Live Show Everywhere: 
Distribution Dynamics and Internet Influence on Concert Location

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Abstract 
While recorded music sales have plummeted sharply due to the prevalence of piracy, live performances have become an important revenue source for artists. We examine how the concert distribution has evolved and how broadband penetration is associated with concert attraction of particular regions. Using unique recent concert data, we find that concert locations have been dispersed over time, but it varies across the level of popularity. Whereas Superstars’ concert distribution follows the Long Tail trend, Underdogs’ concerts are concentrated to the big regions over the period. Next, the change in broadband adoption rate and the number of concerts suggests that the two are positively associated. Particularly, middle-sized areas with higher broadband adoption by the younger generation attracted greater number of concerts. Internet affects Underdogs’ concerts more significantly than Superstars’ concerts.

1. Introduction

The traditional profit-generating structure in many industries has been altered due to the advancement in information technology. The music industry represents one of the most noteworthy cases. Music artists typically generate income in three ways: royalty from recorded music sales, music publishing fees for songwriters, and revenue sharing from live performances. As music becomes available with low costs or even for free, artists who earn income from concerts may be relatively less affected by the decline in music sales [1], [2]. In other words, the sharp drop in recorded music sales came hand in hand with the rise of the live performance market as a new source of income for music artists [3]. Figure 1 displays this trend in the US. According to historical data, CD sales in 2010 amounted to $3.36 billion, which is only a fourth of the $12.9 billion in sales generated in 2001. On top of that, total recording sales in 2010, $6.85 billion, is a half of 2001 levels. This indicates that digital sales did not compensate for the loss of physical sales. By contrast, total concert sales have increased from $1.75 billion in 2001 to $4.25 billion in 2010. Concert sales exceeded total CD sales in 2010 [4]. In this context, artists may have higher incentive to launch successful concert tours rather than selling more CDs [5].

From the industrial organization perspective, the concert industry is seen as a monopolistic competitive market that controls the process of creation of songs, ticket sales, and live tours. A concert is a non-digitized experience good whose value can be fully recognized only when it is consumed. While recorded music can be substituted for digital format, the experience in the concert venue cannot be replaced by watching video clips of previously performed concerts. In this context, the decisions of planning and executing concerts have

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1. This trend was not exclusive to the US. According to BBC news, live performance sales overtook recorded music sales in United Kingdom in 2009 (Source: http://news.bbc.co.uk/2/hi/entertainment/7945998.stm)
2. As for the income from concerts, artists are paid a proportion of the ticket sales, a typical deal giving around 70-85% of the gross ticket revenues to the artists. This percentage is far greater than that of typical royalties that artists receive from CD sales, which is around 10-18% of the retail sales.
3. Source: RIAA (Recording Industry Association of America)
become important for bands and concert promoters. However, unlike ample previous theoretical and empirical literature that has explored the relationship between recorded music and information technology, the concert industry is a relatively unexplored research field despite its rising importance. The existing studies lack a precise estimation of the effect of the Internet on the music industry, because they only consider recorded music sales in their studies rather than having a bigger picture of the entire music market. This paper challenges the previous bias that Internet adoption has influenced the music industry in by and large negative directions [5], [6]. Two major issues can be raised based on this context: which type of artists has been more influenced between Superstars (famous and popular artists) and Underdogs (small and niche artists), and to what degree does the Internet affect concert distribution.

This paper first examines the dynamics of concerts by focusing on the geographical distribution of concert locations, and then estimates the Internet’s effect on concert distribution. More specifically, after investigating whether the concert location distribution has followed the Long Tail trend over the period, the approach draws from the significant differences in broadband adoption rate across geographic locations to assess the influence of broadband adoption on the number of concerts. For the study, the concert history data collected from two unique sources is matched with US Core-Based Statistical Area (CBSA). The findings from rank-size log linear relationships state that the concert distribution of Superstars has remained relatively stable and showed the Long Tail trend. Yet, strengthened Power Law distribution is observed for Underdogs. While popular and well-known bands choose to perform in small areas rather than concentrating more on big markets over the period, small bands have chosen big cities for their concerts.

What caused this discrepancy? As noted earlier, we assume that the variation of Internet adoption has affected this phenomenon. The empirical result indicates that higher broadband adoption has created more concerts after controlling other factors over the period. In particular, broadband penetration among the younger generation in middle-size areas is most highly related to the attraction of concerts. Finally, the results show that the Internet affects the Underdogs’ concert attraction more significantly.

This paper contributes to the growing literature on concert market in the music industry. A study [7] suggests a variety of topics regarding the concert industry for the future research, and other researchers provided a theoretical framework by considering recorded music and concert together [8]. Based on this foundation, researchers conducted empirical works to examine the relationship between recorded music sales and concert revenues in greater details [2]. Their study found a negative impact of file sharing on recorded music sales and offsetting implications for live performances. The study is a substantial foundation of this paper. However, the data they used cover the years 1993-2002, which is a premature period in the Internet era and hardly sufficient to explain all the dynamics of the current concert industry by taking into account the ever-growing use of broadband services. This paper uses up-to-date data by which we were able to explore more recent trends and the impact of the Internet.

This paper is the first study to link the Internet to concerts in the US since Internet adoption has prevailed in the 2000s. To accomplish this task, the discussion proceeds as follows: Section 2 provides research contexts and research hypotheses, and Section 3 describes the data. Section 4 and Section 5 provide empirical models and results, respectively. Section 6 provides an analytical model of an artist’s behavior, and we conclude and discuss our findings and implications in Section 7.

2. Research Contexts and Hypotheses

2.1. The distribution of concerts

The study is associated with previous studies of Pareto (power law) distribution and Long Tail trend in the media industry. The term “Long Tail” describes the phenomenon that niche products make up the large share of the total sales [9]. Some earlier literature identified both the demand side and the supply side to explain the Long Tail phenomenon [10], [11]. The more recent work provides the evidence regarding whether the consumptions of media or the Internet goods follows the Long Tail trend [12], [13]. Our study is an extension for these previous works; however, we emphasize a spatial point-of-view that is different from the conventional approach. We examine whether there has been a trend of either Long Tail or Pareto distribution across regions over time. The unit of analysis is each CBSA, and CBSAs are ranked according to the number of concerts each year. Not surprisingly, highly populated locations such as New York City, Los Angeles, and Chicago hold a great deal of concerts, and less populated regions hold a smaller

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4 A Core Based Statistical Area (CBSA) is an area defined by the Office of Management and Budget based around an urban center of at least 10,000 people and adjacent areas socio-economically tied to the urban center by commuting. Areas defined on the basis of these standards applied to Census 2000 data were announced by OMB in June 2003. These standards are used to replace the definitions of metropolitan areas that were defined in 1990.
number of concerts. In this context, our first hypothesis is:

Hypothesis 1: There are significant differences in concert location distribution between Superstars and Underdogs. The Long Tail trend is stronger with respect to Superstars than Underdogs.

2.2. The impact of broadband adoption on attraction of concerts

Which factor is associated with the change in the concert distribution? We assume that the Internet’s effect is correlated to the dynamics of concert locations as it did in the recorded music market. This topic is relevant to the literature on the effect of information technology on the sales of physical products in the media industry. First, when it comes to movie business, the impact of information technology on DVD sales and box office revenue is a growing research area. Whereas the study found that broadband penetration had a positive impact on DVD sales [14], the other study stated that Internet piracy had no effect on movie theater attendance, but had a negative impact on sales and rentals of movies by survey data [15]. Second, when it comes to the music industry, there is a vast literature in this respect, particularly on piracy. Even though a few empirical studies show the positive sampling effects of file sharing on CD sales [16-18], the majority of studies conclude that file sharing reduces recorded music sales based on practitioners’ opinions [5], [19-21]. Some researchers find that file sharing is unrelated to changes in sales [22-24]. Similarly, there are two competing effects due to Internet adoption in the music industry [20], [22]: a positive effect, such as sampling or awareness effect, and a negative effect, such as substitution effect. Between these two impacts, we argue that the adoption of broadband is positively associated with the change in the concert industry.

Hypothesis 2: Higher broadband penetration is positively associated with more attraction of concerts over the period.

Hypothesis 3: The impact of broadband adoption by the younger generation or high-income group is highly associated with the increase in the number of concerts.

Hypothesis 4: The impact of broadband adoption is more significant in small regions than big regions.

Hypothesis 5: Underdogs are more influenced by the Internet than Superstars.

As broadband adoption increases in smaller regions, demand for concerts is more likely to increase for several reasons. Ticketing websites, artists’ blogs, and social networking services provide more information, about musicians, recent release of albums, upcoming concerts, local venue, bargaining tickets, and so on. The potential audience obtains more information with lower search costs, and suppliers of concerts can promote them with lower marketing costs [10], [11].

3. Data

We employ three data sources. The data on concert history come from Songkick.com6 and Pollstar magazine7. These two sources provide exhaustive history data of all concerts in the period from 2001 to 2010 within the US. The data include information on the main performer (or headliner8), location (city and state), and date. The concert data are mainly based on Songkick, and they were crosschecked with data from Pollstar Boxoffice. All aggregated concerts are classified by CBSA-level. Next, we categorize concerts into “Superstars” and “Underdogs” group. Two distinct groups are divided according to the following criteria: if a band was listed on the Top 200 North American Tours by Pollstar magazine measured by annual gross ticket sales at least once or more in 2000s, the band is classified as a Superstars group. By this standard, 692 independent artists were selected as a reference for the Superstars group, and others in the Underdogs group. A drawback of the data is the difficulty in recognizing actual concert sales and attendance of each concert. It is noteworthy that we assume that the number of concerts is equivalent to the unit sales of products by artists, even if the actual concert sales and the number of audience contain a wide variety. Touring a particular location is accompanied by an artist’s consumption of time and energy; namely, the choice of location yields growth driven by high-speed Internet connections. Household broadband penetration rate in the US reached around 50% at the end of 2006. (Source: http://www.pewinternet.org/Media-Mentions/2006/Broadband-Power-Drives-News-Use.aspx)

6 Songkick.com was created by machine learning experts, and the comprehensive database has been created by using indexes of 135 different ticket vendors, venue websites, and local newspapers.

7 Pollstar Boxoffice database provided by Pollstar Magazine is the most reliable source of concert industry data. Since 1981, the magazine has collected and published concert history data, and venue managers voluntarily provide data to Pollstar based on their incentive scheme. Venues have an incentive to report their data because Pollstar disseminates the information to potential clients. Managers report data on a wide range of musical concerts and occasionally on other entertainment events.

8 It is noted that a concert performed by a single band and a concert performed by more than one band were counted separately when counting the number of headliners. For example, “U2” is an independent headliner. “U2 and Eric Clapton” or “U2 and Dave Matthews Band” are other independent headliners.

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5 According to the Pew Internet study, 50 million Americans obtained their news online on a typical day, with much of that
opportunity costs. As a result, each concert can be regarded as a unit of production, regardless of the size of the concert.

Our third data source is Current Population Survey (CPS) by the US Census Bureau. The Computer Use and Ownership Supplement to the CPS provides broadband penetration levels across CBSA. For each CBSA, we compute the fraction of respondents answering yes to the question of home Internet access using sample weights provided by the CPS. Broadband adoption is measured by the number of responses, in which respondents are accessing the Internet using DSL, cable modem, satellite, WiFi, or fiber optics. After 2000, these data are available for the years, 2001, 2003, 2007, and 2009. The four years of data are divided into two periods, early and late periods by averaging 2001&2003 and 2007&2009, respectively. We also include broadband penetration by younger generation (age: 15-35) and high-income group (annual income: above $60,000), because these groups are considered as a majority of concert audience. The concert history data during 2001-2010 are reported in Figure 2 and Figure 3.

Figure 2. Number of concerts (2001-2010)

(Source: Songkick.com and Pollstar Boxoffice)

Whereas the number of concerts and artists in the Superstars group were relatively stable, those in the Underdogs group have increased over the period. Next, Table 1 displays concert distribution by each quartile on the basis of 365 metropolitan CBSA by the rank order according to the number of concerts each year. It appears that the distribution was highly skewed to the first quartile (large CBSAs such as New York City, Los Angles, Chicago) in 2001, and there was no concert in CBSAs of the fourth quartile in which there are relatively small populations; however, in 2010, the proportion of the top quartile shrank to about 82%, and more than 5% of concerts were performed in CBSAs of the third and fourth quartiles. This characteristic corresponds to the main argument of this study.

Finally, Table 2 presents the number of concerts, broadband penetration, and other demographic characteristics for 248 CBSAs across both early and late periods. The study is based on 365 metropolitan-level CBSAs. However, since concerts have been rare in CBSAs with smaller population size even in metropolitan regions, CBSAs in which the population size is over 100,000 as of 2001 were taken into account; as a result, 248 out of 365 CBSAs are included, and these selected CBSAs cover approximately 80% of the US population. One can easily see that there is a clear difference between the two periods in terms of broadband penetration.

4. Empirical Strategy

4.1. The distribution of concerts

As shown in Table 1, concert location distribution follows the Pareto distribution that states that a top-ranked 20% of CBSAs covers about 80% of concerts. Following [13], our approach is based on a quantile regression model. By examining a series of quantiles of the distribution, one can assess how the concert distribution changes across quantiles with time covariate. The quantile regression model has been widely implemented in the fields of economics and finance [23], and it is being increasingly employed in studies of media and Internet goods [13], [24]. This allows us to study especially whether the possible changes in distribution occur in the head or in the tail. A typical rank-size relationship is merged with this approach, and the model we estimate is the following:

\[
\log(Q_{it}) = \beta_{0}(\gamma) + \beta_{1}(\gamma) \log(band_{it}) + \sum_{j} \beta_{j}(\gamma) Year_{it} \log(rank_{it}) + \delta \cdot \sum_{j} Year_{it} + \epsilon_{it}(\gamma)
\]

where \(Q_{it}\) is the \(\gamma\)th quantile in the yearly share of concerts in CBSA \(i\) at year \(t\), and \(\beta_{0}(\gamma)\) is a constant term. \(Year_{it}\) is time dummy of CBSA \(i\) at year \(t\), and \(Band_{it}\) is the number of bands performed in CBSA \(i\) at year \(t\) and \(Rank_{it}\) is a rank of CBSA \(i\) at year \(t\). \(\epsilon_{it}(\gamma)\) is the error term at quantile \(\gamma\). It is worth noting that the total size of the market obviously affects the number of concerts in each location. An increase in concerts in a large CBSA can reflect either a strengthened Pareto distribution or the expansion of concert market in itself. Hence, to control this potential bias we use shares of locations rather than the number of concerts as the dependent variable [12]. In order to capture whether the concert distribution is more concentrated year-by-year, time dummies are included. The use of
Year dummies allow us to account for a non-linear increase in the shift of concert concentration. As more bands launch more concerts, the shape of concert distribution may shift according to the location choice by the bands. If the Long Tail effect does exist, we expect coefficients associated with the rank to become smaller over the period.

4.2. The impact of broadband penetration on the attraction of concerts.

In the following analysis, we assume that variation in broadband penetration over time and across locations is exogenous to artists’ concert location choices. On the one hand, this assumption seems to reflect reality as other factors mainly affect artists’ decisions to select concert locations. On the other hand, to account for the fact that broadband adoption may depend on local economic and demographic factors, which is correlated with the number of concerts, our regressions include these factors. If the Internet’s influence on concert attractions was the only effect of our interest, then, assuming the exogeneity of changes in Internet penetration, we could identify the effect from the cross-section of concert information. However, a cross-section of observations will not suffice for the identification due to the omitted variable problem and/or time-constant regional factors.

Given these restrictions, we employ the First Difference (FD) strategy. This approach allows us to eliminate unobserved location-specific factors that affect the concert attraction to also be correlated with the broadband penetration. To estimate how broadband penetration is associated with the attraction of concerts across regions, the basic specification is as follows:

\[
\log(Y_{it}) = \beta_0 + \beta_1 \text{internet}_{it} + \beta_2 \text{internet}_{it} D_{it}^{\text{large}} + \beta_3 \text{internet}_{it} D_{it}^{\text{medium}} + \beta_4 \log(\text{pop}_{it}) + \beta_5 \log(\text{venue}_{it}) + \beta_6 \text{youngage}_{it} + \beta_7 \text{highedu}_{it} + \beta_8 \text{male}_{it} + \beta_9 \text{white}_{it} + \beta_{10} \text{highedu}_{it} + \beta_{11} D_{it}^{\text{large}} + \beta_{12} D_{it}^{\text{medium}} + \epsilon_{it} \quad (t=1,2)
\]

\[
\Delta \log(Y) = \beta_1 \Delta \text{internet}_{it} + \beta_2 \Delta \text{internet}_{it} D_{it}^{\text{medium}} + \beta_3 \Delta \text{internet}_{it} D_{it}^{\text{large}} + \beta_4 \Delta \log(\text{pop}_{it}) + \beta_5 \Delta \text{youngage}_{it} + \beta_6 \Delta \text{highedu}_{it} + \beta_7 \Delta \text{male}_{it} + \beta_8 \Delta \text{white}_{it} + \beta_{10} \Delta \text{highedu}_{it} + \Delta \epsilon_{it} \quad (3)
\]

The unit of analysis is metropolitan CBSA \( i \). Since our interest is to examine how the Internet’s effect is different according to the size of regions, the sample is classified into three groups by population size: small region- 100,000-500,000, middle region-500,000-1,000,000, and large region- more than 1,000,000. The dependent variable (Total concert, Superstars’ concert, or Underdogs’ Concert) is measured at CBSA at both early (2001-2004) and late (2007-2010) periods. Variables of interest are internet, (the level of broadband penetration in CBSA \( i \), measured as the percentage of consumers with broadband access) and interaction terms with regional size dummies, \( D_{it}^{\text{medium}} \) and \( D_{it}^{\text{large}} \). It is noteworthy that internet is interchangeable with the broadband penetration among the younger generation and high-income group. Other demographic factors are controlled, such as age, income, education, gender, and race. Finally, we also include the population size and the number of available venues that should be positively correlated with the number of concerts. By differencing two periods, the region fixed effect and time-variant constant are eliminated as well as the venue term since we assume that the number of venues did not change in the given period.

There are three econometric issues that our approach must address: endogeneity, sufficient variation, and standard errors. In our specification, the broadband penetration variable denotes a proxy variable to measure Internet activities that are related to concerts. While some specific factors such as artists’ online promotion and communication with their fans have a positive effect on the increase in concerts by raising awareness, other factors such as watching a video clip of a previous live performance can have a negative substitution effect. We assume that broadband penetration explains the mixed impact of the Internet’s effect. In addition, assuming that \( \Delta \epsilon_{it} \) and \( \Delta \text{internet}_{it} \) are uncorrelated may be reasonable after controlling other demographic factors in specification (3). Second, as shown in Table 2, the difference between two periods of broadband penetration has sufficient variations across CBSAs. Finally, we assume that \( \Delta \epsilon_{it} \) is a normal independently and identically distributed variable, but used robust standard errors in our estimation.

5. Results

5.1. The distribution of concerts.

Table 3 reports the estimation results of rank-size relationships for OLS and quantile regression models for the 25th and 75th quantiles. First of all, the fit of the models is reasonably good in all specifications. Second, as expected, it is observed that the number of artists performed \((\log(\text{band}))\) does indeed have a strong and significant negative impact on the concert shares for all specifications. It is also observed that this impact is stronger for lower quantile than for higher quantile or OLS, suggesting that the mechanical impact of share dilution affects small regions more than big
regions. However, Year and log(rank) terms also exhibit significant effects. This confirms that the shift in the distribution of concerts does not only stem from a mechanical effect.

Next, the previous study suggests that appropriate Pareto parameters are in the range of 0.9 to 1.5 for OLS results [25], and all coefficient estimates of log(rank) every year are significant in the range. The change in magnitude of coefficients of log(rank) and its interaction terms indicate whether the distribution follows either the Long Tail or Pareto trend over the period. In Column (1) to (3), total concert distribution has become more concentrated in big markets. More specifically, the coefficient estimate of log(rank) in 2001 was -1.196 and this has decreased by -0.229 in 2010.

A more interesting result comes from the comparison between Superstars and Underdogs. While the slopes of Superstars have become gradually gentler, those of Underdog have become quickly steeper. At the same time, the constant (y-intercept in the graph) became smaller for Superstars and greater for Underdogs. That is, Superstars perform more concerts in smaller regions, and it follows the Long Tail trend geographically and over the period. By contrast, Underdogs hold more concerts in big cities, which indicates that the Power Law trend has been strengthened. The first hypothesis is supported from these findings. The plausible drivers of the trends are related to widespread Internet usage. As Superstars communicate with their fans via online social media, they discover unmet needs through fans living in smaller towns. From the perspective of Underdogs, online channels could be utilized to promote their songs and activities, and then, in order to reduce risks, they are likely to launch their tours in big towns where population size is sufficiently large. Results from quantile regressions are consistent with those from OLS, but the magnitudes of coefficient estimates are mostly greater than those from OLS. This might indicate that the distribution of concerts is highly skewed; namely, more variety of variations is observed in both sides. Overall, our findings state that there is a complex rank-size relationship, which offers possible interpretations for the mixed results on the Long Tail and Pareto trends. However, it is clear that Superstars and Underdogs show distinct behaviors in terms of choosing concert locations.

5.2. The impact of broadband penetration on the attraction of concerts

Before presenting the FD results, our primary interest, we start with cross-sectional approach for both the early and late periods by Equation (2) in Section 4, and Table 4 displays the results. In Column (1) through (6), none of the coefficient estimates regarding broadband penetration show statistically significant impacts on the number of concert in the given period, whereas population size and the number of venues are positively and significantly correlated with the number of concert. The other interesting finding is that ratios of younger people between ages 15 to 35 and highly educated people are positively associated with the number of concerts. This can be interpreted that these groups would be the major audience of concerts. Not surprisingly, this OLS specification is likely to suffer from omitted variable problems. In spite of a set of demographic factors in the specification, other unobserved factors are not considered at all.[12]

Thus, FD method is applied for eliminating time-constant effects, and the results are reported in Table 5. Broadband penetration rate is positively associated with the attraction of new concerts in all specifications through Column (1) to (9), and they are statistically significant. In Column (1), while 1% higher broadband penetration in small region is associated with the increase in the number of concerts by 1.04%. In middle-size region, broadband impact is greater by 1.07% than in the small-size region. In Column (2) and (3), we can see that broadband adoption by either the younger generation or the high-income group has a stronger impact on the increase of concerts than overall broadband adoption. In Column (2), a 1% increase in broadband penetration of younger generation in the middle region is associated with the increase in the number of concerts by 7.45% (3.54%+3.91%). The impact of broadband adoption by the high-income group in the same region is 4.26% (2.02%+2.24%), which is still greater than the impact of the overall penetration. When it comes to the comparison between Superstars (Column (4)-(6) and Underdogs (Column (7)-(9)), one can clearly see that impact on Underdogs’ concerts is greater than that on Superstars. Particularly, 1% higher broadband penetration of younger

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10 Superstars: 0.343(2001) vs. -0.595 (2010), Underdogs: 0.680(2001) vs. 1.321(2010)
11 To strengthen our results, we checked if the distribution of concert locations in a particular year is different from others. Kolmogorov-Smirnov test was applied in each pair of years. Test results revealed that the distributions were significantly different across years.
12 We also considered the unobserved factors affecting the dependent variable by including region and period fixed effects to capture time-constant and time-varying factors, respectively. The pooled OLS results showed that broadband penetrations in middle and large regions are positively and significantly associated with the number of concerts unlike the previous single cross section results. However, this approach still contains the omitted variable problem.
generation in the middle region is associated with a 9.55% (3.40%+5.15%) increase in Underdogs’ concerts in Column (8). Most control variables are not statistically significant throughout all specifications in Table 5. In a nutshell, broadband adoption is positively correlated with growth of concerts, which indicates that positive awareness effects through online channels are essential for the increase in live performances.

6. Analytical Model of Artists’ Time Allocation

We found empirical evidence that artists have chosen to perform more concerts in diverse places over the period despite the fact that it requires more time and effort. Intuitively, the main reason might be a decrease of their income from recorded music sales. From a theoretical perspective, this is related to their time allocation problem to maximize utility (or income). A considerable amount of research has examined the behavior of decision-makers when resource allocation decisions meet with setbacks such as decreased revenues or increased costs, resulting in unanticipated and unfavorable long-term outcomes [26]. We analyze why artists devote themselves to perform more concerts by economic theory of the allocation of time. While traditional economic theory explains that the supply of hours of work from an individual is valued at his rate of pay, we can see artists’ optimal time allocation in a more realistic and reasonably way by including the hours of work of the individual in his utility function, which is based on the vast literature regarding time allocation issue [26-29]. Artists may spend his time in either recording or live performance activities, and their choice relies on time and money at the same time. According to the model provided in the study [26], the objects of artist preference are assumed to be uses of time or activities measured in units of time. Thus, we have time spent at each activity such as recording and live tours. Artists choose the most preferred set of activities subject to the behavioral constraints imposed by the availability of time and money. The artist’s utility function is

\[ U = U(a_i) \quad (i=1,2,...,n) \quad (4) \]

\( a_i \) is the number of units of time the artist spends in the \( i^{th} \) activity. For instance, the recording work is a primary and necessary activity, which is \( a_1 \), and each live tour can be \( a_2, a_3, ..., a_n \). The artist’s attempt to maximize utility is subject to two constraints.

\[ \sum_{i=1}^{n} a_i = T \quad (5) \]

\[ \sum_{i=1}^{n} r_i a_i + M = 0 \quad (6) \]

Assuming that the unit of time is an hour, the cost per hour \( (r_i) \) is positive if an artist pays for the activity (e.g. an artist’s own leisure activity), negative if he is paid (e.g. album royalties and concert revenues), and zero if the activity is free. \( r_i \) of some activities may be equal to the sum of several different costs that are involved in the activity \( i \). We also assume that an artist needs a minimum amount of money for his living, \( M \). Using the technique of Lagrange multipliers, a new function can be formed from the utility function and the two constraints.

\[ L = u(a_i) + \mu \left( \sum_{i=1}^{n} a_i - T \right) + \lambda \left( \sum_{i=1}^{n} r_i a_i + M \right) \quad (7) \]

The first order conditions for a utility maximum found by setting the partial derivatives of (7) equals zero, and the following equations are obtained for each activity, \( i \).

\[ u_i = \mu + \lambda r_i \quad \text{or} \quad u_i - \lambda r_i = \mu \quad (8) \]

\( \mu \) is the marginal utility of time and \( \lambda \) is the marginal utility of money. Thus, the hours spent in each activity depend on its utility and on the rate per hour, which is paid or received for undertaking the activity [26]. The second form in (8) can be applied to the artist’s decision to be involved in more tours. In this form, the equations state that if the artist’s time allocation among his activities is optimal, then a small increase in the time spent in the concert accompanied by an equal decrease in the time spent in the recording would make him no better off and no worse off. If \( r_i \) is negative (he is paid), the earning exactly compensates him for the use of his time in that activity. Thus, if \( r_{\text{Record}} \) is the rate of pay for the artist’s recording activity, \( r_{\text{Record}} \) represents the artist’s valuation of the use of his time in that activity, since he sells his time in that activity. On the other hand if the artist pays and is paid for an activity simultaneously, e.g. if he pays \( r_{\text{Travel}} \) per hour for travel of his tour and he is paid \( r_{\text{Ticket sales}} \) per hour from his live concert, his valuation of time in the activity, concert, \( (r_{\text{Concert}}) \) appears to be the sum of all relevant activities. According to the historical data in Section 1, whereas \( r_{\text{Recording}} \) has clearly decreased, \( r_{\text{Concert}} \) has grown over the period. Thus, based on (8), artists’ time allocation strategies by which they perform more concerts are reasonably explained. Moreover, if we define marginal return of substitution (MRS) between recording and concert as the time in

\[ \text{For instance, } r_i \text{ of a live tour would be the outcome from sum of total revenue and some of total costs including a venue rental, stage installation, and so on.} \]
recording which would compensate the artist for the loss of a marginal unit of time in concert, then

$$\text{MRS} = \frac{u_{\text{recording}}}{u_{\text{concert}}} = \frac{\mu + \lambda^r_{\text{recording}}}{\mu + \lambda^r_{\text{concert}}} \quad (9)$$

In equilibrium, the ratio of the prices is obtained by manipulating (9).

$$\frac{r_{\text{recording}}}{r_{\text{concert}}} = \frac{u_{\text{recording}} - \mu}{u_{\text{concert}} - \mu} \quad \text{or} \quad r_{\text{concert}} = \frac{u_{\text{concert}} - \mu}{u_{\text{recording}} - \mu} r_{\text{recording}} \quad (10)$$

$$r_{\text{concert}}$$ is equal to the value of time spent in concert. In this context, we can consider behaviors of Superstars and Underdogs. Since Superstars’ recording revenues is initially high, they want to achieve relatively high concert revenues. This is the reason they initially focused on concerts in big markets. As the recording revenues dramatically decreased over the period, they were willing to perform their live tours in smaller cities. By contrast, since Underdogs’ initial recording sales were pretty low or almost zero, their threshold to perform their concerts was lower than that of Superstars. Simultaneously, it is straightforward to assume that expected marginal utility from concerts in big markets is greater than that in small markets for Underdogs; therefore, Underdogs may prefer performing in big markets rather than small markets when other conditions are controlled.

7. Conclusions

The decision to select a concert location is an activity in which profit maximization and social influences play a key role. The location choice is the outcome of a decision process that combines prediction of potential audience with their direct or indirect experience. As many researchers examined, the proliferation of online channels has shifted the revenue structure of the music industry. Accordingly, concerts have become more important for bands under the environment in which digital piracy is widespread leading to loss of recorded music sales. To some extent, concerts are not complementary activities for selling more CDs anymore. Instead, live performances per se are the major sources of income for artists that compensate for reduced incomes from the conventional methods [4]. This paper examined concert distribution dynamics that were generated by concert suppliers’ behavioral change, and several interesting findings are extracted. First, more small towns have attracted concerts over the period; simultaneously, there is an incremental number of concerts are performed in big markets. Popularity matters in this context. While Superstars go to small towns for their concerts that correspond to Long Tail trend, Underdogs go to big places to captivate new and wide-ranging audience.

Second, Internet adoption seems to play a pivotal role in delivering valuable and abundant up-to-date information about concerts to potential audience. We found that middle-size towns with higher broadband penetration rates remarkably attracted more concerts than other regions. The Internet’s influence has become greater for broadband adoption by younger generation. Broadband penetration is more highly associated with Underdogs’ concerts rather than Superstars’.

Our study is not without limitations. Firstly, we only consider the supply-side of the concert industry due to the limited data availability in terms of actual sales and the number of audience in each concert. Some impressive dynamics might have occurred in the demand side, such as the impact of the increasing ticket price. Secondly, we only consider broadband penetration and online activities as key factors impacting concerts dynamics, but there may be other forces that influence the number of concerts and distribution dynamics. These limitations leave room for future research agenda. Promising research can be conducted with concert sales data, as an extension to this study.

8. References


**Appendix**

### Table 1. Concert location distribution by quartile

<table>
<thead>
<tr>
<th>CBSA (N=365)</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Quartile</td>
<td>88.74%</td>
<td>86.51%</td>
<td>87.04%</td>
<td>86.82%</td>
<td>86.10%</td>
<td>86.93%</td>
<td>83.33%</td>
<td>85.09%</td>
<td>85.57%</td>
<td>82.69%</td>
</tr>
<tr>
<td>2nd Quartile</td>
<td>8.63%</td>
<td>10.55%</td>
<td>10.31%</td>
<td>10.68%</td>
<td>9.29%</td>
<td>10.25%</td>
<td>11.86%</td>
<td>10.79%</td>
<td>10.18%</td>
<td>12.24%</td>
</tr>
<tr>
<td>3rd Quartile</td>
<td>2.64%</td>
<td>2.94%</td>
<td>2.65%</td>
<td>2.50%</td>
<td>2.61%</td>
<td>2.83%</td>
<td>3.62%</td>
<td>3.32%</td>
<td>2.93%</td>
<td>3.47%</td>
</tr>
<tr>
<td>4th Quartile</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>1.18%</td>
<td>0.79%</td>
<td>1.31%</td>
<td>1.60%</td>
</tr>
</tbody>
</table>

### Table 2. Data summary: broadband penetration and demographic characteristics

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>log(total concert)</td>
<td>1.662 ± 1.319</td>
<td>2.306 ± 1.628</td>
</tr>
<tr>
<td>log(Superstar’s concert)</td>
<td>1.319 ± 1.585</td>
<td>1.628 ± 1.676</td>
</tr>
<tr>
<td>log(Underdog’s concert)</td>
<td>1.138 ± 1.469</td>
<td>1.905 ± 1.788</td>
</tr>
<tr>
<td>Broadband adoption rate</td>
<td>0.164 ± 0.056</td>
<td>0.607 ± 0.100</td>
</tr>
<tr>
<td>Broadband adoption rate (age:15-35)</td>
<td>0.049 ± 0.021</td>
<td>0.173 ± 0.044</td>
</tr>
<tr>
<td>Broadband adoption rate (high income)</td>
<td>0.097 ± 0.043</td>
<td>0.265 ± 0.094</td>
</tr>
<tr>
<td>% of male</td>
<td>0.483 ± 0.020</td>
<td>0.484 ± 0.249</td>
</tr>
<tr>
<td>% of white people</td>
<td>0.843 ± 0.107</td>
<td>0.837 ± 0.114</td>
</tr>
<tr>
<td>% of younger generation (age:15-35)</td>
<td>0.266 ± 0.038</td>
<td>0.259 ± 0.043</td>
</tr>
<tr>
<td>% of high-income people*</td>
<td>0.370 ± 0.091</td>
<td>0.317 ± 0.099</td>
</tr>
<tr>
<td>% of high-education people**</td>
<td>0.178 ± 0.049</td>
<td>0.194 ± 0.066</td>
</tr>
</tbody>
</table>

Note: * High income band- annual income: above $60,000 High education level- above bachelor degree
Table 3: Result: estimates of the rank-size relationship

<table>
<thead>
<tr>
<th>Newspaper Rank</th>
<th>Total concert</th>
<th>Superstar concert</th>
<th>Underdog concert</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-2.15(0.12)</td>
<td>-3.49(0.23)</td>
<td>-1.13(0.11)</td>
</tr>
<tr>
<td>2</td>
<td>-1.19(0.01)</td>
<td>-1.32(0.13)</td>
<td>-1.31(0.13)</td>
</tr>
<tr>
<td>3</td>
<td>-0.20(0.09)</td>
<td>-0.48(0.17)</td>
<td>-0.48(0.17)</td>
</tr>
<tr>
<td>4</td>
<td>-1.13(0.06)</td>
<td>-2.47(0.06)</td>
<td>-1.57(0.04)</td>
</tr>
<tr>
<td>5</td>
<td>-0.86(0.09)</td>
<td>-1.46(0.07)</td>
<td>-1.97(0.11)</td>
</tr>
<tr>
<td>6</td>
<td>-1.85(0.08)</td>
<td>-2.11(0.09)</td>
<td>-2.17(0.05)</td>
</tr>
<tr>
<td>7</td>
<td>-1.41(0.05)</td>
<td>-2.37(0.10)</td>
<td>-1.86(0.03)</td>
</tr>
<tr>
<td>8</td>
<td>-1.86(0.13)</td>
<td>-2.93(1.13)</td>
<td>-1.85(0.08)</td>
</tr>
<tr>
<td>9</td>
<td>-2.09(0.09)</td>
<td>-3.40(0.90)</td>
<td>-1.13(0.06)</td>
</tr>
<tr>
<td>10</td>
<td>-2.54(0.07)</td>
<td>-2.91(0.92)</td>
<td>-1.64(0.03)</td>
</tr>
</tbody>
</table>

Table 4: Results: Robust OLS

<table>
<thead>
<tr>
<th>DV (2)</th>
<th>log(total concert)</th>
<th>log(Superstars' concert)</th>
<th>log(Underdogs' concert)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.497(1.665)</td>
<td>-0.441(814)</td>
<td>2.206(1421)</td>
</tr>
<tr>
<td>2</td>
<td>-1.18(2.452)</td>
<td>-1.14(1.118)</td>
<td>-1.54(2.586)</td>
</tr>
</tbody>
</table>

Table 5: Result: estimates of the rank-size relationship

<table>
<thead>
<tr>
<th>Newspaper Rank</th>
<th>Total concert</th>
<th>Superstar concert</th>
<th>Underdog concert</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.497(1.665)</td>
<td>-0.441(814)</td>
<td>2.206(1421)</td>
</tr>
<tr>
<td>2</td>
<td>-1.18(2.452)</td>
<td>-1.14(1.118)</td>
<td>-1.54(2.586)</td>
</tr>
</tbody>
</table>

Table 6: Results: the impact of broadband penetration (First Difference)

<table>
<thead>
<tr>
<th>DV</th>
<th>Δ log(total concert)</th>
<th>Δ log(Superstars' concert)</th>
<th>Δ log(Underdogs' concert)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δ broadband</td>
<td>0.103**</td>
<td>-0.429**</td>
<td>0.316**</td>
</tr>
<tr>
<td>(Younger age)</td>
<td>-3.548**(0.521)</td>
<td>-1.439**</td>
<td>-</td>
</tr>
<tr>
<td>(High Income)</td>
<td>-0.219**</td>
<td></td>
<td>0.815**</td>
</tr>
<tr>
<td>Δ broadband</td>
<td>1.075***</td>
<td>3.907***</td>
<td>2.242***</td>
</tr>
<tr>
<td>(High Income)</td>
<td>-0.695**</td>
<td>2.608***</td>
<td>1.853***</td>
</tr>
<tr>
<td>Δ broadband</td>
<td>0.356</td>
<td>1.567</td>
<td>0.704</td>
</tr>
<tr>
<td>Δ Age</td>
<td>0.221</td>
<td>0.578</td>
<td>0.547</td>
</tr>
<tr>
<td>Δ High Income</td>
<td>0.244</td>
<td>0.825</td>
<td>0.610</td>
</tr>
<tr>
<td>Δ White people</td>
<td>-0.22</td>
<td>0.584</td>
<td>0.556</td>
</tr>
<tr>
<td>Δ log(pop)</td>
<td>0.199</td>
<td>0.675</td>
<td>0.439</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.528</td>
<td>0.547</td>
<td>0.529</td>
</tr>
</tbody>
</table>

Note: * indicates significance at the 1%, 5% and 10% levels (two-sided test), respectively (standard error in parentheses)