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Abstract

The Japanese concert market is distinct from live-concert markets in other countries because of its reliance on cheap tickets sold through the fan clubs and concert ticket lotteries. Most of the tickets of famous artists are sold through their fan clubs' pre-order lottery system at uniform prices instead of through third-party platforms at different prices. Such a strategy seems counterintuitive, as entertainment firms may explore additional profitability by making seats publicly available and varying ticket price with seat quality. By forming two theoretical models, we explore the pricing strategy of Japanese firms from two aspects: habit formation process and random seating assignment. From the first model, we conclude that, with habit formation, firms' overall optimal prices are lower than the first period optimal prices. From the second model, we find that random seating assignment with uniform price always yields less revenue than price differentiation. This result suggests that Japanese firms might use lotteries due to reasons other than profit maximization in the primary market.

1. Introduction

For consumers outside of Japan, buying a concert ticket is simply one click on mainstream ticket service websites such as *Ticketmaster*. Concert tickets are categorized and priced by sections and are released through these ticket service websites (Courty, 2000). Seldom are the seats fan-exclusive; regardless of being a fan or not, buyers log in the same websites, choose their best and most affordable seats, and pay after their seat selections. According to International Federation of the Phonographic Industry (IFPI), the top 20 best-selling artists in 2017, including Ed Sheeran and Taylor Swift, sold their concert tours on *Ticketmaster* or other publicly available third-party websites.

Things are different in Japan. The usage of fan clubs to release tickets is rarely seen in live-music markets other than Japan. Fan clubs in other countries, according to the official website of IFPI's top 20 best-selling artists in 2017, are mainly responsible for updating recent news or upcoming events of the artists and selling their merchandised goods. In addition to such services, Japanese fan clubs serve as the preferred media of distribution of tickets, rather than ticket service websites available to the general public. Most Japanese artists and K-pop artists in Japan established online fan clubs exclusive to Japanese residents, and annual fees and sometimes lump sum entrance fees are required for fan club memberships. According to *The Concert Mobilization Power Ranking* by *Nikkei Style* (the entertainment subsection of Japan' s largest financial newspaper *The Nihon Keizai Shinbun*)[1], which ranks the top 100 best-selling artists annually, all top 20 artists/groups in 2017 and 18 out of the top 20s in 2016[2] have their own online fan clubs. Tohoshinki, the top-ranked artist group in 2018, sold 1.28 million concert tickets, mostly through its fan club pre-order service[3].

The seating prices and seating assignments of a pre-order process are noteworthy. During a pre-order process, members can submit applications to enter a ticket lottery. Every member of the fan club has an equal probability of getting selected regardless of his/her nationality, income level, or fan-age. Subsequently, fan clubs release the results of all the lotteries at the same time, randomly distributing ticket purchasing rights to applicants for each concert. Such a distribution of tickets reflects a weaker

[1]See https://style.nikkei.com/article/DGXMZO23540530W7A111C1000000?channel=DF280120166614 and https://style.nikkei.com/article/DGXMZO09498620U6A111C1000000?channel=DF280120166614.
[2]See Appendix A for survey criteria and further information of the top 20 artists.
[3]See the official website of Tohoshinki: https://bigeast.smtown-fc.jp/faq.

price differentiating system of Japanese concert market. Those who won the lottery are charged at a uniform price regardless of seating assignments, that is, every selected member has an equal probability of seating in the front rows without making an extra payment. Overall, tickets sold through the pre-order process are released earlier, priced cheaper, and usually better seated than those available to the general public, who only get access after the pre-order process ends.

However, according to a standard textbook, Japanese suppliers would have extracted more surplus from consumers had they practiced price discrimination. This study explores why Japanese artists would prefer the lottery distribution system than the system that is practiced elsewhere in the world. We first explore whether fan clubs could increase the revenue of suppliers through a habit formation process. Then, we examine the pricing strategy of direct ticket sale verses that of lottery sale within a model which categorizes seats based on their qualities. In addition, we explore whether and under what circumstances random seating assignments would increase the revenue of the suppliers.

1.1. **A Summary of the Japanese Music Industry.** One possible explanation of the adoption of such an ticket distribution system links to the prosperous idol industry in Japan, as 26 out of 29 Top 20 artists in 2016 and 2017 are idols according to the Concert Mobilization Power Ranking (see footnote 1). In the idol industry, artists are not only suppliers of music but also entities that fans emotionally attach to. Their job, is "to sell dreams" (Oi, 2016). The relationship between idols and music consumers, who are mostly their fans, deviates from the cold-blooded supplier-consumers relationship in economics textbooks. Rather, artists and fans are bonded by mutual support. Artists provide music and, more importantly, emotional support to fans; consequently, fans support idols financially, buying music records and concert tickets. An important part of the emotional support is the detachment from real life, as fans feel the support regardless of their nationality, income level or fan-age. Idols therefore would not discriminate their fans based on these criteria during ticket distribution, encouraging fans to continue supporting their idols. Non-fans do not maintain this mutual support relationship, so they are almost excluded from the ticket selling system.

However, such an explanation does not hold in the case of South Korea. As a country that is also obsessed with the idol industry, South Korea adopted the global ticket distribution system instead. Audiences buy tickets at third party websites during the

same time period, and ticket prices are differentiated by seat qualities. For example, BTS, the best-selling South Korean idol group so far in 2018, sold their tickets on *Interpark*[4], the South Korean equivalent to *Ticketmaster*. We therefore question, does any reason other than emotional support cause the difference in the Japanese ticket distribution system? We believe the answer lies in the characteristics of the two music industries; therefore, we extract three features from Japanese music industry and compare them to that of South Korean industry below.

Japan has a much larger music industry than South Korea. According to the Recording Industry Association of Japan(RIAJ), Japan sold physical and digital records that were worth 2.728 billion USD in 2017, ranked the 2^{nd} globally[5]; in comparison, those sold in South Korea were worth 494.4 million USD, ranked the 6^{th} globally. Japan also has a larger live-concert market. In 2017, 47,793,539 concert tickets were sold in Japan, bringing in total revenue of 2.936 billion USD[6]; meanwhile, total revenue in South Korea was only 0.3 billion USD at an average cost of 92 USD per ticket[7], which was less than 1/9 of that in Japan.

Nevertheless, the Japanese market seems to be less competitive or diverse. *Chosun News* (one of the major South Korean newspapers) states that 436 South Korean groups (at an average size of 5-6 members) and countless solo singers debuted from 2007 to 2017[8]. During the same period, 3370 Japanese artists debuted despite of its huge market according to RIAJ[9]. Even though the numbers of debut artists in Japan and South Korea do not show a great disparity, given the size difference between the two markets, it is fair to conclude that Japanese music market is much less competitive.

Another distinction stands in the longevity of the careers of artists. Artists in the Japanese market are able to maintain their fame and attention longer because their fans are more loyal than South Korean fans. According to 2017 *Oricon Albums Chart*, the top 20 best-selling artists/groups in Japan have an average stage life of 16.4 years[10]

[4]See https://www.soompi.com/article/1209921wpp/bts-sells-tickets-love-concerts-seoul.
[5]See https://www.riaj.or.jp/riaj/open/open-record!file?fid=1638.
[6]See All-Japan Concert and Live Entertainment Promoters Conference(ACPC) 2017 Yearly Report: http://www.acpc.or.jp/marketing/kiso_detail.php?year=2017.
[7]See 2017 South Korea Music Market White Paper from Korea Creative Content Agency (KOCCA): http://www.kocca.kr/cop/bbs/view/B0000146/1832355.do?searchCnd=.
[8]See http://news.chosun.com/site/data/html_dir/2017/07/22/201707220093.
[9]See http://www.riaj.or.jp/e/data/others/debut.html.
[10]*Oricon* is the most authoritative music chart in Japan. See https://www.oricon.co.jp/rank/ja/y/2017/.

while artists career in South Korea only averaged around 7.2 years according to *Gaon Albums Chart*[11]. The long-lasting passion from Japanese fans becomes more evident if we look at the K-pop artists who perform in both Japan and South Korea. Tohoshinki, the alternative alias of the South Korea duo band TVXQ in Japan, is the best-known example. Tohoshinki debuted in 2004 and succeeded in 2006 in South Korea; concurrently, they debuted in 2005 and succeeded in 2007 in Japan. In 2008, Tohoshinki reached its peak time by selling 502,387 albums[12], breaking the record since 2004; however, their popularity at home has been decreasing ever since. In 2018, Tohoshinki returned in both markets after 2 years of military conscription. Their newest album sales in South Korea dropped to 141,786[13], which was less than 1/3 of their sales in 2008 and less than 1/14 of 2018's best-selling South Korean album[14]; however, their fame did not fade away in Japan. In comparison to their 2008 Japanese concert tour which they sold 177,000 tickets in 2 months, in 2018 they managed to achieve Top 1 in Nikkei Style Japanese Concert Mobilization Ranking, selling 1.28 million concert tickets in 4 months[15].

In conclusion, our previous explanation of the prevalence of the Japanese ticket distribution system is reasonable. Characteristics of the Japanese concert market created its unique environment. Having fervent and loyal consumers, the Japanese concert market implemented fan clubs to maintain fan relationship with the artists, which in reciprocal ensures selling of tickets.

2. Approach

First of all, the prevalence of idols in the Japanese music industry leads to a monopolistic competition status of the market. Since fans have limited attention and energy, idols need to stand out from the crowd in order to attract fans; therefore, idols are not perfect substitutes for one another. That said, ample resources in the large Japanese market and limited amount of artists have led to relatively low levels of monopolistic competition. Secondly, the longevity of idols' career largely depend on fans' continual support. Such a nature suggests a habit formation process, where buyer's marginal

[11] *Gaon* is the most authoritative music chart in South Korea. See http://www.gaonchart.co.kr/main/section/chart/album.gaon?nationGbn=T&serviceGbn=&termGbn=year.
[12] See http://www.newsen.com/news_view.php?uid=200901080836191002
[13] See http://gaonchart.co.kr/main/section/chart/album.gaon?nationGbn=T&serviceGbn=&targetTime=05&hitYear=2018&termGbn=month.
[14] See http://www.gaonchart.co.kr/main/section/chart/album.gaon?nationGbn=T&serviceGbn=&targetTime=10&hitYear=2018&termGbn=month.
[15] See http://yorozu-do.com/concert-ranking/.

utility increases if he/she has attended concerts of that artist previously. If suppliers could decrease the entry price for new consumers, consumers would be more willing to buy tickets in the future because such actions maximize their utility according to the habit formation process. As a result, suppliers increase their long-run payoffs. Moreover, random seating assignment within fan clubs in uniformly low price might be a strategy to create more profits compared to direct ticket sale. Consumers might be more likely to spend money on tickets if the lottery is cheap enough.

We use two separate theoretical models to capture these features of the Japanese music industry. The first model combines elements of habit formation and monopolistic competition to depict the Japanese idol industry. By solving the equilibrium in both the supply and the demand sides, we show how consumers and firms respond to changes in the intensities of habit formation and monopolistic competition. On the demand side, we assume that consumers are initially the same (not predisposed to either artist) and only live for two periods. Consumption of concert tickets is addictive, measured by a habit formation parameter. Each consumer chooses the amount of the number of tickets in a monopolistically competitive market. On the supply side, where revenue function is the price of ticket multiplies the number of tickets sold, firms need to decide on a pricing strategies to maximize their revenue.

The second model describes firms' pricing strategies that compose of different seat qualities. On the supply side, each firm offers two types of seats, good seats and bad seats. It then either assigns seats randomly at a uniform price, the exact way seen in the lottery system, or sells seats at different prices. On the demand side, each consumer can choose to buy a ticket/lottery or not to buy at all. The utility of each consumer is subject to a normally distributed individual preference. We explore the pricing strategies of lottery and direct ticket sale under monopoly. We find that selling tickets directly always result in more profits than selling lotteries.

This paper aims to offer the rationale behind the popularity of fan clubs and lotteries in the Japanese concert ticket distribution system. It contributes to the current research by asking a new question in concert ticket pricing and proposing a theoretical explanation. We capture habit formation, monopolistic competition, and random seating assignment characteristics of the concert ticket market, and apply the corresponding theoretical models to the specific case of Japanese live-concert market. We demonstrate how the habit formation process, and the seat quality influence suppliers'

revenue.

3. Literature Review

Ticket pricing in the primary and the secondary market has been extensively studied. Courty (2000) offers an introduction to the players, the policies, and the potential determinants of ticket pricing in the live-concert market. Courty describes that the entertainment industry is vertically divided among performers, agents, promoters, venues, and ticket agencies. Since no conflict of interests among the artists and the other supply-side actors exists in this study, we simplify the supply side actors into one actor: the firms. Courty also states that the ticket price does not vary much among different market structures. Courty and Pagliero (2014) include an exhaustive overview of the theories behind the rationing of the tickets, suggesting that the suppliers might set the price in favor of the 'fairness' claim of the fans, or build up goodwill to intensify the emotional connection between the fans and the artists. In other words, it is possible that the Japanese suppliers intentionally set the price to build up a larger and firmer fan base in order to affect their spending behavior in the long run.

As one major feature of the Japanese concert market, price differentiation has already been covered by a lot of articles. Orbach and Einav (2007) conduct a theoretical study on the uniform pricing in the movie theater. They suggest that uniform pricing, the second-best solution is optimal since, price differentiation, the first-best solution is not available due to the legal constraints on vertical arrangements. In contrast, in the live-performance market, studies have shown that price differentiation is more profitable than uniform pricing. Leslie (2004) tests the effect of second-degree (different price for different seat qualities) and third-degree price discrimination (different price for different customers) on a Broadway play. Through an empirical analysis, he finds that uniform pricing leads to lower overall attendance and does not increase total consumer surplus; moreover, price discrimination increases the profit of the firms by 5%, when compared to uniform pricing. In addition, Huntington (1983) suggests that the optimal strategy for box offices is to set ticket prices according to the income levels of the consumers. He applies his theoretical framework to the Arts Council clients and shows that the theaters that provide a range of prices yield more revenue than those who provide uniform price. The optimal ticket pricing strategy, price differentiation, seems to contradict the pricing strategy used in Japan.

Some economists look into the pricing strategy in monopolistic competition. In his textbook, Tirole (1988) includes a monopolistic competition model. He shows that the price elasticity of the demand and the optimal price depend on the degree of differentiation. Katz (1984) studies price discrimination in monopolistic competition. He shows that price discrimination redistributes surplus from uninformed to informed consumers. Therefore, uniform pricing is more efficient if the discriminated group account for a small portion of the potential consumers.

The existing literature in economics seldom studies the effect of fans on the music industry. However, Stigler and Becker (1977) construct a habit formation model of the time spent on music, besides other beneficial addictions. Exposure to music increase the stock of music capital, and then addiction lowers the cost of spending time on music. In other words, the accumulation of the stock of music capital increases the marginal utility of time allocated to music. Also, habit formation has proved to have positive effects on the suppliers in the long run in a more general case. Becker and Murphy (1988) develop a theoretical model on addiction, assuming that consumers are rational. They suggest that steady-state consumption is not stable and consumption of the goods increases over time if the consumption is above the steady-state level. If we regard the emotional attachment to the artists as a less strong version of addiction, this theory shows that the loyalty or the emotional attachment to the artists can increase the consumption of artists. These results imply that the habit formation process encourages consumers to expand their spending on this good over time.

Pollak (1977) suggests a deterministic habit formation model where every exposure to the goods inevitably increases the like/dislike to that goods, and thus increases the marginal utility of the goods. This finding suggests that a small expenditure on the artists might lead to an increase in the spending on the artists in the future. His model implies that consumption in the distant past has less effect on current consumption than that in the recent past. In contrast, Lévy-Garboua and Montmarquette (1996) design another habit formation model of theater demand. They assume that people are unaware of their own tastes so they depend on experience to discover their tastes. Current consumption does not directly affect the utility from future consumption, but rather serves as a means to reveal the consumers' preference. In other words, consumers learn by consuming. This assumption is more compatible with differentiated cultural goods. They conclude that the probability of attending the theater increases as long as the theater-going experience creates positive marginal utility, i.e. the consumer enjoys what he/she saw; it decreases as the price of the theater or the marginal

utility of wealth decreases. Following this habit formation theory, Castiglione and Infante (2016) conduct empirical research on 34-year panel data on regional annual theater attendance. They show that the past consumption of the theater significantly raises the marginal utility of current consumption of theater. Therefore, the theater is an addictive good. These findings suggest us that a habit formation model could be used to describe the consumption of concert tickets. For simplicity, we decide to adapt Pollak's model where people inevitably get addicted to the artist.

4. Habit Formation Model

4.1. **Setup.**

Supply Side. Assume n firms exist in the live-concert market, each selling the tickets of its own performances. Consumers live for two periods, $t = 1, 2$. During each period t, each consumer chooses to buy the number of concert tickets from each firm i, denoted as $q_{i,t}$, where the price, p_i, is sticky for $t = 1, 2$; and the number of other goods, q_0, where the price is one for both periods. We assume a constant marginal cost c in each ticket so that the revenue of each firm per consumer in each period t is:

$$\phi_{i,t} = (p_i - c)\, q_{i,t}. \tag{4.1}$$

Demand Side. Assume the budget constraint of each consumer in each period is given by:

$$I_t = q_{0,t} + \sum_{j=1}^{n} p_i\, q_{i,t}. \tag{4.2}$$

The utility function of each consumer is:

$$U = u_1(q_{0,1}, x_1) + u_2(q_{0,2}, x_2),$$

where $\frac{\partial u_t}{\partial x_t} > 0$, and $\frac{\partial u_t}{\partial q_0} > 0$. Note that x_t is given by

$$x_t = \begin{cases} (\sum_{j=1}^{n} q_{j,1}^{\rho})^{\frac{1}{\rho}} & \text{if} \quad t = 1 \\ (\sum_{j=1}^{n} (q_{j,1}^{\alpha}\, q_{j,2})^{\rho})^{\frac{1}{\rho}} & \text{if} \quad t = 2. \end{cases}$$

The parameter α is referred as the *habit formation intensity*. The intensity of the monopolistic competition is denoted as ρ. We assume $\rho \leq 1$ for concavity, and $\rho \geq 0$ for positive monopolistic price. As $\rho \to 1$, q_i become perfect substitutes; as $\rho \to -\infty$, q_i become perfect complements.

4.2. **Equilibrium.**

Demand Side. We assume an interior solution, so we set MRS equals to price ratio, after replacing q_0 with the budget constraint:

$$\frac{\partial u_t}{\partial q_{i,t}} = \frac{\partial u_t}{\partial q_{0,1}} \cdot \frac{\partial q_{0,1}}{\partial q_{i,t}} + \frac{\partial u_t}{\partial x_t} \cdot \frac{\partial x_t}{\partial q_{i,t}} = 0. \tag{4.3}$$

Now, use budget constraint in (4.3) to replace $q_{0,t}$, and set $V_0 = \frac{\partial u_t}{\partial q_{0,t}}$ and $V_1 = \frac{\partial u_t}{\partial x_t}$:

$$p_i = \frac{V_1}{V_0} \cdot \frac{\partial x_t}{\partial q_{i,t}}, \tag{4.4}$$

where

$$\frac{\partial x_t}{\partial q_{i,t}} = \begin{cases} (\sum_{j=1}^{n} q_{j,1}^{\rho})^{\frac{1-\rho}{\rho}} \cdot q_{j,1}^{\rho-1} & \text{if} \quad t = 1 \\ (\sum_{j=1}^{n} (q_{j,1}^{\alpha}\, q_{j,2})^{\rho})^{\frac{1-\rho}{\rho}} \cdot q_{j,1}^{\alpha\rho}\, q_{j,2}^{\rho-1} & \text{if} \quad t = 2. \end{cases}$$

According to Tirole (1988), a change in $q_{i,1}$ has little impact on $\sum_{j=1}^{n} q_{j,1}^{\rho}$, V_0 and V_1, because n is large. Then, the demand function of firm i during period 1 could be approximated as:

$$q_{i,1} = k_1\, p_i^{\frac{1}{\rho-1}}, \quad k_1 = (\frac{V_1}{V_0})^{\frac{1}{\rho-1}} \cdot (\sum_{j=1}^{n} q_{j,1}^{\rho})^{\frac{1}{\rho}} > 0, \tag{4.5}$$

where k_1 is treated as a constant. Similarly, the demand function of firm i during period 2 could be approximated as:

$$q_{i,2} = k_2\, p_i^{\frac{1}{\rho-1}}\, q_{i,1}^{\frac{\alpha\rho}{1-\rho}}, \quad k_2 = (\frac{V_1}{V_0})^{\frac{1}{\rho-1}} \cdot (\sum_{j=1}^{n} (q_{j,1}^{\alpha}\, q_{j,2})^{\rho})^{\frac{1}{\rho}} > 0, \tag{4.6}$$

where k_2 is treated as a constant.

Supply Side. By (4.5), the price of i during period 1 could be expressed in the form below

$$p_i = \kappa_1 \cdot q_{i,1}^{\rho-1}, \text{ where } \kappa_1 = k_1^{1-\rho}. \tag{4.7}$$

Similarly, price of i during period 2 could be expressed as:

$$p_i = \kappa_2 \cdot q_{i,1}^{\alpha\rho}\, q_{i,2}^{\rho-1}, \text{ where } \kappa_2 = k_2^{1-\rho}. \tag{4.8}$$

The price elasticity of demand for i during periods 1 and 2 is

$$\epsilon_{i,t} = -\frac{\partial q_{i,t}}{\partial p_i} \cdot \frac{p_i}{q_{i,t}} = \frac{1}{1-\rho}. \tag{4.9}$$

Note that even though κ_1 and κ_2 are different, they do not influence the value of elasticity of demand. Thus, the price of i is still the same in both periods. If the firms

are not forward-looking, then the firms set the price to

$$p_i = \frac{c}{1 - \frac{1}{\epsilon_{i,t}}} = \frac{c}{\rho} \tag{4.10}$$

in both periods. However, if we consider the firms forward-looking, p_i should be set in order to maximize the joint revenue of both periods. Therefore, we set the marginal revenue to zero and obtain:

$$\frac{\partial(\phi_{i,1} + \phi_{i,2})}{\partial p_i} = (q_{i,1} + q_{i,2}) + (\frac{\partial q_{i,1}}{\partial p_i} + \frac{\partial q_{i,2}}{\partial p_i})\,(p_i - c) = 0. \tag{4.11}$$

Expand (4.11), then we have:

$$(p_i - \frac{c}{\rho}) \cdot \Theta + \Delta = 0,$$

where

$$\Theta = \frac{\rho}{\rho - 1} \cdot q_{i,2} \cdot p_i^{-1}, \text{ and } \Delta = q_{i,1} + \frac{\partial q_{i,1}}{\partial p_i}\,(p_i - c)\,(\frac{\alpha\rho}{1-\rho}\,q_{i,1} + 1).$$

The fact that $\Theta < 0$ and $\Delta < 0$[16] indicates that $p_i < \frac{c}{\rho}$. A price lower than that stated in (4.10) is required for the maximization of the combined revenue.

Results. Accordingly, firms may maximize their revenue by increasing their ticket sale during the initial period and at the same time accelerating the habit formation process. Fan clubs, which sell cheap tickets, serve such purposes perfectly. The Japanese fan clubs speed up the habit formation process by creating more intensive interactions between the artists and the fans such as the member-exclusive greetings from the artists, member-exclusive merchandised goods, and member-exclusive online events. Concurrently, cheap tickets sold in the fan clubs decrease the entry price of the tickets, allowing consumers to afford more tickets during the first period.

5. Seat Quality Model

5.1. **Direct Ticket Sale.**

Setup. Assume only one firm exists in the live-concert market. The firm sells two types of seats: good seats and bad seats, at prices p_H and p_L, respectively. Each consumer can choose to buy a good seat, a bad seat, or nothing. If a consumer buys a good seat, the payoff is x_H; if a consumer buys a bad seat, the payoff is x_L; and if the consumer

[16]See Appendix B.

decides not to buy, the payoff is zero. The utility of each option is:

$$v_s = \begin{cases} x_H - p_H & \text{if buys a good seat} \\ x_L - p_L & \text{if buys a bad seat} \\ 0 & \text{if decides not to buy,} \end{cases}$$

where $s \in \{H, L, 0\}$ represents different options. Each consumer chooses the utility-maximizing option based on the utility of each option, v_s, and individual preference, ϵ_s, with respect to seat quality. Therefore, the utility function of each consumer is

$$U = \max_s v_s - \epsilon_s,$$

where $\epsilon_s \sim$ iid $N(0, \sigma)$ if $s \in \{H, L\}$, and $\epsilon_s = 0$ if $s = 0$. In other words, we assume the mean values of ϵ_s for good seats and bad seats are zero, and the standard deviation of the distributions of seat preference, σ_s, are equal, i.e. $\sigma_L = \sigma_H = \sigma$. In addition, the individual preference for no buying is zero.

Revenue. The probability of buying a good seat is

$$\begin{aligned} \Pr H &= \Pr(v_H - \epsilon_H > v_L - \epsilon_L,\ v_H - \epsilon_H > 0) \\ &= \Pr(v_H - v_L > \epsilon_H - \epsilon_L,\ v_H > \epsilon_H). \end{aligned}$$

Since $(\epsilon_H - \epsilon_L,\ \epsilon_H) \sim N_2(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 2\sigma^2 & \sigma^2 \\ \sigma^2 & \sigma^2 \end{pmatrix})$[17], $\Pr H$ could be obtained by the cumulative distribution function (CDF) of this joint distribution. Similarly, the probability of buying a bad seat is

$$\begin{aligned} \Pr L &= \Pr(v_L - \epsilon_L > v_H - \epsilon_H,\ v_L - \epsilon_L > 0) \\ &= \Pr(v_L - v_H > \epsilon_L - \epsilon_H,\ v_L > \epsilon_L), \end{aligned}$$

and $\Pr L$ could be obtained by the CDF of $(\epsilon_L - \epsilon_H,\ \epsilon_L) \sim N_2(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 2\sigma^2 & \sigma^2 \\ \sigma^2 & \sigma^2 \end{pmatrix})$ [18].

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[17]The covariance matrix $\begin{pmatrix} Var(\epsilon_H - \epsilon_L) & Cov(\epsilon_H - \epsilon_L, \epsilon_H) \\ Cov(\epsilon_H - \epsilon_L, \epsilon_H) & Var(\epsilon_H) \end{pmatrix}$ could be calculated as follows: $Var(\epsilon_H - \epsilon_L) = 2\sigma^2$ and $Var(\epsilon_H) = \sigma^2$ by assumption, and

$$Cov(\epsilon_H - \epsilon_L, \epsilon_H) = Cov(\epsilon_H, \epsilon_H) - Cov(\epsilon_H, \epsilon_L) = Var(\epsilon_H) - Cov(\epsilon_H, \epsilon_L) = \sigma^2,$$

because the covariance between ϵ_H and ϵ_L, uncorrelated by assumption, is 0.

[18]Similarly, the covariance matrix $\begin{pmatrix} Var(\epsilon_L - \epsilon_H) & Cov(\epsilon_L - \epsilon_H, \epsilon_L) \\ Cov(\epsilon_L - \epsilon_H, \epsilon_L) & Var(\epsilon_L) \end{pmatrix}$ could be calculated as follows: $Var(\epsilon_L - \epsilon_H) = 2\sigma^2$ and $Var(\epsilon_L) = \sigma^2$ by assumption, and $Cov(\epsilon_L - \epsilon_H,\ \epsilon_L) = \sigma^2$ by similar process in footnote 17.

The revenue of the firm is

$$R_D = \Pr H\,(p_H - c) + \Pr L\,(p_L - c),$$

where the constant c is the marginal cost of a seat.

5.2. **Lottery Sale.**

Setup. Assume only one firm exists in the live-concert market. Unlike in 5.1, the firm sells both types of seats by lottery at a uniform price, p_{LT}. The probability of getting a good seat is π, and that of getting a bad seat is $1-\pi$. For each consumer, the payoff is x_H for a good seat, x_L for a bad seat, and zero for not to buy. The utility of each option is

$$v_s = \begin{cases} \pi x_H + (1-\pi)x_L - p_{LT} & \text{if decides to buy a lottery} \\ 0 \quad \text{if decides not to buy a lottery,} \end{cases}$$

where $s \in \{LT, 0\}$ represents different options. Each consumer's preference for the seat quality follows a normal distribution as in 5.1. The utility function of each individual is

$$U = \max_s v_s - \epsilon_s,$$

where $\epsilon_s \sim$ iid $N(0, \sigma_{LT})$ if $s = LT$, and $\epsilon_s = 0$ if $s = 0$. That is, the preference for the lottery, ϵ_{LT}, has a mean zero, and the standard deviation of buying lottery is $\sigma_{LT} = \sqrt{\pi^2 + (1-\pi)^2}\cdot\sigma$. Just as in 5.1, the individual preference of not buying is zero.

Revenue. Thus, the probability of buying a lottery is

$$\Pr LT = \Pr(v_{LT} - \epsilon_{LT} > 0) \;=\; \Pr(v_{LT} > \epsilon_{LT}).$$

The revenue of the firm is

$$R_{LT} = \Pr LT\,(p_{LT} - c)$$

where the constant c is the marginal cost of a seat.

5.3. **Numerical Analysis.** We want to decide which of the two ticket distribution strategies above is optimal for this firm, considering changes in the preference distribution, i.e. μ and σ, of each consumer. Because a consumer's preference for seats follows a normal distribution, a closed form expression for R_D or R_{LT} is not available. Therefore, we conduct a numerical analysis to explore when $R_D - R_{LT} > 0$ in a given range.

In the numerical analysis, π, σ and c are parameters and x_L and x_H are independent variables. First, numerical values of π, σ and c are arbitrarily selected, and the region where $R_D - R_{LT} > 0$ in a given range of x_L and x_H is shaded. Changes in the shape of the shaded region are observed when the parameter values are adjusted. Changes in the scales of the variables cause no changes in the shapes of the shaded region; hence, the ranges of the variables are set at $x_L, x_H \in [0, 15]$. In addition, the ranges of the parameters are set at $\pi \in [0, 0.5]$, $\sigma \in [0, 10]$, $c \in [0, 15]$. Moreover, c is assumed to be less than or equal to the price of the seat. In every given combination of x_L and x_H, the firm finds the p_{LT}, p_H and p_L that maximize the profit from lottery and direct ticket sale, respectively. Then, we compare the R_{LT} and R_D with the profit maximizing prices found in the previous step, and color the point (x_L, x_H) where $R_D - R_{LT} > 0$.

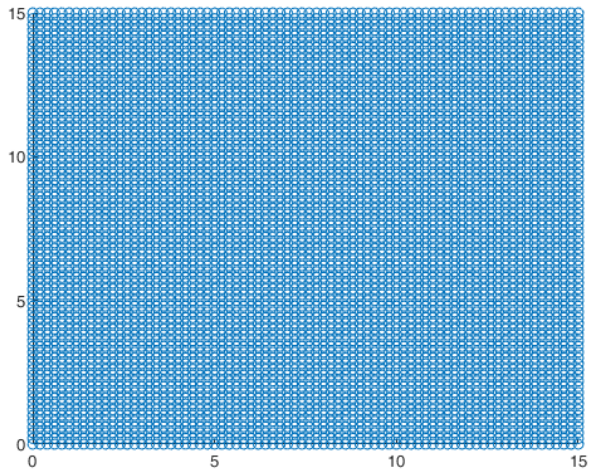

Fig. 1. The horizontal axis represents x_L, and the vertical axis represents x_H. In this graph, $c = 1$, $\pi = 0.3$, $\sigma = 2$. The shaded region represents circumstances where direct ticket sale is preferred than lottery, i.e. $R_D - R_{LT} > 0$.

A typical shape of the shaded region is obtained (shown in Figure 1), where direct sale always earn more than lottery. The same graph showed up even if we changed the parameter values, or the range of the variables. Without the loss of generality, we can conclude that the lottery is never preferable if profit is the only concern of the firm. No matter how widely the consumers' preferences distributed and how likely the consumers get good seats through lotteries, price differentiation always make more profit.

6. Discussion

This paper attempts to explain the prevalence of fan clubs and ticket lottery in the Japanese live-concert market. We develop two models describing firms' pricing strategies under habit formation and different seat quality. In the first model, we show that, if the ticket price is sticky, a ticket price lower than first period optimal price is required to maximize firms' two-period revenue. Therefore, it is in suppliers' interest to establish fan clubs with intensive interactions between artists and their fans to foster the habit formation process. Combined with the cheap nature of tickets, new consumers are encouraged to join clubs, buy tickets, and become loyal to the artists. The result from the first model correspond to actual Japanese live-concert market. In reality, the firms set low price for the tickets in order to induce the fans to buy tickets. The cheap tickets help the consumers to form a habit to attend performance, i.e. become fans of an artist. Consequently, they will attend their concerts more frequently. The faster consumers convert to fans, the more tickets they buy. Correspondingly, the artist/firm earns more revenue. Applications of the habit formation models can be extended to all experience goods. The habit formation model can study the pricing strategies of other cultural goods, such as theater and cinemas, or other goods that are addictive, such as alcohol and drugs. Similar to live-concerts, future consumption of these goods is dependent on their current consumption, whilst suppliers are price-makers.

In the second model, we evaluate and compare the revenues of ticket-selling with and without lottery under the heterogeneity of consumers. We observe that sales through lottery are never preferable in terms of revenue. The Japanese firms might have used lottery system due to concerns other than revenue. One possible explanation, as mentioned in the introduction, is that the firms/artist value 'fairness' among the fans more than the revenue of live-concerts. Fans need to know they are not discriminated based on their income level in order to maintain or intensify their emotional attachment to the artist. The emotional attachment, however, is the key element that drives fans to spend money on the artists, especially for those artists in the idol industry. Lottery of sports game tickets in universities function in a similar mechanism. Instead of directly selling the tickets based on the seat quality, universities use lotteries to determine the seats of the student tickets. The sense of fairness help students form emotional attachment to their universities, which increase the possibility for the students to make donation after they graduate. In addition, lotteries might cut down transactions in the secondary market. With price differentiation and first-come first-served basis, scalpers prefer to buy as many good seats as they can immediately, and put those tickets on

the secondary market at a extra price. In comparison, lotteries discourage the scalpers with their uncertainty. Consumers would only come to the scalpers if the scalpers have tickets or good seats. If the chances of getting tickets, or good seats, for consumers are the same as scalpers, consumers prefer to draw lotteries rather than buy from scalpers.

Several limitations of the model are noticed. First, future model could include the profits scalpers earn in the secondary market. Our current model assume the firms are indifferent to the revenues scalpers make in the secondary market. However, firms in the live-concert market show strong hostility to scalpers (Courty and Pagliero, 2014). In this case, lotteries might be more favorable if firms want to minimize scalpers' profit, because scalpers could not secure goods seats under this system. Secondly, further implication of this research topic could consider integrating the habit formation model to the seat quality model. Although our current seat quality model incorporates heterogeneity of individuals' preferences by including an error term, it only weakly captures the progression of habit formation. Whether being fans or not, all consumers in this model are subjected to random external shocks. As a result, this model overlooks the difference between fans and non-fans, one of the most important characteristics in the Japanese idol industry. Future research could replace the payoff of attending each concert from a constant value to an expression containing habit formation index. Last but not the least, a more realistic model should consider the scarcity of the tickets/lotteries. In our model, we assume that every consumer will be guaranteed a ticket once they enter the lottery for simplification, which is far away from reality. The immediate next step should consider the ticket/lottery price determined by both the supply and the demand sides.

Appendix A

Survey Standards

(1) Pick up single performances of major artists from January 1 to December 31 of the given year.
(2) Assuming that tickets at each venue were sold out, we added the number of people we set up by our magazine and made it "Concert mobilizing power".
(3) Paid domestic single singing performances to be held during the above period are subject. Performances that multiple artists appear (excluding guests and undercards), festivals, handshake associations, school festivals, etc. were excluded.
(4) Singing is the main fan club event (charged) is counted.
(5) Concerts with passports such as "Mizami live" are not counted.
(6) Does not include official announcements as of mid-October.

Official Fanclub Address:

(1) Johnny's Family: https://exfamily.jp/
(2) EXILE FAMILY: https://www.johnnys-net.jp/page?id=jfcAgree
(3) BIGBANG: https://vip.fc.AvexEntertainment.jp/qa/faq/
(4) Momoiro Clover Z: http://fc.momoclo.net/pc/admission/index.php?utm_source=momoclofc&utm_medium=loginbanner&utm_content=pc&utm_campaign=fcoginbanner
(5) AAA: https://global-fc.net/aaapartyworld/news/3946/45721/
(6) EXO: https://exo-l-japan.smtown-fc.jp/page/member_agreement
(7) SHINee: https://shinee.jp/fansite/
(8) DREAMS COME TRUE: http://dreamscometrue.com/fanclub/
(9) Perfume: https://pta-world.com/term/
(10) Kobukuro: http://fc.momoclo.net/pc/admission/index.php?utm_source=momoclofc&utm_medium=loginbanner&utm_content=pc&utm_campaign=fcoginbanner
(11) Kyosuke Himuro: http://www.himuro.com/fanclub/guidance/
(12) iKON: https://ikon.fc.AvexEntertainment.jp/
(13) Mr. Children: http://www.mrchildren.jp/fam/
(14) Tohoshinki: https://bigeast.smtown-fc.jp/faq
(15) Keisuke Kuwata: https://fc.southernallstars.jp/mob/memb/fancLin.php?site=SASFC&ima=5759
(16) Nogizaka46: http://nogizaka46-joho.com/fanclub-mobile-1073#i-2
(17) GLAY: http://www.glay.co.jp/fanclub/about.php#unq_02

(18) Yuzu: https://yuzunowa.com/

(19) ONE OK ROCK: https://oneokrock-pf.com/mob/pageShw.php?site=PF&ima=4127&cd=kiyaku

TABLE 1. Top 20 Artists of The Concert Mobilization Power Ranking 2016

Ranking	Name	Tickets Sold (K)	# Concerts	Nationality	Official Fanclub
1	BIGBANG	1859	60	Korean	Yes
2	Arashi*	939	32	Japanese	Yes
3	Kanjani Eight*	875	35	Japanese	Yes
4	Momoiro Clover Z	636	21	Japanese	Yes
5	Sandaime J Soul Brothers**	634	13	Japanese	Yes
6	Hey! Say! Jump!*	546	36	Japanese	Yes
7	Kis-My-Ft2*	543	11	Japanese	Yes
8	EXILE ATSUSHI**	501	12	Japanese	Yes
9	AAA	489	30	Japanese	Yes
10	Kazumasa Oda	467	49	Japanese	**NO FANCLUB**
11	EXO	465	20	Korean	Yes
12	SHINee	458	25	Korean	Yes
13	Johnny's West*	447	27	Japanese	Yes
14	GENERATIONS**	444	40	Japanese	Yes
15	DREAMS COME TRUE	422	39	Japanese	Yes
16	Perfume	397	20	Japanese	Yes
17	Kobukuro	358	30	Japanese	Yes
18	Kyosuke Himuro	354	7	Japanese	Yes
19	BUMP OF CHICKEN	349	7	Japanese	**NO FANCLUB**
20	iKON	341	30	Korean	Yes

*These artists belong to the Johnny's Family, who are the same official fanclub.
**These artists belong to the EXILE FAMILY, who share the same official fanclub.

TABLE 2. Top 20 Artists of The Concert Mobilization Power Ranking 2017

Ranking	Name	Tickets Sold (K)	# Concerts	Nationality	Official Fanclub
1	Sandaime J Soul Brothers**	1803	37	Japanese	Yes
2	BIGBANG	1022	20	Korean	Yes
3	Kanjani Eight*	990	20	Japanese	Yes
4	Arashi*	844	18	Japanese	Yes
5	Hey! Say! Jump!*	829	37	Japanese	Yes
6	Mr. Children	784	30	Japanese	Yes
7	Tohoshinki	571	11	Korean	Yes
8	SHINee	539	29	Korean	Yes
9	AAA	506	18	Japanese	Yes
10	Kuwata Keisuke	488	20	Japanese	Yes
11	Nogizaka46	467	38	Japanese	Yes
12	iKON	463	33	Japanese	Yes
13	Johnny's West*	406	31	Japanese	Yes
14	EXILE THE SECOND**	387	34	Japanese	Yes
15	NEWS*	383	26	Japanese	Yes
16	Kis-My-Ft2*	380	31	Japanese	Yes
17	GENERATIONS**	377	29	Japanese	Yes
18	GLAY	350	43	Japanese	Yes
19	Yuzu	341	22	Japanese	Yes
20	ONE OK ROCK	340	32	Japanese	Yes

*These artists belong to the Johnny's Family, who are the same official fanclub.
**These artists belong to the EXILE FAMILY, who share the same official fanclub.

Appendix B

Expand (4.11):

$$\begin{aligned}\frac{\partial(\phi_{i,1}+\phi_{i,2})}{\partial p_i} &= k_2\, p_i^{\frac{1}{\rho-1}}\, q_{i,1}^{\frac{\alpha\rho}{1-\rho}} + q_{i,1} + (p_i-c)(\frac{1}{\rho-1}\cdot k_2\, p_i^{\frac{1}{\rho-1}-1}\, q_{i,1}^{\frac{\alpha\rho}{1-\rho}} + \frac{\alpha\rho}{1-\rho}\cdot k_2\, p_i^{\frac{1}{\rho-1}}\, q_{i,1}^{\frac{\alpha\rho}{1-\rho}}\cdot\frac{\partial q_{i,t}}{\partial p_i} + \frac{\partial q_{i,t}}{\partial p_i})\\ &= (p_i + (p_i-c)\cdot\frac{1}{\rho-1})\cdot k_2\, p_i^{\frac{1}{\rho-1}-1}\, q_{i,1}^{\frac{\alpha\rho}{1-\rho}} + q_{i,1} + (p_i-c)\cdot(\frac{\alpha\rho}{1-\rho}\cdot k_2\, p_i^{\frac{1}{\rho-1}}\, q_{i,1}^{\frac{\alpha\rho}{1-\rho}}\cdot\frac{\partial q_{i,t}}{\partial p_i} + \frac{\partial q_{i,t}}{\partial p_i}\\ &= (p_i - \frac{c}{\rho})\cdot\frac{\rho}{\rho-1}\cdot k_2\, p_i^{\frac{1}{\rho-1}-1}\, q_{i,1}^{\frac{\alpha\rho}{1-\rho}} + q_{i,1} + (p_i-c)\cdot(\frac{\alpha\rho}{1-\rho}\cdot k_2\, p_i^{\frac{1}{\rho-1}}\, q_{i,1}^{\frac{\alpha\rho}{1-\rho}}\cdot\frac{\partial q_{i,t}}{\partial p_i} + \frac{\partial q_{i,t}}{\partial p_i})\end{aligned}$$

Because $q_{i,2} = k_2\, p_i^{\frac{1}{\rho-1}}\, q_{i,1}^{\frac{\alpha\rho}{1-\rho}}$, we could simplify the expression as:

$$\frac{\partial(\phi_{i,1}+\phi_{i,2})}{\partial p_i} = (p_i - \frac{c}{\rho})\cdot\frac{\rho}{\rho-1}\cdot q_{i,2}\cdot p_i^{-1} + q_{i,1} + (p_i-c)\cdot(\frac{\alpha\rho}{1-\rho}\cdot q_{i,2}\cdot\frac{\partial q_{i,t}}{\partial p_i} + \frac{\partial q_{i,t}}{\partial p_i}).$$

Set $\Theta = \frac{\rho}{\rho-1}\cdot q_{i,2}\cdot p_i^{-1}$. We find that $\Theta < 0$, since $q_{i,2} > 0$, $p_i > 0$ and $\rho - 1 < 0$. Then,

$$\begin{aligned}\frac{\partial(\phi_{i,1}+\phi_{i,2})}{\partial p_i} &= (p_i - \frac{c}{\rho})\,\Theta + q_{i,1} + (p_i-c)\cdot(\frac{\alpha\rho}{1-\rho}\cdot q_{i,2}\cdot\frac{\partial q_{i,t}}{\partial p_i} + \frac{\partial q_{i,t}}{\partial p_i})\\ &= (p_i - \frac{c}{\rho})\,\Theta + q_{i,1} + (p_i-c)\cdot(\frac{\alpha\rho}{1-\rho}\cdot q_{i,2} + 1)\cdot\frac{\partial q_{i,t}}{\partial p_i}.\end{aligned}$$

Set $\Delta = q_{i,1} + \frac{\partial q_{i,1}}{\partial p_i}\,(p_i-c)\,(\frac{\alpha\rho}{1-\rho}\,q_{i,1} + 1)$, then

$$(p_i - \frac{c}{\rho})\,\Theta + \Delta = 0$$

$$p_i = \frac{c}{\rho} - \frac{\Delta}{\Theta}.$$

If $\Delta < 0$, it is obvious that $p_i < \frac{c}{\rho}$. By simplifying the expression for Δ, we have:

$$\begin{aligned}\Delta &= k_1\, p_i^{\frac{1}{\rho-1}} + (p_i-c)\cdot\frac{1}{\rho-1}\cdot k_1\, p_i^{\frac{1}{\rho-1}-1}\cdot(\frac{\alpha\rho}{1-\rho}\cdot k_1\, p_i^{\frac{1}{\rho-1}} + 1)\\ &= k_1\, p_i^{\frac{1}{\rho-1}-1}(p_i + \frac{1}{\rho-1}\cdot(p_i-c)\cdot(\frac{\alpha\rho}{1-\rho}\cdot k_1\, p_i^{\frac{1}{\rho-1}} + 1)) \qquad (6.1)\\ &= k_1\, p_i^{\frac{1}{\rho-1}-1}\cdot\frac{p_i}{p_i-c}\cdot\frac{\rho}{\rho-1}\cdot(1+\alpha\cdot k_2\, p_i^{\frac{1}{\rho-1}}).\end{aligned}$$

In (12), $\frac{\rho}{\rho-1}$ is less than 0, but other components of the equation is larger than 0, showing that $\Delta < 0$. Consequently, $p_i < \frac{c}{\rho}$.

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