

Research on the Strategy and Social Effect of Firm's Public Welfare Marketing

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Abstract: Since the outbreak of covid-19, the public welfare marketing has been more and more extensive. In view of this, we first establish a theoretical model to study whether two firms producing different quality products participate in public welfare marketing and how to maximize the total donation. Firstly, whether a firm participates in public welfare marketing depends on both the product quality and the proportion of income donation; secondly, public welfare marketing may increase corporate profits and will certainly improve social welfare; thirdly, in order to maximize the total donation, the optimal donation proportion must be a small value. Then, we empirically test our theoretical prediction by capturing the marketing data of solid state in T-mall. Based on research conclusions, we propose several suggestions for firms, government and public welfare organizations in the end.

1 INTRODUCTION

In January 2020, the covid-19 spread rapidly in our country. Hubei, as the hardest-hit area of the epidemic, is in high shortage of medical resources. For this reason, many firms have generously donated money and materials. In addition to direct donations, a lot of firms also raise funds for the affected areas by public welfare marketing. For example, on February 6th, 2020, Shiseido Group launched the "Relay of Love Project", setting 1% of Asia's marketing (estimated to be RMB 130 million) as a charity fund to provide material support to Wuhan. On February 10th, the IT training company Source Code Era launched a public welfare course, and donated income to fight the covid-19. On February 13th, the China Headquarters of the American Serta Group launched the "Surta Angels in Action" charity marketing plan and donated 1,842,004 yuan to the Wuhan Charity Federation.

Although public welfare marketing is very common, especially in the event of major emergencies, there are three academic problems that are not clear: first, when there are differences in product quality, are firms willing to participate in public welfare marketing? On the one hand, participating in public welfare marketing can

improve the corporate image and improve consumers' brand recognition, which helps to improve product pricing power and corporate profits. On the other hand, participating in public welfare marketing means that part of the marketing revenue must be donated, which means the loss of profits. Therefore, when there are differences in product quality, it is difficult to predict the positive and negative impact of participating in public welfare marketing on firm profits. Second, how does public welfare marketing affect social welfare? This issue is directly related to whether the government should advocate public welfare marketing. Third, in order to maximize the total public welfare donation, how to set the optimal proportion of income donation? This problem not only directly affects the willingness of firms to participate in public welfare marketing, but also indirectly affects the amount of donations finally raised, thus affecting the degree of assistance to donors, and even the degree of prevention and control of major disasters.

Our research is closely related to the literature in the field of public welfare marketing. The existing literature is mainly divided into three categories. The first kind of literature studies the impact of public welfare marketing on consumer behavior, and finds that consumers prefer to choose products for public welfare marketing, and the corporate image (Barone,

et al, 2000), consumer characteristics (Grau, Folse, 2007), the correlation between products and public welfare matters (Pracejus, Olsen, 1992) will affect consumers' purchase decisions. The second kind of literature studies the impact of public welfare marketing on public welfare organizations and participating firms. Although public welfare organizations can raise money, they may lose their reputation due to bad brands (Andreasen 1996), and participating firms may increase their income due to public welfare marketing (Lafferty, Goldsmith, 2005). The third kind of literature focuses on the strategy of public welfare marketing. Arora and Henderson (Henderson, 2007) compared the promotion effects of public welfare marketing, discounts and return of commissions. Pracejus *et al.* (Pracejus, et al, 2003) studied whether public welfare donation should be in the form of donation amount or donation proportion, Krishna and Rajan (Krishna, Rajan, 2009) studied how firms should choose products for public welfare marketing. Although the existing literature is of great reference value, these documents don't consider the quality differences between firm products, so they do not consider the impact of product quality on firms' willingness to participate in public welfare marketing and their profits, and it is impossible to analyze how product quality affects the social welfare effect of public welfare marketing, which is the focus of this paper.

Therefore, compared with the existing literature, this paper may have three contributions: first, we build a duopoly competition model with different product quality, and compare the profit changes before and after firms participate in public welfare marketing. Our research conclusions can provide decision-making basis for firms to participate in public welfare marketing. Second, we calculated and compared the total amount of public welfare donations and the corresponding social welfare level under different conditions, and analyzed the impact of public welfare marketing and donation proportion on the total amount of donations and social welfare. Our research conclusion can not only provide a theoretical basis for public welfare organization departments to set the optimal donation proportion, it can also provide reference for government departments to encourage public welfare marketing. Thirdly, we also captured the marketing data of solid-state drives (abbreviated as SSD in the following part) in Tmall and empirically tested the relationship between public welfare marketing and product quality found in our theoretical analysis. These conclusions can provide empirical evidence for encouraging public welfare marketing during major

public health and safety events in China, and have better policy implications and practical enlightenment.

2 THEORETICAL MODEL

Suppose there are two firms competing for output in the market - firm 1 and firm 2, which produce product 1 and product 2 respectively, and the quality of the two products is 1 and s , $s > 1$. In order to simplify the analysis, we assume that the marginal cost and fixed cost of the two firms are zero. If the firm i does not participate in public welfare marketing, the consumer's evaluation of its product is the quality level of the product; If firms i participate in public welfare marketing, consumers' evaluation of the quality of their products will increase due to the enhancement of consumers' emotional identity, which is denoted as Δ ($\Delta > 0$). However, firms i need to donate part of their marketing revenue to public welfare undertakings according to the income donation proportion r set in advance by public welfare organizations or public welfare sponsors. Assuming Δ is relatively small, this hypothesis one is to ensure that when only low-quality products participate in public welfare marketing, their overall quality evaluation is lower than that of high-quality products, that is, to meet $1 + \Delta < s$; the second is to ensure that when only high-quality products participate in public welfare marketing, low-quality products will not be squeezed out of the market. The consumer's utility function is $U = \theta s_i - p$. θ represents the preference parameter of consumers for the product, which is evenly distributed in $[0, 1]$. s_i represents the consumer's evaluation or "confirmation" of product quality.

The sequence of the problem as follows: in the first stage, two firms simultaneously choose whether to participate in charity marketing and compete for output; in the second stage, consumers determine the quality of the product after observing whether the company is conducting charity marketing. And decide whether to buy products and which products to buy. We use backwards induction to solve the equilibrium of the problem.

When neither firm carries out public welfare marketing, we can get the output, price and profit of the firm by solving the problem of profit maximization.

$$q_1^{NN} = \frac{s}{4s-1}, \quad q_2^{NN} = \frac{2s-1}{4s-1}, \quad p_1^{NN} = \frac{s}{4s-1},$$

$$p_2^{NN} = \frac{s(2s-1)}{4s-1}$$

$$\pi_1^{NN} = \frac{s^2}{(4s-1)^2}, \quad \pi_2^{NN} = \frac{s(1-2s)^2}{(4s-1)^2}$$

When firm 1 carries out public welfare marketing, we can get the output, price and profit of the firm by solving the problem of profit maximization.

$$q_1^{RN} = \frac{s}{4s-1-\Delta}, \quad q_2^{RN} = \frac{2s-1-\Delta}{4s-1-\Delta}$$

$$p_1^{RN} = \frac{s(1+\Delta)}{4s-1-\Delta}, \quad p_2^{RN} = \frac{s(2s-1-\Delta)}{4s-1-\Delta}$$

$$\pi_1^{RN} = \frac{(1-r)s^2(1+\Delta)}{(4s-1-\Delta)^2}, \quad \pi_2^{RN} = \frac{s(1-2s+\Delta)^2}{(4s-1-\Delta)^2}$$

When firm 2 carries out public welfare marketing, we can get the output, price and profit of the firm by solving the problem of profit maximization.

$$q_1^{NR} = \frac{s+\Delta}{4s+4\Delta-1}, \quad q_2^{NR} = \frac{2s+2\Delta-1}{4s+4\Delta-1}$$

$$p_1^{NR} = \frac{s+\Delta}{4s+4\Delta-1}, \quad p_2^{NR} = \frac{(s+\Delta)(2s+2\Delta-1)}{4s+4\Delta-1}$$

$$\pi_1^{NR} = \frac{(s+\Delta)^2}{(4s+4\Delta-1)^2},$$

$$\pi_2^{NR} = (1-r) \frac{(s+\Delta)(2s+2\Delta-1)^2}{(4s+4\Delta-1)^2}$$

When both firms carry out public welfare marketing, we can get the output, price and profit of the firm by solving the problem of profit maximization.

$$q_1^{RR} = \frac{s+\Delta}{4s+3\Delta-1}, \quad q_2^{RR} = \frac{2s+\Delta-1}{4s+3\Delta-1}$$

$$p_1^{RR} = \frac{(s+\Delta)(1+\Delta)}{4s+3\Delta-1},$$

$$p_2^{RR} = \frac{(s+\Delta)(2s+\Delta-1)}{4s+3\Delta-1}$$

$$\pi_1^{RR} = (1-r) \frac{(1+\Delta)(s+\Delta)^2}{(4s+3\Delta-1)^2},$$

$$\pi_2^{RR} = (1-r) \frac{(s+\Delta)(2s+\Delta-1)^2}{(4s+3\Delta-1)^2}$$

Proposition 1: Under equilibrium conditions, whether the two firms carry out public welfare marketing is related to the proportion of revenue

donation. Specifically, there are three critical points r_1^*, r_2^* and r_3^* , which satisfy $0 < r_1^* < r_2^* < r_3^* < 1$,

(1) if $r \in (0, r_1^*]$, both firms carry out public welfare marketing;

(2) if $r \in (r_1^*, r_2^*]$, firm 2 carries out public welfare marketing;

(3) if $r \in (r_2^*, r_3^*]$, firm 1 carries out public welfare marketing;

(4) if $r \in (r_3^*, 1]$, neither firm carries out public welfare marketing.

Proposition 1 has two implications: first, in order to encourage both firms to participate in public welfare marketing, the donation proportion must be set relatively small, that is $r \in (0, r_1^*]$; Otherwise, If the donation ratio is high (more than r_1^*), at least one firm does not participate in public welfare marketing, or even two firms do not participate in public welfare marketing. Second, the willingness of firms to participate in public welfare marketing depends on both the proportion of revenue donation and the quality of their products. Therefore, we get a theoretical conclusion to be empirically tested: if the proportion of donation is low, the higher the quality of products, the more willing they are to carry out public welfare marketing; however, if the proportion of donation is high, the lower the quality of products, the more willing they are to carry out public welfare marketing.

Proposition 2: Compared with not participating in public welfare marketing, the profits of firms participating in public welfare marketing may increase or decrease. Specifically, there are two critical values \tilde{r}_1 and \tilde{r}_2 , which satisfy $0 < \tilde{r}_1 < \tilde{r}_2 < r_1^*$,

(1) If $r \in (0, r_1^*]$, both firms participate in public welfare marketing, there may be three situations about the profits of the firms compared with the both firms do not participate in public welfare marketing: if $r \in (0, \tilde{r}_1]$, the profits of both firms increased; if $r \in (\tilde{r}_1, \tilde{r}_2]$, the profit of firm 1 increased and the profit of firm 2 decreased; if $r \in (\tilde{r}_2, r_1^*]$, the profits of both firms decreased.

(2) If $r \in (r_1^*, r_3^*]$, compared with the two firms that do not participate in public welfare marketing, the profits of firms that participate in public welfare marketing increase and the profits of firms that do not participate in public welfare marketing decrease.

Comparing the total social welfare in four situations, we draw the following conclusions.

Proposition 3: Compared with the two firms that do not carry out public welfare marketing, public

welfare marketing improves social welfare, and the social welfare is the largest when both firms carry out public welfare marketing.

From the perspective of firms, it can be seen from proposition 2 that compared with not participating in public welfare marketing, the profits of firms participating in public welfare marketing may increase or decrease, but the profits of firms are only part of the gross income of the industry, and the other part of the gross income of the industry is public welfare donation. Because social welfare includes two parts, namely, industry gross income and consumer surplus, our analysis shows that public welfare marketing increase the gross income of the whole industry and consumer surplus due to enhancing consumers' "identity", so public welfare marketing improve social welfare; Moreover, when both firms carry out public welfare marketing, the social welfare reaches the maximum.

3 EMPIRICAL TEST

3.1 Materials and Methods

In the empirical test, we chose SSD as the research object mainly based on two reasons: firstly, because the horizontal difference of SSD samples is small, we can try to avoid the interference of other factors other than product quality; secondly, because products of SSD are relatively simple, there are clear indicators to measure the quality difference between samples. Since the indicators such as commodity quality and whether commodities participate in public welfare marketing are less affected by time changes, we conduct an empirical study using the SSD data of Tmall, and capture product information through data capture software. Due to the failure of commodity ID and the fact that a single commodity ID corresponds to multiple commodities, we obtained 400 valid samples through manual screening.

We take whether the product participates in public welfare marketing (denoted as y) as the explained variable. The explained variable is a virtual variable. If the firm carries out public welfare marketing, it is recorded as 1, otherwise it is recorded as 0. The core explanatory variable we choose is product quality. For SSD, the larger the space, the more data can be stored, so the hard disk space is an important indicator of their quality, that is, the higher the quality of SSD, the larger the space it has. The threshold variable is the proportion of public welfare donations, and the control variables include monthly marketing,

popularity, cumulative reviews and price, service, logistics, description and rank.

The hypothesis we want to test is that if the proportion of public welfare donations is low, the higher the quality of products, the more willing they are to carry out public welfare marketing; if the proportion of public welfare donations is high, the lower the quality of products, the more willing to carry out public welfare marketing. Therefore, we use threshold regression model for empirical research. The regression equation is as follows:

$$\ln \frac{P}{1-P} = \beta_0 + \beta_1 \cdot \text{Quality} \cdot I(r \leq \gamma) + \beta_2 \cdot \text{Quality} \cdot I(r > \gamma) + \beta_3 X_i + \varepsilon$$

Where, r represents threshold variable, γ represents unknown threshold value, $I(\cdot)$ represents index function, X_i represents control variable and ε represents random disturbance term.

3.2 Results & Discussion

The regression results of sample data are shown in Table 3. It can be seen from table 1 that when the proportion of public welfare donation is less than or equal to 0.0266667%, the higher the quality of products, the more willing they are to carry out public welfare marketing; When the proportion of public welfare donation is greater than 0.0266667%, the lower the quality of products, the more willing they are to carry out public welfare marketing. The regression results can verify our previous theoretical expectations. In terms of control variables, the price and logistics scores are significant before and after the threshold, specifically: (1) When the proportion of public welfare donation is low, the products with lower price are more willing to carry out public welfare marketing; when the proportion of public welfare donation is high, the products with higher price are more willing to carry out public welfare marketing. The reason is that under other conditions, low price means that the profit space of products is small. If the proportion of donation is too high, it is not conducive to the profit maximization goal of low-cost products. When the proportion of profit donation is low, low-price products are willing to participate in public welfare marketing; (2) Products with low logistics scores are more willing to demonstrate their product quality through public welfare marketing. When the proportion of public welfare donations increases, products with lower logistics scores are more willing to participate in public welfare marketing. The reason is that under other conditions,

consumers are less likely to choose products with low logistics scores, and public welfare marketing helps to improve consumers' evaluation of products. Therefore, products with low logistics scores are more willing to participate in public welfare marketing.

Table 1: Results of regression.

threshold value $\gamma = 0.0266667\%$		
	$r \leq \gamma$	$r > \gamma$
Quality	0.000139576*** (3.005)	-0.000463083* (-1.8017)
Price	-0.000053497** (-1.968)	0.000354339*** (3.976)
Marketing	-0.000034391 (-0.652)	- 0.006452529*** (-3.938)
Review	0.0000048187 (0.4534)	-0.001450056 (-1.3232)
Popularity	-0.0000032302 (-0.3761)	0.000150267 (1.2034)
Description	0.504443912 (0.9623)	0.692010066 (0.693)
Service	0.586749092 (1.292)	-1.32822055 (-0.6409)
Logistics	-1.16531424** (-2.4667)	-5.70283681** (-2.8019)
Rank	0.000017266 (0.0947)	-.000942945** (-2.0036)

Note: ***, **, * respectively represents significant at 1%, 5% and 10% significant levels; the values in parentheses are Z statistics.

4 CONCLUSIONS

Our study finds that whether a firm participates in public welfare marketing depends on both the product quality and the proportion of income donation; public welfare marketing may increase the profits of firms and will certainly improve social welfare; in order to maximize the total donation, the optimal donation proportion must be a relatively small value. The conclusions have some policy implications. Firstly, firms should actively formulate public welfare marketing strategies according to their product quality. Specifically, in order to achieve the double "harvest" of corporate reputation and corporate profits, firms selling high-quality products should try to choose public welfare projects with a low donation proportion; however, firms selling low-quality products should try to choose public welfare projects with a high proportion of donations. Secondly, public

welfare marketing can not only benefit industry profits and public welfare undertakings as a whole, but also increase consumer surplus, so as to improve social welfare. Moreover, if the proportion of income donation can be set appropriately, it can meet the multi-objective requirements of firms, public welfare, consumers and social welfare at the same time, and engage in a win-win situation. Thus, government departments should vigorously advocate public welfare marketing, especially in the current situation of fighting with covid-19. Finally, for public welfare organizations, in the critical period of epidemic prevention, the goal can be adjusted to maximize public welfare donations, and an appropriate donation proportion can be set to encourage more firms to participate in public welfare marketing, so as to better integrate public welfare forces and contribute to the epidemic stricken areas. With the gradual improvement of the epidemic situation, public welfare organizations should fully consider the interests of firms and appropriately reduce the donation proportion, so as to achieve a win-win situation between public welfare undertakings and firm profits.

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APPENDIX

$$r_1^* = \frac{-\Delta + 16s^2\Delta - \Delta^2 + 32s\Delta^2 + 16\Delta^3}{1 - 8s + 16s^2 - 7\Delta + 24s\Delta + 16s^2\Delta + 8\Delta^2 + 32s\Delta^2 + 16\Delta^3}$$

$$r_2^* = \frac{\Delta(64s^4 + 64s^3(\Delta - 1) + (\Delta^2 - 1)^2 - 4s^2(10\Delta + \Delta^2 - 7) - 4s(2 - \Delta + 3\Delta^2))}{(s + \Delta)(1 + 8s^2 + 2s(\Delta - 3) - \Delta^2)^2}$$

$$r_3^* = \frac{\Delta(16s^2 - \Delta - 1)}{(1 + \Delta)(1 - 4s)^2}$$

$$\tilde{r}_1 = \frac{\Delta(1 - 8s + 24s^2 - 40s^3 + 32s^4) + \Delta^2(-2 + 12s - 36s^2 + 44s^3) + \Delta^3a}{s - 12s^2 + 52s^3 - 96s^4 + 64s^5 + \Delta(1 - 14s + 72s^2 - 160s^3 + 128s^4) + \Delta^2(-2 + 21s - 72s^2 + 80s^3) + \Delta^3a}$$

$$\tilde{r}_2 = \frac{\Delta(2s - 9s^2 + 16s^4) + \Delta^2(1 - 6s - 9s^2 + 32s^3) + \Delta^3a}{s^2 - 8s^3 + 16s^4 + \Delta(2s - 15s^2 + 24s^3 + 16s^4) + \Delta^2(1 - 6s + 32s^3) + \Delta^3a}$$

