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I'll Try That, Too – A Field Experiment in Retailing on the Effect of Variety During Display Promotions

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Abstract: *The effect of variety on consumer choice has been studied extensively, with some stream of literature showing the positive effects on choice and others arguing that too many alternatives may result in negative consequences (i.e., choice deferral or no purchase at all), often referred to as choice overload. In a field experiment with a major chocolate brand conducted at a German retail chain, we test for variety during a price and display promotion. Participating stores either include the full variety of products on the display or a reduced selection (low variety). Contrary to the literature on choice overload, we find a significantly positive effect of the display promotion on unit sales, which is stronger for stores with high variety. Further findings show a stronger promotion uplift for less popular products in stores with high variety on the display. This suggests that more variety may increase consumers' willingness to try new products, when the financial risk is low. We also test for the effect of product distribution on displays by analysing the number of facings. Additionally, we introduce an approach to determine an optimal space allocation of products on the display. Our findings suggest that an even distribution results in the highest profits for the retailer. We contribute to the literature on variety for consumer choices by offering insights from actual purchases with store-level scanner data of display promotions.* [1]

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1 Introduction

Promotions at the point of sale (PoS) account for a large part of overall expenses in retailing. For example, in Germany, about 10% of gross advertising expenditures is spent for PoS marketing (11.2% in 2017, 9.8% in 2019; EHI Marketingmonitor). Although digital alternatives are on the rise, the more traditional promotional instruments such as in-store displays at the PoS are still applied on a regular basis explaining the relevant share of spending. They are used to boost sales of certain product categories, for the introduction of new products and simply to get the attention of shoppers given the seemingly endless choices they are facing.

Previous literature confirms the positive effect of implementing in-store displays (ISD) on consumer behavior: ISD are attention-grabbing due to the additional space and thus, help consumers when forming their consideration sets. This is specifically relevant to a brand currently on promotion. Increased attention by ISD, given the extensive number of alternatives in assortments in each product category, help to manage possible alternatives or by directing the customer's attention to a particular brand. On the other hand, research shows that too many alternatives (in a store) may have a negative effect on decision making as well, potentially resulting in a purchase delay or choice not to purchase at all (Iyengar and Lepper, 2000; Chernev et al., 2015). Does this apply similarly to the display space or do consumers react differently as the products presented are already a selection of the general assortment? More specifically, we ask what is the optimal level of variety (number of products) on the display? Is it better to focus on the best-selling products of a brand or to display the whole product line? Addressing marketing instruments at the point of sale is important because most purchase decisions happen when consumers are already in the store. Thus, attention-grabbing promotional tools can have a crucial impact on not only how many but also *which* products are bought in the end.

Displays offer an additional space (i.e., second placement) for the products on promotion and are usually placed in the store's main aisle or close to the checkouts in order to attract shoppers' attention. The underlying assumption that displays positively affect product purchases has been well confirmed by research (see, e.g., Wilkinson, Mason, and Paksoy, 1982; Inman, Winer, and Ferraro, 2009). Several studies show further, that displays can directly increase brand choice, even when controlling for the effect of other discounts (cf. Gupta, 1988; Erdem and Sun, 2002). Inman et al. (2009) suggest that the impact of promotional displays is even larger for unplanned purchases, meaning purchases consumers have not intended to do before entering the store. This is plausible, as products on displays are easily to grab and thus, displays can enhance unplanned purchases among customers.

One prominent behavioral explanation in the literature of why displays have an impact on brand choice is that they help to form consideration sets (Allenby and Ginter, 1995; Mehta et al., 2003). Consequently, brand choice that has not been planned in advance will be more susceptible for products on a display given the higher exposure to that brand. Displays are therefore a very effective point of sale marketing tool to increase (brand) sales.

Retailers have several options when planning an in-store display promotion. Since displays do not only differ according to their location in the store, but also to the size of the display or its layout. A display's layout may include, how many and which products are exhibited but also whether products are evenly or disproportionately distributed. In this paper, we will focus on the layout of the display and how it affects sales. More specifically, we test for the effect of variety offered on the display as well as the distribution of products.

A display's layout can be organized in two dimensions: firstly, which products and how many are selected to be displayed. A brand may decide to put all its products on the display or a selection. Secondly, displays usually provide more space than just enough to show every product once. The number of facings are often equally divided among the different products but this offers also the opportunity to show one product more dominantly by allocating it more facings (display space) compared to the other products. Arguments for such a skewed distribution may be that certain products are generally more popular or that a brand wants to attract more attention to a certain product, for example, if this is a newly introduced product to the brand's line. Or simply because some products sell better than others.

The present study aims to determine, how a variation in the display layout affects (aggregate) brand sales and, as a consequence, to identify the optimal display layout for retailers. In this context, we examine the role of variety on displays, as research shows both positive sides of variety (Lancaster, 1990) as well as negative consequences on choice behavior of consumers (Chernev et al., 2015; Iyengar and Lepper, 2000). By analyzing data from the field, we are able to provide results that reflect actual purchase behavior under regular shopping conditions.

There are several characteristics of ISD, that have been addressed in the literature to have an impact on consumer responses, e.g., what type of display is applied (i.e., end-cap display, shelf-adjustment, free-standing or digital) and where it is located within the store (Breugelmans and Campo, 2011; Garrido-Morgado et al., 2021; Han et al., 2022), the effect of showcasing complementary products on a display (Randon et al., 2021), and what type of store it is placed in (Roggeveen et al., 2016). We contribute to the research by focusing on the layout of a display addressing the variety of products on display and how the selection of products displayed can maximize purchase decisions of shoppers.

The distribution of products and their assigned number of facings are heavily researched with respect to shelf layout (see, e.g., Rooderkerk & Lehmann, 2021) but despite the recognizable costs and the perceived importance that is shown in the frequent application of displays in retailing, those effects have not been discussed further for displays. The aim of this research is to fill this gap. In our study, we use a field experiment to estimate the effect of different levels of variety on a display during a price promotion on unit sales for chocolate. We believe, that this approach provides valuable insights for both, retailers and manufacturers, on how to optimally organize in-store displays.

From the perspective of the retailer, it is not only relevant how many products are sold but also, which products are the better sellers, and adjust the supply accordingly in order to minimize costs (e.g., storage). The manufacturer on the other hand, is focused on maximizing profits by the optimal allocation of products in the stores and increasing their brand awareness. For both perspectives, an optimal display allocation positively can support their intentions.

We test two research questions regarding the layout of displays to determine, how a retailer can maximize the promotion effectiveness of a display, and further, use the results for managerial implications. One feature addresses the variety shown on a display. In our context, variety refers to the number of unique products placed on the display. Given research evidence on negative consequences of variety in choice, we test whether a higher number of products may actually cause an increase or a reduction in sales. Thus, our first research question addresses this issue: (1) What influence does variety on a display (high variety vs. reduced variety) have on the unit sales effect of a price promotion at the brand level? Based on the results, we identify the display variant with the greatest effect on unit sales.

The question of the effect of variety on consumer choice has been extensively discussed in research, mainly by addressing whether a choice has been made. Variety does not necessarily reflect solely *how many* products are sold but can also influence, *which* products consumers choose. For example, Babin, Darden and Griffin (1994) found that consumers perceive shopping as more enjoyable when variety is high compared to a reduced set of alternatives. A greater choice set may encourage consumers to explore products they usually exclude from their consideration set. We want to look specifically also on what choice a consumer makes depending on the number of alternatives presented to her. Thus, we further ask: (2) Does the choice situation (high variety vs. reduced variety) have an impact on the product-specific promotion effects? We test whether certain products experience a different effect on a display than others and how this varies between display variants.

As mentioned before, another aspect of a display organization is the distribution of products, which we capture by the number of facings of each product. An equal distribution may be the most intuitive way to allocate display space. However, an unequal distribution enables to display a higher proportion of high selling products and potentially increase sales and minimize costs of restocking. As part of our experimental design, the number of facings of the products on the display varies - both among products and display variants. We develop a sales response model based on our collected data and further, integrate the variation of facings. We utilize this model to address an important question for retailing: what is the optimal display space allocation with regard to the number of facings? An optimization of facings offers relevant insights for retailers to further increase profits of promotional activities including in-store displays.

The remainder of the paper is structured as follows: we continue with a review of relevant literature in the field of variety of product assortments in order to position our study accordingly. Next, we introduce our field study by outlining the experimental setting. After describing the collected data, we address research question (1) by introducing the methodology, results, followed by a short discussion with respect to the underlying research question. We proceed in the same manner for research question (2). Based on our results, we introduce our approach of optimizing the allocation of display space. We conclude with a general discussion of potential insights and implications based on our findings as well as potential limitations.

2 Positioning in the Literature

There are several streams of literature that are relevant for our research questions. Most importantly, we address the extensive literature regarding variety in choice. As we also consider display layouts with respect to the distribution of products, we shortly discuss the related literature as well in order to position our study accordingly. Variety continues to be a crucial part of the decision-making research and is usually considered as a positive feature in economics and marketing. Big companies intend to increase their market power/brand power by offering more variety within a product line. This strategy is in line with the assumption according to standard economic theory, that a greater variety (i.e., a higher number of alternatives) in a choice set increases the probability of consumers finding a choice that meets their heterogeneous preferences (Baumol and Ide, 1956). On the other hand, a higher number of options increases the cognitive costs associated with a choice. Consequently, shoppers are

overwhelmed by too many alternatives and suffer from choice overload. Choice overload is a mental construct and describes the difficulty for shoppers of making a choice when confronted with too many options (Chernev, 2003; Iyengar, and Lepper, 2000; Schwartz, 2003). Choice overload refers to a prominent stream of literature that highlights the negative effects of variety. It is relevant for retailers as well because its consequences include post purchase regret, choice deferral or simply not doing a purchase at all (for an overview, see Chernev et al., 2015). For example, Iyengar and Lepper (2000) show that the probability to make a purchase is higher when exposed to an assortment comprising of 6 flavors of jam than to an assortment of 24 flavors. Our experimental design has a strong similarity with the field experiment of Iyengar and Lepper (2000), which emphasizes the need to address choice overload. Both experiments include a secondary placement in a store (display/tasting booth), and manipulate the number of products offered. In our case, however, the product category (chocolate) is more likely to be selected in an unplanned purchase as chocolate is a more frequently consumed product category than jam and thus more salient with easily accessible information (see Inman et al., 2009). In the past years, more than 20 Mio. people in Germany consume chocolate at least once a week (VuMa, 2021).

In a meta-analysis, Chernev et al. (2015) identify four key factors that moderate the impact of variety on choice overload. They find that each of these four factors have a significant impact on choice overload, such that higher levels of decision task difficulty (e.g., number of attributes describing each option), greater choice set complexity (e.g., does not contain a dominant option), higher preference uncertainty (shoppers cannot evaluate the benefits of the choice options), and a more prominent, effort-minimizing goal facilitates choice overload. For the product category chocolate, we expect a high proportion of unplanned purchases, with a low degree of decision task difficulty (i.e., not many attributes to evaluate) and rather little preference uncertainty – assuming customers are familiar with the market leader of chocolate and aware of their own taste preferences. As Germany is one of the leading countries in chocolate consumption with a per capita of 7,9 kg in 2017, a familiarity with available products seems reasonable to assume. Given these assumptions, the findings of Chernev et al. (2015) do not suggest a clear direction for our setting in terms of choice overload. Thus, the expectation of how variety affects choice is not clear a priori.

A different perspective is to test, what brand is ultimately selected by customers. As Berger, Draganska and Simonson (2007) argue, most studies on choice overload focus on whether a choice is made at all, while in many purchase situations, a more relevant question is which brand consumers will select. Consumers often know that they want to make a purchase in a

certain product category but they have not decided on the brand. Their findings show that variety of a brand serves as quality cue, resulting in a more likely selection of a brand with high variety.

Most studies consider the choice of just one alternative. In actual purchase situations, for example, in retail stores, consumers are usually not bound to just one alternative but can buy several items at once. In that context, research shows that shoppers tend to select a greater variety of products when they choose multiple products for future consumption simultaneously rather than spread out over several periods. This is referred to as diversification bias in the literature (Read and Loewenstein, 1995). The price reduction during the promotion in our sample increases the likelihood of a purchase for future periods (and thus, the quantity of purchase). However, the diversification bias does not necessarily imply the absence of choice overload; shoppers may choose multiple alternatives precisely because they are not able to select a certain alternative. In our research, the presence of the diversification bias is interesting in terms of variety on a product level rather than trying to determine behavioral biases on aggregate choice behavior. Based on findings on the diversification bias, we expect to observe a more diversified product bundle selected by consumers, when there are more alternatives available. Shifting potential future consumption to an earlier period because of a promotion (i.e., a reduction of price) is likely to enhance a bundle of several products at once rather than spreading the consumption over several periods.

Previous studies have addressed the distribution of products with respect to the impact on sales (Drèze, Hoch, and Purk, 1994) and brand evaluation (Chandon, Hutchinson, and Bradlow, 2009). They find a positive effect on sales when increasing the number of facings; however, that effect is diminishing with more facings. We expect to find a similar effect in our analysis: products not shown on the display will exhibit significantly smaller sales compared to being placed on the ISD. And further, this effect will be higher for products with more facings but the effect size will decline with the number of facings. These above-mentioned studies consider the role of product facings for shelf layout. To our knowledge, there are no studies on the influence of variety and the distribution of facings regarding display promotions. Taking into account additional (display) space may have a different effect. We contribute to the research by closing this gap and further, by providing real purchase data.

3 Field Study

3.1 Experimental Design

The field experiment was conducted in collaboration with a major retail chain in Germany. In total, 24 stores of the retailer were selected to participate in the experiment. These stores were located in three different states in Western Germany, making sure to cover different zip codes and to ensure that no consumers may shop at several of the participating stores.

In our setting, the promotion was conducted with a chocolate brand, which is considered one of the country's market leaders in the product category. The chocolate bar manufacturer produces its regular chocolate bars in 100g packs and offers a variety of 23 products for that size, which are included in the experiment.

Our analysis covers eleven weeks in early 2016. During this time, there were two national feature supported price promotions for the 100g size. In week 7, the promotion entailed a 30% discount, resulting in a price of 0.69€; the discount in week 11 was slightly lower, offering a 20% price reduction, which results in a price of 0.79€ for one chocolate. The various displays were placed during the price promotion weeks and remained there for a total of two weeks in a row (i.e., one week longer than the price promotion lasted). All promotions were also announced in advance via the retailer's brochure. The brochure is accessible online on the website and distributed via mail as print version to a significant number of households within Germany.

The participating stores were equally divided into three groups of eight stores each. As the retailer is offering all products (full variety) in the regular shelves, we consider the stores with all products on the display (23 products) as control group. The other two groups included stores that served as test groups offering a reduced variety (16 products); test group 1 containing the best-selling flavors, while test group 2 offered an alternative selection. More specifically, the test groups differed in one product on the display and their distribution (i.e., the number of facings of each product). At the end of the week, displays in participating stores were checked and, if necessary, filled with new products to ensure that (the number of) products and facings still match the given requirements of the respective experimental group. The displays were placed in the main aisle of each store. During the time of the experiment, there also occurred a promotion of the main competitor brand (week 4), which offers chocolate bars of the same size. *Figure 1* summarizes the experimental design in a timeline, including all price promotions described above.

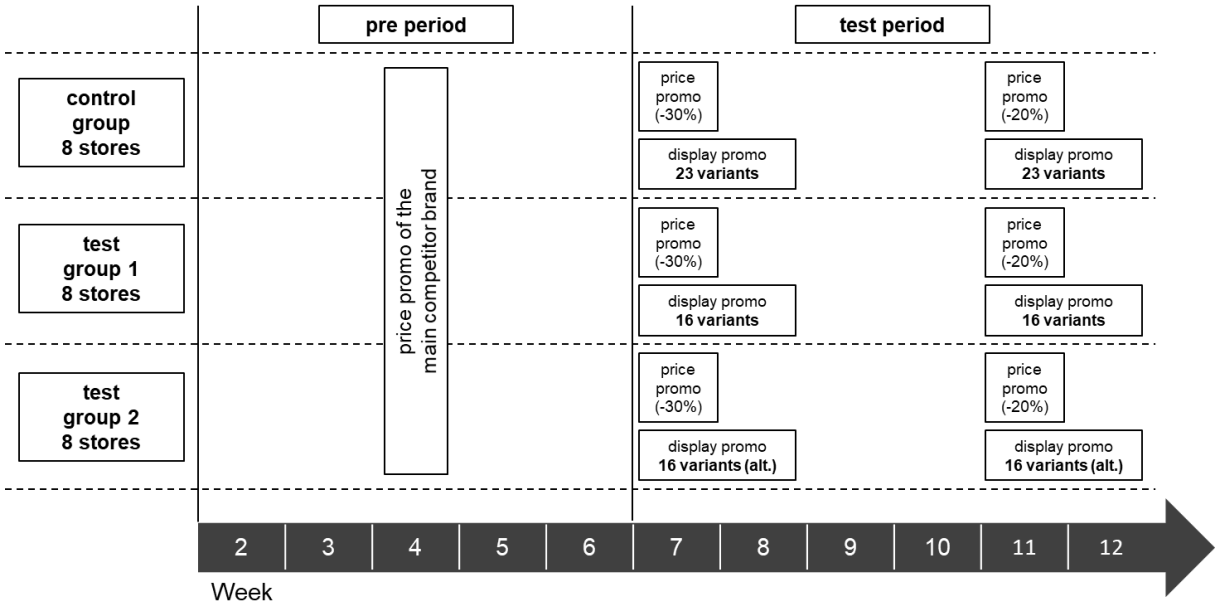
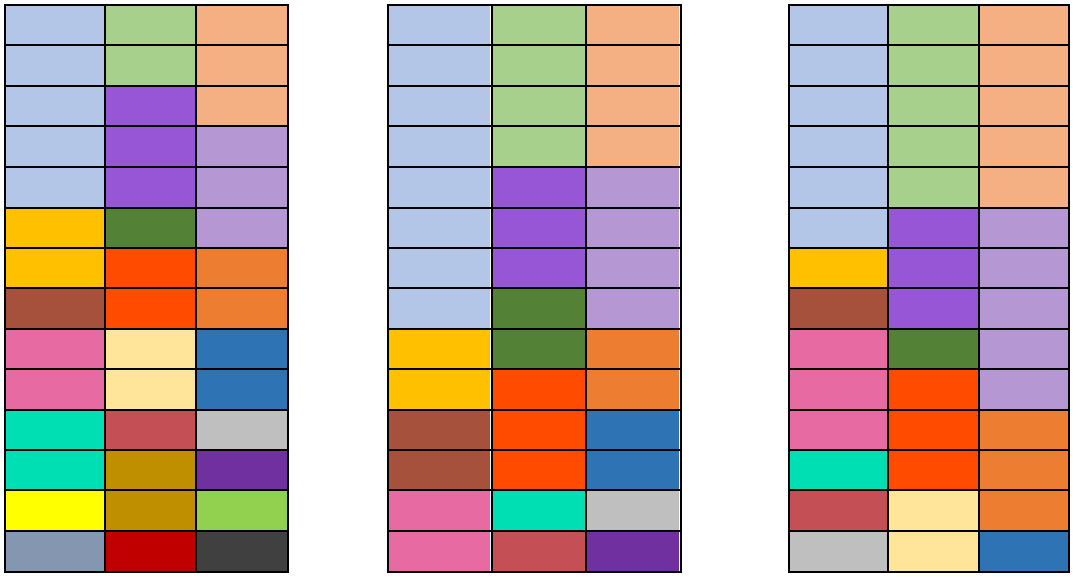


Figure 1: Timeline of the Experimental Design

Promotions similar to the ones in the experiment that include in-store displays are offered on a regular basis in the participating retail stores. This ensures a realistic shopping experience and should not induce consumers to behave differently from their usual purchasing behavior.

As mentioned before, the layout of the display among the three store groups differed in the products presented as well as the number of facings of each product. *Figure 2* illustrates the distribution of products for each group. Each display provides space for a total of 42 facings and varies in the specific distribution. Different colors embody different products, while the same color across display variants denotes the same product, respectively[2]. We can see that the display variant of the control group (left) seems to portray a more even distribution compared to the other groups that include only a reduced variety. We can also see that some products have more dedicated display space than others across all display variants (the products illustrated in the upper half of each display); those products correspond to the generally high-selling items of the brand. More specifically, the light-blue colored spaces represent the top-selling flavor Milk Chocolate, which is given the most display space in all stores. Other products are represented by much less space or even not displayed at all; these are illustrated rather on the lower half of the display variants.

[2] There is no information about the order of products on the display; the one illustrated in figure 2 is randomly chosen for illustration purposes. We can only assume the number of facings for each product as given.



2.a Control group 2.b Test group 1 2.c Test group 2

Figure 2: Schematic representation of display variants for the control group (left), test group 1 (middle), and test group 2 (right).

3.2 Data Description

We use weekly store-level scanner data to estimate the promotion effects of the different displays. The data cover a period of 11 weeks in 2016, from January (week 2) to March (week 12) for 24 stores in Germany. The sample contains information on unit sales, prices of products, and the number of facings on the display for each product and store. The price for a chocolate bar was 0,99 € without the promotion; during promotion weeks, the discounted price of a chocolate was 0,69 € in week 7 (30% discount) and 0,79 € in week 11 (20% discount), respectively. All products of the brand had the same price, so we can exclude any choice based on price discrimination. The number of facings for each product varied across stores – depending on the experimental group they were assigned to (see *figure 2*). In addition, display placements and other promotional activities for the competitive products in the category were provided as well.

Figure 3 shows the average sales across the whole time period of 11 weeks, under consideration of each group separately. We can observe that average sales were relatively stable in the weeks without a promotion across stores and test groups (close to 200 pieces per week for each store), with some minor variation and slightly better performance for test group 2. However, this does not seem to have a big impact and is likely due to variations among stores. Thus, we assume no significant differences among our treatments. During the weeks with a price promotion, sales increased tremendously - up to almost 1400 pieces in week 7 and 900-1000 pieces in week 11.

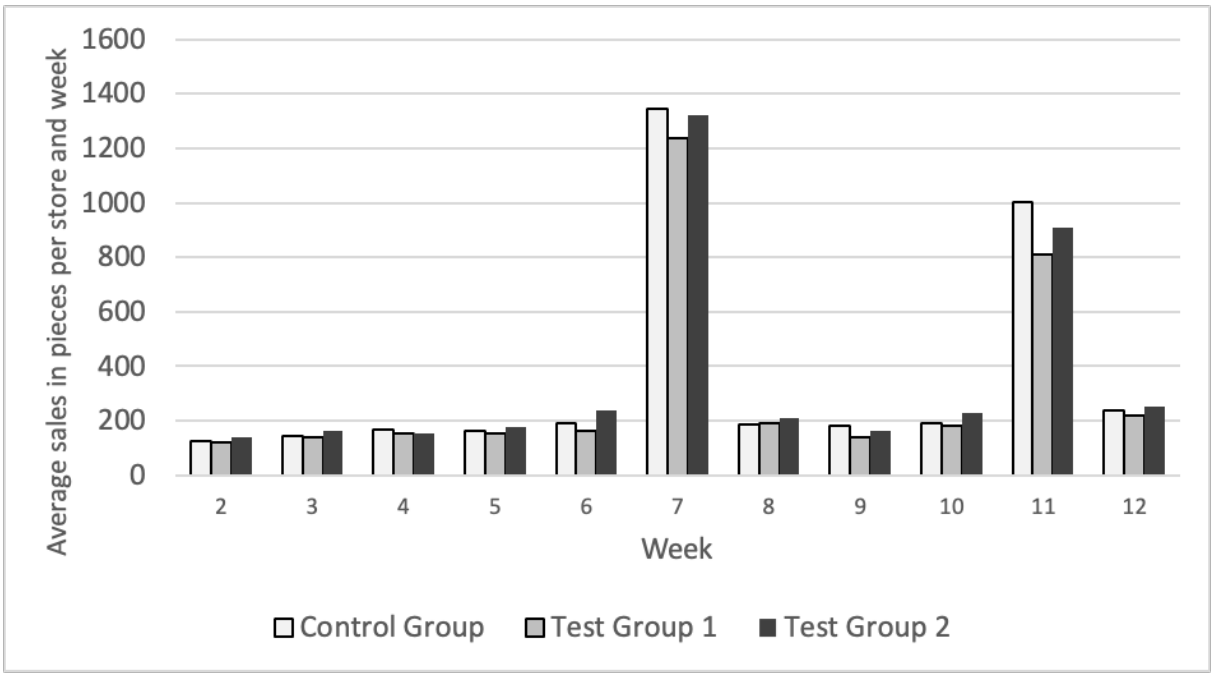


Figure 3: Average sales of the brand's chocolates per store for each week by group

The difference in sales between promotion weeks was plausible due to the difference in the price discount between both promotions. We can observe a slightly higher sales for stores in the control group compared to the test groups. Interestingly, from the two test groups, stores of group 2 seem to experience higher sales during promotions than the ones of group 1, even though group 1 included the top-selling products on the display. As the average sales is slightly higher for test group 2 in weeks without promotions as well, the difference is likely explained by store heterogeneity again. An alternative explanation may arise due to the difference in distribution on the display: the display allocation in test group 2 dedicated more space to the low-selling products compared to stores attributed to test group 1 (as well as a more unequal distribution among flavors). The higher space dedicated to low-selling products may have a more attention-grabbing effect on consumers than recognizing mostly familiar products.

As outlined in the experimental design, the displays remained in the stores an additional week after the price reduction. When looking at those weeks (week 8 and 12, respectively), there is no obvious increase visible compared to the other regular weeks. Interpreting this information as displays by themselves are not an effective promotion instrument should be treated with caution, as after a promotion, there is often a drop in sales due to saturation, which may be a contrary effect to the deployment of a display. Assuming a drop in sales after the termination of the temporary price reduction would suggest that the negative saturation effect and the positive impact of the display cancel each other out. Given our data, we cannot separate the two

effects, though. Surprisingly, we do not observe a decrease in sales during the competitor's promotion in week 4. This may be explained by the brand's dominant position in the product category.

Finally, when comparing the stores' sales before and after the first promotion, we cannot see any obvious change suggesting that the promotional event in week 7 affected the following purchases as well. This indicates, that we can use both promotion weeks as treatment periods for our identification.

On a product level, we notice a strong variation of sales: there are some chocolates that were clearly top sellers such as the *Milk chocolate*, showing a turnover of around 6 times more than other, less popular, products.

Additionally, the number of products that were put on the display as well as the units that have been left at the end of the promotion, have been counted for each store. Consequently, we can derive the sales that directly result from the display. *Table 2* summarizes, for each treatment group and promotion week, the number of sold units on the display as well as the fraction that was not sold. After the first promotion (week 7), 36.1% of the chocolate bars in the control group remained on the display.

	Control group	Test group 1	Test group 2
Number of units on the display	782	782	746
Promotion week 7			
Unit sales	500	441	428
Leftover units	282	341	318
Share	36,1%	43,6%	42,6%
Promotion week 11			
Unit sales	444	368	372
Leftover units	338	414	374
Share	43,2%	52,9%	50,1%
Average	39,6%	48,3%	46,4%

Table 2: Products Left on the Display

In test groups, the share was higher: 43.6% (test group 1) and 42.6% (test group 2). After the second promotion (week 11), the number of remaining chocolates on the display was again lower in the control group (42.3%; test group 1: 52.9%; test group 2: 50.1%). The observed numbers suggest that a higher variety on the display attracts more attention and, consequently, results in better sales. Additionally, the difference in shares may result in lower costs of labor (i.e., re-organizing products from the display into the shelf, storing them, etc.) associated with the display promotion on the part of the retailer. See *table 2* below for a more detailed summary of the results.

Based on our descriptive results, our experimental data do not suggest that variety has a negative effect on brand sales. In the next section, we will address our analysis to identify a causal effect of variety on sales.

4 Aggregate Sales

We first address the approach and respective results of aggregate sales on the brand level - aligned with our research question (1) before focusing on the product-specific level. We start with the methodological approach, followed by a summary of results and a short discussion.

4.1 Methodology

To test for the effect of different variety levels on brand unit sales, we applied a log-linear model with a difference-in-differences (DiD) approach for the treatments to identify the causal effect of variety on the display.

Our model is based on a simple form of DiD regression,

$$y_{it} = \beta_0 + \alpha \cdot T_i + \beta_1 \cdot P_t + \beta_2 \cdot (P_t \cdot T_i) + \gamma' \cdot X_{it} + \varepsilon_{it} \qquad (1)$$

where P_t represents a variable for fixed effects of the treatment periods (in our case, the promo weeks), T_i the inherent differences between treatment groups and the interaction of $P_t \cdot T_i$, being 1 in case of a treatment period and treatment group. Thus, β_2 represents the difference in effect of the treatment (promotion) between our test groups and control group (different display layouts). Our dependent variable y_{it} is specified as $y_{it} = \ln(sales_{it})$ to account for non-linear effects.

Other than accounting for all periods after the (first) promotion as treated time periods ($weeks > 7$), we assume the promotion effect is mostly affecting the respective week, in which

the promotion is taking place, and will not have a significant effect on future shopping weeks - at least on the aggregate level (consumers may buy flavors during promotions they have not known before and thus, their product preferences for the future could be affected; however, purchase quantity of the brand should mainly be regulated by the temporary price reduction during the promotion week). This is also supported by the data on average sales (*figure 3*).

In our case, the treatment T_i is defined as the manipulated display layout. We differentiate by our design among the three different test groups, with test group 1 and 2 specified as the treatment. The special case here is that the manipulated differences between the test groups only occur during the treatment periods P_t. Thus, we expect to find no significant effect for T_i when taking into account P_t. We vary our approach for T_i by accounting for individual store effects instead of including test group differences. The former controls for variation among stores, which also captures heterogeneity among store groups.

We identify our treatment as the combination of price promotion and display and control for differences in promotional effect due to display design by treatment groups (interaction effect). Given the nature of often reoccurring promotions, as well as no significant differences in sales before and after the first treatment (week 7), we consider both promotion weeks as treatments but not the weeks in between. We test for different variations in variables P_t, T_i, and X_{it} as well as with and without intercept. Our final model specification is as follows,

$$ln(sales_{it}) = \alpha' \cdot store_i + \boldsymbol{\beta_1} \cdot \boldsymbol{promo_{it}} + \boldsymbol{\beta_2} \cdot \boldsymbol{promo_{it}} \cdot \boldsymbol{treat_{it}} + \gamma' \cdot X_{it} + \varepsilon_{it}, \qquad (2)$$

where $y_{it} = ln(sales_{it})$ denotes the sales for store *i* at time *t*, $store_i$ represents the store-dummy variables (1 if observation is in store *i*), $promo_{it}$ denotes, whether there was a price and display promotion in store *i* in week *t* (1 for week 7 and 11, 0 otherwise), $treat_{it}$ indicates the store's treatment (1 for reduced variety on the display), and $promo_{it} \cdot treat_{it}$ is the interaction effect of the reduced variety treatment and promotion, respectively. X_{it} represents a matrix of control variables including competitors' promotions and the weeks of promotions with a display only (week 8 and 12). The (transformed) estimated parameters ($\exp(\beta_i)$) should be interpreted as promotion multipliers. For example, a promotion multiplier (β_1) with a value of 2 for price and display promotion means a doubling of brand unit sales.

We include several other model specifications that vary in specifications of treatment, promotion and/or control variables: model 1 represents a generalized approach by

differentiating between two treatment conditions for variety (high/low variety) and combining the two promotion weeks; model 2 further divides the low variety into the two test groups and model 3 and 4 are variations of the other two with further incorporating promotion weeks separately. In our final model 5, we control for store effects (instead of test groups) in our treatment variable and let the interaction of treatment and promotion be among the two variety treatments (i.e., we do not consider test group 1 and 2 separately). For an overview of the model specifications, see *table 1* below.

Control variables are varied as well; we do, however, not find a change of our variables of interest when including or excluding certain controls.

Model specifications					
	model 1	model 2	model 3	model 4	model 5
Intercept	✓	✓	✓	✓	
Treatment effect					
Pooled test groups	✓		✓		
test group 1		✓		✓	
test group 2		✓		✓	
store effects					✓
Promotion effect					
week 7 & 11	✓	✓			✓
week 7			✓	✓	
week 11			✓	✓	
Interaction effect	✓	✓		✓	✓
separate for test groups		✓		✓	
separate for weeks			✓	✓	
Control variables					
display only week 8	✓	✓	✓	✓	✓
display only week 12	✓	✓	✓	✓	✓
promotion competitor	✓	✓	✓	✓	✓
$adj.\ R^2$	0.842	0.847	0.851	0.856	0.998

Table 1: Overview of model specifications

4.2 Results

We concentrate on our selected model *(5). Table 2* shows a summary of the results on weekly *log brand unit sales.* As expected, our estimation confirms a strong and significant promotion effect on sales for all stores. More specifically, we can observe that stores showing the full variety of the product line on the display (stores of the control group with 23 products) increase their unit sales by 631.2% during the promotion (based on a promotion multiplier of 7.312=exp(1.990)). The promotion estimate confirms the observed unit sales in *figure 3* and indicates a strong promotional impact for the product category. When we look at the effect for

stores with a reduced variety on the display, we note that this promotion effect is weaker: The results show that a display with fewer products (reduced variety, 16 products) has a negative effect on the promotional effect. The estimated interaction effect of promotion and tests groups is negative and (marginally) significant (-0.137, $p < 0.1$). This corresponds to an additional promotion multiplier of 0.872 (=exp(-0.137)) and means that the promotion multiplier in the test groups is 12.8% (=1-0.887) lower than in the control group.

Our estimates for the store effects range from 4.693 to 5.452 – absorbing all variation across stores. As we do not specifically label stores according to their treatment (full variety or reduced variety), it is not clear whether there is an inherent difference between treatment groups. We do, however, test in our model (1) for different variety treatments instead of store effects and can observe that this effect is not significant (0.031, p-value=0.5), which suggests that there are no systematic differences between stores of the treatments in weeks without the promotion. Displays in general seem to encourage purchases as well. The weeks showcasing only a display (without a temporary price reduction) have a significantly positive effect; interestingly, this effect is stronger after the second price reduction. A potential explanation may be that the saturation effect after the second price reduction is smaller, given the smaller discount compared to the one in week 7. Finally, we observe no impact on sales when the main competitor in the market is on promotion. The lack of significance potentially arises because consumers already have strong preferences for one of the brands and are not likely to switch during promotional offers.

Model (5): log(brand sales)				
	Coeff.	SE		Mult.
Treatment Promotion				
store dummies (mean)	5.063	0.075	***	157.994
promo (week 7 & 11)	1.990	0.068	***	7.312
promo · treatment	-0.137	0.082	*	0.872
Control Variables				
display only (week 8)	0.177	0.053	**	1.194
display only (week 12)	0.415	0.070	***	1.514
promo competitor	-0.030	0.053	n.s.	0.971
N	264			

Notes: $*$ $p < 0.10$; $**$ $p < 0.05$; $***$ $p < 0.01$; n.s. not significant

Table 2: Aggregate brand sales

4.3 Discussion

In our study, we observe a higher promotional effect on unit sales, when stores apply an ISD with the full variety of products rather than filling it only with a selection such as the top-sellers or an alternative selection. Based on our analysis, we cannot confirm any tendency of choice overload caused by the display variant. We rather observe the opposite, suggesting that for ISD, a high variety of products has an even better promotional uplift for brand sales.

In the next section, we address research question (2) and concentrate on the product level to test, whether a manipulation of variety on displays changes the product-specific preferences of consumers.

5 Product-Specific Sales

As our results on the brand level show, we cannot observe a negative effect of variety. Instead, presenting the whole product line during the promotion week on the display induces higher sales. This difference in sales is significant at a 10% level. In section 5, we address research question (2) by analyzing whether the display layout affects, which products are more likely to be purchased given the different variety levels. We conclude with a presentation of the results and a short discussion.

5.1 Methodology

For analyzing the effect of variety on the product level, we used a two-step hierarchical approach. In the first step, we estimated the effects of the price and display promotion (hence referred to as promotion) at the product level by using hierarchical Bayes (HB) for each treatment group separately. The estimation equation is very similar to equation (1). The difference is that the equation is estimated at the product level. Because there are some products that have not been sold at all in certain weeks and stores, we aggregated the data at the group level. For each product, we calculated the average sales per group. Our goal was to allow the promotion effect to vary between products. We used a conventional HB formulation for a random coefficient regression model and a multivariate normal population distribution to specify the heterogeneity between the products:

$$log(sales_{gpt}) = \gamma_0 + \gamma_i \cdot promo\ week_{gpt} + \delta' \cdot X_{gpt} + \varepsilon_{gpt}, \qquad (3)$$

where $sales_{gpt}$ denotes the unit sales of product p in group g for week t, and $promo\ week_{gpt}$ is a dummy variable that indicates, whether there was a price and display promotion of product

p in group g in week *7* or *11*. X_{gpt} represents a matrix of control variables including competitor's promotions and the weeks of promotions with a display only. A useful property of Bayesian hierarchical linear models is that absurdly large values of the least squares coefficients are shrunk toward more reasonable values. The transformed estimated parameters ($\exp(\gamma_i)$) should be interpreted as promotion multipliers.

The aim of the second stage regression is to understand whether the promotion effects differ between the products and what influence the choice situation (high variety vs. reduced variety) has on the promotion effects.

In the second stage, we used the (log) posterior means of the promotion multiplier from the first step as our new dependent variable (γ_{pgt}). We used baseline unit sales of the products as an indicator of the general attractiveness of the product. Baseline unit sales represent the estimated unit sales of product *p* in group *g* in weeks without a promotion. The value is the posterior mean from the first stage regression ($\exp(\gamma_0)$).

$$log(\gamma_{pgt}) = \beta_0 + \beta_1 \cdot tg1 + \beta_2 \cdot tg2 + \boldsymbol{\beta_3} \cdot \boldsymbol{log(baseline_{pg})} + \boldsymbol{\beta_4} \cdot \boldsymbol{log(baseline_{pg})} \cdot \boldsymbol{tg1} + \boldsymbol{\beta_5} \cdot \boldsymbol{log(baseline_{pg})} \cdot \boldsymbol{tg2} + \beta_6 \cdot promo_{pgt} + \boldsymbol{\lambda'} \cdot \boldsymbol{facings_{kpg}} + \varepsilon_{pgt} \qquad ()$$

The second stage model (key variables in bold) decomposes the log promotion multiplier of product p in group g during price promotion week t into (i) effects of baseline unit sales ($baseline_{pg}$), (ii) interaction effect of baseline unit sales and test groups (*tg1* and *tg2*), (iii) effects of the number of facings on the display ($facings_{kpg},\ with\ k = [0, \geq 4]$), (iv) effects of the promotion week (($promo_{pgt}$, reference is week 11), (v) and test group effects (*tg1* and *tg2*). Note that the maximum number of facings is four in our model to retrieve a sufficiently high number of observations in the last category of facings. The model was estimated by OLS. We used the natural logarithm (*log*) of baseline unit sales to interpret the coefficients as elasticities.

5.2 Results

The results of the second stage regression display the relation of a product's general attractiveness compared to the promotion uplift. *Table 3* below summarizes the estimation results. Surprisingly, products that are usually very popular, experience a lower promotion uplift than less popular products: the results show that baseline unit sales have a negative impact on the promotion multiplier of a promotion. The estimated baseline unit sales elasticity indicates that a 1% increase in general sales decreases the promotional effect by 23.8% (-0.238, (p <

0.01). This effect accounts for stores with high variety on the display during promotion weeks. When we examine the effect for stores that are assigned to a test group, showcasing a reduced variety during a display promotion, we see that this negative effect is significantly weaker. The interaction effects of (log) baseline unit sales and test groups are positive and significant (test group 1: 0.086, $p < 0.10$; test group 2: 0.098, $p < 0.05$). Based on the estimates, we conclude that a 1% increase in baseline sales for a product sold in stores of test group 1 (2) decreases the promotional effect by 14.6% (13.4%). The results suggest that shoppers in stores including a display with high variety are more willing to try new, yet unfamiliar, products.

To estimate the effect of the number of facings on the promotion multiplier of a promotion, we created four dummy-coded variables. The reference category is no facing on the display. This means that the product was only placed on the shelf. The last dummy variable is grouped into four and more facings on the display. Compared to the reference category, all effects are significantly positive (1 facing: 0.276; 2 facings: 0.388; 3 facings: 0.441; 4 and more facings: 0.464; $p < 0.01$). For example, if a product was assigned two facings on the display, the promotion multiplier of a price and display promotion increases by a factor of 1.474 (=exp(0.388)). We do, however, observe that the positive effect of more display space is limited: the estimated response function is characterized by diminishing returns to scale as the number of facings increases.

Model (II) dependent variable: log(promotion multiplier)				
	Coeff.	SE		Mult.
Product Characteristics				
log (baseline)	-0.232	0.032	***	
log (baseline) · tg 1	0.086	0.044	*	
log (baseline) · tg 2	0.098	0.048	**	
test group 1	-0.265	0.081	***	0.767
test group 2	-0.369	0.096	***	0.691
facings = 1	0.276	0.039	***	1.317
facings = 2	0.388	0.043	***	1.474
facings = 3	0.441	0.052	***	1.554
facings ≥ 4	0.464	0.063	***	1.590
Control Variables				
constant	1.909	0.065	***	
promo (week 7)	0.385	0.020	***	1.470
N	138			
adj. R^2	0.845			

Notes: ∗ $p < 0.10$; ∗∗ $p < 0.05$; ∗∗∗ $p < 0.01$; Mult. = exp(coeff.)

Table 3: Second Stage Regression

Additionally, we can verify our results from the aggregate analysis with respect to the uplift in sales caused by variety on the display. On the product level, the promotion multiplier is significantly reduced for stores with reduced variety, regardless which treatment condition we consider. The display variant assigned to stores in test group 1 exhibits a slightly smaller reduction 1 (-0.265, $p < 0.01$) compared to the estimate for stores in test group 2 (-0.369, $p < 0.01$). Given that the display variant in test group 1 includes all high-selling products, the effect sizes seem reasonable. We also controlled for the impact of the promotion week. As expected, the promotional effect on the product level is higher for the first promotion week (week 7), in which the price deduction was larger (promotion week 7: 0.385, $p < 0.01$). This is in line with the results on the aggregate level as well.

5.3 Discussion

Following up on research question (2), we do find different effects of variety on the product level. Generally, promotions seem to have a greater impact on low-selling product, probably because the consumers' attention is toward these products is induced by instruments such as displays in the store. More interestingly, we observe that the stronger promotional uplift for less popular products is significantly higher for stores, in which displays show the full variety of products. Considering the selection on the display for test group 1 is concentrating on the high-selling products, this difference may be partially explained by the design of the display variants. However, the difference to the display variant of test group 2 is even higher, even though the selection is not concentrated on the high-selling products as much as in test group 2. Based on our results, we conclude that variety on the display matters, depending what products a retailer wants to sell.

In the next section, we apply our results to derive managerial implications relevant for the retailer.

6 Managerial Implications for the Allocation of Display Space

The results of the second stage regression showed diminishing returns to scale as the number of facings on the display increases. This means that the additional effectiveness of the promotion for the display variant decreased. We use this information to optimize the allocation of the current display space in the control group with 23 products for week 7. Our main goal here is to derive a general recommendation for the design of the display during a promotion.

To solve the optimization problem, the profit function was set up from the retailer's point of view. The profit function is made up of the sum of the profits of the individual products p.

$$\max_{\{facings_{kp}\}} Profit = \sum_{p=1}^{23} (price - discount - variable\ costs) \cdot sales_p.$$

where $price$ is the regular price of 0.99€ for the brand and $discount$ is the price reduction of 0.30€ during the price promotion. The promotional price is therefore 0.69€. The $variable\ costs$ to the retailer are kept constant and have been computed using an average margin of 40% (Kopalle et al., 2012). This leads to variable costs of 0.59€. $Price$, $discount$ and $variable\ costs$ are identical for all products of the brand. The demand for product p ($sales_p$) is determined by multiplying the baseline unit sales ($baseline_p$) by the $promo\ multiplier$ of product p,

$$sales_p = baseline_p \cdot promo\ multiplier_p.$$

The promotion multiplier is derived from the second stage regression and depends on the number of facings,

$$promo\ multiplier_p = exp\big(\beta_0 + \beta_3 \cdot log\big(baseline_p\big) + \beta_6 + \lambda' \cdot facings_{kp}\big).$$

The decision variable of the retailer is the number of facings per product on the display. The profit function was maximized under the constraint that only 42 facings were available, and the decision variable was an integer. We have restricted the number of facings per variant to a maximum of four, since the last category of the dummy coding for the number of facings was combined with four or more facings. At this point, we are more interested in analyzing the optimal distribution of the facings depending on the baseline sales of the variants. Further, each product was allocated at least one facing on the display. This implies that a reduced variety was not possible in this case.

The results of the optimization showed that the profit from the retailer's point of view could be increased by 0.85%. *Table 4* shows the baseline sales of the 23 products as well as the current and the profit-optimal allocation of the facings on the display. The table is sorted by baseline

sales in descending order. In the current allocation of display space, the product with the highest baseline unit sales had five facings. The product with the second highest baseline unit sales has three facings and the variant with the third highest baseline unit sales has a total of two facings.

Baseline sales	Facings Display (Current)	Facings Display (Optimal)	Delta Facings
32.47	5	4	-1
17.47	3	3	0
8.99	2	2	0
8.12	2	2	0
8.06	3	2	-1
7.36	3	2	-1
6.34	2	2	0
6.31	1	2	1
5.95	1	2	1
5.61	2	2	0
5.48	2	2	0
5.08	1	2	1
5.07	2	2	0
5.00	1	2	1
4.56	2	2	0
4.44	1	2	1
3.97	2	1	-1
3.81	2	1	-1
2.82	1	1	0
2.41	1	1	0
2.40	1	1	0
2.30	1	1	0
2.12	1	1	0

Table 4: Current and optimal display allocation

When looking at the number of facings for the products with baseline sales between four and eight units, no uniform pattern can be detected with respect to the allocated facings. For these products, one facing as well as two facings are used on the display. In contrast, a uniform structure can be seen in the optimal allocation. The lower the baseline sales, the fewer facings on the display. The two products with the highest baseline sales also have the highest number of facings (four and three, respectively). Most other products (14) are allocated 2 facings and the seven products with the lowest baseline sales have only one facing.

7 Discussion

In this study, we analyzed how display layout - with a focus on the dimensions of variety and distribution - influences consumer purchase behavior. We addressed this in two research questions and our managerial implications. This section summarizes the main findings with respect to our initial research questions and discusses implications that are derived based on the previous results.

Research question (1) addressed the influence of display variant as an indicator for a high or reduced variety on the unit sales effect of a price promotion. Our findings reveal that a display with reduced variety (16 variants) does not have a positive effect for the brand on the promotional effect. On the contrary: the effect of a promotion with a display showing a reduced variety is significantly weaker (-12.8%). The design of our study has similarities to other experiments that tested for choice overload (cf. Iyengar & Lepper, 2000). However, we cannot confirm such a negative impact of variety on choice. It might be that customers infer certain characteristics from a higher choice set. Berger et al. (2007) found that consumers utilize variety as a cue for quality, thus assuming that the brand offers better products in case there is more variety on display. However, this does not explain, why we observe a different effect than in the experiment of Iyengar and Lepper (2000). A simple explanation for those differences may be the lower consumption frequency of the product category jam, combined with a stronger quality cue provided by the tasting booth.

The descriptive analysis, that examined the number of products that were left on display after each promotion period showed as well, that there are significantly fewer chocolate bars left on the displays with a high number of variants (23 variants) than for the two test groups. The trend is observable for both promotion periods. The results support our findings above, suggesting that higher variety on the display not only results in higher overall sales but also seems to bear less cost for the retailers. From a retailer's perspective, these insights motivate the potential additional effort that may arise from more unique products on the display in terms of, e.g., restocking during promotions. A possible explanation of for higher sales may of course be explained economically, simply because consumers' preferences are better represented with a more extensive selection of alternatives. An alternative explanation may lie in the context of a price promotion, encouraging customers simply to buy more products (i.e., N>1). For example, a customer may be more willing to buy 5 chocolate bars of different products rather than buying 5 chocolates of the same kind. With more variety of products, the likelihood of shoppers buying

larger amounts increases. We will discuss this more detailed with regard to our next objective, research question (2):

Our results of the second stage regression show that especially products that are less popular during non-promotional weeks have a disproportionately high promotion effect. The promotional effect is particularly high for these products if there is full variety on the display (23 products), suggesting that consumers are interested in new products – at least when the threshold is not very high (i.e., a price reduction and more eye-catching placement in the store). An explanation could be, that consumers do not feel overwhelmed but rather see an opportunity in new or unknown products when the risks of a suboptimal choice are low. Furthermore, the results show that the promotional effect decreases with each additional facing, suggesting a highly skewed distribution on the display is not optimal. Indeed, this finding is in line with the study of Drèze et al. (1994), who found that additional facings that go beyond the minimum level have only a restricted impact on brand sales. An explanation may be given by the tendency that consumers perceive a layout, which is consistent with a person's internal product categorization as more positive compared to one that does not match the internal order. Roederkerk and Lehmann (2021) analyzed how the degree of congruency of shelf and internal layout influence the perceived variety of product assortments. They find that a congruency comes with high perceived variety whereas the absence of congruent layout induces a high perceived complexity of the assortment. On a display, consumers may expect a rather equal distribution of different products and thus, are more likely to make a purchase.

It is important to compare the results of this study with those from Iyengar and Lepper's (2001) research. Their findings suggest that shoppers were much more likely to purchase jam if they had encountered the display of only 6 jams rather than 24 different flavors on the display. The two studies differ in several dimensions. First, Iyengar and Lepper (2001) used a tasting booth to attract the potential shoppers. As part of our experiment, we used a national feature supported price promotion week to place the different displays with different varieties. Second, the two categories chocolate and jam differ significantly. Chocolate as product category is considered to easily induce impulsive purchases of consumers. Thirdly, the jam experiment was conducted in an upscale grocery store, whereas the present experiment was carried out in a normal supermarket. As Roggeveen et al. (2016) point out, displays have different effects across store types. Lastly, the number of alternatives in the reduced variety condition differ immensely, which suggests either different thresholds for choice overload regarding certain product categories, or a non-linear impact of variety on utility (i.e., utility curve may be U-shaped with an increasing number of alternatives). In their meta-analysis, Chernev et al. (2015) also point

out that most studies testing for choice overload compare variety levels of 6 vs. 23 alternatives. Our sample considers a display containing 16 vs. 23 products, which is in our opinion reflecting a much more realistic scenario compared to the rather artificial laboratory experiments. Especially for a product category such as chocolate, consumers are used to a comparably high variety in flavors. Although, our selected variety levels may complicate a comparison with previous studies, our main concern was to guarantee a shopping setting that was as realistic as possible.

A different argument for more purchases in stores with high variety could be a high quantity of products driven by some customers. On average, this may happen more often in stores with high variety. Given, chocolate is consumed more frequently or in more quantity than jam, it is likely to assume a purchase of multiple products.

We contribute to the literature by closing the gap in research of how variety on in-store display affects consumer choices. Additionally, we incorporate the number of facings and analyze the optimal display layout from the perspective of retailing. An increase of profit by 0.85% may not seem that much but on an aggregate level, this can have a notable impact on overall revenues.

Our field study shows that in a promotional setting with additional product space, such as in-store displays, variety is likely a good thing. More interestingly, the specific product choice is significantly affected by the level of variety. To our knowledge, this approach has not been used in the literature so far and should be investigated further in the future.

Additionally, our experimental setting by itself provides valuable insights from real purchase data. The composition of promotion (i.e., a temporary price reduction in combination with a display) is a common practice in retailing and thus, reflects a natural shopping situation. The relatively high number of alternatives for both variety conditions show, that consumers are not necessarily overwhelmed by the offered choice and suffer from choice overload.

Finally, our study offers valuable insights and implications for retailing. As most research in the field of variety concentrate more on the perspective of consumer behavior, we focus on the supplier side. Managerial implications are discussed in the next section.

7.1 Managerial Implications

Both retailers and manufacturers can benefit from an increased understanding of the impact of variety on sales. As displays have not been the focus of this field of research, our results can provide crucial implications for retailers. As a recommendation, manufacturers and retailers should place displays with many products of a given product category. Although, the enormous

number of alternatives of stores' assortments may justify choice overload of consumers, our results show that this does not seem to apply to displays. On the contrary, more alternatives seem to encourage customers to make a purchase. Our findings show that higher variety not only induces higher sales but also comes with less costs for the retailer in terms of setting up and reorganizing the products that are left at the end of the promotion. We found for both promotion weeks that there are significantly fewer chocolate bars left on the displays with a high number of variants (23 variants) than for the two test groups. The results support our findings above, suggesting that higher variety on the display not only results in higher overall sales but also seems to bear less cost for the retailers. From a retailer's perspective, these insights motivate the potential additional effort that may arise from more unique products on the display in terms of, e.g., restocking during promotions. An explanation may simply be that consumers' preferences are quite heterogeneous and, thus, better represented with a more extensive selection of alternatives.

Additionally, our results show that displays with a high number of products stimulate the demand for less popular products. This suggests that shoppers are willing to try new products when the financial risk is reduced. For retailers, this is a useful insight to introduce new products in a store; an unknown product of a category may be better established during a promotion. A higher variety does not seem to be distracting from unfamiliar products but rather encourage customers to select those. Display promotions could even help retailers to sell - not necessarily new but also less popular - products of a category. Placing them on displays can improve overall sales and consequently, storage costs of less popular products can be reduced.

Finally, our results can also be used to optimize the number of facings on the display. The results of our optimization model show that the number of facings should be relatively evenly distributed rather than having some products dominate the display space. An optimal display allocation can increase sales by 0.85 %. Given that in retailing, promotion weeks including a display are scheduled regularly and several times a year, a better display design can result in a significant increase of a brand's profits.

7.2 Limitations and Further Research

This research has certain limitations that need to be addressed in future research. Our results are limited to one specific product category. The effect of variety on the display on sales may well differ across categories. The product category chocolate is strongly characterized by a susceptibility to unplanned purchases and a rather frequent consumption, which can influence the result. Future research studies could extend this analysis to more categories such as

utilitarian products, non-stock-pileable or purchases that are more likely to be planned in advance. Additionally, more research is required at the disaggregated level. Our data could not provide individualized purchase data and thus, we could not control for multiple purchases or variety within a consumer's choices. Loyalty card data could help to better understand the individual purchase decisions during different promotion scenarios. Alternatively, a controlled lab experiment could make individual purchase patterns more transparent.

Regarding the layout of in-store displays, a concern that can be raised that we do not control for potential order effects. As literature concentrating on shelf layout shows, the order of products can affect the purchase frequency of certain products (i.e., products on eye-sight are more likely to be selected from customers). We acknowledge the limitation in our findings arising from the missing information; however, the order of products in the field is hard to control for and likely to be disrupted in an actual retail store. We therefore assume no systematic placements in our particular field study and thus, no order effects.

Finally, our design does not allow for a clear separation of the temporary price reduction and the display promotion. As this is not necessarily the focus in our research, but rather showcasing a typical promotion case in the participating retail stores, we do not think this weakens our results.

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