Brand Name and Private Label Price Setting by a Monopoly Store

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Abstract

A monopoly that sells to brand-name loyal customers and to price-sensitive customers must decide whether to carry both name-brand and a private-label products and how much to charge. The monopoly may charge either more or less for the brand name if it carries a private label, and the price differential between the products is sensitive to cost and taste parameters.

Keywords: brand name, private label, monopoly, pricing

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Under what conditions does a store choose to carry both a brand-name and a private label product? If a store introduces a private label, does it raise or lower the price of the brand name? How does the differential between the brand-name and private-label prices vary with costs and taste parameters? If price-sensitive consumers choose between a private label and a brand name, might the store set a higher brand-name price than the price that would maximize profit if it sold to only brand-loyal customers? We address these questions, using a model with brand-loyal customers and price-sensitive customers who switch between a brand name and a private label as their relative prices change.

Many stores—particularly drug and grocery stores—carry nearly identical national-brand and private-label (or store-label) products, and private label products' share of many food and other markets has grown rapidly in recent years. As of 2009, the share of private labels was over 16 percent in drug stores (PLMA Yearbook) and over 20 percent in 48 out of 117 grocery categories (Nielsen). Although there is a large empirical literature concerning carrying and pricing private label and brand name products (e.g., Chintagunta et al. 2002, Ward et al. 2002, Barsky et al. 2003), there has been relatively little theoretical work on this topic (though see Horowitz 2000).

1. Model

A monopoly store sells Q units of a brand-name product at a price P and q units of a private-label product at a price p. The monopoly grocery store faces a lower constant wholesale price (marginal and average cost) for the private label, m, than for the brand name, M. Thus, if it could get the same price or nearly the same price for both products, it would prefer to sell only the private label.

However, the store's *loyal customers* are willing to buy only the name brand, and its other customers, *switchers*, are willing to pay a premium for the name brand. The loyal customers' aggregate demand curve is $Q(P)$. Each of the n switchers buys either one unit of the private label or one unit of the brand name. Switchers buy the private label if the price differential between the brand name and the private label, $P - p$, is greater than x, and otherwise buy the brand name. We call $p \leq P - x$ the "price-differential constraint:" If the private label price p is strictly less than $P - x$, the switchers buy n units of the private label and none of the brand name. If $p > P - x$, they buy n units of the brand name.

In addition, switchers will buy one unit of a private-label or brand-name product only if the price is less than their reserve prices. According to this "reserve-price constraint," switchers are willing to spend no more than $\overline{p}$ on the private-label good and no more than $\overline{p} + x$ on the brand name. (This reserve-price constraint prevents the store from raising its prices to switchers without bounds.)

To ensure that the store can sell to both groups of consumers, we make two additional assumptions. First, we assume that $\overline{p}$ is strictly less than P^*, where P^* is the profit maximizing monopoly price that the grocery would charge for the brand-name good if it sold to only the loyal customers. Second, we assume that the monopoly can profitably sell products to both groups: $\overline{p} > m$, the wholesale price for the private label, and $P^* > M$, the wholesale price of the brand name.

We start by considering the extreme case where the grocery store sells an identical product under a brand name and as a private label so that $M = m$. Switchers recognize that the products are identical ($x = 0$), but loyal customers believe that the brand name is superior. This setting is the same as in Salop's (1977) noisy monopoly model. The monopoly price discriminates by spuriously differentiating the products, which prevents resale of the low-price good from the informed switchers to the loyal customers who will not buy the private label. The monopoly charges the loyal customers P^* for the brand-name product and charges the switchers $\overline{p} < P^*$ for the private label product, extracting all economic surplus from the n switchers.

We now assume that x is strictly positive and $M > m$, which is widely observed. If the amount by which switchers prefer the brand name is less than the wholesale price differential, $x < M - m$, and the prices are such that switchers are indifferent as to which good they buy, $P = \overline{p} + x$, then the monopoly makes more from selling the private label rather than the brand name to switchers.

The monopoly's pricing behavior depends on whether the price-differential or reserve-price constraint binds. The Lagrangian, where we allow for the possibility that the store sells both goods, is

$$L = (P - M)Q(P) + (p - m)n + \lambda(\overline{p} - p) + \mu(P - x - p). \quad (1)$$

Assuming that P and p are strictly positive, the Kuhn-Tucker conditions are

$$L_P = (P - M)Q'(P) + Q(P) + \mu = 0 \quad (2)$$

$$L_p = n - \lambda - \mu = 0 \quad (3)$$

$$L_\lambda = \overline{p} - p \geq 0 \quad (4)$$

$$\lambda L_\lambda = 0 \quad (5)$$

$$L_\mu = P - x - p \geq 0 \quad (6)$$

$$\mu L_\mu = 0 \quad (7)$$

$$\lambda \geq 0 \tag{8}$$

$$\mu \geq 0, \tag{9}$$

where a subscript indicates that we are partially differentiating with respect to that variable. Because L is linear in the private label price, either the reserve price or the price differential constraint must bind if the monopoly sells the private label.

2. Comparative Statics

We first consider the case where the reserve-price constraint does not bind: $\bar{p} > p$. Consequently, Equation (4) is a strict inequality, so we know that $\lambda = 0$ from Equation (5). Setting λ equal to zero in Equation (3), we find that $L_p = n - \mu = 0$, hence $\mu = n$. Substituting n for μ in Equation (2), we learn that

$$L_P = (P - M)Q'(P) + Q(P) + n = 0 \tag{10}$$

determines P. Moreover, because $\mu > 0$, $L_\mu = 0$ by Equation (7), Equation (6) holds with equality: $p = P - x$.

The comparative statics properties of $\bar{p}$, x, and n are clear cut where the price-differential constraint binds. Because $\bar{p} > p$, an increase in the reserve price, $\bar{p}$, does not affect either P or p. We also know from Equation (10) that P does not depend on the brand-name value differential, x. However, because $p = P - x$, an increase in x lowers p. That is, switchers pay less for the private label the greater they believe is the value of the quality difference, x.

To determine the effect of an increase in n—so that the number of switchers and hence the quantity they buy rises relative to the quantity sold to name-brand-loyal consumers—we totally differentiate Equation (10) to obtain

$$\frac{\mathrm{d}P}{\mathrm{d}n} = -\frac{1}{2Q' + (P - M)Q''}.$$

The denominator is the second derivative of the Lagrangian with respect to P, so that using the second-order condition, we know that an increase in n results in a higher P, which causes $p = P - x$ to rise. The monopoly sets the brand-name price, P, above the monopoly price, P^*, it would charge if it sold to only loyal customers, which is determined by $(P^* - M)Q'(P^*) + Q(P^*) = 0$.

It pays for the monopoly to sell both goods if it makes a larger per unit profit on the private label than on the brand name: $p - m = P - x - m > P - M$, which holds if $x < M - m$. That is, the extra value that switchers get from the brand name is less than the differential cost to the grocery of providing the brand name rather than the private label. Thus, the monopoly lowers p when x increases.

Next we consider the case where the price-differential constraint does not bind: $P - x > p$. From Equations (6) and (7), we find that $\mu = 0$. Consequently, using Equation (2), we conclude that $L_P = (P - M)Q' + Q = 0$, determines the brand-name price, so $P = P^*$. Moreover, using Equation (3), we find that $L_p = n - \lambda = 0$, which implies that $\lambda = n$. Thus, $L_\lambda = 0$, so the reserve-price constraint binds: $\bar{p} = p$. Here, the grocery store "segregates" the two types of consumers, charging the switchers $\bar{p}$, extracting all their economic surplus, and charges loyal customers P^*, which maximizes its profit from sales to only loyal customers. This result is the same as in the noisy monopoly model.

When the reserve-price constraint binds and the price differential constraint is slack, changes in x and n have no effect on the pricing of either good. An increase in $\bar{p}$ causes p to rise but does not affect P.

It is not necessarily true that the monopoly sells both goods. If $\bar{p}$ is high and n is large, the grocery store may prefer to sell only the private label because $m < M$. This case is not very interesting because few grocery stores sell only a private label. However, we do observe grocery stores that sell only the brand name. If only the brand name is sold to both groups, the total profit is $\pi = (P - M)[Q(P) + n]$. The first-order condition is the same as in Equation (10):

$$Q + (P - M)Q_P + n = 0,$$

if $P \leq \overline{p} - x$. Thus, the brand-name price would be the same as when the grocery sells both goods and the price-differential constraint binds. The difference is that the monopoly makes more money selling only the brand name good here because $P - M > P - x - m$, or equivalently, $x > M - m$.

Alternatively, if the P determined by Equation (10) is greater than $\overline{p} + x$, then the monopoly cannot charge both groups such a high price. One possibility is that it sells only to the loyal customers. The other is that it lowers its price to $P = \overline{p} + x$. It will sell both goods if it can make a higher profit than if it sells only the brand-name to both. Thus, the larger is x, the more likely that it pays to sell only the brand-name good. To sell the brand-name good to both groups, the monopoly must lower the brand-name price thereby losing money from sales to loyal customers. It is willing to do that if n is relatively large and hence the monopoly earns a larger payoff from selling to the switchers.

To illustrate our analytical results, we use a linear example where $Q = 24 - P$, $n = 2$, $M = 4$, and $m = 1$. We examine how the monopoly's pricing behavior varies with $\overline{p}$, the threshold price for the switchers. By our earlier assumptions, $\overline{p} > m = 1$ and $\overline{p} < P^* = 14$, which is the monopoly price if the good is sold to only the loyal customers. We summarize two cases in Table 1, where x equals 4 or 2.

Initially, we assume that $x = 4$, which is greater than the gap between the wholesale prices: $M - m = 3$. When the private-label reserve price $\overline{p}$ is relatively low ($\overline{p} \leq 8.5$), the grocery sells both goods. The reserve-price constraint binds but the price-differential constraint does not. At higher values of $\bar{p}$, the monopoly sells only the brand-name good.

Figure 1 shows how P and p vary with $\bar{p}$. The grocery sells the brand name at $P = P^* = 14$ and the private label at $p = \bar{p} \leq 8.5$. Where $8.5 < \bar{p} \leq 11$, the monopoly sells the brand name at $P = \bar{p} + x$, which is the maximum price that switchers will pay for the brand name good. As $\bar{p}$ increases beyond 8.5, the p line ends because the store does not carry the private label. For $\bar{p} > 11$, the grocery sells the brand name at the price determined by Equation (10), where $P = 15 > P^*$. Thus, the grocery raises the brand-name price when $\bar{p}$ exceeds $P - x = 15 - 4 = 11$. Figure 1 shows that P is first constant, then falls discontinuously, and finally rises as $\bar{p}$ increases. Therefore, a store that carries both the national brand and the private label may charge more or less for the national brand than if it sells only the national brand.

Now, we assume that $x = 2$, which is less than the gap between the wholesale prices: $M - m = 3$. When $\bar{p}$ is relatively small ($\leq 12 = P^* - x$), the grocery sells the brand name at $P = P^* = 14$ and the private label at $p = \bar{p}$. The price-differential constraint does not bind, but the reserve-price constraint is binding. At intermediate values of $\bar{p}$, $11 < \bar{p} \leq 13$, the monopoly sells only the brand-name good at $P = \bar{p} + x$. For $\bar{p} > 13$, the grocery sells both goods and the price-differential constraint (but not the reserve-price constraint) binds. The brand-name price is determined by Equation (10), $P = 15 > P^*$, and the private-label price is $p = P - x < \bar{p}$. Figure 2 shows how P and p vary with $\bar{p}$. The gap in the p plot occurs in the range of $\bar{p}$ where only the brand name is sold ($11 < \bar{p} \leq 13$). Here, P either does not change or increases as $\bar{p}$ increases. A store that carries both the national brand and the private label may charge either more or less for the national brand than would a store that did not carry the private label.

3. Conclusions

We draw six conclusions from this analysis. First, if switchers view brand-name and private-label products as identical (no quality premium, $x = 0$), the monopoly price discriminates, setting $P = P^*$ and $p = \bar{p}$.

Second, for $x > 0$ and in the range of parameters where the price-ceiling constraint binds, $p = \bar{p}$, the monopoly sells the brand-name for $P = P^*$. In this range, changes in the number of switchers, n, or switchers' brand-name premium, x, do not affect the prices. An increase in $\bar{p}$ causes the price of the private label to rise but does not affect the price of the brand name, which remains at P^*.

Third, in the range of parameters where the private-label price is less than the reserve price, $p < \bar{p}$, the price-differential constraint binds, so the monopoly sets the private-label price at $p = P - x$ and the brand-name price is above the profit-maximizing price if it sold to only loyal customers: $P > P^*$. An increase in n causes P and p to rise by the same amount. In this range, an increase in x does not affect P, but causes p to fall. An increase in $\bar{p}$ does not affect p or P. Because prices rise with n, an important empirical implication is that prices may be higher in stores in communities with many poor people, younger people, and large families.

Fourth, if the monopoly sells only the brand name, the monopoly charges a price $P > P^*$ unless $\bar{p}$ is too low to result in sales to switchers. With a lower $\bar{p}$, $P = \bar{p} + x < P^*$, or the single-price monopoly may not sell to the switchers (if there are relatively few of them).

Fifth, whether a store sells a private label depends on the parameters. All else the same, if small stores face higher costs for private labels than larger stores or chains, they are less likely to sell a private label. The price of the private label does not depend on m if the private label is sold; however, m helps determine whether the store sells the private label.

Sixth, as the reservation price of price-sensitive switchers rises, the price differential between the brand name and private label initially falls. However, if the reservation price rises further, the store may stop carrying the private label.

Thus, even with this simple theoretical model, the presence of a private label may be associated with a higher or lower brand-name price. Whether the monopoly sells a private label depends on the number of switchers, how much more switchers value the brand name, and how much lower is the monopoly's cost of the private label rather than the brand name.

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Table 1

Brand-Name Price, *P*, and the Private-Label (PL) Price, *p*, Vary with the Private-Label Reserve Price, $\bar{p}$, and the Value Switchers Place on the Brand Name, *x*

	$x = 4$	$x = 2$
$\bar{p} < 8.5$	$P = P^* = 14$ $p = \bar{p}$	$P = P^* = 14$ $p = \bar{p}$
$8.5 < \bar{p} \leq 11$	$P = \bar{p} + x$ PL not sold	$P = P^* = 14$ $p = \bar{p}$
$11 < \bar{p} \leq 13$	$P = 15$ PL not sold	$P = \bar{p} + x$ PL not sold
$13 < \bar{p}$	$P = 15 > P^*$ PL not sold	$P = 15$ $p = P - x = 13$

Note: Figure 1 plots P and p for the $x = 4$ case and Figure 2 shows the $x = 2$ case.

Figure 1

Brand-Name Price, *P*, and Private-Label Price, *p*, Vary with $\bar{p}$ Where *x* = 2

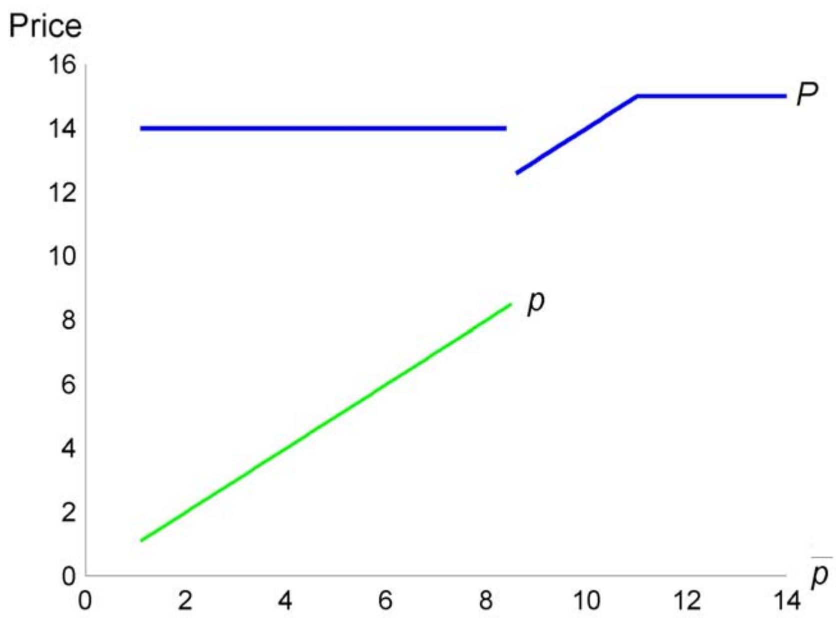

Figure 2

Brand-Name Price, *P*, and Private-Label Price, *p*, Vary with $\bar{p}$ Where *x* = 4