Consumer Bounded Rationality and Price Adjustment Policy: A Natural Connection

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Let’s first read a story written and posted on the thekrazycouponlady.com website:

“Like many Krazy Coupon Ladies, I consider myself a smart and savvy shopper, but I’ll be the first to admit that sometimes my emotions get the best of me. I saw a beautiful cashmere sweater at one of my favorite shops last week for 30% off; it even came in petite sizes—it was too perfect. I thought I had an amazing deal. **It was still more than I would normally spend, but I went against my gut and bought it anyway.** The next day I got an email that they were now all 40% off—just my luck! Thankfully, while I was online I came across their price adjustment policy and got an additional $10 credited back to my card. Since I had such good luck with this, I thought I’d share a few other fabulous price adjustment policies so hopefully you can save more money and stress less this season!” (from [http://thekrazycouponlady.com/price-adjustment-policies](http://thekrazycouponlady.com/price-adjustment-policies), accessed on June 27, 2017)

**Source:** [http://thekrazycouponlady.com/price-adjustment-policies](http://thekrazycouponlady.com/price-adjustment-policies)

**Price Adjustment Policy** in this story is actually called posterior price matching (PM) in the existing literature (see, e.g., Lai et al. 2010, Lee et al. 2015 and references therein). Under PM policies, the seller will fully refund a consumer the difference
between what the consumer paid (in the regular period) and the latest price (in the markdown period) if the latter is lower, provided that the consumer submits the claim for the refund to the seller. Such a policy is widely used in practice by numerous retailers, including the fifteen retailers listed on the thekrazycouponlady.com website such as Ann Taylor, Athleta, Banana Republic, Gap, Kmart, Macy’s, Target, Walmart, among many others.

A fundamental question is: Why is PM used? The extensive literature has offered the following explanations: to reduce inventory, to soften competition, to price discriminate consumers, and to eliminate consumer strategic waiting incentives. Recall that, in the story at the beginning, the “Krazy Coupon Lady” says that “\textit{It was still more than I would normally spend, but I went against my gut and bought it anyway.}” This kind of purchasing behavior appears “irrational” since it is based on a “belief” (of the likelihood of future markdown) that sounds arbitrary and may be incorrect. The “Krazy Coupon Lady” is certainly not alone; in real life, there could be many consumers who share similar purchasing behaviors. What are the implications for the firm facing consumers who may have incorrect beliefs and irrational purchasing behaviors? Does consumer behavior matter in this context and how? In this paper, Huang et al. (2017) answer those questions using a simple framework of modelling consumer “bounded rationality” in which consumers follow a simple learning heuristic (dubbed as “anecdotal reasoning”) and hence may have incorrect beliefs. Huang et al. (2017) show that bounded rationality (which has been largely overlooked in the existing literature) does play a significant role.

What is bounded rationality? Well, in general, that is actually a non-trivial question, even leading behavioral economists do not have a crystal clear definition yet. For instance, Spiegler (2011) says that “\textit{The term bounded rationality is notoriously vague.}” This term was originally coined by Nobel-prize winner Simon in 1957 to describe human being’s limits in formulating and solving complex problems and in processing information. Simon and two other later Nobel-prize winners Kahneman and Kversky argue that humans are not perfectly rational, and normally take reasoning shortcuts or heuristics that may lead to suboptimal decisions. In the particular context of markdowns with PM policies, consumer bounded rationality is simply consumers’ inability of perfectly estimating the probability of future markdowns. Such an inability could be due to many different factors, for example, lack of sufficient information, limitation of cognitive capability, etc.

How to model bounded rationality? We use the so-called anecdotal reasoning framework to capture bounded rationality where the number of anecdotes a consumer obtains can be interpreted as how boundedly rational the consumer is. Each consumer
simply takes the sample average to estimate the likelihood of future markdowns. This framework is **general** since it actually generalizes the commonly-used Nash equilibrium solution concept. Meanwhile, it is **parsimonious** since it only has a single parameter. It is also **powerful** since it can be applied in a variety of important business settings (see, e.g., Huang and Yu 2014, Huang and Chen 2015, Huang and Liu 2015, among others). We do hope and believe that this general, parsimonious and powerful framework will be used in many other settings as well, as the Nash equilibrium concept has already been.

Based on what we know from the extensive literature, where it is customarily assumed that consumers always have “rational expectations,” i.e., they have perfectly correct beliefs about the probability of future markdowns, a firm should **not** use the PM policy if it is a monopoly selling to homogenous and it has no pressure to dispose leftover inventory. Interestingly, in Huang et al. (2017), we show that when consumers have boundedly rational expectations, the firm may have incentives to use the PM policy.

Why can consumer bounded rationality alone provide a firm an opportunity to make a profit by using a PM policy? The fundamental reason is that if the firm markdown with some probability, then different consumers typically get different anecdotes and hence heterogeneous beliefs. That is to say, probabilistic markdown creates heterogeneity among consumers so that some of them **underestimate** the likelihood of seeing markdowns while the others **overestimate** that likelihood. We hence have two baskets of consumers: a basket of “underestimators” and a basket of “overestimators.” Increasing the markdown probability increases the number of overestimators and hence more purchasers, but at the expense of a lower profit margin. We show that this tradeoff is non-trivial and interesting. It turns out that the optimal markdown probability may be non-degenerate, i.e., strictly between zero and one. Therefore, probabilistic markdowns with PM may allow the firm to take advantage of consumer bounded rationality.

After demonstrating the important role of customer boundedly rational expectations and how to implement PM policies when the firm can commit to a fixed markdown probability, our research then proceeds to solve another practically relevant problem in which how a firm should **dynamically** manage its markdowns if it can adjust the markdown probability in each selling season. The results indicate that it is profit-maximizing to set the neighboring markdown probabilities as far apart from each other as possible due to the substitutability between them. If the markdown probability in the previous season is higher, then the firm has an incentive to decrease the markdown probability in the current season. The reason is that, a higher markdown probability in the previous season means a higher demand in the current season, which consequently leads to more profit losses due to more price-matching refund. Thus, firms using PM
with probabilistic markdowns are recommended to adopt a cyclic policy: it is profit-maximizing to mark down with probability one followed with a small probability cyclically to exploit customer bounded rationality.

Our findings underscore the importance of consumer bounded rationality and provide managerial and practical guidelines on how to manage PM when customers are boundedly rational. Beyond that, it is our hope that this paper provides one example to stimulate many more examples towards answering this general, natural and important question for both academics and practitioners in our field: How robust are the existing findings and managerial insights with respect to the “full rationality” assumption (that is implicitly embedded in Nash equilibria)?

References


