retailer r in region a in first 26 weeks = 500 liter WEEK1 = 400 liters WEEK2 = 300 liters Mean volume sales of brand i at retailer r in region a across all 104 weeks = 520 liters *Computation of stock variable:* **$INV_{ira,1}$** = 500 l + 2l = 502 l **$INV_{ira,2}$** = 500 l + (400 l - 520 l) + 2l = 382 l **$INV_{ira,3}$** = 380 l + (300 l - 520 l) + 2l = 162 l
Copula term for price (Preg or PI) and store flyer (SF) variables (GfK)	Cop_{cirat}	$\Phi^{-1}(H(PRICE_{cirat}))$ where Φ^{-1} is the inverse of the cumulative normal distribution function, and H(.) the empirical distribution of the PRICE variable *c*, with *c* equals either PI, Preg, or SF.	*Regular price for brand i at retailer r in region a:* WEEK1 = 1.5 €/l WEEK2 = 1.45 €/l WEEK3 = 1.55 €/l *$H(Preg_{irat})$:* WEEK1 = .667 WEEK2 = .333 WEEK3 = .999* **$Cop_{Preg\ irat}$** = *$\Phi^{-1}(H(Preg_{irat})$:* WEEK1 = .431 WEEK2 = -.431 WEEK3 = 5.199 * set to $1\text{-}10^{-15}$ since the empirical distribution function at 1 does not exist.

Panel B – Variables in Level 2 Model

Variable	Symbol	Operationalization	Example calculation
Brand type	B.PRIVATE	Brand type of brand i (1 if private label, 0 if national brand)	
Brand price premium over PL (GfK)	$B.PRIPREM_i$	Price premium of brand *i* over private label prices (Ailawadi, Lehmann, and Neslin 2003) We compute brand *i*'s price premium for each retailer-region combination that carries brand *i* as the ratio of the mean regular price ($Preg_i$) of brand *i* at retailer *r* in region *a* across all weeks to the mean regular price of the private label(s) ($Preg_{PL}$) offered in the category of brand *i* at retailer *r* in region *a* across all weeks. We then take the mean across these retailer-region combinations, using as weights each retailer-region combination's share in total category volume sales across all weeks. If retailer *r* in region *a* offers more than one private label in the category, we compute $Preg_{PL}$ as the mean regular price across the private labels, using as weights their share in total private label volume sales of brand i's category at retailer *r* in region *a* across all weeks. We consider only regular private labels, not premium private labels.	*Mean regular prices across all weeks of brand i & the PL for each retailer-region combination:* RET-REG1: brand *i*:= 1.5 €/l; PL: 1.1 €/l RET-REG2: brand *i*: = 1.3 €/l; PL: 1.0 €/l RET-REG3: brand *i*: = 1.3 €/l; PL: .9 €/l *Weights:* RET-REG1 = 10m liters/40m liters = .25 RET-REG2 = 15m liters/40m liters = .375 RET-REG3 = 15m liters/40m liters = .375 **$B.PRIPREM_i$** = .25·(1.5/1.1) + .375·(1.3/1.0) + .375·(1.3/.9) = 1.34
Brand price volatility (GfK)	$B.PRIVOL_i$	Price volatility across time of brand *i* We compute brand *i*'s price volatility for each retailer-region combination that carries brand *i* as the coefficient of variation of the actual price of brand *i* at retailer *r* in region *a* across all weeks.	*Coefficient of variation of actual price of brand i across all weeks at each retailer-region combination:* RET-REG1 = .25 RET-REG2 = .15 RET-REG3 = .10

		We then take the mean across these retailer-region combinations, using as weights each retailer-region combination's volume sales across all weeks.	*Weights:* RET-REG1 = 1,000 l/8,000 l = .125 RET-REG2 = 2,000 l/8,000 l = .25 RET-REG3 = 5,000 l/8,000 l = .625 **B.PRIVOLA$_i$ =** .125 * .25 + .25 * .15 + .625 * .10 = .131
Brand market share (GfK)	B.MS$_i$	Market share of brand *i* = volume sales of brand *i* in the market (summed across all retailer-region-week combinations) divided by volume sales of the category of brand *i* in the market.	*Volume sales of brand i in the market:* VOLi = 50,000 liters *Volume sales of the category of brand i in the market:* VOLcat = 400,000 liters **B.MS$_i$ =** 50,000 l/400,000 l = .125
Category price level (GfK)	C.PRILEV$_i$	Average price level for one unit in the category of brand *i* We determine the mean price per unit (e.g., bottle or package) by dividing the sum of the revenues in the category of brand *i* in the market (summed across all brand-retailer-region-week combinations) by the number of units sold in the category of brand *i* in the market.	*Revenues in the category of brand i:* REVcat = €7.5m Unit sales in the category of brand *i*: VOLcat = 700,000 units **C.PRILEV$_i$ =** €7.5m / 700,000 = €10.71
Number of brands in category (GfK)	C.NBRDS$_i$	Number of brands in category of brand *i* = total number of brands that are sold in the category of brand *i* across all retailer-region-week combinations and that meet our selection criteria (see section 4)	
Category advertising intensity (Nielsen)	C.ADV$_i$	TV advertising by all manufacturers in the category of brand *i* We divide manufacturer TV advertising spending in the category of brand *i* (in €, summed across all brands in the category and across all weeks) by the sum of manufacturer TV advertising spending across *all* 44 categories in our dataset.	*TV advertising by all brands in the category across all weeks:* CAT1 = € 15m CAT2 = € 20m CAT3 = € 5m *For brand i that is sold in category 1:* **C.ADV$_i$ =** €15 m / (€15 m + €20 m + €5 m)

			= .375
Category impulsivity (survey)	$C.IMPULS_i$	Impulse buying in category of brand *i.* Measured on a 2-item scale from 1=low impulse to 7=high impulse (Rook and Fisher 1995): - *"I often buy things spontaneously from the category (category)."* - *"I often buy things from the category (category) without thinking."*	
Category involvement (survey)	$C.INVOLV_i$	Involvement in category of brand *i.* Measured on a 2-item scale from 1=low involvement to 7=high involvement (Zaichkowsky 1985): - *"The category (category) interests me."* - *"The category (category) is important to me."*	
Category hedonism (survey)	$C.HEDON_i$	Hedonic (vs. utilitarian) nature of category of brand *i.* Measured on a single-item scale from 1=utilitarian to 7=hedonic (Voss, Spangenberg, and Grohmann 2003): *"Hedonic products are pleasant and fun, something that is enjoyable and appeals to the senses, e.g., perfume. Utilitarian products are useful, practical, and functional, something that helps achieve a goal, e.g., a backpack. Is the category (category) more hedonic or more utilitarian?"*	

WEB APPENDIX 2: RETAILER PROMOTION ACTIVITY BY RETAIL CHAIN

Table W2: Retailer Promotion Activity by Retail Chain

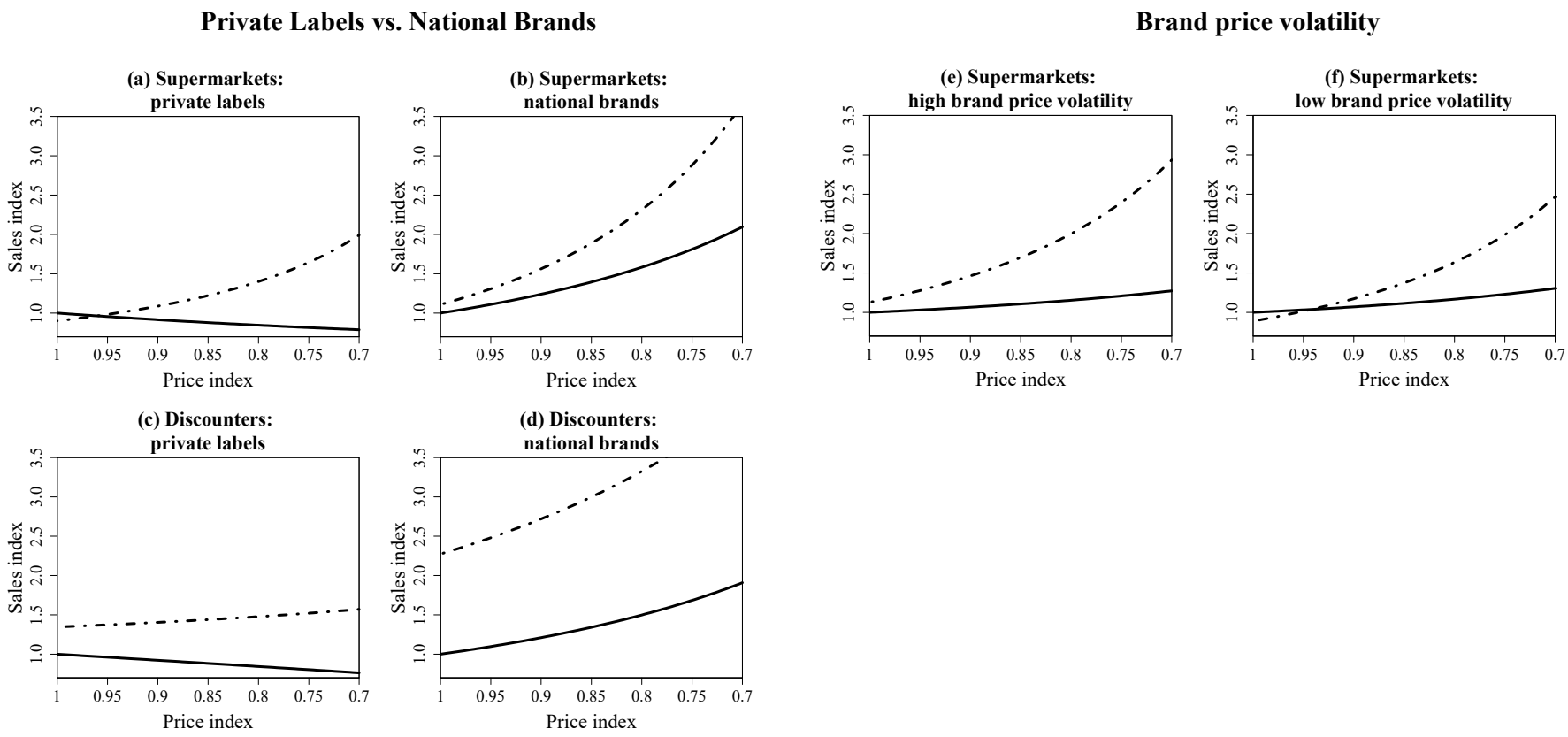
		Supermarkets			Discounters		
	Promotion type	**Retailer 1**	**Retailer 2**	**Retailer 3**	**Retailer 4**	**Retailer 5**	**Retailer 6**
a	Price cut only	4,852 (26%)	5,761 (18%)	3,901 (25%)	1,203 (20%)	3,374 (31%)	6,178 (56%)
b	Store flyer only	6,955 (37%)	15,437 (48%)	5,107 (33%)	2,816 (48%)	4,758 (44%)	2,336 (21%)
a&b	Price cut & store flyer	6,988 (37%)	10,938 (34%)	6,628 (42%)	1,870 (32%)	2,630 (24%)	2,562 (23%)

Notes: Number of brand-retailer-region-week combinations (share of the total number of observations for the respective retailer format). Based on brand-retailer-region combinations with at least one form of marketing support (price cut only, store flyer only, or both).

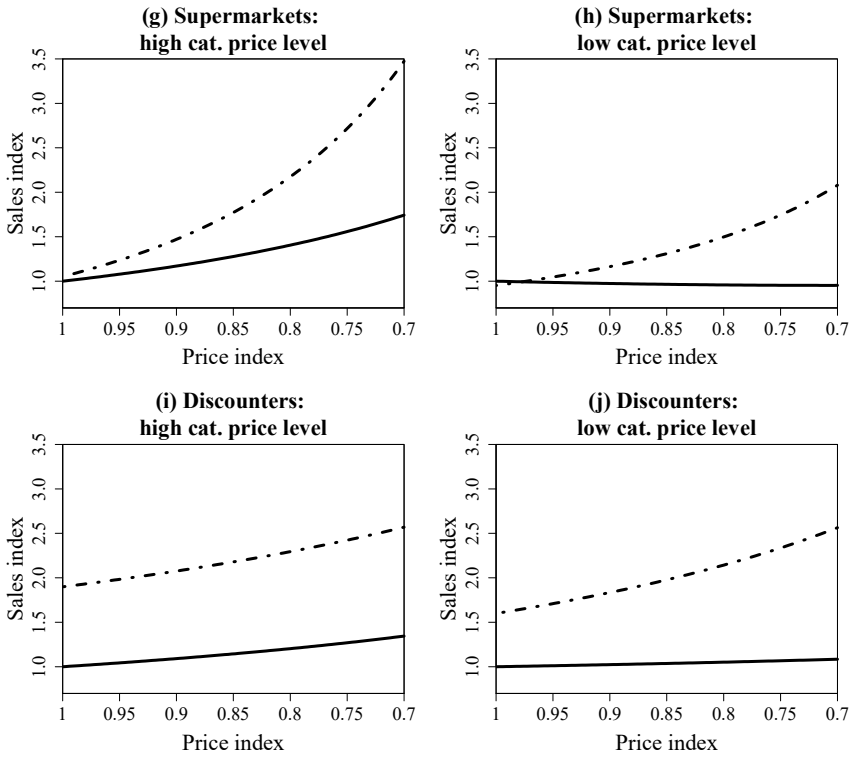
WEB APPENDIX 3: EFFECTS OF DRIVERS ON THE SYNERGY BETWEEN PRICE CUTS AND STORE FLYER ADVERTISING

The following Figure W3 shows the simulation results for the synergy at different levels of drivers. It includes drivers for which we find significant effects (Table 8) and that are not already depicted in Figure 5.

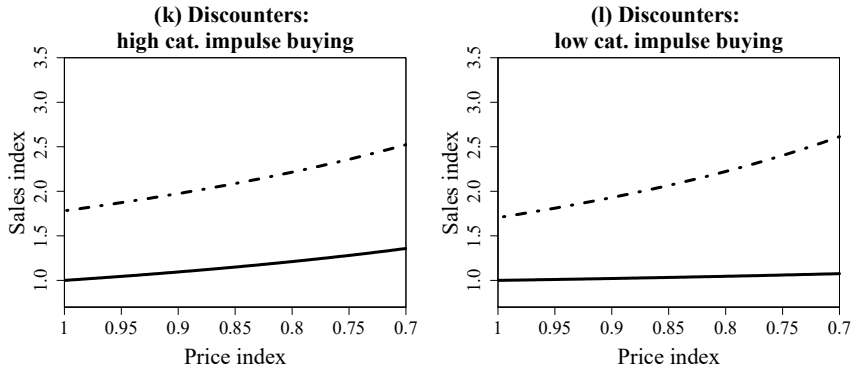
Figure W3: Synergy at Different Levels of Drivers



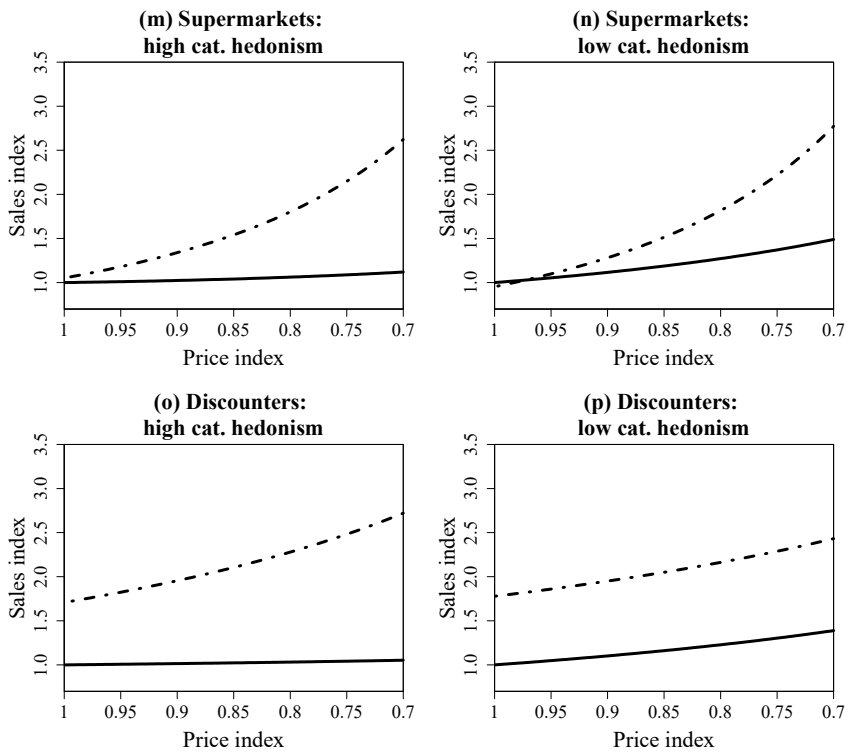
Category price level



Category impulse buying



Category hedonism



In all four robustness checks, the results are very similar to those from the main model (see Table W4.2). The average synergy is positive in all cases, as indicated by negative interaction effects in the first three robustness checks, and a comparison of multipliers for the different promotion scenarios in the fourth check. In the second check, the negative interaction is no longer significant at discounters, which may be due to a much smaller sample size (see Table W4.1). In the first three robustness checks, we find that the mean interaction is significantly larger at discounters than at supermarkets ($p < .01$), in line with the main model results and our expectation of a less favorable synergy at discounters. Note that we no longer directly estimate an interaction in RC 4 (which contains dummy variables for different promotion scenarios).

Table W4.1: Sample Sizes

	Supermarkets	**Discounters**
Main model	163,060	120,494
RC 1: No exclusion of outliers	164,175	121,200
RC 2: Only brands with all promotion scenarios	139,345	78,583
RC 3: Alternative number added to continuous variables with zero values	163,060	120,494
RC 4: Dummy coding for promotion tools	163,060	120,494

Notes: Number of brand-retailer-region-week combinations. RC = Robustness Check.

Table W4.2: Model Coefficients in the Robustness Checks: Effects of Price Cuts and Store Flyer advertising, Interaction and its Drivers

	Supermarkets	Discounters	Meta-analytic Z
Main model			
PI ($\gamma_{1,0}$)	-1.53 ***	-.63 ***	- ***
SF ($\gamma_{2,0}$)	.11 ***	.66 ***	+ ***
PI x SF ($\gamma_{3,0}$)	-2.66 ***	-.62 **	- ***
PI x SF x Private label ($\gamma_{3,1}$)	-2.20 ***	-1.47 **	- ***
PI x SF x Brand price premium ($\gamma_{3,2}$)	.27 ***	.80 ***	+ ***
PI x SF x Brand price volatility ($\gamma_{3,3}$)	2.99 *	-4.70	+
PI x SF x Brand market share ($\gamma_{3,4}$)	.78	-1.18	+
PI x SF x Cat. price level ($\gamma_{3,5}$)	.42 ***	.70 ***	+ ***
PI x SF x Cat. no. of brands ($\gamma_{3,6}$)	-.01	.00	+ *
PI x SF x Cat. advertising int. ($\gamma_{3,7}$)	8.67 ***	-19.56 ***	-
PI x SF x Cat. impulse buying ($\gamma_{3,8}$)	.12	.67 **	+
PI x SF x Cat. involvement ($\gamma_{3,9}$)	-.02	.17	+
PI x SF x Cat. hedonism ($\gamma_{3,10}$)	-.12 **	-.45 ***	- ***
RC 1: No exclusion of outliers			
PI ($\gamma_{1,0}$)	-1.51 ***	-.63 ***	- ***
SF ($\gamma_{2,0}$)	-.20 ***	.53 ***	+ ***
PI x SF ($\gamma_{3,0}$)	-2.88 ***	-.83 ***	- ***
PI x SF x Private label ($\gamma_{3,1}$)	-2.43 ***	-1.20 **	- ***
PI x SF x Brand price premium ($\gamma_{3,2}$)	.15 *	.83 ***	+ ***
PI x SF x Brand price volatility ($\gamma_{3,3}$)	4.18 ***	-2.12	+ **
PI x SF x Brand market share ($\gamma_{3,4}$)	.86	-.83	+
PI x SF x Cat. price level ($\gamma_{3,5}$)	.38 ***	.60 ***	+ ***
PI x SF x Cat. no. of brands ($\gamma_{3,6}$)	-.01	.01	-
PI x SF x Cat. advertising int. ($\gamma_{3,7}$)	9.92 ***	-17.30 ***	+
PI x SF x Cat. impulse buying ($\gamma_{3,8}$)	.02	.58 **	+
PI x SF x Cat. involvement ($\gamma_{3,9}$)	-.20	.32	-
PI x SF x Cat. hedonism ($\gamma_{3,10}$)	-.08	-.36 ***	- ***
RC 2: Only brands with all promotion scenarios			
PI ($\gamma_{1,0}$)	-2.02 ***	-1.16 ***	- ***
SF ($\gamma_{2,0}$)	-.15 ***	.81 ***	+ ***
PI x SF ($\gamma_{3,0}$)	-2.36 ***	-.03	- ***
PI x SF x Private label ($\gamma_{3,1}$)	-1.12 *	-.28	-
PI x SF x Brand price premium ($\gamma_{3,2}$)	.15 *	.13 ***	+ ***
PI x SF x Brand price volatility ($\gamma_{3,3}$)	3.88 **	-8.15 *	+
PI x SF x Brand market share ($\gamma_{3,4}$)	.67	-2.34	+
PI x SF x Cat. price level ($\gamma_{3,5}$)	.38 ***	.60 **	+ ***
PI x SF x Cat. no. of brands ($\gamma_{3,6}$)	-.01	-.02	-
PI x SF x Cat. advertising int. ($\gamma_{3,7}$)	10.23 ***	-19.06 ***	+ ***
PI x SF x Cat. impulse buying ($\gamma_{3,8}$)	.11	.69 *	+
PI x SF x Cat. involvement ($\gamma_{3,9}$)	-.21	.47	-
PI x SF x Cat. hedonism ($\gamma_{3,10}$)	-.11 **	-.55 ***	- ***

RC 3: Alternative number added to continuous variables with zero values			
PI ($\gamma_{1,0}$)	-1.44 ***	-.25	- ***
SF ($\gamma_{2,0}$)	.57 ***	.50 ***	+ ***
PI x SF ($\gamma_{3,0}$)	-1.09 ***	-.49 ***	- ***
PI x SF x Private label ($\gamma_{3,1}$)	-.66 **	-.31	- ***
PI x SF x Brand price premium ($\gamma_{3,2}$)	.00	.44 ***	+ ***
PI x SF x Brand price volatility ($\gamma_{3,3}$)	-.52	-1.36	-
PI x SF x Brand market share ($\gamma_{3,4}$)	-.08	-.01	-
PI x SF x Cat. price level ($\gamma_{3,5}$)	.15 ***	.38 ***	+ ***
PI x SF x Cat. no. of brands ($\gamma_{3,6}$)	-.01 *	.00	-
PI x SF x Cat. advertising int. ($\gamma_{3,7}$)	5.28 ***	-7.73 ***	+
PI x SF x Cat. impulse buying ($\gamma_{3,8}$)	-.04	.15	+
PI x SF x Cat. involvement ($\gamma_{3,9}$)	-.06	-.13	-
PI x SF x Cat. hedonism ($\gamma_{3,10}$)	-.03	-.12 **	- *
RC 4: Dummy coding marketing instruments			
PI	.48 ***	.43 ***	+ ***
SF	.30 ***	.72 ***	+ ***
PI & SF	1.19 ***	1.27 ***	+ ***

Notes: * $p < .10$, ** $p < .05$, *** $p < .01$. Unstandardized coefficients.

In RC 4, the coefficients are logarithmized multipliers. E.g., exp(.48) = 1.62 is the multiplier for price cuts only at supermarkets, indicating that a price cut increases sales by 62%.