Price Promotions and Brand Loyalty: Empirical Evidence for the German Breakfast Cereals Market

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Abstract

Price promotions are important marketing activities for (food) retailers; brand loyalty is a major requisite to foster brands' assets. Several theoretical papers have analyzed the relationship between price promotions and brand loyalty resulting in mixed or perhaps contradictory outcomes; only a few empirical studies for (European) grocery markets are available to test which model(s) might be most relevant to reflect pricing strategies in food retailing. In this analysis, two detailed data sets for the German ready-to-eat breakfast cereals market are merged to investigate the relationship between price promotions and brand loyalty. We find significant empirical evidence that stronger brands tend to be promoted less frequently at lower discounts compared to weaker brands. The reason might be that price reductions are more costly for brands having loyal customers who are willing to accept higher mark-ups. Therefore stronger brands might need to come up with alternative measures to recruit new customers instead of offering attractive promotional sales.

Keywords: Price Promotion, Brand Loyalty, Food Retailing, Ready-to-Eat Cereals, Germany, Instruments, Tobit

1. Introduction

Promotional sales in various forms such as price promotions, coupons or displays are dominant features in the grocery business marketing mix around the globe. In the German sector of food retailing price promotions are the most frequent instrument to attract customers or to increase sales. For example, consumers find significant temporary price reductions for coffee (chocolate or frozen pizza) in one of five (ten) weeks in combined supermarkets in Germany.[1] Ready-to-eat breakfast cereals are regularly price promoted as well. Particular brands in certain retail outlets are put on sale up to 24 % of the time. Average discounts are set between 8% and 15%.

Several attempts have been undertaken in the economic and marketing literature to explain the occurrence of sales. In the first models discrimination between informed and uniformed consumers leads to a mixed pricing strategy in which either high or low prices are set in most periods (Varian, 1980). Other arguments to result price promotions within an equilibrium mixed strategy are based on household storage (Blattberg et al., 1981), loss leader (Lal and Matutes, 1984), differences in the reference prices between consumers (Sobel, 1984) or transaction cost differentials between consumers (Narasimhan, 1984). All these models do not consider that pricing strategies within a grocery store differ for the various products or brands offered. Narasimhan (1988) first proposes a model that leads to different pricing strategies within a store for brands. He argues that brand loyal customers might play a critical role for the pricing strategy of manufacturers and/or retailers.

Driven by empirical observations of deviating pricing policies between brands (strong and weak with respect to the degree of loyalty, large and small with respect to the number of loyal customers) in the same store, for instance in regard to the price promotional strategy, various authors have developed models to explain the observed behavior in a rational equilibrium framework. The main feature analyzed is whether or not and how a set of customers loyal to different brands influences the promotional strategy of brands, especially the impact on the frequency (frequency) of promotional sales und the level of the promotional price reduction (depth). Significant contributions to the problem can be found in Raju et al. (1990), Rao (1991), Agrawal (1996), Anderson and Kumar (2007), Jing and Wen (2008) and Koçaş and Bohlmann (2008). For these models no unambiguous result is obtained; depending on the setting almost every outcome is possible which calls for rigid empirical testing to decide which approach might be relevant to the real world.

To date very few comprehensive empirical studies on the impact of brand loyalty on frequency and depth of price promotions have been published, in particular employing data from (European) retail markets. Agrawal (1996) analyses seven different product categories in the US food retail market and finds that stronger brands are promoted less often but more deeply. Koçaş and Bohlmann (2008) use data for books sold online and reveals that price promotional strategies depend on the ratio of loyal to price-sensitive consumers. Smaller brands are

[1] See Schaper and Loy (2010). Hosken and Reiffen (2004: 137) and Berck et al. (2008: 1261) show for the US that twenty to fifty percent of stores' product price variation can be attributed to variations due to sales' prices.

found to be promoted more often at higher discounts. Allender and Richards (2009) investigate the market for breakfast cereals in the United States using a household scanner data sample. They find a negative correlation between the degree of brand loyalty and frequency as well as depth of price promotions.

The present study uses a combination of two detailed data sets for the breakfast cereals market in Germany. To measure brand loyalty we employ a household panel data set which records the actual consumption behavior of 14.000 households in the period from 2000 to 2001. The brand specific retail price promotional strategy is derived from a retail scanner data set for 108 retailers in Germany over the same period which is very likely to result in more reliable estimators of brand specific promotional strategies compared to a household scanner panel. To test the impact of brand loyalty on promotional pricing strategies in the empirical model, we also include certain aspects that might interact in this relationship such as manufacturer and retail chain specific effects that to our knowledge have not been considered in the literature so far. The empirical model provides strong evidence for a negative impact of the degree brand loyalty on the magnitude (depth) and frequency (frequency) of price promotions. This main result is robust over different specifications and empirical measurements of brand loyalty and promotional sales. Stronger brands are promoted less often with shallower discounts compared to weak brands. On the contrary, the size of the loyal segment positively influences the frequency and depth of price promotions. But even though this result is statistically significant, the size of the coefficients, namely the economic relevance, is negligibly small. Suppliers often charge the reservation price for strong brands and promote weak brands in the competition for non loyal consumer segments. In a dynamic perspective, this result could imply that stronger brands need to look for alternative promotional strategies to attract new customers and to keep their loyal consumer segment.

The paper is organized as follows. In section two, we briefly review the existing literature on the relationship between price promotions and brand loyalty. In the following section, the data sets are presented. Some descriptive statistics of measures of price promotion and brand loyalty are shown. In section four we develop the model specification, report and discuss estimation results. Finally, we summarize our findings.

2. Brief Literature Review

Brand loyalty describes consumers' attitude or behavior that directly effects the consumption decision and thereby determines retailers' optimal pricing strategies. In most models brand loyal behavior is either defined by the maximum price differential consumers are willing to accept before they switch to price reduced brands (degree of loyalty) and/or by the size of the loyal consumer segments (extent of loyalty). Brands might differ with respect to the level of loyalty and/or the size of their loyal consumer segment. A strong brand has either customers who accept a high price differential before they switch to another brand or a large brand has many loyal customers (large loyal segment).

The predominant feature of the models is represented by the trade-off between either charging a higher price to loyal customers (loyal segments) or being the low price alternative in the market to win the shoppers or customers that are normally loyal to other brands, e.g. by offering high and frequent discounts. "The two key comparative statics of interest are the average depth of discounts and the frequency of promotions" (Narasimhan, 1988). Existing theoretical models however differ in their particular set-up in which often small modifications can lead to significant changes in comparative static results. Even parameter variations under the same model set can us lead to different conclusions.

Narasimhan (1988) for example shows that both brands grant the same discount. The larger brand promotes less often. However, "if the switchers are willing to pay a premium to one of the brands, ….a premium price brand in general will offer a higher average discount and also promote more often unless its share of the loyal segment is very large" (Narasimhan, 1988: 441).

In their seminal contribution, Raju et al. (1990) investigate the simultaneous pricing strategies of two competing manufacturers. Consumers are loyal towards either one of the brands and the degree of brand loyalty differs between brands. The authors argue that the stronger brand promotes less often but more deeply. The weaker brand uses promotions for defensive purposes by giving incentives to its loyal customers not to switch, while the stronger brand aggressively tries to attract customers that are loyal to the weaker brand.

Rao (1991) assumes that the two manufacturers sequentially choose the regular price as well as the frequency and depth of price promotions. Thus, manufacturers are able to react on each other's decisions. In his model, only one manufacturer (the 'stronger' firm) has loyal clients. The loyal clients' willingness to pay a price premium for their favorite brand differs across consumers. In the mixed strategy equilibrium, the weaker brand pursues an 'every day low price' (EDLP) strategy with a lower regular price and no price promotions. The stronger brand chooses a higher regular price but engages in price promotional activities. In this outcome of the sequential game both price setting strategies function as a defensive tool to keep the loyal customers at the strong brand and the non-loyal consumers at the EDLP brand.

Narasimhan (1988), Raju et al. (1990) as well as Rao (1991) do not consider the influence of a retailer located between manufacturers and consumers on the pricing strategy which in particular for food products is likely to be important. The food retail chains in Germany and many other places are highly concentrated and sell several brands for most food items. The execution of market power over small and medium size food processors and the consumers might also be an issue especially at the regional level. Agrawal (1996) extends former models by including a monopoly retailer who sells (both) manufacturers' brands. The retailer faces two options: Option one is to sell both brands at the consumers' reference price to the respective loyal segment. Option two is to offer either one of the brands on promotion to target the entire market in the respective period. To do so, the promotional depth needs to exceed the level of loyalty of the respective other brand. Because the level of loyalty is higher for the stronger firm, discounts for the weaker brand need to be higher. As this option is costly for the retailer (loss by the price reduction in the loyal segment), it is used less often. Agrawal's (1996) option two results that the stronger (weaker) brand will be promoted more (less) often but less (more) strongly.

While earlier models (Raju et al. 1990, Rao 1991 and Agrawal 1996) assume in general that all consumers are loyal towards a specific brand, more recent studies (Anderson and Kumar 2007, Koçaş and Bohlmann 2008, Jing and Wen 2008) include switching consumer segments. Also in Anderson and Kumar (2007), brand loyalty is no longer modeled as a static characteristic of consumers; firms can transform price-sensitive consumers ('switchers') into loyal clients. The firms differ in the power to create customer loyalty. A fraction of the price-sensitive segment becomes loyal to the brand being the cheapest one in the period before. The stronger firm is able to convince a larger share to become loyal. The trade-off that firms face in this model is to either "harvest" its loyal segment by charging a higher price or to invest in potential new loyal customer by lowering the price. In equilibrium, the stronger firm promotes more often and deeper as its persuading power is higher: the size of the price-sensitive segment is positively related to the depth and frequency of discount.

Koçaş and Bohlmann (2008) investigate price competition between three retailers (but do not include the upstream manufacturers' pricing decisions). Retailers differ in the size of their loyal consumer segment as well as how many price-sensitive consumers are aware of their prices. Again, the equilibrium is characterized by the trade-off between charging a high price to the loyal clients and lowering prices to capture a higher market share. The authors extend the model by determining the optimal pricing strategies contingent on the ratio between price sensitive and loyal customers. Compared to the smallest retailer, the large retailer can either have a smaller or higher 'sensitive to loyal ratio'. If the ratio is higher, the stronger retailer promotes more often and offers a larger discount.

Depending upon the nature of products, Jing and Wen (2008) differentiate between three different levels of overall brand loyalty: high, intermediate or low. Consumers are divided into two segments, consumers who are loyal to the stronger brand and price sensitive consumers. The authors investigate the impact of different levels of brand loyalty and also distinguish between markets according to the relative size of respective consumer segments (larger loyal or large price sensitive consumer segment), so that finally six different equilibrium solutions occur. In general, with an increasing price sensitive segment both brands will offer deeper and more frequent promotions. The stronger brand will promote more aggressively when the overall degree of brand loyalty is lower because it is less profitable to absorb the higher willingness to pay of its loyal segment.

In conclusion we can summarize that the resulting pricing equilibriums vary depending on the model's set up. The models differ in the way the consumer's are modeled (inclusion of a switching segment, number of loyal groups), the number of players (duopoly or triopoly), the distributional channel (inclusion of a common retailer), the way the decisions are made (simultaneously or sequentially) and whether dynamic aspects are incorporated.

Crucial is also how the asymmetry between the brands is realized. Do the brands differ with respect to the level of loyalty or segment size?

Some models match in several assumptions but nevertheless come to diverging conclusions because the emerging equilibriums are contingent on the interaction of all assumptions being imposed. Identifying assumptions leading to certain predictions is impossible, as the effects are overlaid.

The major predictions regarding the impact of brand loyalty on the frequency and depth of price promotions described above are briefly summarized in the following graphs (Figure 1).

Figure 1: Theoretical Pricing Distributions

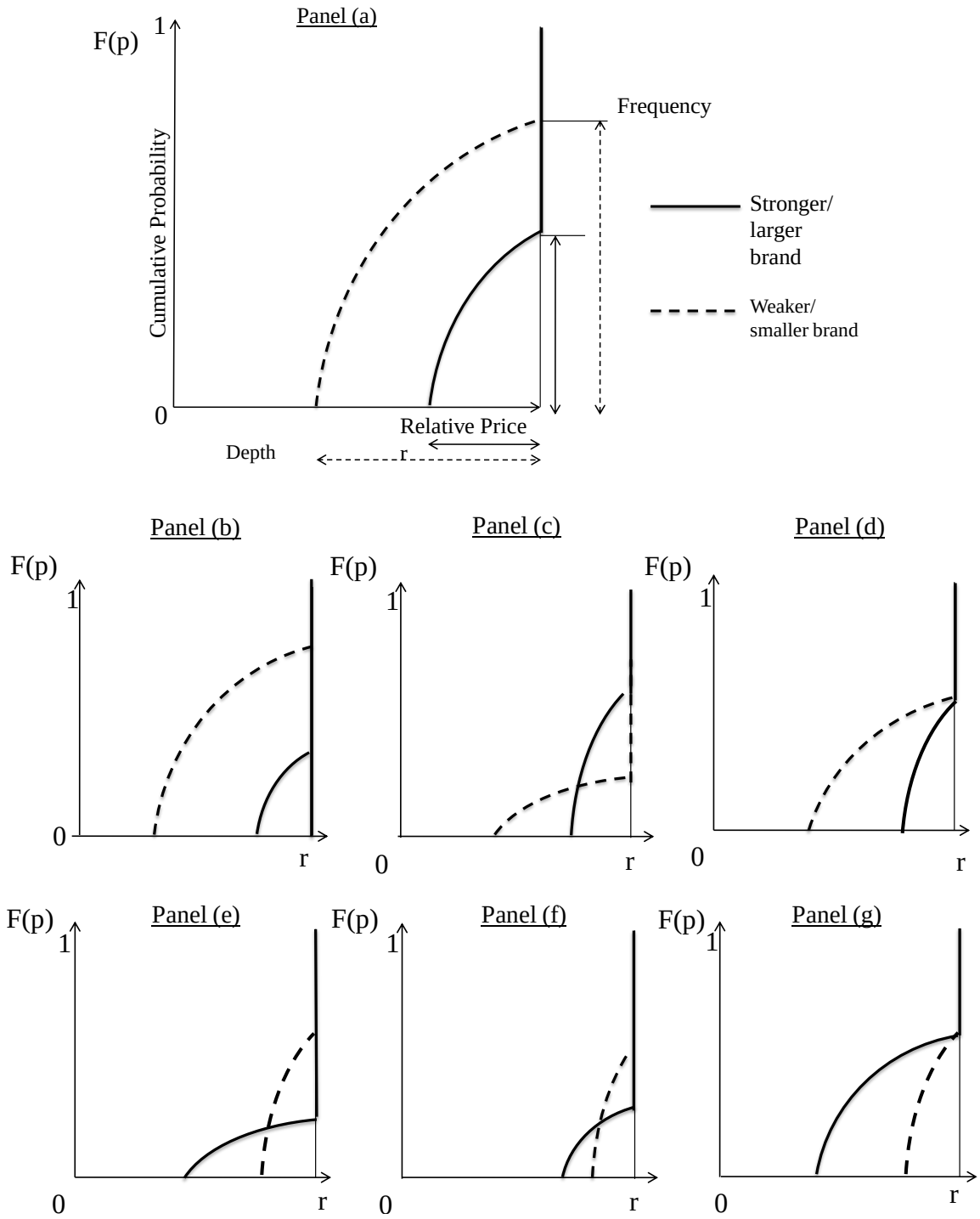


Figure 1 shows the relationship between the depth (the discounted price relative to the regular price) on the x-axis and the frequency of the price promotion (the cumulative probability of price promotions) on the y-axis for a strong or large (continuous line) and a weak or small brand (dotted line). In panel (a), the stronger brand offers smaller average discounts and promotes less frequently compared with the weak brand. Increasing brand loyalty is associated with less frequent and also smaller promotions (as suggested by Koçaş and Bohlmann (2008) when the weakest retailer has relatively few loyal customers). Panel (b) suggests that the stronger brand offers more and deeper discounts, a hypothesis put forward by Anderson and Kumar (1200) as well as Koçaş and Bohlmann (2008) in the case of more price-sensitive consumers being aware of the stronger firm. Panel (c) in Figure 1 corresponds to the findings reported in Agrarwal (1996): a high degree of brand loyalty is associated with more frequent but smaller price promotions. The reverse case is pictured in panel (e). The remaining three panels are visualizations of equilibrium solutions derived by Jing and Wen (2008). In panel (f) the average discounts equal, whereas in panel (d) and (g) the frequencies of promotions match. In presence of large loyal segments, the stronger brand promotes deeper to defend them (panel (g)). The frequencies of price promotions are mainly driven by the overall level of brand loyalty. Panel (f) represents a market of high brand loyalty, thus the stronger brand chooses to absorb its loyal clients' willingness to pay, whereas in panel (d) and (g) the overall level of brand loyalty drops so that the stronger brand intensifies its efforts to compete for the switching consumers and promotes relatively more often.

3. Data and Definition of Variables

We use two detailed data sets for the German ready-to-eat breakfast cereals market; a household scanner and a retail scanner data set. The household scanner data set is provided by the GfK (Gesellschaft für Konsumforschung: Association for Consumer Research) for the years 2000 and 2001. This data set includes the reporting of about 14,000 households on their daily food purchases. Each purchased product can be identified by its EAN (European Article Number). Further information about the point of sale, the date of purchase, price promotions and information on household characteristics such as household size, employment and age of the household lead are also available in the data set. This data is ideal to study the consumer behavior at the household level, e.g. to measuring the level and the extent of brand loyalty in the read-to-eat cereals market.

To evaluate the dynamics of individual store's price setting, complete panels of store prices are needed. The consumer scan data at hand do not allow identifying individual stores. Further prices are not available for every week and store. Also the price reporting shows some deficiencies. Einav et al. (2010) find that reporting of prices within Nielsen Homescan data is of limited quality due to self-reporting of prices and promotions. In particular price promotions are likely to be over represented in the sample.[2] Therefore, we use a second data base that directly reports prices and volumes at the individual store's level. The retail scanner data set is provided by MaDaKom GmbH (Markt-Daten-Komunikation: market data communication). The data covers 104 weeks from January 2000 to December 2001 which matches the time span the GfK data is available. The data reports individual (EAN) product prices, volumes, promotions etc. for 108 retailers located throughout Germany.[3] Stores are classified by size, number of checkouts, location, and affiliation to a retail chain. Retailers provide additional information on specific marketing instruments such as special packing, display, feature, or price promotion of the products. The data is reported on a weekly basis.

The ready-to-eat breakfast cereals market has been frequently studied in economics and marketing (see Nevo, 2001, Allender and Richards 2009). The market is characterized by high concentration ratios, high price-cost margins, large advertising to sales ratios and numerous introductions of new products (Nevo, 2001). These

[2] Though households scan the products purchased, they have to enter price manually from the receipt. The latter is likely to be a source of error. As households are expected to buy products on sale more often, the appearance of sales is inherently over represented in the Homescan sample.

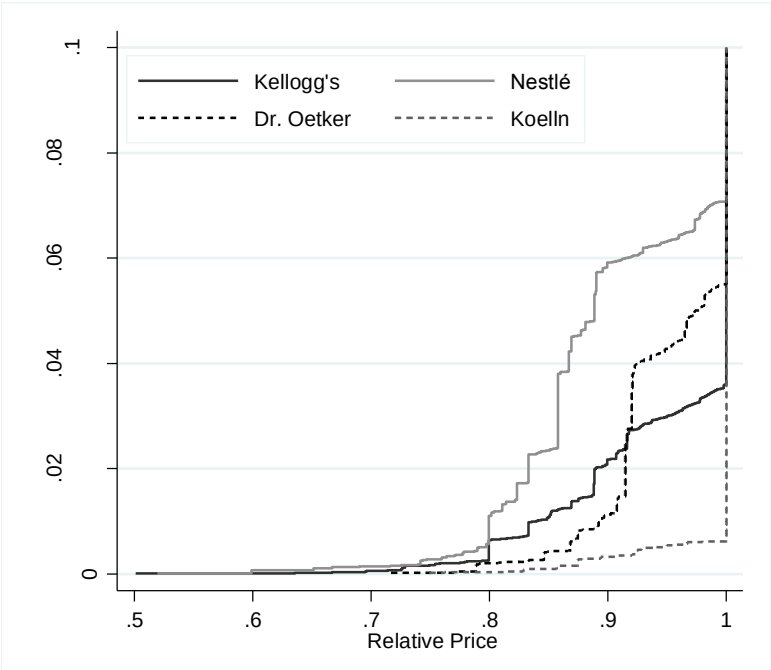
[3] This data set does not include two German EDLP discounters, Aldi and Lidl. Given the focus of our study (to analyze the impact of brand loyalty on retailers' price promotions), this is not serious problem since Aldi and Lidl pursue an EDLP strategy and never use price promotions.

market characteristics - particularly the oligopolistic market structure - match the assumptions made in many theoretical models. Another important requisite in the models is that products are highly substitutable, processed by different manufacturers and are marketed under different brands. For ready-to-eat breakfast cereals these assumptions seem very plausible (Scherer and Ross, 1990).

We match household and retail scanner data by products and stores available in both data sets. As some important retail chains do not publish or sell data to market research companies, MaDaKom only cover parts of the market. For example, private labels sold by Aldi or Lidl (important discounters with a significant market share), are not reported in the retail scan data set. In both samples we find the same 129 EAN out of a total of 142 in the retail scan and 375 in the home scan data set. From these we select only products with a market share greater than one percent based on the retail scan data set and with a significant number of consumers who bought the respective product over the entire period in the GfK sample. In the final matched sample we selected 23 sub brands which belong to four corporate brands, namely Kellogg's, Nestlé, Dr. Oetker and Kölln.

To investigate the relationship between price promotions and brand loyalty, measures for both terms need to be constructed. We follow Hermann et al. (2005) and define a price promotion based on the following three conditions: (a) the price of a particular product is at least 5% below the regular price[4], b) the duration of a price promotion does not exceed four weeks, and (c) following a price promotion the price rises. Price promotions are calculated for each EAN code separately for products being sold over the entire period.[5] The analysis builds upon 1,729 price series from 108 different retailers belonging to five different retail chains or key accounts (Metro, Markant, Tengelmann, Edeka and Rewe).[6]

Figure 2: Empirical Pricing Distributions



Main features of price promotional strategies are the frequency and depth of price promotions. Among the brands in the sample which have been promoted at least once, the average promotional frequency is 6.12 percent, i.e. on average 1 out of 16 items are on sale in a given time period. The average depth of promotions is 14.4

[4] A price is called regular if it is in effect in four consecutive weeks.

[5] The MaDaKom provided a definition and calculated dummy variable according to the definition. However, the dummy variable did show some miscalculations; therefore a new indicator variable is calculated based on the MaDaKom definition of a promotional price.

[6] As we only considered price series with less than 20% missing observations, the number of observations reduces from 108*23=2,484 potential observations to 1,729 observations.

percent. 1729 observations remain in our sample; each time series represents one of 23 sub-brands at one of 108 retailers. For 60 % of the time series at least one price promotion is observed. The substantial variation in price promotional features underlines the importance of analyzing retailers and brands individually without averaging over brands as in Agrawal (1996) or Allender and Richards (2009).
The empirical relationship between depth and frequency of price promotions aggregated on corporate brand level is illustrated in Figure 2. On average, Nestlé promotes most often and offers relatively deep discounts. Kellogg's and Kölln's cumulative distribution of relative prices lies almost parallel to Nestlé's. Thus, one can conclude that both promote less often and provide smaller price reductions. Dr. Oetker, who is only represented through two sub-brands in our sample, promotes more often offering shallower discounts compared to Kellogg's. This results in a cumulative probability line intersecting with Kellogg's. Compared to the seven different cases shown in Figure 1, the actual empirical distribution most closely resembles panels (a) and (b). The cumulative pricing distributions are almost parallel to each other, implying a complementary relationship between the depth and frequency of price reductions. Either a brand offers strong and frequent or small and infrequent price discounts.

Since it was first mentioned by Copeland in 1923, the concept of brand loyalty is comprehensively discussed in the literature. Empirical measures are classified into measures only considering the behavioral or attitudinal component of brand loyalty and those of a composite nature. Behavioral measures evaluate a consumer's purchase history using e.g. panel data, whereas attitudinal measures explore a consumer's attitude towards competing brands e.g. though a questionnaire. Rundle-Thiele and Bennett (2001) presented a survey of this literature and found that in the market of fast moving consumer goods (FMCG) it is valid to apply behavioral measures. The behavioral measures of brand loyalty can be grouped into proportion-of-purchase, sequence-of-purchase, probability-of-purchase, synthesis and miscellaneous measures. As our research focuses on ready-to-eat breakfast cereals which belong to the class of FMGC and as the operationalization of brand loyalty is still highly debated among brand loyalty researchers, we chose three different measures.
A survey of this literature is presented by Rundle-Thiele and Bennett (2001). On the basis of scanner data it is impossible to estimate the price differential between brands that consumers are willing to accept before they switch to alternative brands. This measure is typically used to define brand loyalty in theoretical models. However, brand loyalty is also assessable by analyzing consumption patterns in time. In this study we apply three well known measures, namely average length of the brand run, repurchase probability, and return probability. We define and apply all measures at the level of the sub-brand to allow as much flexibility and extract as much information as possible. Thereby, we allow loyalty to differ for the various sub-brands that are summarized under the corporate brands.
A brand run is defined as a consecutive sequence of purchases of the same brand by one particular household. The average length of the brand run is the average number of consecutive purchases of a particular brand for each household over the entire period. The repurchase probability is calculated from a first-order Markov matrix and gives the probability of purchasing a particular brand again conditional on a previous purchase of the same sub-brand occasion. The return probability measures the probability of returning to a particular brand conditional on a previous purchase of another sub-brand.
All three measures of brand loyalty are computed for each household for all 23 sub-brands and are then aggregated over all households. A household is labeled as loyal towards a brand a, if its degree of loyalty is highest for brand a. To aggregate the results on brand level, we count all household being loyal towards a brand (segment size) and average of the loyalty scores of these loyal households (degree of loyalty).

The variables entering our model are summarized in Table 1. Price promotions are characterized through two variables, namely the depth and frequency of price reductions. Our core variable to describe the brands is the degree of loyalty, estimated in three alternative ways. As some theoretical models also define brand loyalty according to the size of the loyal segments, we also include the segment sizes. Finally, retail chain, format and manufacturer dummies are also included in our model in order to separate these effects from brand loyalty specific effects.

Table 1: Descriptive Statistics

	Mean	Standard Deviation	Min	Max
Dependent Variables				
Depth of Price Promotions	0.08	0.08	0	0.6
Frequency of Price Promotions	0.04	0.05	0	0.24
Independent Variables				
Degree of Loyalty – Brand Loyalty	4.73	1.11	2.58	7.87
Segment Size – Brand Loyalty	131.94	107.6	12	336
Degree of Loyalty – Repurchase Prob.	0.52	0.06	0.26	0.63
Segment Size – Repurchase Prob.	125.18	92.32	8	299
Degree of Loyalty – Return Probability	0.70	0.05	0.61	0.83
Segment Size – Return Probability	78.52	57.63	5	189
Edeka	0.26	0.44	0	1
Markant	0.16	0.37	0	1
Metro	0.27	0.45	0	1
Rewe	0.13	0.34	0	1
Tengelmann	0.13	0.33	0	1
Misc.	0.05	0.22	0	1
Discounter	0.06	0.24	0	1
Dr. Oetker	0.07	0.26	0	1
Kellogg‘s	0.69	0.46	0	1
Koelln	0.04	0.19	0	1
Nestlé	0.2	0.4	0	1

4. Model Specification and Estimation Results

To test the impact of brand loyalty on price promotional strategies, we estimate three different model specifications for the two dependent variables respectively (the frequency and depth of price promotions). The model specifications only differ in the measure of brand loyalty that is used (see above for the definition of brand runs, repurchase probabilities, and return probabilities). Both dependent variables are left censored. About 40 percent of the time series under study do not indicate any price promotions and are represented by a zero, thus we employ a Tobit model.
As raised by Huang et al. (2006) another concern is the potential endogeneity of the measures of brand loyalty. Price promotional strategies are used to influence consumers’ purchasing decisions and thus might determine the level of brand loyalty. The rejection of the null hypothesis in the Wu-Hausmann-test of exogeneity at the 5% significance level for five of the six specifications indicates that the OLS estimator might deliver inconsistent estimates (Hausman, 1978). We apply a two stage Instrumental-Variable Tobit Model (IVTobit) by using household characteristics as well as retailer and manufacturer dummies as instruments to extract brand loyalty that is exogenous to the model specification.

In Table 2 parameter estimates for the impact of three different measures of brand loyalty on the frequency (columns 1 to 3) and depth of price promotions (columns 4 to 6) are reported. Across all specifications we find a significant negative coefficient for the degree of brand loyalty. Stronger brands are promoted less often and strong brand are promoted at lower discounts. This finding is consistent with theoretical models of Jing and Wen

(2008) and Koçaş and Bohlmann (2008) (compare Figure 1, panel (a)). Jing and Wen (2008) predict stronger brands to promote less often and to provide a smaller discount in a market with a large segment of price-sensitive consumers. The weaker brand targets its pricing strategy at price-sensitive customers instead of invading the stronger brand's loyal customer base. Thus, the stronger brand is not forced to act aggressively in the market.

Table 2 further suggests that brands with a larger loyal customer segment are being promoted more aggressively by stronger brands. The number of households counted loyal towards a brand is labeled as segment size.[7] Similar results are obtained when the market share is used as an explanatory variable instead; the explanatory power of the model is somewhat lower in this case. Brands with a larger segment of loyal consumers (larger market share) are more often on sale and their price discounts are larger, ceteris paribus. These results are in contrast to Van Oest and Franses (2005), who suggest that the stronger brand promotes more often and offers a larger discount, and correspond to Jing and Wen (2008), Hosken and Reiffen (2004) as well as Lal and Matutes (1989, 1994). These authors investigate how differences in the 'popularity' of goods affect their probability of being on sale and argue that 'within groups of products that are close substitutes, more popular products are more likely to go on sales than less popular products' (Hosken and Reiffen, 2004: 154).

Comparing the effects of the degree of loyalty to the size of the loyal segment, we find that the degree of loyalty is of greater economic importance. Even though the segment size coefficients are statistically significant, their coefficients are extremely small.

The coefficients of the retail chain and manufacturer dummies are also highly significant and consistent across the different models. Especially the discounters promote less aggressively (Table 2 suggests a significantly lower frequency of sales and depth of price promotions for this format) which is in line with their "Everyday Low Price Strategy". Manufacturer specific effects indicate that Nestlé – the runner up in the market behind Kellogg's – prices more aggressively in terms of offering larger and more frequent discounts.

We have also carried out a number of specification tests to evaluate the stability of our empirical results. To obtain valid results from an IV regression, each instrument needs to satisfy two conditions: instrumental relevance and instrumental exogeneity. Instrumental relevance can only be defended on theoretical grounds. Household characteristics are found to influence the extent of brand loyalty for food products in Wettstein et al. (2009), thus we use household income and size as instrumental variables. In the first stage regressions the F-statistics for the joint significance of the instruments are also highly significant across all estimations but one and the coefficient of determination ranges from 27 to 63%.

With regard to instrumental exogeneity Table 2 also reports the Wald test, which tests whether the instrumented variables are in fact endogenous. In five out of six specifications we can reject the null hypothesis of no endogeneity, thus the IV approach seems to be correct. Regarding the strength of the selected instruments, we tested against underidentification and weak instruments using the rk statistic derived in Kleibergen and Paap (2006) for non i.i.d. error terms.

Tobit models are extremely sensitive to heteroskedastic error terms. If heteroskedasticity is present in the data, the estimates will be biased and inconsistent. Thus, we repeated our estimations using Powell's 'Censored Least Absolute Deviations' (CLAD) estimator (Kilic et al., 2009), which is robust to heteroskedasticity. The estimation results are very similar to those reported in Table 2 and are available upon request.

The results reported so far remain nearly identical when modifying the definition of price promotions. Instead of requiring a price reduction of more than 5 % for a maximum time span of four weeks, we experimented with 2.5%, 7.5%, 10%, and 15% thresholds for time spans of three and five consecutive weeks, respectively. We also repeated our regressions using OLS, 2SLS and a Tobit model without instruments; the results remain unchanged and are available from the authors upon request.

[7] The 'segment size' for a particular brand is defined as the number of households that have the highest degree of loyalty towards this particular brand (in comparison to all other brands).

Table 2: Influence of Brand Loyalty on Frequency and Depth of Promotions (IVTobit Model)

	Dependent Variable					
	Frequency of Price Promotions			Depth of Price Promotions		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.084*** (4.92)	0.245*** (4.90)	0.232*** (4.28)	0.147*** (4.25)	0.473*** (4.61)	0.429*** (4.20)
Degree of Brand Loyalty						
Average Length of Brand Run	-0.011** (-2.97)			-0.022** (-2.80)		
Repurchase Probability		-0.394***(-4.28)			-0.786***(-4.17)	
Return Probability			-0.299***(-3.86)			-0.555***(-3.80)
Segment Size *1000	0.275*** (4.06)	0.559*** (4.91)	1.263*** (5.41)	0.743*** (5.41)	1.310*** (5.63)	2.370*** (3.36)
Retail Chain Dummies						
Markant	-0.009 (-1.95)	-0.010* (-1.99)	-0.006 (-0.90)	-0.017 (-1.74)	-0.019 (-1.78)	-0.013 (-1.00)
Metro	0.028*** (6.87)	0.027*** (6.11)	0.028*** (5.05)	0.001 (0.14)	-0.001 (-0.13)	0.001 (0.09)
Rewe	-0.077***(-12.3)	-0.077***(-11.7)	-0.077***(-9.95)	-0.174***(-13.9)	-0.174***(-13.0)	-0.175***(-11.8)
Tengelmann	-0.051***(-8.29)	-0.051***(-7.78)	-0.054***(-6.83)	-0.041***(-3.44)	-0.041** (-3.15)	-0.048** (-3.21)
Others	-0.033***(-4.29)	-0.036***(-4.40)	-0.047***(-4.24)	-0.022 (-1.42)	-0.029 (-1.72)	-0.044* (-2.14)
Discounter Dummy	-0.084***(-7.66)	-0.097***(-7.97)	-0.122***(-6.12)	-0.211***(-10.1)	-0.235***(-9.93)	-0.265***(-7.11)
Manufacturer Dummies						
Kellogg's	-0.053***(-5.46)	-0.101***(-5.78)	-0.116***(-4.27)	-0.083***(-4.19)	-0.173***(-4.85)	-0.172***(-3.37)
Koelln	-0.087***(-7.79)	-0.113***(-8.44)	-0.115***(-7.07)	-0.116***(-5.27)	-0.171***(-6.31)	-0.159***(-5.23)
Nestlé	0.013 (1.83)	-0.028* (-2.11)	-0.025 (-1.75)	-0.029* (1.99)	-0.055* (-2.03)	-0.040 (-1.46)
LL [LL(β=0)]	-11203.49 [669.33]	-6030.16 [669.33]	-4581.84 [669.33]	-11959.83[20.44]	-6828.57 [20.44]	-5327.54 [20.44]
Wald Test of Exogeneity	0.106	0.000	0.000	0.000	0.000	0.000
N	1,729	1,729	1,729	1,729	1,729	1,729

Remarks: The reference category for the retail chain dummies is 'Edeka', the reference category for the manufacturer dummies is 'Dr. Oetker'. t-values in parenthesis. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

5. Conclusions

Price promotions are important marketing activities for (food) retailers, particularly in Germany; brand loyalty is a major requisite to foster brands' assets. Several theoretical papers have analyzed the relationship between price promotions and brand loyalty resulting in mixed outcomes. With our study we intend to extend the few number of empirical studies for (European) grocery markets that are available to test which model(s) might be most relevant to reflect pricing strategies in food retailing.

Earlier models by Raju et al. (1990), Rao (1991) and Agrawal (1996) assume in general that all consumers are loyal towards a specific brand, more recent studies by Anderson and Kumar (2007), Koçaş and Bohlmann (2008), Jing and Wen (2008) include switching consumer segments. Koçaş and Bohlmann (2008) as well as Jing and Wen (2008) show that under certain conditions the weaker retailer promotes more often and offers a larger discount compared to the stronger brand.

In this study we merge weekly retail scanner and daily consumer scan data for the German ready-to-eat breakfast cereals market to investigate the impact of brand loyalty on retailers' price promotional strategies. The key result of this study is that brand loyalty significantly influences the design of a price promotional strategy (even when taking into account that brand loyalty might be endogeneous as well as controlling for manufacturer and retail chain effects). For all three measures of brand loyalty (the average length of the brand run, the repurchase probability, and the return probability), we find strong empirical support for a negative impact of the degree of brand loyalty on the aggressiveness of promotional strategies: stronger brands tend to be promoted less frequently and price discounts are smaller, ceteris paribus. This results support the theoretical models presented by Koçaş and Bohlmann (2008) and Jing and Wen (2008). However, we also find a slight impact of the segment size that offsets the former relationship. Segment size (as well as the market share) of a particular brand is positively related to the frequency and depth of price reductions. These results would provide some evidence for the model by Anderson and Kumar (2007). Considering the size of the two effects the first relationship outweighs by far the second. An additional interpretations might be that the first relationship holds for the corporate brands while the latter is valid for the respective sub-brands, meaning that a corporate brand more likely promotes popular sub-brands.

Although we have been able to explore the relationship between brand loyalty and price promotional strategies on the basis of a unique data set, a few caveats pertain. First, pricing decisions of retailers typically are made in a multi-product environment which implies a complex set of interactions between different products. These interactions are not addressed in the current study due to the obvious dimensionality issue for a large equation system, but are worthy for further investigation. Second, theoretical and empirical studies typically investigate the relationship between brand loyalty and promotional strategies in a static context. Data permitting, it would be interesting to learn more about how price promotions dynamically influence consumer behavior and how changes in the degree of loyalty then feed back to pricing strategies. Analyzing the dynamics of the relationship between brand loyalty and promotional strategies is beyond the scope of the current study and is deferred to further investigations.

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