Couponing Strategies in Competition Between a National Brand and a Private Label Product☆

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Abstract

This paper explores the couponing strategies when a national brand competes with a store brand by discussing three different kinds of coupons: manufacturers' coupons, retailers' national brand coupons, and retailers' private label coupons. We show that the positioning of the private label product in terms of quality and feature differentiation from the national brand play an important role in determining the face value of the manufacturer's coupon and retailer's national brand coupon. In particular, a larger degree of feature differentiation drives the manufacturer to increase its coupon value, and the retailer responds by decreasing the value of its own coupon for the brand name product. In contrast, with an increase in private label quality, the couponing strategies taken by the manufacturer and the retailer depend on which segment of consumers is in the market for the private label product. Additionally, the retailer's private label coupon value is only impacted by the difference in consumers' willingness to pay but not by private label positioning. Empirical results on the effect of feature differentiation on national brand and private label coupon values are consistent with our theoretical predictions.

☆Researchers own analyses calculated (or derived) based in part on data from The Nielsen Company (US), LLC and marketing databases provided through the Nielsen Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the Nielsen data are those of the researcher(s) and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein.

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1. Introduction

Coupon redemption volume for grocery stores and mass merchandisers increased by 16.7% and 30.2%, respectively, from the first half of 2008 to the first half of 2009 (NCH Marketing Services, Inc., 2009). In the fourth quarter of 2016, 89% of consumers used at least one coupon.[1] From an individual consumer's perspective, coupons represent a simple price discount to induce purchases. However, from a manufacturer's perspective, coupons can be used to discriminate between more and less price-sensitive consumers (Narasimhan, 1984; Vilcassim and Wittink, 1987; Gerstner et al., 1994).

Additionally, retailers no longer only act as distributors of manufacturers' products. They carry national brand (NB) products on shelves while simultaneously offering consumers private label (PL) products and functioning as manufacturers. Moreover, whereas once only NB manufacturers issued coupons, now retailers also issue coupons on both NB and PL products. These retailer coupons are now a very common marketing strategy: In the consumer packaged goods category, retailer coupons were available for 87% of PL products and 25% of NB products in 2006, while manufacturer coupons were offered for 20% of NB products.[2]

These two trends—increased use of coupons and spread to PL products—motivate us to examine the couponing strategies of brand name manufacturers and retailers. Concentrating on cents-off (as opposed to percent-off or buy-n-get-one-free) coupons, we model couponing strategies by a brand name manufacturer and a retailer that may choose to offer a PL product. Our theoretical analysis finds that both feature and quality differentiation between the NB and the PL products are important determinants of the face value of coupons offered. An examination of retail scanner data supports those results.

Due to their increasing market share, PL products are increasingly taken seriously as

[1] Inmar Associates, Feb. 14, 2017, Winston-Salem, NC: https://www.inmar.com/press-release/inmar-study-of-2016-coupon-activity-reveals-changes-in-shopper-preferences/

[2] Own calculation based on Nielsen Homescan data.

competitors to NB products in many product categories.[3] Retailers thus face dual roles as downstream parts of the NB supply chain and as competitors to the NB. This duality provides a fascinating backdrop for studying couponing strategies. In particular, retailers trying to promote their PL product may consider decreasing couponing activity on the NB product or increasing its couponing on the PL product. In response, a manufacturer might increase its couponing on the NB product.

Very few scholarly studies or trade analyses report on the intersection of private label and couponing practices. Even within the literature on couponing strategies, few papers have paid attention to the behavior of the three types of coupons—manufacturers' NB coupons and retailers' NB and PL coupons—investigated in this study. One exception is Sethuraman and Mittelstaedt (1992), who explore empirically how the PL share is impacted by NB manufacturer couponing activity, NB store couponing activity, and PL store couponing activity. They find that manufacturer coupons are used to deter PL expansion and that consumers of NBs are disinclined to switch to purchase PLs, even when PLs are promoted with store coupons. Their results are consistent with their assumption that PL customers are price-sensitive and NB customers are price-insensitive. We add to Sethuraman and Mittelstaedt's work in three ways: We develop and analyze a theoretical model as the basis of our predictions; we allow all consumers (price-sensitive and price-insensitive) to consume the PL product, which leads to the interesting situation that under certain parameter values in equilibrium only the price-insensitive consumers purchase the PL product; and we study factors affecting coupon values (i.e., coupon values are our dependent variables, while Sethuraman and Mittelstaedt treat them as independent variables). Our results are consistent with Sethuraman and Mittelstaedt's insofar as we find that increased manufacturer coupon

[3]PL market share is high in several food categories in various countries. For example, Bergès-Sennou et al. (2004) document that the market share by value for frozen foods is especially high in Spain (33.9%), Germany (36%), France (36.3%), the United Kingdom (45.4%), and Belgium (49%). In Belgium, the market share by volume is close to 60%.

values might be used as a means to reduce PL uptake.

In contrast to Sethuraman and Mittelstaedt, Hoch and Banerji (1993) indicate that a price discount on NBs does not significantly lower the PL share. They conclude that major PL customers are not necessarily price-sensitive. Similarly, Dhar and Hoch (1997) show mixed signs in different food product categories when regressing PL market share on the average price gap between PLs and NBs: Whether the PL customers are price-sensitive or not remains unknown. In other words, the patterns of the couponing activities shown in Sethuraman and Mittelstaedt (1992) deserve to be further explored.

In this paper, we extend the literatures on coupons and PL products by combining the two. In terms of the literature on PL, we contribute by studying how competition between PL and NB products pans out in the presence of coupons. We add to the literature on coupons by incorporating PL and NB competition into models of couponing and exploring how PL positioning affects coupon values. Based on and extending work by Choi and Coughlan (2006), we model the three types of coupons in a competition between an NB and a PL. In particular, this paper assumes that there are two types of consumers: Price-insensitive consumers, who never search for coupons, and price-sensitive consumers, who always search for coupons and use them whenever available. By considering a series of retailer decisions—including whether to offer the PL, pricing both products, and promoting one or both products by offering coupons—we show that PL positioning plays an important role in determining couponing strategies in NB versus PL competition.

In our model, the retailer positions the PL (i) vertically by choosing PL quality relative to NB quality and (ii) horizontally by choosing the degree of feature differentiation between the PL and the NB. While both Mills (1995) and Bontems et al. (1999) indicate that PL quality (relative to NB quality) is the only factor driving the retailer's choice to offer or not offer the PL product, we show that whether the PL is offered also depends on the degree of feature differentiation between the two products. In particular, it is possible for a PL with features that are similar to those of the NB not to be offered, despite high PL quality.

We further find that the two dimensions of PL positioning have different impacts on couponing strategies. For a fixed PL quality, the manufacturer tends to increase its coupon value as the degree of feature differentiation between the two products increases, while the retailer responds by decreasing the value of its store coupon on the NB.

In contrast, for a fixed degree of feature differentiation, couponing strategies depend on the actions of price-sensitive consumers. Interestingly, if PL quality is low, price-sensitive consumers are not interested in the PL product and only price-insensitive consumers consider purchasing it. In this case, the manufacturer's coupon value decreases and the retailer's NB coupon increases with increasing PL quality. As PL quality increases to a certain level, it becomes attractive to price-sensitive consumers, at which point the manufacturer increases its coupon value to mitigate the loss associated with price-sensitive consumers' uptake of the PL. The retailer responds by decreasing the NB store coupon. For even higher PL quality, the manufacturer reduces its wholesale price rather than changing the coupon value as competition with the PL product gets more intense for all consumers (both price-sensitive and price-insensitive); manufacturer and store coupons are unaffected by further changes in PL quality. The PL coupon, meanwhile, is not at all affected by PL positioning once it is offered. These results are consistent with Chung and Lee (2017), who find that the best position for PLs may not be "as close as possible" to the NB.

These strategies suggest that price-sensitive consumers are not necessarily the target customers of the PL product. In fact, this paper shows that for a fixed PL quality (fixed degree of feature differentiation), a larger degree of feature differentiation (higher PL quality) is required for price-sensitive consumers to consume the PL product than for price-insensitive consumers. Thus, there occurs a scenario in which price-sensitive consumers only purchase the NB product, while price-insensitive consumers buy both products.

The remainder of this paper is organized as follows: In Section 2 we present the theoretical model. In Section 3 we derive the equilibrium, and in Section 4 we further investigate equilibrium conditions through numerical analysis. Section 5 empirically tests our model's predictions, and Section 6 concludes.

2. Model

Consider an economy with one manufacturer, one retailer, and a unit mass of consumers. The manufacturer produces its NB product and sells it to the retailer at wholesale price w. The retailer then re-sells it to the consumers at retail price p_N. Besides the NB product, the retailer can choose to produce and offer to consumers its own PL product. The retail price of the PL product is p_P. The manufacturer and the retailer can both issue coupons for the NB product to consumers. The manufacturer's and retailer's coupons are denoted m and s_N, respectively; m and s_N equal the price deductions given to consumers at checkout and are charged to the issuer of the coupon (either the manufacturer or retailer). If the retailer chooses to offer the PL product to consumers, the store coupon for the PL product is denoted by s_P. Here and throughout the paper, the subscripts N and P refer to the NB and the PL, respectively, and the superscripts H and L refer to the consumers of the same designation.

There are two types of consumers, H and L, and their shares among all consumers are $(1 - \lambda)$ and λ, respectively, where $0 < \lambda < 1$. Consumers of type H are relatively price-insensitive and consumers of type L are relatively price-sensitive, so that for any given quantity their willingness to pay is below that of consumers of type H by the difference d. Additionally, consumers of type H never use coupons; in contrast, consumers of type L always use coupons when available. Thus, the two types of consumers pay different prices for the goods:

$$\begin{aligned} P_N^H &= p_N & \qquad P_N^L &= p_N - m - s_N \\ P_P^H &= p_P & \qquad P_P^L &= p_P - s_P \end{aligned} \tag{1}$$

Consumer i chooses purchase quantities q_N^i and q_P^i of the NB and the PL goods, respectively, to maximize the following utility function:[4]

$$U^i(q_N^i, q_P^i) = (\alpha_N^i - P_N^i)q_N^i + (\alpha_P^i - P_P^i)q_P^i - \frac{1}{2}\left(\beta_N\left(q_N^i\right)^2 + \beta_P\left(q_P^i\right)^2 + 2\gamma q_N^i q_P^i\right) \tag{2}$$

We set the maximum willingness to pay (WTP) to $\alpha_N^H = \alpha_N$ and $\alpha_N^L = \alpha_N - d$ for the NB product and to $\alpha_P^H = \alpha_P$ and $\alpha_P^L = \alpha_P - d$ for the PL product, where $\alpha_N > \alpha_P > d > (\alpha_P - c_P)\frac{\gamma}{\beta_P}$ (c_P represents the marginal costs of producing the PL product and will be discussed in more detail later). Thus, both types of consumers prefer the NB product to the PL item. Because all consumers' utility depends in the same way on the αs, α_N and α_P can be interpreted as quality of the NB and PL products, respectively. The lower bound on d allows us to focus on situations where the quality difference is sufficiently large (i.e., where the PL product is perceived to be discretely worse than the NB product).[5] β_N, β_P, and γ are identical for both types of consumers. As Choi and Coughlan (2006) point out, β_i captures consumers' rate of saturation for product i; γ measures the substitutability or feature differentiation of the products. We concentrate on cases where $\beta_P > \beta_N > \gamma > 0$, so that the PL product can neither perfectly imitate nor completely differentiate itself from the NB product and consumers reach their saturation earlier for the PL product.

[4]Similar utility functions have been used frequently, for example, by Dixit and Joseph E. Stiglitz (1977), Singh and Vives (1984), and Choi and Coughlan (2006).

[5]Assuming a higher quality of the NB product is consistent with casual observation of PL products in many consumer packaged goods markets. These products tend to sell at lower prices yet often catch a smaller market share than leading NB products.

At the beginning of the game, α_N, α_P, and γ are given exogenously. The interaction between the manufacturer and the retailer proceeds in the following three stages (similar to Bontems et al. (1999)):

In the first stage, retailer and manufacturer observe the quality of the NB product (α_N) as well as quality (α_P) and feature differentiation (γ) of a PL product that the retailer has the technical expertise to produce.[6]

In the second stage, the manufacturer chooses the wholesale price w and coupon value m for the NB and makes a take-it-or-leave-it offer (w, m) to the retailer. The manufacturer chooses w and m to maximize its profit, where $c_N \in [0, \alpha_N - d)$ is the constant marginal cost of producing the NB product:

$$\max_{w,m} \Omega = (1-\lambda)(w - c_N)q_N^H + \lambda(w - m - c_N)q_N^L \;\text{ s.t. }\; w \geq 0, m \geq 0 \tag{3}$$

In the third stage, the retailer decides whether to accept or reject the manufacturer's proposal (i.e., whether to sell the NB product) and whether to introduce the PL product, incurring a constant marginal cost $c_P \in [0, \alpha_P - d)$. The retailer also makes pricing and couponing decisions that maximize its profit from selling the two products to the two types of consumers:

$$\begin{aligned}
\max_{p_N, p_P, s_N, s_P} \pi = (1-\lambda)(p_N - w)q_N^H + (1-\lambda)(p_P - c_P)\, q_P^H + \lambda(p_N - w - s_N)q_N^L \\
+ \lambda(p_P - s_P - c_P)q_P^L \\
\text{s.t. } p_N \geq 0, p_P \geq 0, s_N \geq 0, s_P \geq 0 \\
q_P^H = q_P^L = 0 \textit{ if PL product not offered} \\
q_N^H = q_N^L = 0 \textit{ if NB product not offered}
\end{aligned} \tag{4}$$

[6] Note that a larger γ implies less feature differentiation.

Given the decisions made by the manufacturer and the retailer in the first three stages, both consumers maximize their own utility functions, respectively, by deciding their optimal quantities of consumption for the NB product and the PL product.

3. Equilibrium

We now discuss the equilibrium of the game described in the previous section. We simplify our analysis by focusing on cases where $\alpha_N^L - c_N > (\alpha_P^L - c_P)\frac{\gamma}{\beta_P}$ so that (loosely speaking) the welfare generated by the NB product cannot be too far below the PL product's welfare impact.[7] Casual observation of markets for many products (e.g., soda) seem to justify this assumption, as "private-label products are more or less physically identical to nationally branded products, but the branded product commands a higher market price due to characteristics not related to marginal costs of either manufacturing or retail handling." (Barsky et al. (2003))

The equilibrium can be found by backward induction. First, we solve for consumer behavior given product characteristics, prices, and coupon values. We then maximize the retailer's profit function to find its prices and coupon values conditional on manufacturer behavior and product characteristics. Finally, we obtain the wholesale price and manufacturer coupon value by maximizing the manufacturer's profit. The results of this process are derived in Web Appendix A and summarized in the following lemma and propositions:

Lemma 1. *Manufacturer price and coupon decisions, retailer decision whether to offer the PL product, and retailer price and coupon decisions are independent of the share of consumers who are price-sensitive.*

Proof. All results follow from the derivation of the equilibria in Web Appendix A. □

[7] We also assume $\frac{\alpha_P}{\alpha_N - c_N} > \frac{\gamma}{2\beta_N}$ if $\phi < \frac{\alpha_P^L - c_P}{\alpha_N^L - c_N}$ and $\frac{\alpha_P^L}{\alpha_N^L - c_N} > \frac{\gamma}{2\beta_N}$ if $\frac{\alpha_P^L - c_P}{\alpha_N^L - c_N} \leq \phi \leq \frac{\alpha_P - c_P}{\alpha_N - c_N}$, where $\phi = \frac{\gamma}{2\beta_N - \frac{\gamma^2}{\beta_P}}$.

This result is interesting, as one would expect the share of consumers with high WTP to affect pricing. However, coupons effectively allow setting different prices for the two consumer types. Those prices will be set optimally, independent of the size of those groups.

Proposition 1. *Holding feature differentiation (PL quality) and all other parameter values constant, there are three types of equilibria:*

I *For low PL quality (low degrees of feature differentiation), all consumers purchase the NB product and no consumers purchase the PL product. The retailer does not offer the PL product.*

II *For moderate PL quality (moderate degrees of feature differentiation), all consumers purchase the NB product and only consumers of type H purchase the PL product.*

III *For high PL quality (high degrees of feature differentiation), all consumers purchase both products.*

While the first and third cases in Proposition 1 are intuitive, the second case (i.e. only less price-sensitive consumers purchase the PL product) is somewhat surprising. The reason for this becomes evident, however, when one considers the relation of the various WTPs in the model. H's WTP is greater than L's for both goods by the difference d. Since the WTP for the PL is smaller than for the NB and d represents a constant difference between the two consumers' WTPs, its proportional effect on the PL product is stronger. Thus, L has in effect a stronger distaste for the PL product when compared to the NB item. In more technical terms:

$$\frac{\alpha_P^H}{\alpha_N^H} = \frac{\alpha_P}{\alpha_N} > \frac{\alpha_P - d}{\alpha_N - d} = \frac{\alpha_P^L}{\alpha_N^L}.$$

Table 1 shows manufacturer and retailer behavior in equilibrium for each case listed in Proposition 1. The main results are summarized in Propositions 2 through 6 below. To develop a better intuition for our results, we additionally provide plots based on specific parameter values. These are for illustration purposes only, and all our findings in this section are derived directly from the expressions provided in Table 1. For the plots presented here, we use the following parameter values: $\alpha_N = 3$, $\beta_N = 1$, $\beta_P = 2$, $d = 0.2$, $c_N = 0.3$, $c_P = 0.1$. We provide graphs varying either α_P or γ. In the former case, we fix $\gamma = 0.3$ and allow for $\alpha_P \in (0.3, 1.2]$; in the latter case, we set $\alpha_P = 0.4$ and $\gamma \in (0, 0.5]$. Based on our robustness checks, using different parameter sets would yield qualitatively comparable results.

Proposition 2. *If the PL product is offered, the NB wholesale price and the manufacturer NB coupon value increase in feature differentiation.*

<<Figure 1 about here>>

In Figure 1 and in all plots, to simplify the discussion, we distinguish three different zones (corresponding to the three types of equilibria mentioned in Proposition 1) that vary in terms of manufacturer, retailer, and consumer behavior. In equilibrium I the PL product is not offered. In equilibrium II only consumers of type H consume the NB product. And in equilibrium III all consumers purchase both goods. When looking at the figure, also remember that the degree of feature differentiation is larger for smaller values of γ. Therefore, the horizontal axis in Figures 1 and 2 is reversed, so that γ decreases but feature differentiation increases as we move right.

Intuitively, increasing feature differentiation reduces the competitive pressure exerted by the PL product; hence, the manufacturer is able to charge a higher wholesale price. In order to avoid a drastically reduced demand by price-sensitive consumers, the manufacturer also offers an increased coupon value. As Proposition 3 shows, in the face of higher wholesale prices, the retailer also charges a higher price for the NB product when feature differentiation is high. However, the retailer's NB coupon value decreases with increasing feature differentiation because the retailer's incentives are not quite aligned with the manufacturer's. From the retailer's perspective, the increased manufacturer coupon value already does enough to maintain demand by price-sensitive consumers. In fact, the retailer benefits from higher PL sales if price-sensitive consumers buy less of the NB product; hence, the retailer does not need to provide a large coupon.

Proposition 3. *If the PL product is offered, the NB retail price decreases and the retailer NB coupon value increases in feature differentiation.*

<<Figure 2 about here>>

The next two propositions turn to the effect of PL quality on coupons and prices.

Proposition 4. *If the PL product is offered, the NB wholesale price decreases in PL quality. The manufacturer NB coupon value first decreases in PL quality while only price-insensitive consumers buy the PL good and stays constant in PL quality when all consumers buy the PL good.*

<<Figure 3 about here>>

The changes in the wholesale price make sense in order to maintain market share for the NB product as the PL product becomes a stronger competitor. The value of the manufacturer coupon can at first be reduced by the same amount as long as price-sensitive consumers only purchase the NB product, but this changes when PL quality is high enough to draw purchases by consumers of type L: Now the coupon remains constant in order to prevent the market share with price-sensitive consumers from dropping too much.

Proposition 5. *If the PL product is offered, the NB retail price decreases in PL quality. The retailer's NB coupon first increases in PL quality while only price-insensitive consumers buy the PL good and stays constant in PL quality when all consumers buy the PL good.*

<<Figure 4 about here>>

Similar to the above, the retailer makes use of the manufacturer's moves. It reacts to the reduced wholesale price by reducing the retail price. On the other hand, when the manufacturer increases its NB coupon, the retailer reduces its own NB coupon since the demand lost for the NB product leads to increased PL purchases.

Our final proposition discusses the determinants of the PL price and coupon value.

Proposition 6. *If the PL product is offered, its price increases in PL quality and is independent of the degree of feature differentiation. The PL coupon is only offered if all consumers purchase both goods, and its value is independent of PL quality and the degree of feature differentiation.*

It is unsurprising that the retailer charges a higher price for a better PL product. The higher PL quality leads to a greater surplus for consumers, and the retailer captures part of this increase by raising the price. The PL couponing behavior is similarly intuitive: There is no need for any PL coupons unless all consumers purchase the PL product. When this is the case, keeping the coupon value constant means that the retailer extracts part of the increased consumer surplus from both consumer groups. The lack of a reaction to the degree of feature differentiation also makes sense. While the manufacturer reacts to the closer competition, the retailer, selling both products, feels no need to do so. In essence, it is relatively less important to the retailer whether consumers purchase the NB product or the PL product.

4. Empirical Evidence

In this section, we report results from empirical analyses designed to test the main results derived above. We focus on the relationship between the value of cents-off coupons and the degree of feature differentiation between the PL and NB products. In particular, we test the following theoretical results (presented above in Propositions 3 and 6):

Result 1. *Retailers' NB coupons have a lower face value when the degree of feature differentiation between the PL and NB products is higher.*

Result 2. *The face value of retailers' PL coupons is unrelated to the degree of feature differentiation.*

4.1. Data

For our empirical analysis, we use Nielsen Homescan data representing consumer packaged goods purchase decisions of a panel of approximately 40,000 U.S. households in 52 geographical markets. We restrict our data to purchases in the year 2006 to avoid problems from changing product characteristics over time and aggregate them to the quarterly level. We further concentrate on three specific product categories: ketchup, peanut butter, and mayonnaise.[8]

We focus on food retailers with market power, so that their PL products can gain enough market share to warrant consideration in the manufacturer's profit-maximization problem. Thus, for each quarter-product combination we identify the retailer with the best-selling PL product in each of the 52 geographical markets and focus our analysis on coupons by these retailers. For each retailer thus identified, we then identify the NB targeted by the PL product. In doing so, we assume that the NB with the highest market share *at a given retailer* is the targeted NB (i.e., the brand with which the PL aims to compete most directly).

The average coupon value per ounce is about \$0.03, a number that reflects that we don't observe any coupon availability for a substantial number of observations. We do not explicitly adjust for price differences between the products. These are minor, as we observe very similar price points for the three products in our analysis. Additionally, our theoretical results are for cents-off rather than percent-off coupons, so that a normalization by price

[8]These three categories have been analyzed in several empirical studies on pricing, coupon usage, or store brand purchases. For example, Villas-Boas and Zhao (2005) and Sudhir (2001) analyze interactions among manufacturers and between retailers and manufacturers using data from ketchup and peanut butter purchases, respectively; Silva-Risso and Bucklin (2004) use the ketchup category to investigate the effect of coupon promotions; and Hansen et al. (2006) examine store brand purchase behavior in the mayonnaise and peanut butter categories.

would not allow us to directly test our model's results.

To uncover a correlation of feature differentiation on coupon values, we first need to measure the degree of feature differentiation between the PL and the leading NB products. To do so, we record for each purchase the following product attributes: flavor, form, formula, container, salt content, style, type, product, variety, product size, and packaging. We define feature differentiation as the number of product attributes that differ between the PL and NB products. For example, assume the PL product has a higher salt content and comes in a smaller package, but is otherwise identical to the NB product. Then the two products differ on the dimensions salt content and product size, so our measure of feature differentiation would be equal to two. On average, this number is between one and two, indicating that PL products usually share most product characteristics with the leading NB.

4.2. Analysis

To determine the effect of feature differentiation on coupons, we first run simple ordinary least squares (OLS) regressions with store coupons on NB and store coupons on PL, respectively, as dependent variables.

We include additional variables to control for factors outside of our theoretical model which abstracts away from competition across national brands or across multiple retailers. These controls include dummies indicating whether the two NB with the largest sales in the store are the overall market leaders; a dummy indicating whether the second-most sold PL brand in the store is the second-most sold PL brand overall; several market share and market concentration; and basic demographic information.

This results in the following regression equations:

$$\begin{aligned} NBCoupon_{tpr} &= \phi_0^{NB} + \phi_1^{NB} FD_{tpr} + \phi_2^{NB} X_{tpr} + \epsilon_{tpr}^{NB} \\ \text{and } PLCoupon_{tpr} &= \phi_0^{PL} + \phi_1^{PL} FD_{tpr} + \phi_2^{PL} X_{tpr} + \epsilon_{tpr}^{PL} \end{aligned} \tag{5}$$

where t, p, and r indicate a quarter, a product, and a retailer, respectively; $NBCoupon_{tpr}$ and $PLCoupon_{tpr}$ are the values of retailer coupons for the NB and PL product, respectively (the endogenous variables); FD_{tpr} is the degree of feature differentiation between the leading NB product and the leading PL product (our exogenous variable of interest); X_{tpr} is a vector of control variables including store characteristics, market characteristics, demographic information about the market r operates in, and other controls variables; and ϵ_{tpr}^{NB} and ϵ_{tpr}^{PL} are stochastic shocks reflecting (from the perspective of the econometrician) unknown factors influencing shopping decisions.

For each purchase in our data, we observe whether a coupon was or was not used and (if applicable) the value of the coupon. If we do not observe coupon use, we are faced with two possibilities: either no coupon was available or a coupon was available but consumers did not search for one (in the latter case, all consumers correspond to type H in our theoretical model). In our first set of analyses (equations (5)), we drop those observations, since it is unclear which of those possible explanations is correct. In additional regressions (discussed below) we attempt to separate out those two cases.

The results of the regressions of equations (5) are reported in Table 2. The regressions are consistent with our theoretical results. They show a significantly negative effect of feature differentiation on the value of store NB coupons, but not on PL coupons.

For a second set of regressions, we reconsider missing coupon data. As discussed above, these could stem from two causes: either no coupon was available or a coupon was available but not used by consumers. To distinguish between those cases, we assume that observing any coupon use during the year within the same geographical-product market indicates that at least one consumer searched for coupons. Thus, if for some quarters in the year we do not see any coupon use, this would imply that no coupons were offered by the stores. In this case we would assign a zero coupon value to the quarter-market-product observation. If, however, during the whole year we do not observe any coupon use for the product-market combination we drop the observation as we cannot distinguish between lack of availability of and lack of searching for coupons. We thus create a censored (rather than truncated) dataset which we use for SUR Tobit regressions.

Besides treatment of the zero coupons, the SUR Tobit regressions are identical to the OLS regressions described above. In particular, FD_{tpr} remains the variable of interest and we use the same control variables X_{tpr} as in (5). The results of these regressions are presented in Table 3 and are again consistent with our theoretical model. Indeed, the significance of feature differentiation on stores' NB coupons is now stronger than under OLS, while there is still no significant effect on PL coupons.

As mentioned above, our regressions include several store characteristics, market characteristics, and demographic values as control variables. We include those to bridge the gap between the theoretical model, which necessarily incorporates simplifications and abstractions, and the real world. For example, we include dummies indicating how the largest brands at each retailer fare nationwide as a measure of competitive pressure; in a very competitive environment, it would be much more likely that the national leader falls to a lower position in certain markets or at individual stores. To check whether these variables alter our results, we run several robustness checks, presented in Tables B.1 and B.2 in Web Appendix B, in which we exclude some of those dummies and market characteristics. Those analyses yield results that are qualitatively comparable to the results discussed in this section.[9]

5. Conclusion

In this article, we analyze couponing behavior by manufacturers and retailers in the context of competition between an NB and a PL product. We allow for two different dimensions of differentiation (quality vs. feature differentiation) and find that both are important

[9]For space reasons, we only present robustness checks for the SUR Tobit regressions in the manuscript. Robustness checks for the truncated regressions are available upon request.

determinants of pricing and couponing behavior.

More specifically, we find that:

- For a higher degree of feature differentiation, the NB wholesale price and the manufacturer's NB coupon value are higher, but the NB retail price and the retailer's NB coupons value are lower.

- For a higher degree of PL quality, the NB wholesale price is lower. The manufacturer's NB coupon value first decreases and then increases with increasing PL quality and the retailer's PL coupon values change in the opposite direction.

- Price and face value of retailers' PL coupons are unrelated to the degree of feature differentiation and retailers' PL coupon values are unrelated to PL quality.

- There are situations in which only the less price-sensitive consumers purchase the PL item.

We also conduct empirical analysis of the effect of feature differentiation on coupon values using scanner data from geographical markets across the United States and for several product categories. The results are consistent with our theoretical findings.

Our research provides insights for practitioners who are in a position to set prices and coupon values for both NB and PL products. Our results can additionally inform retailers' decisions regarding the optimal design of their NB products in terms of quality and feature differentiation.

To our knowledge, this is the first systematic analysis of couponing behavior when an NB and a PL compete. It is, however, just a start in uncovering the complexities and considerations of offering coupons with this dual cooperation–competition relationship between manufacturer and retailer. Questions remaining unanswered and left to future research include equilibrium behavior for percent-off coupons, competition among retailers, and competition among multiple NBs, to name but a few.

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Web Appendix A

Sketched Derivation of Equilibrium Solutions

We start with the case in which all consumers purchase both of the products. We then proceed to discuss situations in which the equilibrium involves some consumers not purchasing both products.

Case 1: Basic Scenario

Suppose consumers of both types are willing to purchase both of the NB and the PL products. We can derive the price-insensitive and price-sensitive consumers' demand systems by using the respective utility functions and solving two first-order conditions ($\partial U^i/\partial q^i_N = 0$, $\partial U^i/\partial q^i_P = 0$):

$$
\begin{aligned}
q^H_N &= \frac{1}{\beta_N\beta_P - \gamma^2}\left[(\alpha_N - p_N)\beta_P + \gamma(p_P - \alpha_P)\right] \\
q^H_P &= \frac{1}{\beta_N\beta_P - \gamma^2}\left[(\alpha_P - p_P)\beta_N + \gamma(p_N - \alpha_N)\right] \\
q^L_N &= \frac{1}{\beta_N\beta_P - \gamma^2}\left[(\alpha^L_N - p_N + m + s_N)\beta_P + \gamma(p_P - s_P - \alpha^L_P)\right] \\
q^L_P &= \frac{1}{\beta_N\beta_P - \gamma^2}\left[(\alpha^L_P - p_P + s_P)\beta_N + \gamma(p_N - m - s_N - \alpha^L_N)\right]
\end{aligned}
\tag{A.1}
$$

Substituting the demand systems (A.1) into the retailer's profit-maximization problem in (4), we can solve four first-order conditions ($\partial\pi/\partial p_N = 0$, $\partial\pi/\partial p_P = 0$, $\partial\pi/\partial s_N = 0$, $\partial\pi/\partial s_P = 0$) to derive the retailer's best responses to w and m:

$$
\begin{aligned}
p_N &= \frac{1}{2}(\alpha_N + w) \qquad & p_P &= \frac{1}{2}(\alpha_P + c_P) \\
s_N &= \frac{1}{2}(d - m) \qquad & s_P &= \frac{1}{2}d
\end{aligned}
\tag{A.2}
$$

Plugging (A.2) into (A.1), we can now obtain q_N^H, q_P^H, q_N^L, and q_P^L and functions of w and m. We can then obtain conditions for them to be strictly positive as required here:

$$q_N^H > 0 \Leftrightarrow w < \alpha_N - \frac{\gamma}{\beta_P}\alpha_P \tag{A.3}$$

$$q_P^H > 0 \Leftrightarrow w > \alpha_N - \frac{\beta_N}{\gamma}\alpha_P \tag{A.4}$$

$$q_N^L > 0 \Leftrightarrow w < \alpha_N^L + m - \frac{\gamma}{\beta_P}\alpha_P^L \tag{A.5}$$

$$q_P^L > 0 \Leftrightarrow w > \alpha_N^L + m - \frac{\beta_N}{\gamma}\alpha_P^L \tag{A.6}$$

The manufacturer's equilibrium strategy can now be derived by substituting those consumption quantities into the manufacturer's profit-maximization problem (3) and solving two first-order conditions ($\partial\Omega/\partial w = 0$ and $\partial\Omega/\partial s = 0$):

$$\begin{aligned} w &= \frac{(\alpha_N + c_N)\beta_P - (\alpha_P - c_P)\gamma}{2\beta_P} \\ m &= \frac{d(\beta_P - \gamma)}{2\beta_P} \end{aligned} \tag{A.7}$$

Now we can find equilibrium retailer prices, retailer coupons:

$$\begin{aligned} p_N &= \frac{1}{4}(3\alpha_N + c_N) - \frac{\gamma}{4\beta_P}(\alpha_P - c_P) \qquad & p_P &= \frac{1}{2}(\alpha_P + c_P) \\ s_N &= \frac{1}{4}d(1 + \frac{\gamma}{\beta_P}) & s_P &= \frac{1}{2}d \end{aligned} \tag{A.8}$$

Thus, demand quantities are

$$q_N^H = \frac{A}{4}[(\alpha_N - c_N)\beta_P - (\alpha_P - c_P)\gamma] \tag{A.9}$$

$$q_P^H = \frac{A}{4\beta_P}[(2\beta_N\beta_P - \gamma^2)(\alpha_P - c_P) - \beta_P\gamma(\alpha_N - c_N)] \tag{A.10}$$

$$q_N^L = \frac{A}{4}[(\alpha_N^L - c_N)\beta_P - (\alpha_P^L - c_P)\gamma] \tag{A.11}$$

$$q_P^L = \frac{A}{4\beta_P}[(2\beta_N\beta_P - \gamma^2)(\alpha_P^L - c_P) - \beta_P\gamma(\alpha_N^L - c_N)]. \tag{A.12}$$

For our derivations so far, we had assumed that all consumers demand both goods in positive quantities. For q_N^H and q_N^L this always holds: q_N^H can easily be expressed as $q_N^H = q_N^L + \frac{A}{4}d(\beta_P - \gamma) > q_N^L$; hence, $q_N^L > 0$ implies $q_N^H > 0$. $q_N^L > 0$ follows immediately from $\alpha_N^L - c_N > (\alpha_P^L - c_P)\frac{\gamma}{\beta_P}$.

$q_P^H > 0$ and $q_P^L > 0$ can be re-written $\frac{\alpha_P - c_P}{\alpha_N - c_N} > \frac{\gamma\beta_P}{2\beta_N\beta_P - \gamma^2}$ and $\frac{\alpha_P^L - c_P}{\alpha_N^L - c_N} > \frac{\gamma\beta_P}{2\beta_N\beta_P - \gamma^2}$, respectively. If $\alpha_P^L - c_P < \alpha_N^L - c_N$, then $\frac{\alpha_P - c_P}{\alpha_N - c_N} > \frac{\alpha_P^L - c_P}{\alpha_N^L - c_N}$. Hence, in this case the situation discussed here is an equilibrium if $\frac{\alpha_P^L - c_P}{\alpha_N^L - c_N} > \frac{\gamma\beta_P}{2\beta_N\beta_P - \gamma^2}$; we have to look for an equilibrium with $q_P^H > 0$ and $q_P^L = 0$ if $\frac{\alpha_P - c_P}{\alpha_N - c_N} > \frac{\gamma\beta_P}{2\beta_N\beta_P - \gamma^2} > \frac{\alpha_P^L - c_P}{\alpha_N^L - c_N}$; and we have to look for an equilibrium with $q_P^H = q_P^L = 0$ if $\frac{\alpha_P - c_P}{\alpha_N - c_N} < \frac{\gamma\beta_P}{2\beta_N\beta_P - \gamma^2}$.

If, on the other hand, $\alpha_P^L - c_P \geq \alpha_N^L - c_N$ then $q_P^H > 0$ and $q_P^L > 0$ always holds, because $\frac{\alpha_P - c_P}{\alpha_N - c_N}$ and $\frac{\alpha_P^L - c_P}{\alpha_N^L - c_N}$ become (weakly) greater than 1, while $\frac{\gamma\beta_P}{2\beta_N\beta_P - \gamma^2} < 1$.

Case 2: $\frac{\alpha_P - c_P}{\alpha_N - c_N} > \frac{\gamma\beta_P}{2\beta_N\beta_P - \gamma^2} > \frac{\alpha_P^L - c_P}{\alpha_N^L - c_N}$

As our analysis above indicates, in this case we have $q_N^H > 0, q_N^L > 0, q_P^H > 0$, and $q_P^L = 0$. Using the utility functions, we derive the quantities of consumption as follows:

$$
\begin{aligned}
q_N^H &= \frac{1}{\beta_N\beta_P - \gamma^2}\left[(\alpha_N - p_N)\beta_P + \gamma(p_P - \alpha_P)\right] \\
q_P^H &= \frac{1}{\beta_N\beta_P - \gamma^2}\left[(\alpha_P - p_P)\beta_N + \gamma(p_N - \alpha_N)\right] \\
q_N^L &= \frac{1}{\beta_N}\left(\alpha_N - d - p_N + m + s_N\right) \\
q_P^L &= 0
\end{aligned}
\tag{A.13}
$$

The retailer's best responses can then be derived by using quantities of consumption in (A.13) and solving three first-order conditions ($\partial\pi/\partial p_N = 0$, $\partial\pi/\partial p_P = 0$, $\partial\pi/\partial s_N = 0$) for the retailer's profit maximization problem:

$$
\begin{aligned}
p_N &= \frac{w + \alpha_N^H}{2} & \qquad p_P &= \frac{\alpha_P^H + c_P}{2} \\
s_N &= \frac{d - m}{2} & \qquad s_P &= 0
\end{aligned}
\tag{A.14}
$$

Substituting the retailer's best responses (A.14) and the quantities (A.13) into the manufacturer's profit maximization problem, we can now find the optimal wholesale price and coupon value:

$$
\begin{aligned}
w &= \frac{(\alpha_N + c_N)\beta_P - (\alpha_P - c_P)\gamma}{2\beta_P} \\
m &= \frac{d}{2} - \frac{\gamma}{2\beta_P}(\alpha_P - c_P)
\end{aligned}
\tag{A.15}
$$

It is easy to verify that all prices and coupon values are positive. By plugging prices and coupon values into (A.13), we can now determine the demand quantities in this case:

$$\begin{aligned}
q_N^H &= \frac{A}{4}(\alpha_N\beta_P - \alpha_P\gamma - \beta_P c_N + \gamma c_P) \\
q_P^H &= \frac{A}{4\beta_P}[(2\beta_N\beta_P - \gamma^2)(\alpha_P - c_P) - \beta_P\gamma(\alpha_N - c_N)] \\
q_N^L &= \frac{\alpha_N^L - c_N}{4\beta_N} \\
q_P^L &= 0
\end{aligned} \tag{A.16}$$

It is readily confirmed that $q_N^H > 0$, $q_N^L > 0$, and $q_P^H > 0$.[10] Finally, as required, (A.6) does not hold.[11]

Case 3: $\frac{\alpha_P - c_P}{\alpha_N - c_N} < \frac{\gamma\beta_P}{2\beta_N\beta_P - \gamma^2}$

From above, we know that $q_P^H = 0$ and $q_P^L = 0$ if $\frac{\alpha_P - c_P}{\alpha_N - c_N} < \frac{\gamma\beta_P}{2\beta_N\beta_P - \gamma^2}$.[12] The consumers' quantities of consumption on the NB product are listed as follows:

$$\begin{aligned}
q_N^H &= \frac{1}{\beta_N}(\alpha_N - p_N) \\
q_P^H &= 0 \\
q_N^L &= \frac{1}{\beta_N}(\alpha_N - d - p_N + m + s_N) \\
q_P^L &= 0
\end{aligned} \tag{A.17}$$

[10] $q_N^H > 0$ follows from $\alpha_N - c_N > \alpha_P - c_P$; $q_N^L > 0$ is immediately obvious because $c_N < \alpha_N^L$; and $q_P^H > 0$ follows from $\frac{\alpha_P - c_P}{\alpha_N - c_N} > \frac{\gamma\beta_P}{2\beta_N\beta_P - \gamma^2}$.

[11] (A.6) is violated because $w > \alpha_N^L + m - \frac{\beta_N}{\gamma}\alpha_P^L \Leftrightarrow \frac{\alpha_N + c_N}{2} - \frac{d}{2} > \alpha_N^L - \frac{\beta_N}{\gamma}\alpha_P^L \Leftrightarrow \frac{\alpha_P^L}{\alpha_N^L - c_N} > \frac{\gamma}{2\beta_N}$.

[12] In Case 1, we established that there is no equilibrium in which q_P^H, q_P^L, q_N^H, and q_N^L are all positive. In Case 2, we showed that an equilibrium with q_P^H, q_N^H, and q_N^L all positive only exists if $\frac{\alpha_P - c_P}{\alpha_N - c_N} > \frac{\gamma\beta_P}{2\beta_N\beta_P - \gamma^2}$. Furthermore, Case 1 also showed us that $q_P^L > 0$ implies $q_P^H > 0$.

Deriving the retailer's best responses in the usual way, we get:

$$
\begin{aligned}
p_N &= \frac{1}{2}(w + \alpha_N) \\
s_N &= \frac{1}{2}(d - m)
\end{aligned}
\tag{A.18}
$$

Substituting (A.18) and (A.17) into the manufacturer's profit function, we can now find the optimal wholesale price and coupon value:

$$
\begin{aligned}
w &= \frac{1}{2}(c_N + \alpha_N) \\
m &= \frac{d}{2}
\end{aligned}
\tag{A.19}
$$

Again, all prices and coupon values are obviously positive. Now we can find the demand quantities by plugging prices and coupon values into (A.17):

$$
\begin{aligned}
q_N^H &= \frac{\alpha_N - c_N}{4\beta_N} \\
q_P^H &= 0 \\
q_N^L &= \frac{\alpha_N - d - c_N}{4\beta_N} \\
q_P^L &= 0
\end{aligned}
\tag{A.20}
$$

q_N^H and q_N^L are obviously positive. Additionally, (A.4) and (A.6) do not hold, as required in this subsection.[13]

[13](A.4) is violated because $w > \alpha_N - \frac{\beta_N}{\gamma}\alpha_P \Leftrightarrow \frac{c_N + \alpha_N}{2} > \alpha_N - \frac{\beta_N}{\gamma}\alpha_P \Leftrightarrow \frac{\beta_N}{\gamma}\alpha_P > \frac{\alpha_N - c_N}{2} \Leftrightarrow \frac{\alpha_P}{\alpha_N - c_N} > \frac{\gamma}{2\beta_N}$. Violation of (A.4) implies violation of (A.6) as discussed above.

Web Appendix B

Robustness Checks for Empirical Results

<Tables B.1 and B.2 here>

Table 1: Manufacturer and Retailer Behavior in Equilibrium

	$\frac{\alpha_P^L - c_P}{\alpha_N^L - c_N} > \phi$	$\frac{\alpha_P - c_P}{\alpha_N - c_N} \geq \phi \geq \frac{\alpha_P^L - c_P}{\alpha_N^L - c_N}$	$\phi > \frac{\alpha_P - c_P}{\alpha_N - c_N}$
w	$\frac{(\alpha_N + c_N)\beta_P - (\alpha_P - c_P)\gamma}{2\beta_P}$	$\frac{(\alpha_N + c_N)\beta_P - (\alpha_P - c_P)\gamma}{2\beta_P}$	$\frac{c_N + \alpha_N}{2}$
m	$\frac{d(\beta_P - \gamma)}{2\beta_P}$	$\frac{d}{2} - \frac{\gamma(\alpha_P - c_P)}{2\beta_P}$	$\frac{d}{2}$
p_N	$\frac{(3\alpha_N + c_N)\beta_P - (\alpha_P - c_P)\gamma}{4\beta_P}$	$\frac{(3\alpha_N + c_N)\beta_P - (\alpha_P - c_P)\gamma}{4\beta_P}$	$\frac{3\alpha_N + c_N}{4}$
s_N	$\frac{d}{4}\frac{\beta_P + \gamma}{\beta_P}$	$\frac{d}{4} + \frac{\gamma(\alpha_P - c_P)}{4\beta_P}$	$\frac{d}{4}$
p_P	$\frac{\alpha_P + c_P}{2}$	$\frac{\alpha_P + c_P}{2}$	∞
s_P	$\frac{d}{2}$	0	0

Table 2: Regression Results (Truncated Models)

	NB Retail Coupons	PL Retail Coupons
Store Characteristics		
Feature differentiation	-0.549*	-0.637
	(-1.76)	(-0.83)
Standard deviation of weekly prices	1.275***	0.066
	(4.21)	(0.54)
Manufacturer coupon for largest NB offered	0.031	1.475
	(0.04)	(0.72)
Store's largest NB is largest of all NBs	-0.205	4.454***
	(-0.17)	(3.2)
Store's 2nd-largest NB is largest of all NBs	-0.208	5.028**
	(-0.15)	(2.77)
Store's 2nd-largest PL is 2nd of all PLs	-0.552	0.202
	(-0.61)	(0.18)
Market Characteristics		
Private label share	1.271	9.651
	(0.17)	(0.75)
Private label distribution	-1.724	1.219
	(-0.49)	(0.13)
Number of national brands	0.135	0.072
	(1.13)	(0.43)
National brand Herfindahl index	-9.014**	0.319
	(-2.40)	(0.05)
Supermarket retail CR4	3.901	2.597
	(1.02)	(0.35)
Demographic Information		
Average income	$-1.95 \cdot 10^{-6}$	$3.063 \cdot 10^{-4}$***
	(-0.04)	(3.03)
Average household size	-2.510	-2.159
	(-0.92)	(-0.33)
Average age of female heads of households	-0.091	0.941
	(-0.39)	(1.57)
Percent hispanic	19.856***	3.595
	(2.72)	(0.27)
Female HH working over 35 hours	-4.824	-24.549*
	(-0.44)	(-1.66)
Female HH with at least college degree	-10.876	-27.875**
	(-1.39)	(-2.1)
Other Control variables		
Product dummy-mayo	2.205	-1.907
	(1.55)	(-0.79)
Product dummy-ketchup	3.101**	-2.677
	(2.00)	(-0.95)
Quarter	-1.999	-0.923**
	(-0.83)	(-2.42)
Constant	19.333	-41.649
	(0.90)	(-0.76)
Observations	114	77

Notes: z-statistics in parentheses. *,**, and *** indicate statistical significance at the 90%, 95%, and 99% level, respectively.

Table 3: Regression Results (SUR Tobit Models)

	NB Retail Coupons	PL Retail Coupons
Store Characteristics		
Feature differentiation	-0.990**	0.342
	(-2.25)	(0.52)
Standard deviation of weekly prices	1.079***	0.080
	(3.07)	(0.16)
Manufacturer coupon for largest NB offered	1.391	1.212
	(1.40)	(0.83)
Store's largest NB is largest of all NBs	0.948	1.867**
	(1.06)	(2.31)
Store's 2nd-largest NB is largest of all NBs	-0.094	2.003
	(-0.07)	(1.33)
Store's 2nd-largest NB is 2nd of all PLs	-0.867	0.905
	(-1.08)	(1.01)
Market Characteristics		
Private label share	8.125	4.907
	(1.16)	(0.50)
Private label distribution	8.608*	-3.909
	(1.7)	(-0.58)
Number of national brands	0.165	0.054
	(1.41)	(0.39)
National brand Herfindahl index	-2.566	-2.010
	(-0.82)	(-0.44)
Supermarket retail CR4	3.386	7.870
	(0.70)	(1.23)
Demographic Information		
Average income	$7.92 \cdot 10^{-5}$	$10.28 \cdot 10^{-5}$
	(1.43)	(1.19)
Average household size	-0.046	0.730
	(-0.01)	(0.15)
Average age of female heads of households	0.092	0.450
	(0.30)	(1.14)
Percent hispanic	32.735***	18.317**
	(3.98)	(2.01)
Female HH working over 35 hours	-13.800	-22.058
	(-1.01)	(-1.35)
Female HH with at least college degree	-14.878*	-31.658**
	(-1.74)	(-2.73)
Other Control Variables		
Product dummy-mayo	3.387**	-1.606
	(2.24)	(-0.72)
Product dummy-ketchup	3.695**	-2.518
	(2.30)	(-1.05)
Quarter	0.032	-0.555
	(0.12)	(-1.47)
Constant	-8.211	-9.101
	(-0.26)	(-0.23)
Observations	86	86

Notes: z-statistics in parentheses. *,**, and *** indicate statistical significance at the 90%, 95%, and 99% level, respectively.

Table B.1: Robustness Checks for Regression of NB Retail Coupons (SUR Tobit Models)

	NB Ret. Coupons	NB Ret. Coupons	NB Ret. Coupons
Store Characteristics			
Feature differentiation	-0.927**	-0.994**	-0.903**
	(-2.14)	(-2.17)	(-2.04)
Standard deviation of weekly prices	0.883**	1.070***	1.022***
	(2.15)	(2.92)	(2.73)
Mfr coupon for largest NB offered	1.932*	1.673	1.333
	(1.65)	(1.56)	(1.31)
Store's largest NB is largest of all NBs			0.993
			(1.14)
Store's 2nd-largest NB is largest of all NBs			0.069
			(0.05)
Store's 2nd-largest PL is 2nd of all PLs			
Market Characteristics			
Private label share		9.506	7.738
		(1.47)	(1.12)
Private label distribution		9.244*	9.257*
		(1.82)	(1.72)
Number of national brands		0.170	0.164
		(1.56)	(1.40)
National brand Herfindahl index		-2.525	-2.930
		(-0.80)	(-0.94)
Supermarket retail CR4		2.481	3.430
		(0.54)	(0.71)
Demographic Information			
Average income	$3.38 \cdot 10^{-5}$	$9.04 \cdot 10^{-5}$	$8.07 \cdot 10^{-5}$
	(0.64)	(1.64)	(1.47)
Average household size	-3.206	0.101	0.323
	(-0.83)	(0.03)	(0.08)
Avg age of female heads of households	-0.024	0.072	0.074
	(-0.08)	(0.24)	(0.24)
Percent hispanic	25.771***	29.875***	31.921***
	(3.41)	(3.80)	(8.40)
Female HH working over 35 hours	-15.203	-18.435	-18.280
	(-1.16)	(-1.59)	(-1.52)
Female HH with at least college degree	-11.399	-14.487*	-15.648*
	(-1.29)	(-1.72)	(-1.84)
Other Control Variables			
Product dummy-mayo	0.369	3.933***	3.605**
	(0.37)	(2.77)	(1.55)
Product dummy-ketchup	0.185	4.292***	3.958**
	(0.17)	(2.68)	(2.36)
Quarter	0.156	0.034	0.015
	(0.59)	(0.13)	(0.06)
Constant	17.944	-6.802	-6.667
	(0.62)	(-0.22)	(-0.21)

Notes: z-statistics in parentheses. *,**, and *** indicate statistical significance at the 90%, 95%, and 99% level, respectively.

Table B.2: Robustness Checks for Regression of PL Retail Coupons (SUR Tobit Models)

	PL Ret. Coupons	PL Ret. Coupons	PL Ret. Coupons
Store Characteristics			
Feature differentiation	-0.156	0.121	0.259
	(-0.25)	(0.19)	(0.39)
Standard deviation of weekly prices	0.251	0.366	0.170
	(0.52)	(0.71)	(0.34)
Mfr coupon for largest NB offered	1.894	1.691	1.272
	(1.37)	(1.27)	(0.85)
Store's largest NB is largest of all NBs			1.830**
			(2.21)
Store's 2nd-largest NB is largest of all NBs			1.810
			(1.20)
Store's 2nd-largest PL is 2nd of all PLs			
Market Characteristics			
Private label share		7.601	5.573
		(0.75)	(0.57)
Private label distribution		-4.104	-4.625
		(-0.64)	(-0.72)
Number of national brands		0.102	0.050
		(0.75)	(0.36)
National brand Herfindahl index		0.085	-1.722
		(0.02)	(-0.38)
Supermarket retail CR4		7.560	7.795
		(1.18)	(1.23)
Demographic Information			
Average income	$3.64 \cdot 10^{-5}$	$7.9 \cdot 10^{-5}$	$1.01 \cdot 10^{-4}$
	(0.46)	(0.88)	(1.18)
Average household size	-2.198	1.102	0.382
	(-0.46)	(0.22)	(0.08)
Avg age of female heads of households	0.336	0.499	0.473
	(0.81)	(1.21)	(1.20)
Percent hispanic	19.552**	17.444*	19.096**
	(2.00)	(1.84)	(2.19)
Female HH working over 35 hours	-2.942	-14.018	-17.328
	(-0.20)	(-0.80)	(-1.05)
Female HH with at least college degree	-24.839**	-29.773**	-30.681***
	(-2.41)	(-2.53)	(-2.68)
Other Control Variables			
Product dummy-mayo	-1.82	-0.880	-1.810
	(-1.60)	(-0.42)	(-0.84)
Product dummy-ketchup	-3.493***	-1.913	-2.739
	(-2.67)	(-0.83)	(-1.18)
Quarter	-0.331	-0.466	-0.546
	(-0.92)	(-1.26)	(-1.45)
Constant	3.130	-16.347	-11.145
	(0.08)	(-0.41)	(-0.29)

Notes: z-statistics in parentheses. *,**, and *** indicate statistical significance at the 90%, 95%, and 99% level, respectively.

Figure 1: Manufacturer's NB Coupon Value and Price with Feature Differentiation

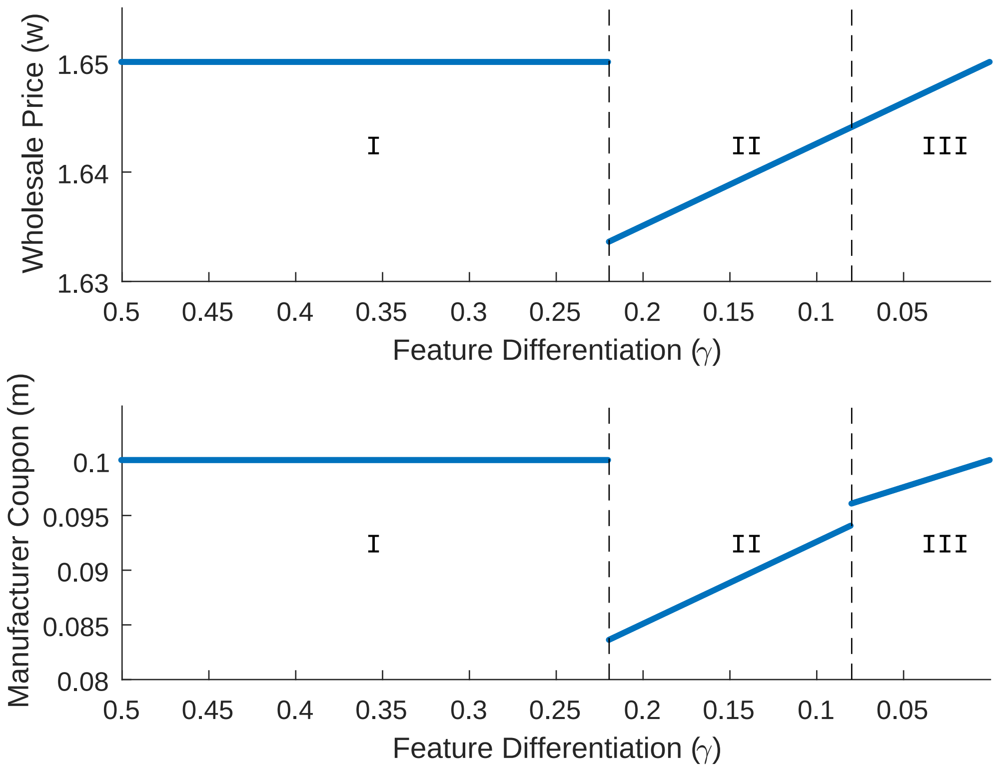

Figure 2: Retailer's NB Coupon Value with Changing Feature Differentiation

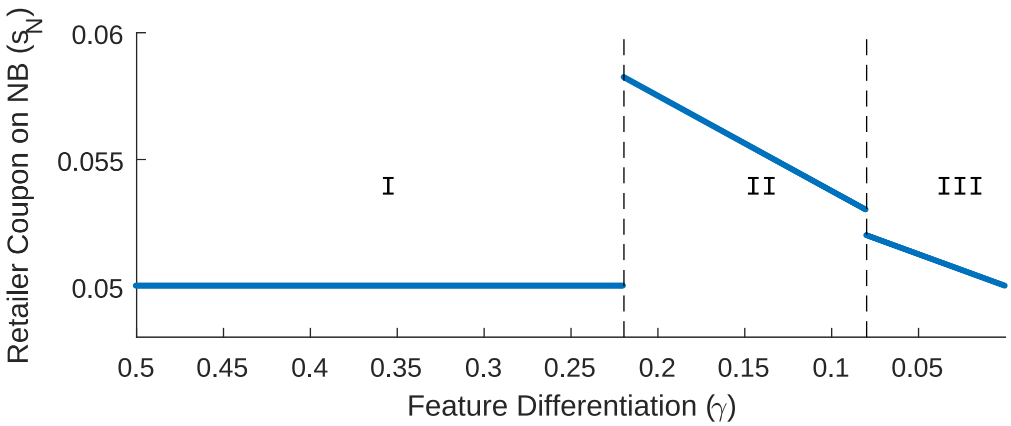

Figure 3: Manufacturer's NB Coupon Value and Price with Changing PL Quality

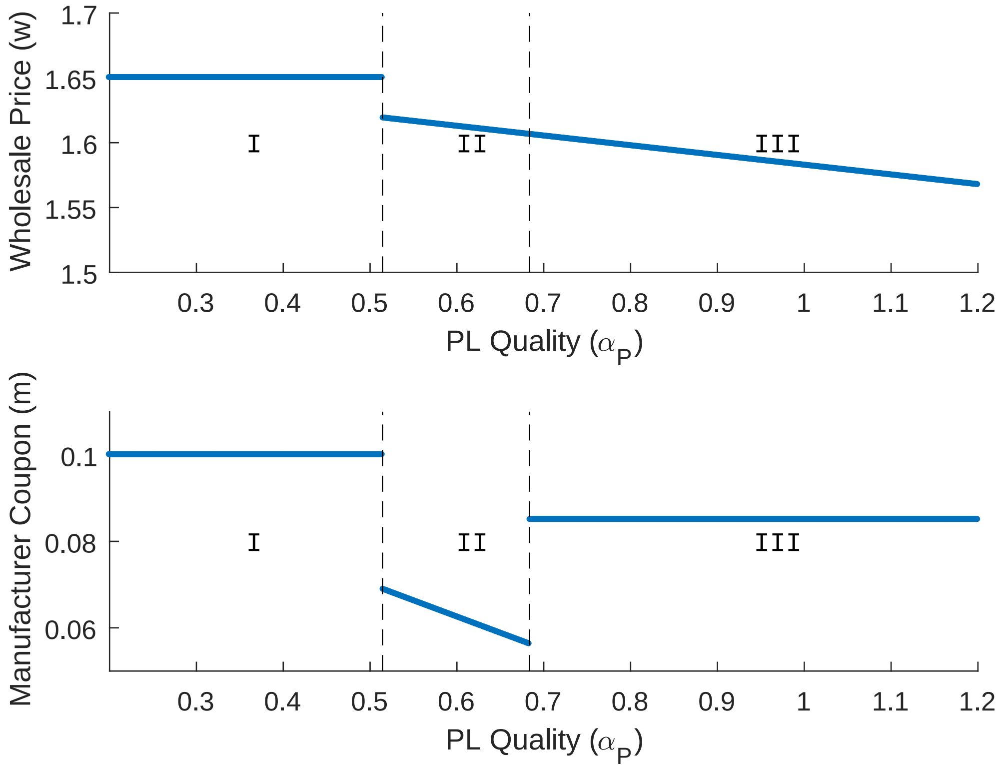

Figure 4: Retailer's NB Coupon Value with Changing PL Quality