Which Professional Sport Team has the Best Marketing Ability in Driving Attendance? The Stochastic Frontier Approach

Hyunwoong Pyun, West Virginia University
Jeeyoon (Jamie) Kim, Syracuse University
Yongjae Kim, Kutztown University

Method - Quantitative (Professional Sport) 20-minute oral presentation (including questions) Abstract 2017-165

For professional sport teams, revenue generation is an important necessity for profit maximization, and a significant portion of revenue comes from home game attendance. Each sport team operates in different circumstances such as market size, venue, and team performance. While given circumstances have a significant influence on attendance, teams only have limited control over them. Therefore, it is up to team’s marketing ability to increase the number of attendance under given circumstances (e.g., Barilla, Gruben, & Levernier, 2008; Kappe, Blank, & DeSarbo, 2014; Watanabe, Yan, & Soebbing, 2015). While team’s marketing ability can be assessed based on the total number of attendance, factoring in given circumstances in the assessment is critical, as two teams driving same numbers of attendance at a different size market and/or with a winning or losing team does not imply same levels of marketing ability. Then, within given circumstances, which sport team has the best marketing ability in driving attendance? We propose the Stochastic Frontier Model as an approach to answer the question.

The Stochastic Frontier Model was developed in the field of economics to estimate technical inefficiency in production processes (Aigner, Lovell, & Schmidt, 1977; Kumbhakar & Lovell, 2003) and to assess managerial efficiency in various industries (e.g., Chen, 2007; Rosko, 2001). The “frontier” is the maximum output (e.g., production, cost, revenue, or profit) that can be achieved with certain input (e.g., capital, labor, product quality, and location; Kumbhakar & Lovell, 2003). Firms have different frontiers as input varies. Even with the same amount of input, outputs can vary as firms have different levels of managerial efficiency. Efficiency is the ability of the firm to reach the frontier, assessed based on the disparity between the frontier and observed outputs. In technical terms, the frontier function is a composite of observed output, input, and composite error. The deviation from frontier to observed output (i.e., composite error) is assumed to be a compound of inefficiency and random disturbance that can be isolated through statistical treatment. The Stochastic Frontier Model is widely used in economics, as well as sport-related topics (in assessing efficiencies in coaching and labor markets; Humphreys & Pyun, 2016; Lee, 2010). However, the approach has not yet been used in relation to sport marketing.

We argue that marketing abilities of sport teams can be captured through the Stochastic Frontier Model. Applying the approach to the professional sport context, we posit that number of attendance can be considered as output, and given circumstances (i.e., factors not related to marketing ability; e.g., player payroll, team performance, venue, home-city market size) as input. The marketing ability of a team can be assessed based on efficiency, while the frontier indicates the maximum number of attendance achievable. To test our proposition, a study is underway to assess the marketing ability of the Major League Baseball (MLB) teams based on seasonal attendance from 1995 to 2014.

For the assessment, we apply Cornwell, Schmidt, and Sickles’ time-varying Stochastic Frontier Model (1990). The model allows different time trends for different teams, availing better comparisons of efficiency among teams and within a team over time (Lee, 2014). This model basically extends fixed effects panel analysis by assuming unit-specific time-varying inefficiency as a quadratic function of time, after controlling for all possible covariates. In our analysis, seasonal attendance will be used as a dependent variable (data from game-level box score, provided by baseball-reference.com; post-season game attendance not included in the numbers). To control for given circumstances, we will include variables related to team performance (e.g., winning percentage, number of all-star player, post-season appearance, and team total payroll; data from sources such as baseball-reference.com, ESPN, and USA Today website), venue (e.g., stadium capacity, and built year; from each team’s and MLB’s website), and home-city characteristics (e.g., demographic, population, personal income, unemployment rate, existence of other sport
team; data from the U.S. Census Bureau and the Bureau of Labor Statistics) as covariates. Formally:

\[ \ln(\text{ATT}_{it}) = \alpha + X_{it} \beta - u_{it} + v_{it} \quad (1) \]

where \( \ln(\text{ATT}_{it}) \) indicates a natural log of annual attendance for team \( i \) in year \( t \). We apply log transformation, aligning with various studies on game attendance and stochastic frontier analysis. \( X_{it} \) is a vector of all covariates discussed above, and \( v_{it} \) is an error term. Our main interest lies on team-specific time-varying marketing ability, which is captured by \( u_{it} \). Following Cornwell, Schmidt, and Sickles’ model (1990), we assume that \( u_{it} \) is a quadratic function of time:

\[ u_{it} = u_{1i} + u_{2i} t + u_{3i} t^2 \quad (2) \]

where \( u_{1i}, u_{2i}, u_{3i} \) indicate team-specific coefficients which capture the time trend of marketing ability.

In the current stage, data collection is in progress. Data analysis will be completed by the end of January 2017. Once data is analyzed, the following information will be available for each MBL teams: (1) the relative ranking of marketing ability of MLB teams, for each season; (2) the fluctuation of marketing ability of each MLB teams, from 1995 to 2014 seasons; and (3) the maximum number of attendance achievable (i.e., the frontier), for each team in each season. Based on the findings, sport marketers will be able to identify which team showcased superior marketing ability in which year, and marketing initiatives the respective team or year can be benchmarked. Also, providing information on the maximum number of attendance achievable (i.e., frontier) will be useful for sport teams to set aggressive yet reachable attendance goals.

Overall, the Stochastic Frontier Analysis is proposed and will be assessed as an approach to assess marketing ability. The approach will be informative in understanding a sport team’s marketing ability considering imperfect competitive conditions (i.e., given circumstances). Such leveled assessment provides novel insight availing direct comparisons of marketing abilities among various sport teams in different circumstances. While the analysis is applied to the MLB in this study, the approach can be implemented to other professional sport leagues (e.g., NFL, NHL, NBA, and MLS) as well. In applying the approach to other contexts, one suggestion is to consider each team's marketing resources (e.g., marketing expenditure, the number of marketing staff), if information is available; however, the respective information is currently not open to the public.