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Hsiu-Yuan Tsao

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Abstract Following the Blattberg and Deighton (BD) model, we incorporate market share growth to explore links between acquisition and retention. We then devise a method for nonlinear programming using a spreadsheet to balance the objectives of market share growth in the short term and customer equity in the long term. The aim of this approach is to determine the optimal spending allocation for customer acquisition and retention and, by applying this allocation to the numerical example used in the original BD model, to balance these objectives. We demonstrate that the differential unit cost of marginal effects, ceiling rate, efficiency, and allocation of spending on acquisition and retention to achieve market share growth can maximize customer equity. We also develop a criterion to help firms decide where to place spending emphasis, that is, on retaining existing customers or on gaining new ones, while keeping the objectives of market share growth and customer equity firmly in mind.

Keywords Customer retention and acquisition · Ceiling rate · Marginal cost · Customer equity · Market share growth

1 Introduction

Blattberg and Deighton (1996) used a decision calculus approach to construct a simple model, the BD model, to help managers determine the optimal balance between spending on acquisition and retention. Berger and Nasr Bechwati (2001) used this model to develop their own version with which, given a fixed budget, they allocated spending between acquiring and retaining customers to optimize customer

H.-Y. Tsao
Department of Business Administration, Tamkang University, New Taipei City, Taiwan

H.-Y. Tsao (✉)
No.151 Yingzhuan Rd, Tamsui Dist, New Taipei City 25137, , Taiwan (R.O.C)
e-mail: jodytsao@mail.tku.edu.tw

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equity (CE). Reinartz et al. (2005) subsequently tested both models empirically to explore the division of market spending between customer acquisition and retention and allocation of a firm's budget to the respective communication channels.

Several seminal works have addressed the topic of optimizing customer equity by balancing customer acquisition and retention costs. However, according to double jeopardy theory, brands with a large market share enjoy the benefits of higher market penetration, buying frequency, and loyalty, whereas less popular brands are disadvantaged, not only because they have fewer buyers but also because many are less loyal (McPhee 1963). Proponents of this theory argue that marketing activities are unlikely to enhance loyalty to a brand unless its market share increases (Ehrenberg et al. 2004). There is a further problem of how short-term acquisition and long-term retention programming can achieve such increases (Leeflang and Wittink 2000; Tsao et al. 2010). While the net short-term effect of customer acquisition may be positive in terms of market share or acquisition rate, its long-term effects on brand market share may be negative because of the possibility of adverse effects on brand equity. Therefore, among the various types of promotional budgets, only those with models that quantify the long-term effects of retention programming and variables of acquisition (pricing, coupons, and shipping fees) are promising for firms that hope to make sound choices (Deighton et al. 1994; Lewis 2004). However, little explicit research has simultaneously addressed the dual problems of first deciding between spending on customer acquisition and retention and second, balancing objectives of short-term market share growth and long-term customer equity. Our response in this study is to develop a model and methodology to analyze the potential links of an optimal spending budget, the short-term objective of market share growth, and the long-term objective of customer profitability.

The remainder of the study is organized as follows. First, we explain the roles of the BD model and a method of optimizing CE in the allocation of spending on acquiring and retaining customers. Second, we incorporate market share growth into the model to explore the link between acquisition and retention without budget constraint. Third, we develop a method to balance short-term market share growth and long-term maximization of customer equity. We then apply this approach to data to examine the numerical example in the original BD model. Finally, we offer conclusions, implications, and considerations for further research.

2 The BD model and optimization of budget allocation

In the BD model, the relationship between r (retention rate per customer) and R (dollar retention spending per customer per period) is modeled as follows:

$$r = CR_r[1 - \exp(-\mathrm{k_r R})]. \tag{1}$$

Conversely, R can be the function of r by the inverse function of Eq. 1, as shown in the following equation:

$$R = (-1/k_r) * \ln((CR_r - r)/CR_r). \tag{2}$$

The model assumes that a (acquisition rate per prospect) is a decelerating function of A (acquisition spending per prospect):

$$a = CR_a[1 - \exp -\mathrm{k_a A}]. \tag{3}$$

As with retention rate, A can be a function of a by the inverse function of Eq. 3, as shown in the following equation:

$$A = (-1/k_{\mathrm{a}}) * \ln((CR_{\mathrm{a}} - a)/CR_{\mathrm{a}}). \tag{4}$$

Parameter CR_{a} (acquisition ceiling rate) is the manager's direct assessment of the maximum proportion of targeted prospects converted on condition that there is no limit to spending. Parameter CR_{r} (retention ceiling rate) is the manager's direct assessment of the maximum proportion of targeted prospects retained given the same condition. In addition, k_{r} and k_{a} (retention and acquisition efficiency) can be determined once the manager decides the spending levels and rates for retention and acquisition. While the ceiling rate (CR) is the maximum proportion of targeted prospects, efficiency (K) is the speed at which the rate approaches the ceiling (Blattberg et al. 2008). The form of this function is consistent with the assumption of strictly diminishing returns on acquisition spending. Finally, CE of an average consumer is adopted from the BD model as follows:

$$CE = a[M + (M - R/r) * (r/(1 + d - r))] - A = a[CLV] - A, \tag{5}$$

where M is the margin the firm earns and d is the discount rate for a specific period.

3 The link between retention and acquisition

Thomas (2001) points out that the BD model assumes acquisition and retention spending to be independent. Specifically, the model assumes that acquisition spending has no effect on the relationship between retention spending and its effect, whereas it generally does (Pfeifer 2005). Therefore, we incorporate the prior and current periods of market share to explore the link between rates and costs of acquisition and retention.

One aspect of the spending program for customer retention is a mix of marketing activities to persuade consumers to repurchase the ith brand on the next occasion; these are represented by r_i for the ith brand, or *retention rate*. A program of spending on acquisition is intended to provide a mix of marketing activities that persuade consumers to switch from purchasing other brands to purchasing the ith brand; these are represented by a_i for the ith brand, or *acquisition rate*.

Thus, the market share in the next period, t, for ith brand, Mks_{it}, is a combination of existing and newly acquired customer segments, expressed as follows, where the retention rate in period t is r_{it} and the acquisition rate in period t is a_{it}:

$$Mks_{it} = Mks_{it-1} * r_{it} + \sum_{j=1}^{N} Mks_{jt-1} * a_{it}, (i \neq j). \tag{6}$$

Based on Eq. 6, a constant pool of customers is assumed.[1]

[1] We express some opinions on the issue of market growth in Appendix 1, which is available on request from the author.

Therefore, the acquisition rate a_{it} in period t can be obtained by the following equation:

$$a_{it} = [Mks_{it} - (Mks_{it-1} * r_{it})]/(1 - Mks_{it-1}). \quad (7)$$

Eq. 7 can also be written as follows:

$$r_{it} = [Mks_{it} - (1 - Mks_{it-1}) * a_{it})]/Mks_{it-1}. \quad (8)$$

4 Balancing market share growth and customer equity

In this study, we consider a case with no budget constraint. This is in contrast to the work by Berger and Nasr Bechwati (2001) using a fixed budget constraint. First, the following equation is adopted as *the objective function*:

$$\text{MAX} \quad \text{CE} = \text{a}[\text{CLV}] - \text{A}. \quad (9)$$

Second, market share growth, g, is a preset objective in this study and is shown in the following equation:

$$Mks_{it} = Mks_{it-1} * g. \quad (10)$$

Third, R is *the decision variable*. We have M (the margin the firm earns) and d (the discount rate for a specific period) as *constants*. Therefore, when the retention spending for the focal brand, R, is determined, r is the inverse function of R according to Eq. 1. Furthermore, a is also a function of r and is given prior and current market share according to Eq. 7. In addition, A is the inverse function of a according to Eq. 4. Hence, the optimal solution for the objective function to maximize CE can be obtained by the nonlinear programming of an evolutionary algorithm provided by Microsoft Excel Solver.[2]

5 The differential costs of marginal effect

Studies investigating the unit cost of marginal effect (i.e., marginal cost) of acquisition and retention programs on consumer profitability are rare. Using the original example in the BD model, Pfeifer (2005) proposed that the optimal condition requires that the *marginal costs for acquisition and retention are equal* and that *both equal the CLV*. We propose a variable m and assume that spending on acquisition will be m times greater than that on retention. The variable m will be observed by its variation during a sensitivity analysis using different marginal cost; therefore, we define m as:

$$m = \frac{A_{\text{mc}}}{R_{\text{mc}}} \quad (11)$$

[2] For the details and a discussion of the optimization process, please refer to Appendix 2, which is available on request from the author.

where

$$R_{\mathrm{mc}} = \frac{1}{k_r * (CR_r - r)} \text{ and } \mathrm{A_{mc}} = \frac{1}{\mathrm{k_a} * (\mathrm{CR_a} - \mathrm{a})}. \quad (12)$$

While the marginal cost for acquisition is A_{mc}, the marginal cost for retention is R_{mc}. For details of Eq. 12, see Pfeifer (2005).

6 The numerical example of the BD model

We test the model and method developed in this study on the numerical example found in the paper in which the BD model was originally proposed. The major distinction between the BD model and the model in this study is that we add the constraint of market share growth and focus on the impact of marginal cost on the optimal solution for spending on acquisition and retention.

Rows 1 to 4 (*CR*, *K*, *M*, and *d*) in the Table 1 are the input data for acquisition and retention used in the BD model. Rows 6 and 7 are the prior and current market shares (Mks_{it-1}, Mks_{it}), preset according to *g*; the market share growth rate in Row 5 (*g*) is assumed in this study.

Rows 1 to 7 are the input area, which is given by the original numerical example in the BD model. While the ceiling rates of acquisition and retention are 0.4 and 0.7, the values for efficiency of acquisition and retention are 0.13863 and 0.08473. In addition, the margin earned per customer is 50, and the discounted rate is 0.1. The distinction between the original BD model and the model in this study is that we assume the initial market share of the focal brand to be 0.1 and preset market share growth to be 1.5.

Rows 8 to 11 are the output area, and the optimal solution for acquisition and retention spending is obtained by the following procedure. First, based on Eq. 5,

Table 1 Complete results for the numerical example

Item no.		Acquisition	Retention	Common
1	*CR*	0.4	0.7	
2	*K*	0.13863	0.08473	
3	*M*			50
4	*d*			0.1
5	*g*			1.5
6	Mks_{it-1}			0.1
7	Mks_{it}			0.15
8	Optimal spending (*A*, *R*)	2.61616612	10.194929	
9	Optimal rate (*a*, *r*)	0.12167613	0.4049148	
10	*CLV*			64.459829
11	*CE*			5.2270564

while the maximized *CE* is an objective function with market share objective constraint, the optimal retention spending *R* in Row 8 is the decision variable obtained by nonlinear programming of the evolutionary algorithm provided by Microsoft Excel Solver. Second, the optimal retention rate in Row 9 is a function of retention spending according to Eq. 1. Third, the distinction between the original BD model and the model used in this study is the optimal acquisition rate in Row 9 calculated by Eq. 7 from this study instead of Eq. 3. That is, acquisition is determined by both retention rate and prior and current market share. Fourth, the optimal acquisition spending *A* in Row 8 is the output area and is calculated by Eq. 4 based on the original BD model. Finally, when all the parameters *R*, *r*, *a*, and *A* are obtained, *CLV* and *CE* can be calculated by Eq. 5. The result of optimal solution is shown in Table 1.

7 The differential effect of marginal cost at optimality

On the basis of Eq. 12, as proposed by Pfeifer (2005), the marginal costs of retention and acquisition are obviously affected by both the ceiling rate (*CR*) and efficiency (*K*). Generally, given the same level of effect of acquisition and retention, *the lower the ceiling and the lower the efficiency*, *the greater is the marginal cost*.[3] However, Pfeifer (2005) suggested to uses the marginal costs of retention and acquisition instead of the indirect ceiling rate and efficiency to explore their relationship with customer lifetime value and customer equity at optimality. Thus, in this study, we adopt the analysis method of Pfeifer (2005), using the differential effect of marginal cost, as the basis for further discussion of the role of marginal cost at optimality.

First, we conduct a sensitivity analysis of acquisition and retention spending and their effects to observe changes in differential marginal costs (see Table 2). The numerical example in the BD model uses a specific dataset that includes the high ceiling rate and low marginal cost of retention, and low ceiling rate and high marginal cost of acquisition. However, given the same level of effect, that is, $a=r$, the marginal cost of acquisition is always higher than that of retention, based on the result shown in Table 2. Furthermore, because of the much lower ceiling for acquisition, the marginal cost of acquisition will dramatically increase when it is closer to its ceiling rate of 0.4 compared with the much higher ceiling rate of 0.7 for retention.

Second, we manipulate *g* (market share growth rate) by letting it range from 1 to 4 and increase stepwise by 0.5 to discover the maximum *CE* and the ratio of marginal costs of retention and acquisition. The results are shown in Table 3.

On the basis of the original numerical example in the BD model, Pfeifer (2005) proposed that the optimal condition requires that the marginal costs for acquisition and retention are equal and that both equal the *CLV*. Furthermore, Blattberg et al. (2008) used the term "suboptimal" to demonstrate that, with constraint spending, the optimal solution cannot be reached, based on equal marginal costs for acquisition and

[3] For details of the impact of the ceiling rate (*CR*) and efficiency (*K*) of acquisition and retention on the marginal cost, please refer to Appendix 3, which is available on request from the author.

Table 2 The differential effects and marginal costs of acquisition and retention

Rate (r=a)	R	R_{mc}	A	A_{mc}	m
0.00	0.00	16.86	0.00	18.03	1.07
0.05	0.87	18.16	0.96	20.61	1.14
0.10	1.82	19.67	2.08	24.04	1.22
0.15	2.85	21.46	3.39	28.85	1.34
0.20	3.97	23.60	5.00	36.07	1.53
0.25	5.21	26.23	7.08	48.09	1.83
0.30	6.60	29.51	10.00	72.13	2.44
0.35	8.18	33.72	15.00	144.27	4.28
0.40	10.00	39.34	26.61	721.34	18.34
0.45	12.15	47.21			
0.50	14.79	59.01			
0.55	18.18	78.68			
0.60	22.97	118.02			
0.65	31.15	236.04			
0.70	50.14	1180.22			

retention and customer lifetime value. Therefore, with the market share growth requirement, we attempt to discover how the optimal solution is derived and what it is, based on the BD model via nonlinear programming, and observe what the condition is at optimality in terms of ratio of marginal cost of acquisition and retention and *CLV*.

When the market share growth increases stepwise by 0.5—that is, from 1.0 to 1.5—the suboptimal solution shown in the second row of Table 1, as indicated by a=0.12 and r=0.40 compared with a=0.10 and r=0.12 when g=1, means that achieving greater market share growth requires increases in both acquisition and retention. Please also note that the ratio of marginal cost is m=0.65 and the *CLV* is 64.46. The value of CLV, at this point, is much higher than the marginal cost of acquisition, A_{mc}=25.92, or retention R_{mc}=40.00. This indicates that we should increase spending

Table 3 The ratio of marginal cost, market share growth, and CLV at optimality

g	a	r	A_{mc}	R_{mc}	m	*CLV*	*CE*
1	0.10	0.12	23.85	20.42	1.17	53.93	3.24
1.5	0.12	0.40	25.92	40.00	0.65	64.46	5.23
2	0.17	0.47	31.31	52.07	0.60	66.53	7.31
2.5	0.22	0.50	40.57	59.09	0.69	67.03	9.04
3	0.28	0.52	58.04	65.04	0.89	67.19	10.09
3.16	**0.29**	**0.52**	**67.32**	**67.22**	**1.00**	**67.20**	**10.18**
3.5	0.33	0.54	101.49	73.62	1.38	67.11	9.61
4	0.38	0.59	342.86	106.66	3.21	65.07	3.42

both until marginal cost reaches the *CLV* at optimality. If the marginal cost of acquisition and retention is less than the *CLV*, it is reasonable to continue increasing spending to acquire and retain customers.

If we continue to increase investment in the contribution to market share growth, the optimal level of market share growth g=3.16 and customer equity *CE*=10.18 will be reached when the ratio of marginal cost of acquisition A_{mc}=67.32 divided by that of retention R_{mc}=67.22 is almost equal to one, m=1, and both are almost equal to *CLV*=67.20. Then the maximized customer equity, *CE*=10.18, is obtained; please refer to the row with bold entries in Table 3. The result is quite interesting and consistent with the original numerical example of the BD model without market share growth constraint; that is, at optimality, the marginal cost of acquisition and retention are equal, and both are equal to the *CLV*—all of which are approximately 67.2.

Beyond optimality—the peak of the U-shaped curve in Fig. 1—further investment in retention and acquisition can still result in market share growth, but the *CE* will decrease from 10.18 to 9.61 when market growth is g=4. In the suboptimal solution, the apparent marginal costs of acquisition and retention are 101.49 and 73.62, which are all much higher than the *CLV*, which is 67.11. This indicates that investment in acquisition and retention is not justified because the marginal cost is higher than the *CLV*. In other words, the value is not worth the price.

In summary, a boost in spending on acquisition and retention improves both market share and customer equity. However, beyond the optimal solution, overinvestment in acquisition and retention will damage long-term customer equity, although the short-term market share may continue to grow.

8 Conclusions and implications

Obtaining the optimal balance between short-term market share growth and long-term customer equity is not the ultimate goal of this study. Rather, the objective is to achieve a better understanding of *when* and *why* marketers need to allocate or reallocate their spending between retention and acquisition. Based on the results of this study, we find that the differential marginal costs of acquisition and retention affected by the acquisition and retention ceiling rate, and market share growth rate crucially affect budget allocation, as Fig. 2 illustrates.

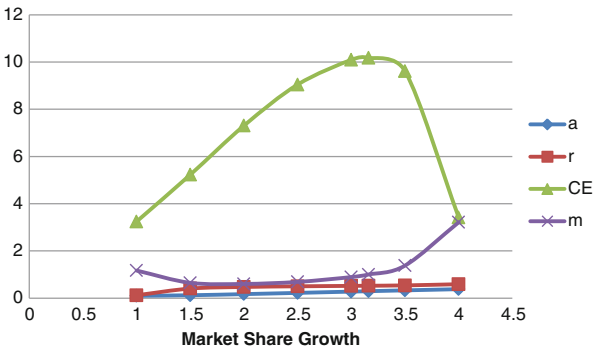

Fig. 1 Effect of differential marginal costs on customer equity for market share growth

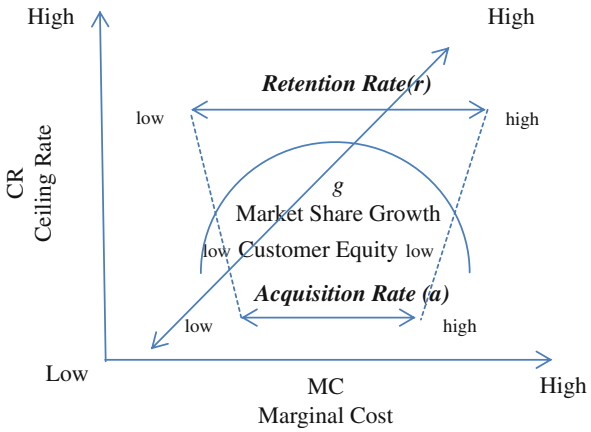

Fig. 2 Optimal budget allocation

First, as for the numerical example of BD model, based on the result shown in Table 2, given the same level of effect of acquisition and retention (i.e., $a=r$), spending on the marginal costs of acquisition is always higher than that on retention. This is why the line at the low end of *Retention Rate* (r) is located slightly to the left of the low end of *Acquisition Rate* (a); please refer to Fig. 2. The implication of this phenomenon is that spending on retention is more effective than spending on acquisition in achieving the same effect in this numerical example. Furthermore, because of the much lower ceiling rate for acquisition, the marginal cost of acquisition will dramatically increase when it approaches its ceiling rate of 0.4 compared with the much higher ceiling rate of retention (0.7). This is why the line of *Retention Rate* (r) is located above the line of *Acquisition Rate* (a), and the line for *Retention Rate* (r) is longer than that for *Acquisition Rate* (a). Therefore, if we connect the lower and upper lines with a dotted line, the result resembles an inverted trapezoid, as Fig. 2 shows. The implication is that, because of the lower ceiling for acquisition, the marginal cost for acquisition is greater and diminishing return on retention is faster than that on acquisition in the numerical example of the BD model.

Second, the curve for *CE* has an inverted U shape, as shown in Figs. 1 and 2. That is, when the retention and acquisition rates are lower, the *CE* is lower. However, when the firm invests in retention and acquisition, the *CE* will improve. In this case, acquisition will counter the diminishing return quickly because of the low ceiling rate; thus, the marginal cost will sharply increase and investment in acquisition will not be an effective way to improve *CE*. However, the ceiling rate of retention is higher; thus, the firm can leverage the retention effect instead of acquisition to improve *CE*. At the peak of the inverted U-shaped curve in Fig. 2, the maximized customer equity $CE=10.18$ is obtained when the marginal costs of acquisition and retention are equal, and both equal customer lifetime value (all are around 67.2) and market share growth is $g=3.16$. Beyond the peak of the inverted U curve, if the firm continues to overinvest in retention, the effect will improve; however, customer equity will be harmed because of the higher marginal cost of retention.

Third, the major distinction between the model used in this study and the BD model is that we attempt to balance market share growth in the short term and

customer equity in the long term, simultaneously. We find that acquisition and retention can both improve market share growth. That is, when a firm invests in acquisition and retention, the market share growth line moves upward and to the right, and *CE* improves as well, as the line market share growth (g) shows in Fig. 2. However, when acquisition is close to its ceiling rate, the firm must rely more on retention to achieve market share growth. With overinvestment in retention, market share growth can still be achieved; however, *CE* will begin to decline. This suggests that to realize market share growth, allocating a large proportion of the spending is an effective way to approach the optimal solution of maximizing *CE*. However, one must consider the law of diminishing returns as well. When too much is spent on retention, the effect will diminish dramatically. Thus, it would be harmful to increase the value of *CE*. In other words: "Short-term market share growth will be harmful to long-term customer equity." Our position is that investment—but not overinvestment—in acquisition and retention will balance both short-term market share growth and long-term customer equity."

Thomas (2001) raised the issue that the BD model ignores the assumption that acquisition spending has no effect on the relationship between retention spending and its effect, or that retention spending has no effect on the relationship between the acquisition spending and its effect, whereas it generally does (Pfeifer 2005). This study incorporates the objective of market share growth into the BD model and successfully demonstrates the relationships, first between rates of retention and acquisition based on Eq. 6 and then between budget allocations for retention and acquisition based on Eqs. 2 and 4.

A common business rule of thumb is that "it costs five times more to acquire a new customer than to retain a customer" (Blattberg and Deighton 1996; Pfeifer 2005). If this is the case, or even if the ratio were less than five to one, should firms allocate more of their marketing budgets to loyalty programs? Pfeifer (2005) proposed that the optimality condition requires that the marginal costs of acquisition and retention are equal and that both are equal to the *CLV*; this clearly indicates the cost in the above quote, which refers to marginal instead of average cost. In our study, we support the crucial role of the differential marginal costs of acquisition and retention on budget allocation to maximize *CE*. That is, with the same effect, budget allocation should favor a lower differential marginal cost of acquisition or retention. In this study, we further propose that the acquisition and retention ceiling rate and efficiency are factors in the pace of budget allocation because as it approaches the ceiling, the marginal cost increases more sharply.

In addition, incorporating the market share growth objective suggests that the accuracy of an "x times more" estimate of acquiring a new customer than of retaining one is not the crucial issue. The results obtained in this study illustrate that allocating some of the marketing budget to retention does not provide better customer equity, even when the marginal cost of retention is less than that of acquisition. That is, when the market share growth rate passes the optimal solution (g=3.16), such as in the case of g=4, it costs 3.21 times more to acquire a new customer than to retain an existing one. Based on the conventional wisdom described in the previous paragraph, a firm should devote its budget to retention. However, because of the much higher market share growth objective, a firm is required to sacrifice customer equity to gain market share growth. In this case, therefore, the conventional wisdom would be: "Short-term

market share growth is harmful to long-term customer equity." However, before reaching the optimal solution (g=3.16), whatever the figure of "x times more" to acquire than to retain a customer, the firm should devote its budgets to both—not only to gain market share but also to improve customer equity.

In summary, we demonstrate how the differential unit cost of marginal effects, ceiling rate, efficiency, and the objective of market share growth affect allocation of spending on acquisition and retention to maximize customer equity.

9 Limitations and future research

The numerical example used in the BD model is a specific dataset that includes the high ceiling rate and low marginal cost of retention, and low ceiling rate and high marginal cost of acquisition. Future research may consider a different combination of ceiling rate and marginal cost to examine budget allocation. In addition, the data used in the basic BD model represent individual-level CLV. Future research might consider how to apply the model to predict the aggregate-level CE and the relationship between CE and market value.

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