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The influence of media attention on retail price competition

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Abstract

Media price comparisons influence how firms set their prices. While it is commonly accepted that more informed consumers tend to drive prices lower, we identify an `intertemporal advertising effect,' where firms leverage their success in price comparisons to boost future demand. When a greater proportion of consumers relies on these comparisons to guide their future purchasing decisions, rather than directly comparing prices themselves, firms may be incentivized to set lower prices to `win' the comparison. This challenges the conventional understanding of how consumer information affects pricing. However, frequent comparisons reduce the impact of individual wins, and the unpredictable timing of these comparisons limits firms' ability to strategically adjust their prices.

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1 Introduction

Supermarket price rankings get significant media attention, but unlike product reviews (e.g., reviews of wine, books and movies), prices are short-term and change frequently. If a consumer buys a book or watches a movie based on consumer journalism recommendations, the consumer will read the same book or watch the same movie as the journalist (the reviewer). In contrast, a price comparison in retail markets provides only a snapshot, without predicting future prices.

The media's focus on price comparisons reflects strong consumer interest, which drives continued attention. Winners of these comparisons often highlight their success in long-term advertising to reinforce their low-price image. While the value of such claims is limited, as firms are free to change prices after the comparison, this shows that retailers believe current pricing impacts future consumer decisions.

Many consumers make routine purchasing decisions, such as grocery shopping, using limited information rather than actively comparing current prices. This behavior aligns with dual-process theories of reasoning, particularly Kahneman's (2011) distinction between System 1 and System 2 thinking. For routine decisions like grocery shopping, consumers typically rely on System 1, which is fast, intuitive, and based on past experiences, rather than engaging System 2, which requires more cognitive effort and active comparison. In these cases, consumers often form an internal reference price (IRP), influenced primarily by past prices. Research indicates that 60-85% of a consumer's IRP is shaped by previous prices (Mazumdar et al., 2005), underscoring the role of System 1 in shaping everyday purchasing behavior.[1]

To explore how media price comparisons can shape consumer expectations about future prices, we model two-period competition between two retailers, based on Hotelling (1929). If a media comparison occurs in the first period, some consumers carry that information forward. By setting a low price initially, a firm can create a favorable impression, influencing demand in the second period—an "intertemporal persuasive advertising effect".[2] While this

[1] See also Posner and Snyder (1975) and Stanovich and West (2000).

[2] Within the literature on advertising there is typically a distinction between informative and persuasive advertising (see Renault, 2015, for a survey). The intertemporal mechanism in our model has some similarities with Haan and Moraga-González (2011), who analyze how a firm through advertising may achieve a more salient place in consumer memories.

effect pushes firms to lower prices in the first period, the comparison winner has an incentive to raise prices later to capitalize on their earlier low-price investment, as some consumers still believe the ranking holds. A common belief is that a higher fraction of consumers that compare *actual* prices lowers prices (Stigler, 1961, and subsequent papers)[3]; we show that when more consumers rely on *historic* prices in media comparisons, prices can decrease.

Our model is inspired by retail grocery markets, where media price comparisons impact competition. In Israel, Ater and Rigbi (2023) found that introducing online price disclosure post-2015 intensified price competition, despite limited consumer use, reducing prices by 4-5%. This was due to media price comparisons. In Norway, the largest newspaper, VG, has published random grocery price comparisons for over 20 years. Foros et al. (2024) show a V-shaped price pattern, with prices dropping before expected VG comparisons and rising afterward. Similar to Israel, a win in VG's price comparison is leveraged for months in advertising, until the next comparison is published. This demonstrates the intertemporal persuasive advertising effect, since a win provides little information about actual prices weeks or months later. Seaton and Waterson (2013) emphasize that UK grocery supermarkets also give huge attention to their position in third-party price comparisons.

2 The model

We apply Hotelling (1929), where Firm 0 is located at $X_0 = 0$ and firm 1 at $X_1 = 1$. Firms compete over two periods, $T = 1, 2$ by setting price at the beginning of each period. A third-party ("the media") might undertake a price comparison with probability ρ_T. Consumers have unit demand each period, and can be one of two types: a fraction $\alpha \in [0, 1]$, type A, has perfect information about the actual price p_{iT} of firm i, $i = 0, 1$, whereas a fraction $(1 - \alpha)$, type B, forms an expectation $\overline{p}^e_{iT}$ about the price of firm i in period T. The "average" consumer's best estimate of the price level at firm i is $p^e_{iT} = \alpha p_{iT} + (1 - \alpha)\,\overline{p}^e_{iT}$. If a price comparison is published in period T, also the type B consumers know the exact prices in that period, such that $p^e_{iT} = p_{iT}$. If there is a price comparison in period 1 but not in period 2, the type B consumers expect the same prices to hold also in period 2, $\overline{p}^e_{i2} = p_{i1}$. The timing in each period is that firms simultaneously set their prices, then nature chooses

[3] Of particular relevance is Robert and Stahl (1993), who show that consumer ignorance may be reduced through consumer searching or informative advertising.

whether there will be a price comparison, consumer expectations are then formed leading to realized demand and profit.

The expected net utility of buying from firm i in period T for a consumer located at x is given by $U_{iT}^e = v - t\,|X_i - x| - p_{iT}^e$, where $v, t > 0$. Throughout, we restrict attention to market coverage and market sharing. From $U_{0T}(x) = U_{1T}(x)$, demand with (superscript C_T) and without (superscript NC_T) a media price comparison in period T is:

$$D_{iT}^{C_T} = \frac{1}{2} - \frac{p_{iT} - p_{jT}}{2t}$$

$$D_{iT}^{NC_T} = \frac{1}{2} - \alpha\frac{p_{iT} - p_{jT}}{2t} - (1-\alpha)\frac{\overline{p}_{iT}^e - \overline{p}_{jT}^e}{2t}$$

Given the timing and normalizing all marginal costs to zero, firm i's expected profit in period T is

$$\pi_{iT} = p_{iT}\left[\rho_T D_{iT}^{C_T} + (1-\rho_T)\, D_{iT}^{NC_T}\right].$$

2.1 Period 2 equilibrium

From $\partial\pi_{i2}/\partial p_{i2} = 0$, we find the period 2 equilibrium prices:[4]

$$p_{i2}^* = \frac{t}{\alpha + \rho_2\,(1-\alpha)} - (1-\alpha)\,(1-\rho_2)\,\frac{\left(\overline{p}_{i2}^e - \overline{p}_{j2}^e\right)}{3\,(\alpha + \rho_2\,(1-\alpha))}$$

If no price comparison has taken place in period 1, since the firms are intrinsically symmetric, the type B consumers expect $\overline{p}_{i2}^e = \overline{p}_{j2}^e$. In contrast, if a price comparison did take place in period 1, we have $\overline{p}_{i2}^e = p_{i1}$ and $\overline{p}_{j2}^e = p_{j1}$. To see the contemporaneous effect (an informative advertising effect as in Stigler, 1961, and subsequent papers) consider the behavior of the second-period price at a symmetric situation, $\overline{p}_{i2}^e = \overline{p}_{j2}^e$ and $p_{i1} = p_{j1}$:[5]

Lemma 1: *(i) The second period prices increase if the fraction of type B consumers increases (α decreases). (ii) The second period prices fall if the probability of a media*

[4] The second-order condition is satisfied, $-\frac{1}{t}\left[\rho_2 + (1-\rho_2)\,\alpha\right] < 0$.

[5] The mechanism is analogous to the seminal paper by Salop and Stiglitz (1977). See also Foros et al. (2024) who present a simple one-period model on media price comparisons.

price comparison increases (ρ_2 increases), *and more so the higher the fraction of type B consumers.*

2.2 Period 1 equilibrium

With probability ρ_1 there is a price comparison in period 1, in which case prices and hence profit in period 2 depends on the prices that the firms charge in period 1. Assuming no discounting, firm i will choose p_{i1} to maximize expected profit over the two periods:

$$\max_{p_{i1}} \Pi_i = \pi_{i1} + \rho_1 \pi_{i2}^{C_1} + (1-\rho_1)\pi_{i2}^{NC_1}$$

If the media does not publish any price comparison in period 1, the prices that the firms charge in that period will have no effect on the optimal price in period 2 ($\partial \pi_{i2}^{NC_1}/\partial p_{i1} = 0$). Furthermore, it is readily determined from the equilibrium in the second period that

$$\frac{\partial \pi_{i2}^{C_1}}{\partial p_{i1}} = -\frac{(1-\rho_2)(1-\alpha)}{3(\alpha+(1-\alpha)\rho_2)} < 0$$

We thus find the optimal price in period 1 by solving $\partial \Pi_i/p_{i1} = \partial \pi_{i1}/\partial p_{i1} + \rho_1 \partial \pi_{i2}^{C_1}/\partial p_{i1} = 0$. Since $\partial \pi_{i1}/\partial p_{i1} < 0$, it follows that each firm increases its intertemporal profit by choosing a lower first-period price than the one that maximizes first-period profit. Hence, setting a low price in period 1 can be considered as an investment that increases profit through creating a favorable price impression among type B consumers (similar to what might be obtained with persuasive advertising). Solving $\partial \Pi_i/\partial p_{i1} = 0$ for the two firms, and dropping subscripts, we can write the equilibrium price in period 1 as[6]

$$p_{T=1}^* = t\frac{3[\alpha+\rho_2(1-\alpha)] - [2(1-\alpha)(1-\rho_2)]\rho_1}{3[\alpha+\rho_1(1-\alpha)][\alpha+\rho_2(1-\alpha)]}$$

It is straightforward to show that the price that each firm charges in period 1 is decreasing in the probability of a price comparison that period ($\partial p_{T=1}^*/\partial \rho_1 < 0$). More surprising is the fact that market prices in period 1 are increasing in the probability of a price comparison in the next period ($\partial p_{T=1}^*/\partial \rho_2 > 0$). The intuition is that the greater the likelihood of a price comparison in period 2, the less likely it is that a firm by charging a low price in

[6] We restrict attention to where we have a positive price in period 1. The second-order condition is given by: $-9(\rho_1+(1-\rho_1)\alpha)(\alpha+\rho_2-\alpha\rho_2)+\rho_1(1-\alpha)^2(1-\rho_2)^2 < 0$

period 1 is able to persuade type B that it will remain a low-cost firm in the future. We can state:

Proposition 1: *The price that each firm charges in period* 1 *is (i) decreasing in the probability of a price comparison in period* 1 *and (ii) increasing in the probability of a price comparison in period* 2*.*

A corollary to Proposition 1 follows:

Corollary 1: *With a price comparison in the first period, the type B consumers carry the learned first-period price over to the second period as long as* $\rho_2 < 1$*. This effect induces the firms to lower their prices in period 1.*

This intertemporal persuasive effect resembles vertical quality differentiation. If perceived quality of one product increases, the demand for that product increases (Shaked and Sutton, 1982). If our model had considered consumers who were informed and uniformed of the vertical qualities of firms' products, then a review that informs about quality would have the same effect as our price comparison mechanism.[7] The media also review and compare experience goods like wine, restaurants, and books. Studies show that media attention boosts future demand—Horverak (2009), Friberg and Grönqvist (2012), and Hilger et al. (2011) link positive wine reviews to higher demand, while Chen et al. (2012) find that pre-release movie reviews impact demand and financial value. Unlike price comparisons, where only a snapshot of current prices is provided, the consumer will drink the same wine and watch the same movie as the reviewer. Restaurant reviews (e.g., the Michelin guide) are a closer parallel to price comparisons, as a favorable review might prompt a restaurant to lower quality or service later, capitalizing on the initial investment in high standards at the time of the review.

It is widely recognized that greater consumer ignorance often leads to higher prices (Stigler, 1961, among others). In our model, we can interpret a larger proportion of type B consumers as indicative of a higher level of consumer ignorance. However, in our framework, an increase in the share of type B consumers may actually result in a decrease in the first-

[7] We are grateful to a referee for pointing this out.

period price. To see this, note that in the neighborhood of $\alpha = 1$ we have:

$$\left.\frac{\partial p^*_{T=1}}{\partial \alpha}\right|_{\alpha=1} = t\frac{(\rho_1 - \widehat{\rho}_1)}{\widehat{\rho}_1},$$

where

$$\widehat{\rho}_1 \equiv \frac{3}{5 - 2\rho_2}.$$

If the likelihood of a price comparison in period 1 is sufficiently large ($\rho_1 > \widehat{\rho}_1$), the expected demand expansion in period 2 of reducing the price in period 1 thus makes it profitable to lower the price in period 1 if the share of type B consumers increases:

Proposition 2: *A small increase in the fraction of type B consumers around* $\alpha = 1$ (*i.e.* α is *slightly reduced below 1) decreases the equilibrium price and profit in period* $T = 1$ *if* $\rho_1 > \widehat{\rho}_1$.

Note the interplay between ρ_1 and ρ_2 behind this result. An increase in ρ_2 will push the equilibrium price up in the first period, and will also increase the value of $\widehat{\rho}_1$. To have an incentive to reduce price in the first period as oultined in Proposition 2, there must be a large enough probability of the two periods being linked together (i.e. that there will be a demand expansion in period 2); this occurs if ρ_1 is sufficeiently large. Hence, as ρ_2 increases, so too must ρ_1 for the result in Proposition 2 to hold.

Figure 1 illustrates the result in Proposition 2, but extends it to cover the whole range $\alpha \in [0, 1]$.[8] For $\rho_1 = 1/5$ (low probability that the media publishes a price comparison in period 1) we have the standard result that the first-period price is decreasing in the number of informed consumers. However, for $\rho_1 = 4/5$ (high probability of a price comparison), the price is increasing in the number of informed consumers.

[8] In this figure, $t = 1$ and $\rho_2 = 0.5$.

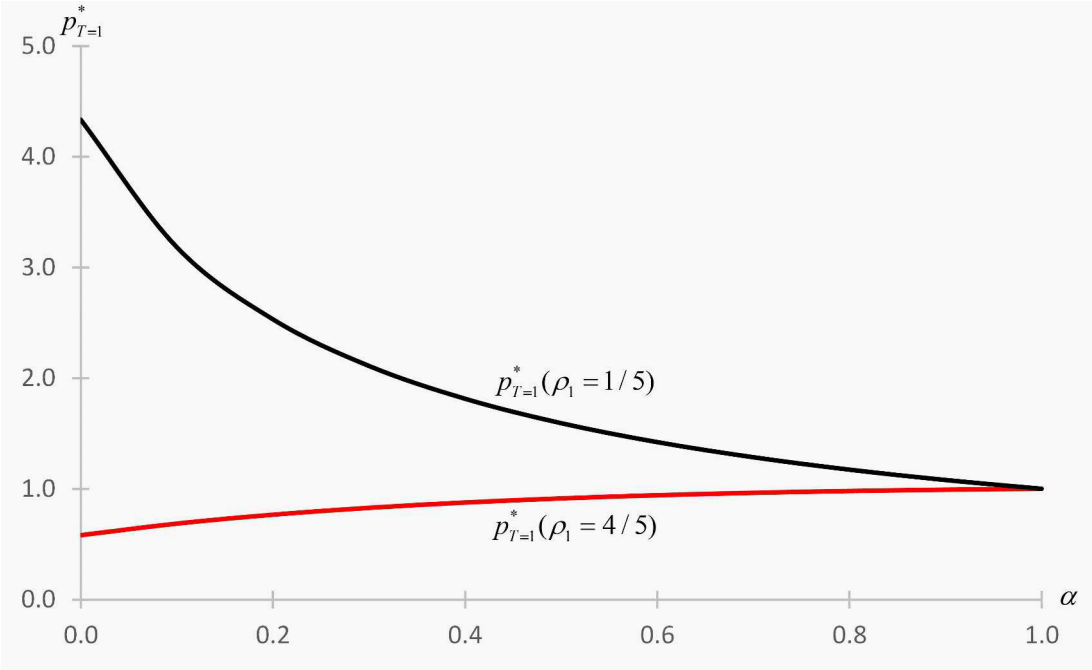

Figure 1: *Prices in the first period.*

3 Consumer welfare

In a symmetric equilibrium we have $p_{i1} = p_{j1}$, and the equilibrium price in period 2 is independent of whether a price comparison took place in period 1:

$$p^*_{T=2} = \frac{t}{\alpha + \rho_2 (1 - \alpha)}.$$

Since the firms serve half of the market each, we have $\pi^*_{T=1} = p^*_{T=1}/2$ and $\pi^*_{T=2} = p^*_{T=2}/2$.

Each consumer buys one unit of either of the goods each period. Consumer utility is therefore directly related to the sum of the prices over the two periods. In the absence of a media price comparison ($\rho_1 = \rho_2 = 0$), we have $p^*_{T=1} = p^*_{T=2} = t/\alpha$. In spite of the fact that firms can attempt to manipulate demand, consumers gain from the possibility of media price comparison since

$$\begin{aligned}
\frac{\partial (p^*_{T=1} + p^*_{T=2})}{\partial \rho_1} &= -t (1 - \alpha) \frac{5\alpha (1 - \rho_2) + 3\rho_2}{6 (\alpha + \rho_1 (1 - \alpha))^2 (\alpha + \rho_2 (1 - \alpha))} < 0 \text{ and} \\
\frac{\partial (p^*_{T=1} + p^*_{T=2})}{\partial \rho_2} &= -t (1 - \alpha) \frac{3\alpha + \rho_1 (1 - 3\alpha)}{6 (\alpha + \rho_1 (1 - \alpha)) (\alpha + \rho_2 (1 - \alpha))^2} < 0.
\end{aligned}$$

As noted, the effect of less consumer ignorance on the price in period 1 is ambiguous whilst it lowers prices in period 2. In sum, the second-period effect dominates since[9]

$$\frac{\partial(p^*_{T=1}+p^*_{T=2})}{\partial\alpha} = t\frac{X\alpha^2+Y\alpha+Z}{3\left(\alpha+\rho_1\left(1-\alpha\right)\right)^2\left(\alpha+\rho_2\left(1-\alpha\right)\right)^2}<0$$

$$\begin{aligned}\text{where } X &= (1-\rho_2)(1-\rho_1)(\rho_1+3\rho_2+2\rho_1\rho_2-6)<0\\ Y &= -2(1-\rho_2)(1-\rho_1)(\rho_1+3\rho_2+2\rho_1\rho_2)<0\\ Z &= (2\rho_2+1)(\rho_2-1)\rho_1^2+\rho_2(\rho_2+2)\rho_1-3\rho_2^2<0\end{aligned}$$

The comparative static effects on prices are summarized in Table 1.

Table 1: Summary of effects

	$\Delta\rho_1>0$	$\Delta\rho_2>0$	$\Delta\alpha<0$ (increasing ignorance)
$\Delta p^*_{T=1}$	$-$	$+$	$\begin{smallmatrix}-\ (\rho_1>\widehat{\rho}_1)\\ +\ (\rho_1<\widehat{\rho}_1)\end{smallmatrix}$
$\Delta p^*_{T=2}$	0	$-$	$+$
$\Delta(p^*_{T=1}+p^*_{T=1})$	$-$	$-$	$+$

More openness about prices would be expected to intensify price competition between the firms, and this is weakly true for the early price comparison. However, when a future price comparison becomes more likely, firms actually raise prices in the first period. The mechanism here is that a low first-period price is unlikely to persuade uninformed customers that a firm will keep a low price in the future since there will be a larger chance that the actual price will be revealed in a comparison. More consumer ignorance does tend to weaken price competition in general although the opposite effect occurs in the early period if there is a sufficiently large chance of a price comparison then. This occurs due to the expected demand expansion in period 2 that follows from setting a low price early on; the low price is quite likely to be revealed to a larger number of uniformed customers since the price comparison occurs with a high probability.

[9] That $X<0$ and $Y<0$ is straightforward to see. A proof that $Z<0$ is in the online appendix.

4 Concluding remarks

It is commonly believed that providing consumers with information reduces prices by lowering ignorance. In static settings, this holds true, as media attention, like price comparisons, discipline firms' pricing behavior. Our analysis introduces a dynamic aspect: while media attention informs consumers, it can also lock them into expectations. A countervailing effect emerges as more consumers rely on price comparisons, making it crucial for firms to win them and boost future demand—a phenomenon we term the "intertemporal advertising effect". Frequent comparisons, however, limit firms' ability to benefit from past victories. The randomness of comparison timing further disciplines pricing behavior, as predictable comparisons would allow firms to manipulate prices when they know no comparisons will occur.

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