Economics Bulletin

Volume 39, Issue 3

Clipping Coupons: Redemption of Offers with Forward-Looking Consumers

Kissan Joseph
University of Kansas

Oksana Loginova
University of Missouri

Abstract

Consumer redemption behavior pertaining to coupons, gift certificates, product sampling, rebates, and the like, has been the focus of much scholarly inquiry and the extant literature has documented two noteworthy empirical regularities - a bump in redemptions close to offer expiry and greater redemption with shorter redemption windows. In the extant work, these phenomena have been explained by invoking myopic consumers. Against this backdrop, we ask a simple question: can these phenomena survive if we assume rational, forward-looking consumers? Accordingly, we develop a model consisting exclusively of forward-looking consumers and incorporate two constructs highlighted in the literature - forgetting and stochastic redemption costs. We derive consumers' period-by-period redemption rule and subsequently illustrate the emergence of the two aforementioned empirical regularities.

Citation: Kissan Joseph and Oksana Loginova, (2019) "Clipping Coupons: Redemption of Offers with Forward-Looking Consumers", *Economics Bulletin*, Volume 39, Issue 3, pages 1694-1700
Contact: Kissan Joseph - kjoseph@ku.edu, Oksana Loginova - loginovao@missouri.edu.
Submitted: April 12, 2019. **Published:** July 07, 2019.

1. Introduction

Consumers often find themselves in a position where they can redeem marketing offers such as coupons, gift certificates, invitations to partake in product sampling, rebates, etc. Not surprisingly, consumer redemption behavior has received a fair amount of research attention and the literature has documented two empirical regularities – a bump close to offer expiry and greater redemption with shorter redemption windows. Specifically, with respect to the bump, Inman and McAlister (1994) incorporate regret theory to examine redemption behavior as the coupon approaches expiration. A key premise of their research is that consumers are myopic in that they do not anticipate or respond to the regret until they experience it. In their empirical work, Inman and McAlister (1994) analyze coupon redemption patterns for various brands in the spaghetti sauce category and find that they do indeed exhibit a bump close to expiry. Similarly, Groupon redemptions also show a bump close to expiry (Gupta, Weaver and Rood 2012). With respect to redemption windows, Shu and Gneezy (2010) hypothesize and empirically find that redemption rates are higher when consumers are assigned to shorter redemption windows. In their conceptualization, Shu and Gneezy (2010) build on resource slack theory (Zauberman and Lynch 2005) which suggests greater discounting of time investments relative to money investments. Such systematic underweighting of effort has also been discussed in Akerlof (1991). Another conceptualization utilized by Shu and Gneezy (2010) is temporal construal theory (Trope and Liberman 2003) which examines how non-monetary costs and benefits are treated in the short run and in the long run. This theory suggests that individuals tend to focus on the desirability aspects of a task in the long run, but then switch to a focus on the feasibility aspects of the task as it actually approaches. Again, it is the consumer's myopic perception of his/her behavior in distant periods that leads to the empirical regularity of greater redemption associated with shorter redemption windows.

While these are very interesting explanations, they nevertheless beg the question: how can such phenomena persist over time as consumers come to learn about their myopia? Another way to ask the same question is whether such phenomena will ever emerge with rational, forward-looking consumers. Accordingly, our primary contribution to the literature is to develop a model that demonstrates how the two aforementioned empirical regularities can arise even in a world consisting exclusively of forward-looking consumers. In spirit, our work is closest to that of Gilpatric (2009) who examines the impact of the distribution of forward-looking consumers on rebate redemptions. Taken together, these two works deepen our understanding of consumer redemption behavior.

In our model, we include two constructs identified in the literature: forgetting and stochastic redemption costs. The notion of forgetting has a rich history in many communication models where consumers forget messages delivered to them. (See, for example, Keller (1987), who highlights the endemic problem of consumers' memory performance in the context of advertising, and Tellis (1998), who discusses the notion of less than perfect carry-over for advertising investments.) We also believe that stochastic redemption costs are an integral aspect of consumer behavior, an idea highlighted by O'Donoghue and Rabin (1999). (See also Chen, Moorthy and Zhang (2005), who utilize a stochastic specification for consumers' marginal utility for money.)

2. Model Setup

We consider a cohort of consumers who in period 1 receive a marketing offer (coupon, gift certificate, invitation to partake in product sampling, rebate) of value x that expires in period N. We make the following key assumptions.

A1: Forgetting. A consumer in possession of the offer faces the possibility that he/she forgets, misplaces, or loses the offer as he/she crosses from one period to the next. We assume that the probability that the consumer will remember the offer is $\rho \in [0, 1]$; conversely, the probability that he/she will forget the offer is $1 - \rho$. The forgotten offer cannot be recalled at a future time.

A2: Stochastic Redemption Costs. Redeeming the offer is costly. We assume that this cost varies stochastically across the periods. In every period, each consumer learns his/her redemption cost c that is drawn from a continuous distribution $F(\cdot)$ with support $[\underline{c}, \overline{c}]$.

A3: Forward-Looking Consumers. All the parameters of the model, x, N, ρ and $F(\cdot)$ are known to the consumers. We assume that the offer is such that $x \geq \underline{c}$. When a consumer redeems the offer, his/her utility is the difference between x and the realized redemption cost. Thus, the consumer may strategically postpone redeeming the offer to take advantage of the possibility of a lower cost realization in the future. For simplicity, we assume there is no discounting between periods.

3. Analysis

Consumer decision-making can be characterized by a set of thresholds c_1, c_2, $\ldots c_N$. When a consumer arrives in period n and the offer has not yet been redeemed or forgotten, the consumer redeems the offer if and only if his/her realized redemption cost does not exceed c_n.

We begin our analysis with the last period. In period N, the consumer redeems the offer as long as the realized cost does not exceed x:

$$c_N = \min\{x, \overline{c}\}.$$

The consumer's expected utility at the beginning of period N (period N value function) is, therefore,

$$V_N = \int_{\underline{c}}^{c_N} (x - c)\, \mathrm{d}F(c).$$

In the next to last period, period $N - 1$, the consumer compares $x - c$ with ρV_N and redeems the offer if and only if $x - c \geq \rho V_N$, or $c \leq x - \rho V_N$. Hence,

$$c_{N-1} = \min\{x - \rho V_N, \overline{c}\}.$$

We then calculate period $N - 1$ value function, which incorporates the consumer's optimal redemption rule in periods $N-1$ and N:

$$\begin{aligned} V_{N-1} &= \int_{\underline{c}}^{c_{N-1}} (x-c)\,\mathrm{d}F(c) + \int_{c_{N-1}}^{\overline{c}} \rho V_N \,\mathrm{d}F(c) \\ &= \int_{\underline{c}}^{c_{N-1}} (x-c)\,\mathrm{d}F(c) + (1-F(c_{N-1}))\rho V_N. \end{aligned}$$

Continuing with backward induction, we obtain the sets of thresholds $\{c_n\}$ and value functions $\{V_n\}$, $n = 1, 2, \ldots N$. The results are summarized in Proposition 1.

Proposition 1. *Among consumers in possession of the offer in period n, only those with the cost realizations below c_n will redeem the offer in that period. The set of thresholds $\{c_n\}$ can be calculated recursively, with the initial condition*

$$\begin{cases} c_N = \min\{x, \overline{c}\}, \\ V_N = \int_{\underline{c}}^{c_N} (x-c)\,\mathrm{d}F(c). \end{cases}$$

and the formula

$$\begin{cases} c_{n-1} = \min\{x - \rho V_n, \overline{c}\}, \\ V_{n-1} = \int_{\underline{c}}^{c_{n-1}} (x-c)\,\mathrm{d}F(c) + (1-F(c_{n-1}))\rho V_n. \end{cases}$$

Corollary 1. *Consumers become less stringent as the expiration date of the offer approaches: $c_1 \leq c_2 \leq \ldots \leq c_N$.*

For the proof of Corollary 1, consider a consumer in possession of the offer in period n. This consumer can do at least as well as a consumer in possession of the offer in period $n+1$ by behaving as if the offer expires one period earlier. This simple observation immediately implies that the value function is higher in period n than in period $n+1$, $V_n \geq V_{n+1}$. Since $c_{n-1} = \min\{x - \rho V_n, \overline{c}\}$ and $c_n = \min\{x - \rho V_{n+1}, \overline{c}\}$, we have $c_{n-1} \leq c_n$ for all n.

Intuitively, consumers are more demanding early on because there are still ample opportunities to realize a low redemption cost. However, as periods go by, the chances to draw a good redemption cost diminish, thereby causing a consumer to be less likely to delay redemption.

We now calculate the number of redemptions in each period n, which we denote by p_n, $n = 1, 2, \ldots N$. In the first period, the number of redemptions is

$$p_1 = \int_{\underline{c}}^{c_1} 1\,\mathrm{d}F(c) = F(c_1).$$

The number of consumers who find themselves in possession of the offer in period 2 is $\rho \int_{c_1}^{\overline{c}} 1\,\mathrm{d}F(c)$. Since fraction $\int_{\underline{c}}^{c_2} 1\,\mathrm{d}F(c)$ of them will redeem the offer, the number of redemptions in period 2 equals

$$p_2 = \rho \int_{c_1}^{\overline{c}} 1\,\mathrm{d}F(c) \int_{\underline{c}}^{c_2} 1\,\mathrm{d}F(c) = \rho(1-F(c_1))F(c_2).$$

In period 3 the number of consumers in possession of the offer is $\rho^2 \int_{c_1}^{\overline{c}} 1\,\mathrm{d}F(c) \int_{c_2}^{\overline{c}} 1\,\mathrm{d}F(c)$;

fraction $\int_{\underline{c}}^{c_3} 1\,\mathrm{d}F(c)$ of them will redeem the offer in that period. Thus,

$$p_3 = \rho^2 \int_{c_1}^{\overline{c}} 1\,\mathrm{d}F(c) \int_{c_2}^{\overline{c}} 1\,\mathrm{d}F(c) \int_{\underline{c}}^{c_3} 1\,\mathrm{d}F(c) = \rho^2(1 - F(c_1))(1 - F(c_2))F(c_3).$$

We have the following proposition.

Proposition 2. *The number of redemptions in period n is given by*

$$p_n = \begin{cases} F(c_1), & \text{if } n = 1, \\ \rho^{n-1}F(c_n)\prod_{k=1}^{n-1}(1 - F(c_k)), & \text{if } n \geq 2. \end{cases}$$

In the remainder of the paper, we use the preceding analysis to investigate consumer redemption behavior. Our primary objective in this endeavor is to demonstrate that it is *possible* to obtain the two aforementioned redemption patterns – a bump at expiry and greater redemption with shorter redemption windows – exclusively with forward-looking consumers. Another objective is to provide some intuition for the emergence of these phenomena. To facilitate meeting these objectives, we restrict our attention to $x \geq \overline{c}$.

A4: Offer Attractiveness. The offer is sufficiently attractive in that $x \geq \overline{c}$.

For redemption costs, we consider three distributions from the beta family: $B(0.4, 0.2)$, $B(0.2, 0.4)$, and $B(1, 1)$. Their densities are depicted in Figure 1. Note that $B(1, 1)$ corresponds to the uniform distribution, while the other two have more mass at the extremes. We include the uniform distribution for completeness but expect the distribution of redemption costs to be bi-modal and asymmetric. The distribution $B(0.4, 0.2)$ depicts a world where the likelihood of extremely large redemption costs is more pronounced than the likelihood of extremely low redemption costs. The distribution $B(0.2, 0.4)$ depicts the reverse. Our expectation for this last distribution is generally consistent with the distribution found for other traits such as intelligence, wherein there is a second mass of highly gifted individuals (Burt 1963).

Suppose $N = 4$, $\rho = 0.95$ and $x = 1.2$. For each of the three distributions we calculate $\{c_n\}$ and $\{p_n\}$, $n = 1, 2, \ldots N$. We also calculate the total number of redemptions $p = \sum_{n=1}^{N} p_n$. The results are recorded in Table 1. We see that in all three cases $\{c_n\}$ is an increasing sequence, as it should be (Corollary 1). Under assumption A4, the consumer in possession of the offer in period N redeems it irrespective of the realized cost, $c_N = \overline{c}$. This explains $c_4 = 1$ in the table. As to the redemption pattern $\{p_n\}$, it is non-monotonic. In the case of $B(0.4, 0.2)$, there is a bump in the last period: $p_4 = 0.234 > p_3 = 0.165$ (shaded gray).

Table 1: $N = 4$, $\rho = 0.95$, $x = 1.2$

	c_1	c_2	c_3	c_4	p_1	p_2	p_3	p_4	p
$B(0.4, 0.2)$	0.465	0.551	0.693	1.000	0.308	0.224	0.165	0.234	0.931
$B(0.2, 0.4)$	0.180	0.234	0.377	1.000	0.529	0.251	0.117	0.066	0.963
$B(1, 1)$	0.382	0.432	0.535	1.000	0.382	0.254	0.169	0.140	0.945

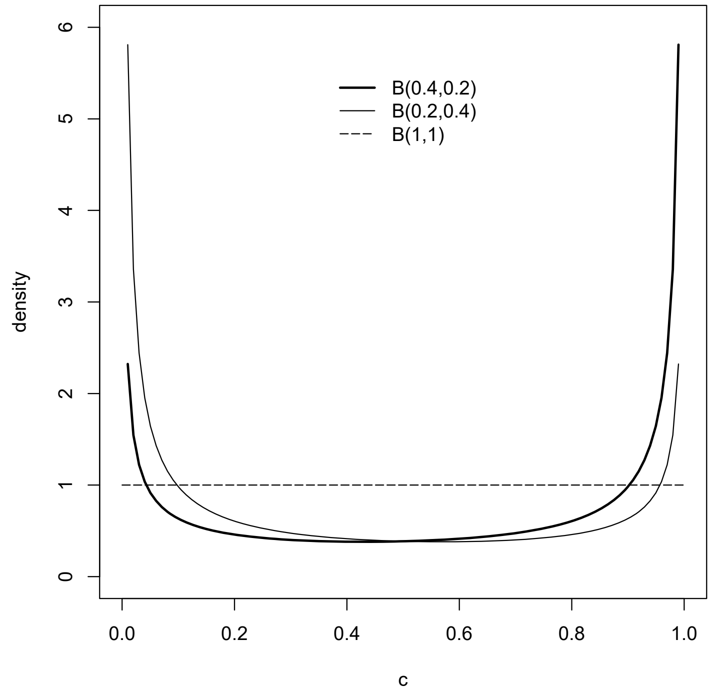

Figure 1: Probability Density Functions for $B(0.4, 0.2)$, $B(0.2, 0.4)$, $B(1, 1)$

If we decrease the probability of remembering the offer, the ending period bump under $B(0.4, 0.2)$ will get smaller. In Table 2, $\rho = 0.85$. We see that $p_4 = 0.140$ is only slightly above $p_3 = 0.123$ (shaded gray). The bump will completely disappear if we push ρ below 0.8.

Thus, we conclude that the ending period bump is present in the redemption pattern when: (i) high values of c receive more weight under $F(\cdot)$, and (ii) the probability of remembering the offer is close to one. Intuitively, more weight on high values of c and a higher probability of remembering the offer increase the likelihood that the consumer arrives into the last period without redeeming the offer. This leads to the ending period bump, as the consumer is forced to redeem.

If we drop assumption A4 (i.e., assume $x \geq \underline{c}$ instead of $x \geq \overline{c}$), there will be fewer redemptions in the final period because redemption may not provide positive value. This will obviate the bump. It will also reduce the total number of redemptions, and therefore scale it to be more in line with real-world redemption rates without impacting the essential calculus of our model dynamics for those consumers described by $x \geq \overline{c}$. Overall, we note that our findings relate very well to offers

Table 2: $N = 4$, $\rho = 0.85$, $x = 1.2$

	c_1	c_2	c_3	c_4	p_1	p_2	p_3	p_4	p
$B(0.4, 0.2)$	0.594	0.645	0.747	1.000	0.359	0.207	0.123	0.140	0.826
$B(0.2, 0.4)$	0.331	0.362	0.463	1.000	0.609	0.207	0.071	0.030	0.917
$B(1, 1)$	0.515	0.539	0.605	1.000	0.515	0.222	0.098	0.054	0.889

characterized by our analysis, e.g., Groupon offers. Groupon offers are very attractive ($x \geq \overline{c}$), exhibit high redemption rates (total redemptions about 45%), and are characterized by a substantial ending period bump (approximately 15%) – please see Figure B in Gupta, Weaver, and Rood (2012).

Next, we want to study the effect of N on the total number of redemptions, p. We obtain the remarkable result that the total number of redemptions is higher under shorter redemptions windows for any $F(\cdot)$ and ρ.

Proposition 3. *The total number of redemptions is higher under shorter redemption windows.*

Consider two worlds that have the same $F(\cdot)$ and ρ, but differ in the number of periods: it is N in one world and $N+1$ in the other. To prove Proposition 3, we need to show that the total number of redemptions will be higher in the N-period world. Let $c'_1, \ldots c'_N$ denote the redemption cost thresholds in the N-period world and $c''_1, \ldots c''_N, c''_{N+1}$ denote the redemption cost thresholds in the $(N+1)$-period world. From Proposition 1 it follows that

$$\underbrace{c'_N = c''_{N+1} = \overline{c}}_{\substack{\text{thresholds in the}\\ \text{last period}}} > \underbrace{c'_{N-1} = c''_N}_{\substack{\text{thresholds in the}\\ \text{next to last period}}} > \underbrace{c'_{N-2} = c''_{N-1}}_{\cdots} > \ldots > c'_1 = c''_2 > c''_1.$$

Thus, as consumers journey across N periods in the N-period world, they face higher (less stringent) redemption thresholds than their counterparts journeying across the first N periods in the $(N+1)$-period world. This fact, coupled with the facts that all surviving offers are redeemed in the last period and the $(N+1)$-period world has one more chance for forgetting, yields the finding that the total number of redemptions is greater in the N-period world.

Of course, offering a longer redemption window is good for consumers and enhances their welfare. However, a longer redemption window results in a lower total number of redemptions which may be at variance with the objectives of the entity making the offer (e.g., a firm attempting to obtain initial product sampling).

4. Conclusion

Previous research on consumer redemption behavior has documented two noteworthy empirical regularities – a bump close to offer expiry and greater redemption with shorter redemption windows. In the extant work, these phenomena have been explained by invoking myopic consumers. In contrast, we develop a model consisting exclusively of forward-looking consumers and demonstrate the emergence of these phenomena for plausible parameter values. Our work thus reveals how these phenomena may arise, and persist, even in the absence of consumer myopia.

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