



Human dynamics of spending: Longitudinal study of a coalition loyalty program



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HIGHLIGHTS

- Large data for consumer behavior in loyalty program is analyzed.
- Two activities, earning and redemption of points, exhibit sharply different behaviors.
- Phase portraits in the 2D space of redeemed and earned points are analyzed as customers get older.
- Strong learning effects that customers learn how to collect and use points are observed.

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ABSTRACT

Large-scale data of a coalition loyalty program is analyzed in terms of the temporal dynamics of customers' behaviors. We report that the two main activities of a loyalty program, earning and redemption of points, exhibit very different behaviors. It is also found that as customers become older from their early 20's, both male and female customers increase their earning and redemption activities until they arrive at the turning points, beyond which both activities decrease. The positions of turning points as well as the maximum earned and redeemed points are found to differ for males and females. On top of these temporal behaviors, we identify that there exists a learning effect and customers learn how to earn and redeem points as their experiences accumulate in time.

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1. Introduction

The total number of possible purchase choices one can make in the most developed countries is roughly estimated as the order of 10^{10} [1]. Due to such an immense number of choices, firms cannot assume for sure that their customers yesterday will still be purchasing their products tomorrow. This huge possibility of purchase choices also makes it impossible for a customer to make a completely rational decision. When we go shopping to buy a pack of milk, we usually pick one shop nearby where we had a good buy or had a pleasant experience, and we are not playing perfect calculation machines considering all the information of the prices, the quality, gas consumption to get the shop, etc. For the sake of customers, they are better off if their choices are somewhat limited: we often buy products we are already familiar with. In the firms' view, they have of course every reason to keep their customers loyal. In this respect, it is not surprising that the first known

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appearance of the loyalty program dates back to more than one hundred years [2], in which customers collect stamps and the firm rewards customers who collect more. Such a loyalty program can give better profit for the firm, and the customers are also better off thanks to the rewards scheme implemented in the program.

As technology developed, the next stage of the loyalty program was led by airline companies in the form of the frequent flyer programs in 1980s. Passengers are identified by the unique identification codes usually put on plastic cards they carry and all previous flight records are stored in the firm's computer. Recorded information is then used to reward customers who fly more frequently. Since 1990s, more and more firms have implemented loyalty programs, and in developed countries majority of population is participating in more than one such a program. In United States, each adult is participating in more than four loyalty programs on average in 2000 [3], and it has been growing even further. From the success of the loyalty program based on a single firm, formations of coalition loyalty programs have become clear trends [3]. Member firms in such a coalition program benefit from sharing of customer information for the firms' marketing activities, and customers participating in the coalition loyalty program can enjoy broader spectrum of services with different types of reward programs. For example, airlines, hotel chains, and car rental service firms form a coalition, and customers can earn and redeem points by using services provided by a firm in the coalition. A customer can earn points (usually in the form of mileage) by flying more and the points can be spent when she stays in a member hotel or when she rents a car.

Since Barabási coined the term "human dynamics" in Ref. [4], it has become an active research area, in which temporal dynamics of human activities such as e-mail and surface mail communications [4,5], library loan [6], Linux command [7], movie rating [8], web surfing [9,10], and short message communication [11,12] have been studied. In most studies of interevent and waiting time distributions in human dynamics, heavy-tailed distributions of the power-law form have been observed. In the present study, we investigate the real data of a coalition loyalty program with research focus on how customer behaviors change in a long period of time. In other words, human dynamics of spending in a long time scale is the main research theme in the present paper.

2. Dataset and notation

In this work, we analyze the coalition loyalty program OKCashbag in Korea. It has become a big success: in 2008, more than 30 million customers had OKCashbag membership and about 2/3 of them were active in the past 6 months. In comparison with the total population of South Korea (about 50 million), we believe that membership of OKCashbag almost reached a saturation point. The dataset used in the present work was provided by SK Marketing & Company (SKM&C), which contains about 3.8 million active anonymous customers who live in Seoul and have been active for 104 months (Jan. 2001–Aug. 2009). We use the earned and redeemed points for each month to perform analysis in this work.

We enumerate anonymous customers by i ($= 1, 2, \dots, N = 3,797,876$), and the time t ($= 1, 2, \dots, T = 104$) is measured in units of month as a consecutive integer starting from $t = 1$ on Jan. 2001. The earned (redeemed) points (measured in units of Korean Won, KRW) by the customer i at time t is denoted as $m_{i,t}^+$ ($m_{i,t}^-$), and thus the total sums of earned and redeemed points over the whole period for the i th customer are written as

$$M_i^+ \equiv \sum_{t=1}^T m_{i,t}^+, \quad M_i^- \equiv \sum_{t=1}^T m_{i,t}^-, \quad (1)$$

respectively. We also quantify the customer activity by using the number of months in which the customer earned or redeemed nonzero points:

$$N_i^+ \equiv \sum_{t=1}^T \{1 - \delta[m_{i,t}^+, 0]\}, \quad N_i^- \equiv \sum_{t=1}^T \{1 - \delta[m_{i,t}^-, 0]\}, \quad (2)$$

with δ being the Kronecker delta, i.e., $\delta(n, 0) = 1$ ($= 0$) for $n = 0$ ($n \neq 0$). The above defined quantities measure characteristics of each customer, while the following quantities characterize temporal change of the whole group of customers:

$$M_t^+ \equiv \sum_{i=1}^N m_{i,t}^+, \quad M_t^- \equiv \sum_{i=1}^N m_{i,t}^-, \quad (3)$$

for the total earned and redeemed points at time t , respectively, and

$$N_t^+ \equiv \sum_{i=1}^N \{1 - \delta[m_{i,t}^+, 0]\}, \quad N_t^- \equiv \sum_{i=1}^N \{1 - \delta[m_{i,t}^-, 0]\} \quad (4)$$

measure the total number of customers who are active in terms of point earning and redemption at time t , respectively.

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