Model of market share affected by social media reputation

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Nowadays, reputation on social media is sometimes very significant to increase market share for consumer goods. According to a standard theory of market share by Berry [1], we can write down a market share for product j as

$$s_j = \frac{e^{\delta_j}}{\sum_k e^{\delta_k}} \quad (1)$$

Here, $\delta_j = x_j\beta - \alpha p_j + \xi_j$, where x_j is product characteristics for product j, p_j is price of product j and ξ_j is product characteristics unobserved by econometrician.

In this study, we assume that the product characteristics unobserved by econometrician ξ_j include social media reputation effects. Using sociophysics approach, we can calculate reputation of product on social media quantitatively using the mathematical model for hit phenomena [2]. According to this theory, we can calculate the reputation of product or topic using the following formulae,

$$\frac{d\langle I(t)\rangle}{dt} = -a\langle I(t)\rangle + D\langle I(t)\rangle + P\langle I(t)\rangle^2 + \big(f(t)\big) \quad (2)$$

where $\langle I(t)\rangle$ is the averaged population on social media. In eq.(2), D and P means the strength of direct communication and indirect communication, respectively. This theory has been presented first as analysis tool for box office business of Japanese film market, but, later, this theory has been applied to many fields as global music tours [3], Facebook impressions[4,5], local events[6], online music[7], election[8], population of stage actor[9] and social scandals[10] like STAP cell scandal in biology research[11,12]. If we can access records, we can even analyze population of stage actors in 19th century.[13]

Including the social media reputation into the marketing share theory, we assume here that $\xi_j = \gamma I_j(t)$ where I_j is the reputation of product j and γ is adjusting parameter. Since the calculated reputation on

social media is time-dependent, the market share itself should be extended to be time-dependent share as follows,

$$s_j(t) = \frac{e^{\delta_j(t)}}{\sum_k e^{\delta_k(t)}} \quad (3)$$

where $\delta_j(t) = x_j(t)\beta - \alpha p_j(t) + \gamma I_j(t)$.

Using this model (eq.(3)) including eq.(2), we can calculate effects of reputation on social media for market share quantitatively. The key parameter γ can be estimated using real marketing data with social media data on the same product.

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