2018

The Impact Of Chinese Air Pollution On Match Attendance Of Chinese Super League

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THE IMPACT OF CHINESE AIR POLLUTION ON MATCH ATTENDANCE OF CHINESE SUPER LEAGUE

A Thesis

Presented in partial fulfillment of requirements

for the

Master of Science of Sport and Recreation Administration

in the Department of Health, Exercise and Recreation Management

The University of Mississippi

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May 2018

ABSTRACT

To date, environmental issues have become one of the most complex social and economic issues across the globe. Specifically, in the context of sport, the literature has considered how sport organizations may use environmental concerns as a way to connect to consumers, such as through the use of environmentally practices to help build the image of sport organizations. However, despite this lineage of studies, research which has focused on how changing environmental conditions may influence sport consumers are virtually non-existent. Such research is especially important in the case of China, where due to the rapid growth of urban areas and industrialization, there has been a range of environmental issues which has plagued the country. Specifically, air pollution has become one of the most urgent problems in everyday public life in China as many urban centers experience heavy air pollution which has been linked to increased mortality rates in the general population. Furthermore, as China is also one of the fastest developing sport marketplaces, the increased number of individuals who attend sporting events are potentially being exposed to health risks through their consumption behaviors. Considering all of this, the present research focuses on investigating the impact that air pollution has on fan attendance for the Chinese Super League (CSL), the top-level of professional soccer in the country. In order to conduct such an examination, this study utilizes economic theory focused on the demand for sport to develop models to analyze match-level attendance at CSL games. Using data from the 2014 to 2016 seasons, multiple regression analysis is conducted to estimate whether air pollution levels influence consumer interest in attending matches. From this,

the findings not only provide understanding about sport consumption behaviors in China, but also have wide-reaching ethical and policy implications for sport organizations, governmental agencies, and other stakeholders.

ACKNOWLEDGMENTS

I would like to thank Dr. Watanabe, Dr. Yan and Dr. Beason for their guidance and support in approaching this research.

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CHAPTER I

INTRODUCTION

In the last decade, there has been an increase in the development of Chinese sports business. According to the General Administration of Sports in China (2015), the annual growth of sport business over the last decade was at the rate of about 18% which is faster than the 10% growth reported for national economic development (Zhang et al, 2017). Though the sporting goods business plays a predominant role, the demand for sport games has also witnessed tremendous growth as evidence by the increases in the number of sporting events and sport fans in the country (Liu, 2016). Particularly, soccer has become one of the most popular spectator sports and received preferential treatment from the government (Gao, 2014). In the case of soccer, the Chinese Super League (CSL) is the highest-tier soccer competition which has experienced a rapid growth. With sixteen clubs located in cities across China, there has been a large amount of cash flow in CSL from various corporations, leading to investment in foreign soccer stars and coaches. These efforts have gradually driven the league to be a huge global spectacle, which attracted soccer fans to purchase tickets and attend matches. In 2016, it was reported that there were 5,789,135 total attendances for all 240 CSL games. According to William (2016), the average attendance of CSL has been over 21,800 people since 2015, which is equivalent to the attendance numbers in top leagues of France and Italy.

At the same time, while professional sports have continued to grow, as has China's other industries in major urban center. Such growth has led to a number of issues including energy

consumption, automobile utility, and industrial emission (Kan, Chen, & Tong, 2012). Thus, air pollution has an extremely critical problem. It is widely known that China has become one of the countries that suffers the worst air quality in the world (Kan et al., 2009). In 2015, there were 18 cities which had heavy air pollution over a span of 20 days in the winter (Polaris Environmental Protection Network, 2016). Furthermore, a new terminology "Chinese haze" was created to describe the polluted air in Chinese cities. Containing various harmful pollutants, including Particle Matter (PM_{10}, $PM_{2.5}$) and gaseous pollutants (ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide) among many others, air pollution has been focused on by scholars concerning its negative influence on human health in both the short and long term (Samet & Zhang, 2015). It was found that exposure to Particle Matter can increase the risks of cardiovascular disease, respiratory disease, and lung cancer, etc. (Pope & Dockery, 2006; Guo et al, 2016).

Notably, air pollution is most significant in North China, however, the haze problem has gradually spread across China especially in locations with large industrial and population growth. Geographically, it has spread from Northeast China to cover large areas across the country. In heavily populated cities along the east coast such as Beijing and Shanghai, the air pollution is more severe than other places, which can be problematic as CSL clubs are mostly located in urban areas. This is further evidenced by examining geographic maps which display the location of CSL clubs and heavy air pollution. As an everyday issue in the life of Chinese people, air pollution has gradually been embedded in public discussion and can further affect individual lifestyle and consumption behaviors (Bickerstaff & Walker, 2001; Bickerstaff, 2003). Based on the socialization theory, individuals may learn about air pollution and formulate their own value systems through other people's assumptions as well as perception and interaction with society as a whole. As such, media communication, scholarly discourse and daily discussion can all add to

the understandings of the consequences of air pollution (Dai, 2013). Specifically, a documentary called "Under the Dome" in 2014 examining Chinese air pollution rapidly caught the attention of the public and provoked a heated discussion over health and well-being (Xinhua, 2015). It was reported that the awareness of air pollution began to change public everyday behaviors, for example, a lot of people in North China stopped outdoor exercise in order to reduce the exposure to haze (Wanyi News, 2015). There is boom of haze economy in industries that manufacture products such as masks, purifiers as well as detector of $PM_{2.5}$ (Sohu, 2016). Considering that consumers may be influenced by air pollution, the study attempts to investigate the impact of environmental factors on the consumption choices of fans.

In a review of the previous literature, it was found that most discussions regarding the environment in a sporting context have merely focused on how sport corporations initiated efforts to influence consumer behaviors to protect the environment. For example, Smith (2014) discussed how environmental considerations have driven sport teams to take green practices to build environment programs such as Sustainable Saturdays for the Seattle Mariners which encouraged people to participate in environmental practices. Nevertheless, there has been very limited discussion about how environmental problems such as air pollution may influence consumer behaviors, and thus affect the business operations of professional sport teams. To be sure, the understandings of economic consequences of air pollution in the sport industry are nonexistent. In addition, there is no literature which has considered air pollution as a potential determinant for sport attendance.

As such, this research proposes two main questions: Does Chinese air pollution have a significant effect on attendance at Chinese Super League matches? If Chinese consumers are sensitive to air pollution, do they respond to the actual level of air pollution, or to the rating

system reported by the media? In order to examine these research questions, this study turns to the sports economics literature which has provided detailed analysis of fan attendance. Within the model, a number of independent variables such as team performance and stadium characteristics are included (Borland & MacDonald, 2003). This study also introduces new variables of air pollution to examine the relationship between CSL match attendance and Chinese air pollution. From this, the multiple regression analysis is conducted on secondary data to estimate results.

The first contribution of this proposed research is examining the relationship between fan attendance and air pollution. Through analyzing how consumers are influenced by air pollution in a sport context, this study carefully reviewed previous publications in regard to the relationship of sport business and environmental factors. As there is limited attention on this topic, it is the first study that focuses on this question and provides evidence of the potential impact of environment on sport business. In addition, as this study reveals the potential impact of air pollution on match attendance and even on sports business, it plays a vital role in the sports literature in building a new framework in sport demand. Additionally, as previous studies on the determinants of sport demand mainly focus on the five categories: consumer preferences; economic factors; quality of viewing; characteristics of sport contests; and supply capacity (Borland & MacDonald, 2003), the findings provide important theoretical and empirical knowledge.

From the perspective of sport management, another contribution is that it is beneficial to examine the economic effect of air pollution on sports matches and in turn help leagues in event planning and management. For example, the results can illustrate if an increase in pollution will lead to a decrease in match attendance in a game day while the coefficients of the results can

suggest how much the air pollution will affect attendance. With the deepening understanding of determinants that affect attendance, it yields implications for sport events in not only China but in other markets plagued by pollution. Furthermore, if air pollution is harmful to attendance, competitiveness, as well as the revenue of teams and clubs, it will be essential for the league to consider its own policies for hosting competitions.

More importantly, this focus of air pollution contributes to a necessary thinking of health of soccer fans. Air pollution can impact public health through increasing the risks of respiratory disease and lung cancers even in a short term (Tertre et al, 2002; Pope & Dockery, 2006). Thus, watching matches and the incidental traveling mean an exposure to the polluted air, which can lead to a health impact on soccer fans. Especially in the case of China where these soccer stadiums are open-air, it is necessary to call for the cooperation of multiple-level systems including sports managers, governmental policy makers, and environmental policy makers to make their efforts together in the decision-making process.

In addition, this study raises new questions of ethics in sports management. Within the prior sports research, most works focused on how sports corporation can prompt stake holders and sports fans to protect our environment. In turn, such practice of sports corporations is assumed to be beneficial to achieve corporate social responsibility which can further affect the image and legitimacy of these corporations. However, no one has considered how environment itself may affect the health and well-being of sports participants. It is important to appeal for the attention of both scholars and corporations to focus on the ethics consideration of the negative influence of environmental factors on sports fans.

The final results utilize data from 2014 to 2016 to analyze whether air pollution can affect fan attendance at CSL matches. It is found that air pollution have no significant impact on

fan attendance, which shows that Chinese soccer fans do not change their consumption behavior for sport based on the level of pollution in the air. From this, it suggests that soccer fans are willing to attend games in dangerous situations where there will be short and long-term health risks.

Air pollution issues have presented significant and complex questions to public social life in China. In the context of sport, it is important to understand the relationship between air pollution and its influence on consumer behaviors. However, with limited attention given to how the environmental factors can impact consumer interest and demand in sport, the purpose of this proposed research is to examine the relationship between such environmental problems and their impact on match attendance of Chinese league. As a global issue, air pollution is not merely a case in China but also in many countries across the world. As such, the findings of this study have important implications for a wide range of stakeholders, organizations and individuals.

CHAPTER II

LITERATURE REVIEW

In the past decade, sports researchers have focused on the intersections of sport as well as society, culture, economy and environment. To date, there is an emerging concern of sport in relation to environment that attracted increasing attention and interest (Babiak & Trendafilova, 2011; Inoue & Kent, 2012). Specifically, current literature carefully examined the relationship between sport event and environment and indicated that sport mutually influences environment (Lee, 2006; Schmidt, 2006; Casper, 2015). For example, in 2007, the European Commission stated that "the practice of sport, sport facilities and sport events all have a significant impact on the environment" (European Commission,2007, p.10). The discussions are most along the line of taking outdoor activities as well as hosting sport events (Font et al., 2001; Muller et al., 2004; Schemel & Erbguth, 2000) as well as big sport events (Preuss, 2007; Collins et al, 2007; Collins et al, 2012). In terms of sport events, hosting these games is usually criticized for abusing energy as well as producing trash and waste, which harms the environment (Schmidt, 2006).

By acknowledging this, an increasing number of practitioners and organizations in sport events at different levels have started to focus on sport and environment by taking measures to mitigate the potential environmental problems of sport events (Babiak & Trendafilova, 2011). The significance of environmental protection in sport leagues was initially proposed by the Centennial Olympics Congress in 1994 (International Olympic Committee, 2005). In the meantime, the Winter Olympics in Lillehammer, Norway, was recognized as the first attempt to

host a “green” Olympic Games (Schmidt, 2006). In addition, FIFA, which is the biggest administrative association of soccer, set a zero-emission group and developed Green Goal as the guidelines for organizations to follow during events in 2006. However, the problem of sport as well as environment is too complex and multi-dimensional to be solved without the multi-level cooperation of government, non-profit organizations and corporations (Babiak & Trendafilova, 2011; Geeraert, 2016). In particular, the European Union (EU), is now viewed as a leader in improving the policy system and promote awareness of environment protection among various sport organizations (Direskens, 2015). Nonetheless, the inclusion and integration of these different objectives as well as policies related to environment are still very limited (Geeraert, 2016).

In regard to the impact of sport event on our environment, a report in International Olympic Committee classified the impact into four different categories in 2005: short-term, long-term, direct, as well as indirect (International Olympic Committee, 2005). There could be crossover effects along these aspects. Specifically, short-term impact refers to noise and local air pollution usually occurred during the event. Meanwhile, due to the construction of facilities and infrastructure, long-term impact may exit after the event, including soil deterioration or water pollution. To illustrate, building professional sport facilities for leagues and events use natural resource (Dolles and Söderman 2010). Furthermore, direct impact is brought by facility building and human behaviors directly involved in the creation and consumption of event. For instance, hockey is widely recognized as relying a lot on water and ice. From the perspective of creating NHL, the ice-making and resurfacing process is responsible for the significant water consumption (NHL sustainability report, 2014). Also, it is also argued to use up too much energy as well as resource while produce emissions (Casper, 2015). According to the 2014 NHL

sustainability report, 408 metric tons of CO2 emission was produced in generating electricity each game (NHL sustainability report, 2014). In particular, it is highly criticized for energy abuse, greenhouse gas emission, and trash creation during large-scale sport events. For instance, the 2006 Super Bowl in Detroit produced 500 tons of the greenhouse gas carbon dioxide (including transportation) (Schmidt, 2006). In the same year, during the World Cup, every match used up to 3 million kilowatt-hours of energy in average, while an estimated 5–10 tons of trash, including water bottles, game notes, wrappers, etc., was produced by these athletes as well as attendants (Schmidt, 2006). Finally, indirect impact is due to new infrastructures, which are built for the event but not directly related to the sport activities (International Olympic Committee, 2005). In addition, some researchers think that the manufacturing, packaging, transporting of numerous goods such as athletic apparel, souvenir, food packaging, and sport event giveaways could all be regarded as indirect factors(Casper,2015).

On the other hand, environment is also significantly related to the operation of sport events. Damaged environment limits the organization of sport events, in which training teams, planning and hosting games can all be interrupted. Factors as water, temperature and air pollution could all been recognized as issues that affect sport (Lee, 2006; Babiak & Trendafilova, 2013; Casper, 2015). As explained in the above, the operation of hockey games is simply inconceivable without water. “At the NHL, water is our DNA. Before many of our players ever took their first stride on NHL ice, they honed their skills on the frozen lakes and ponds of North America and Europe” (NHL, sustainability report, 2014). As such, Global Warming will profoundly cause the lack of freshwater and ice, thus impacting NHL teams to practice (NHL Green, 2012). Take the Hurricane Katrina in New Orleans for another example, it deeply impacted the sport development in that whole area. After the hurricane, the Louisiana

Superdome, which was used as the facility for the New Orleans Saints of the National Football League (NFL), as well as the stadium for local college football, was served to be the shelter for people living temporarily during the 2005 NFL season. The New Orleans Saints, a professional football team in New Orleans, with no space to take training and play, finally played their scheduled home games in other areas. This environmental change actually brought these professional sport teams and leagues not only social but also economic impacts (Casper, 2015).

Sport and the Environment

Mallen (2011) categorized current environmental publications in this field into two themes as environmental management performance and environmental operational performance (Krippendoff, 1980; Wolfe, 1991; Cachay, 1993; Wenner, 1994; Humberstone, 1998; Cantelon & Letters, 2000; Hede, 2008). Specifically, the first theme was composed of four sub-themes: introduction to the environment and sport issue (Brooks, 2006; Busby, 2003; Cantelon & Letters, 2000; Hede, 2008); stakeholder disclosure and power balances (Lesjo, 2000); operational countermeasures (Babiak & Wolfe, 2006; Jones et al, 2006). Secondly, the other theme focused on how to assess and measure environmental "inputs" as well as "outputs" for sport organizations (Mallen, 2011). Specifically, environmental inputs are the consumptions of hosting events such as the use of gas, electricity as well as water, etc. Environmental outputs consist of waste and emissions during sport events.

Most current studies were predominantly focused on the theme of environmental management in which sport organizations have already realized and done in sport and environment (Stubbs & Slack, 2002). Policies, practices of corporations and practitioners as well as the structure of environmental systems are discussed under this theme (Geeraert, 2016). For instance, there was a study that conducted an interview with Davis Stubbs, who is an executive

director at Green Foundations. The interview was concerned with the origin and development of the sport and environment issue, which has gradually been incorporated in bidding criteria for sport event (Stubbs & Slack, 2002). Furthermore, there is a study analyzing the integration of environmental objectives and sport policies in multi-level organizations. Results indicated that the European Union could have become the potential leader in reducing the negative environmental impact of sport through the utilization of various sport governance systems (Geeraert, 2016). Moreover, Babiak & Wolfe (2006) studied several countermeasures at the 2006 Super Bowl XL such as waste management and green planning, which discussed the important idea of corporate social responsibility in the protection of natural environment.

In terms of environmental operational performance, an increasing number of researchers are concerned with the measurement and assessment on practices of various sport organizations. For instance, in evaluating the impact of visitation at sport events, two quantitative approaches: Ecological Footprints and Environmental Input-Output modeling (ENVIO) have been examined (Collin et al. 2009). Results indicated that each approach has its own advantages and limitations, which asked that more care should be taken when using these techniques. Furthermore, Mallen et al. (2010) assessed the environmental performance of the 42nd International Children's Games, which indicated an ambivalent result. According to the article, while a lot of efforts were spared, only limited environmental performance has been achieved. From there, barriers from various aspects of system and culture were studied in this article. In addition, Paquette (2011) carefully examined all the performance of IOC from 1994 to 2008. Results indicated that the Olympic Movement failed to meet the goal of environmental development in Agenda 21, which is a plan enable the Olympic Games to perform sustainably (Paquette, 2011). Based on that, they discussed the specific problems of sustainability practices existed within the Olympic Movement.

From the perspective of the content of environmental programs between host cities and sport event, Preuss (2013) suggested that variances should be noted. Moreover, personnel perceptions were still examined. Casper and Pfahl (2015) studied on the environmental practices and perspectives of staff in US Division III athletics departments, in which too little expertise, skills, awareness and motivation have been found.

Compared with the rapid development of environmental practices by sport organizations and practitioners, there is very limited scholarly research in this field (Sotiriadou & Hill, 2015). It is widely regarded to provide theoretical basis of practices and performance in sport and environment. Though numerous questions are still unanswered, slow growth in this field is now shown through the increase in publications. In particular, a significant trend shows rising attention on CSR in current research, where various sport corporations were found to grow interest in the environmental aspects over these years (Harris, 2008; Mallen et al, 2008; Persson, 2008; Trendafilova, Babiak, & Heinze, 2013).

Corporate Social Responsibility in Sport

Corporate social responsibility (CSR) was defined as the responsibility of corporations to reduce and eliminate adverse effects that they have on our society (Mohr et al, 2001). According to Trendafilova, Babiak, & Heinze (2011; 2013), corporations are driven by both external forces (e.g., societal norms, government regulation) from society and internal interests (e.g., financial opportunities) to be socially responsible in modern society. Thus, businesses are supposed to develop programs in which they take various activities to support both the well-beings of the individual and the society (Mohr & Webb, 2005). In particular, societies and corporations have become more aware of the issues surrounding environmental sustainability (Babiak, 2009; Ioakimidis, 2007; Casper, 2015). To be sure, the issue of environmental sustainability has

gradually grown as a core principle of CSR, driving corporations to meet the environmental demand in business (van Marrewijk &Verre, 2003; Babiak, 2009; Ioakimidis, 2007). The damage to the environment from sport has also attracted the attention of the industry and the scholars. An increasing number of scholars now believe that it is necessary for sport corporations to mitigate the environmental impact of sports (Babiak & Wolfe, 2006; Walker & Kent, 2009; Smith, 2014). Besides the purpose to mitigate the negative environmental impact of sport, various factors also exert pressure on sport organizations to take green practices (Babiak & Tendafilova, 2010).

In sport field, CSR literature has focused on how sport teams, corporations integrated environmental sustainability into their practices (Smith & Websterbeek, 2007; Babiak & Tendafilova, 2010). For sports teams, an increasing number of scholars think that sports teams are helpful in fostering public awareness of environmental sustainability (Chalip, 2016; Casper, 2015). Based on that, there is a recognition that sports teams have the potential to influence fan behavior in protecting the environment (Casper, 2015; Smith, 2014). One of the main reasons is that the certain team and athletes have special star power in society (Walker & Kent, 2009). In other word, the star power that teams provide can serve as important platforms to educate fans and change their everyday behaviors towards becoming more responsible for the environment. Specifically, to address how sports teams can influence consumer behaviors, Inoue & Kent (2012) examined the environmental practices of sports teams and consumer behaviors based on Kelman's internalization theory, where fan internalize the environmental behaviors by observing teams' green practices. The results reviewed a catalytic role of sports teams which motivated consumers to follow and support the green initiatives and perform environmentally in their daily life. Hence, sport fans may develop awareness of environmental sustainability through the

influence of environmental behaviors of teams (Casper, 2015). Nowadays, many teams have made efforts to build environment programs. The Seattle Mariners, for instance, initiated a contest named Sustainable Saturdays, where fans were encouraged to participate in environmental practices. The program was successful in calling on sport fans to find facts around the ballpark about recycling and other environmental practices and to protect environment (Smith, 2014). The Seattle Mariners had provided a very good example. In the first decade of the stadium Safeco Park has reduced energy consumption by 50% as well as water usage by 40%. The facility was also considered as one of the most environmentally friendly facilities within the MLB, exactly because of the teams' practices on environmental concerns. Like the Seattle Mariners, the Philadelphia Eagles have initiated the "Go Green Program" in order to reduce the environmental impact of sport organizations in a financially-responsible manner (Babiak & Trendafilova, 2011). Meanwhile, according to (Blankenbuehler & Kunz, 2014), many environmentally-friendly buildings have been constructed. For instance, the Milwaukee Brewers focused on the construction of environmental venue and its stadium has gained a LEED certification for environmental design due to a state-of-the-art retractable roof (Liu, 2013). Moreover, at the league level, many sport leagues have tried to mitigate the adverse environmental impact sport events may bring. For example, The NHL has taken several measures to reduce carbon emissions and gain energy savings by using on-site solar power and lower-emission energy sources (NHL, 2014). Also, a website called "NHL Green" was launched to report the program's progress and further educate fans (Henly et al., 2012).

From the perspective of customers, claims were found that CSR actions which can benefits the sport organizations may drive the sport corporations to act more environmental (Walker & Kent, 2009). In other word, the consumption behaviors can be significantly impacted

by CSR practices, which in turn could affect the reputation and profits of sport corporation (Klein & Dawar, 2004). The consumption attitude of sports fans has become directly reflective of the gradual increased awareness of companies' CSR actions (Walker & Kent, 2009). Environmental actions of teams and corporations were found to not only improve fan experience but also build better relationships with the sports fans (Blankenbuehler & Kunz, 2014). From this, the efforts to decrease the environmental footprint can bring both financial and strategic benefits for sports corporations by promoting sales and improving brand images (Henly et al., 2012).

Indeed, many managers have highlighted the importance of environmental CSR due to business considerations (Campbell, 2007; Babiak & Tendafilova, 2010). A lot of literature in non-sports fields has identified that institutional as well as economic stimulations may contribute to the applying of environmental CSR (Campbell, 2007; Deephouse & Suchman, 2008). To examine the institutional as well as economic stimulations in adopting CSR, Babiak & Tendafilova (2010) focused on examining the considerations of sport executives. Specifically, a survey was conducted among North American sport organizations to examine the motivations of their sustainable practices. In so doing, two main factors were identified: legitimacy of business and strategic advantages. There were 22% of the representations showed the purpose to address institutional pressure (e.g. societal expectations, behavior of competitors) while 49% were for the strategic motives (e.g. to be first mover, to develop collaboration systems). As such, the results revealed the tendency that environmental CSR behaviors of sports organizations now has been transformed to be a subset of business practices for sport organizations.

Moreover, media communication is also perceived as vehicle to bring external pressure to sports corporations (Barley & Tolbert, 1997). Through interviewing several different executives from sports related corporations, Trendafilova, Babiak and Heinze (2012) found that media can

pressure sport teams and leagues to take environmental actions. Meanwhile, it functions as a useful tool to report these green practices to the stakeholders and public. First, through communications, media could help to prevent sports teams and corporations from inappropriate behaviors that will affect their corporate image. Second, it supports to enhance the reputation and brand of sport teams and corporations while gives environmental education to the public.

Overall, the two goals of CSR are to minimize the ecological footprint of professional sports and to increase public environmental awareness (Schmidt, 2006). Regardless, there are many aspects that current researches and practices of environmental CSR have not been involved, such as air pollution and wild preservation. In particular, air pollution has become a significant worldwide problem that can adversely affect fans' health and sport business. It suggests that further research is needed to address the association between sports industry and other fields.

Air Pollution in China

To date, the deleterious impact of air pollution has been an important topic for scholars in other fields, considering harm can be brought to the well-being of individuals and society (Shy,1979; Brunekreef & Holgate, 2002). China, in particular, is known to suffer the worst air quality in the world (Kan et al., 2009). According to the Chinese Ministry of Environmental Protection (2010), there were 109 cities across all China that did not meet the National Ambient Air Quality Standard (NAAQS) in 2009. The situation has become a lot more severe since then. In 2015, it was reported that 18 cities in China suffered heavy air pollution over a span of 20 days in the winter (Polaris Environmental Protection Network, 2016). Large cities like Beijing, Shanghai and Xi'an have faced particularly more severe air pollution than others (Wang, 2014). Beijing, for instance, became the first city across China to issue the code-orange alert for air pollution in 2013 (Dai, 2013). In the meantime, many of these large cities also feature popular

sport teams and professional leagues such as Chinese Super League (See Figure 1 and Figure 2). The Beijing Guoan soccer club (a professional soccer club in CSL), for instance, is located in the capital city of Beijing with the attendance of more than 30,000 since 2009. However, with the increasing number of leagues and attendance, teams are given more pressure on its exposure of air p

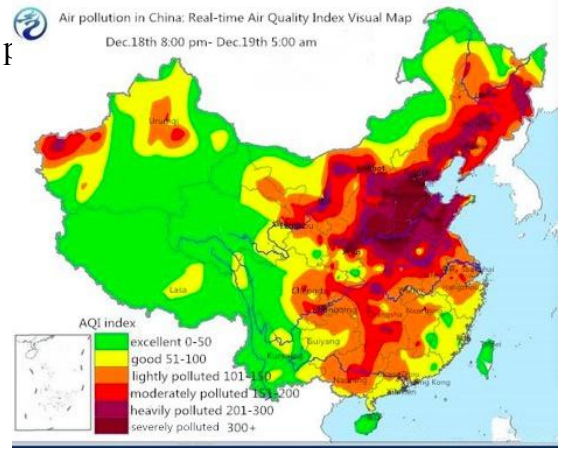

Figure 2.1. Pollution Map

Figure 2.2 Locations of CSL clubs

In fact, a new terminology - "Chinese haze" - was created to describe various air pollutants of high concentrations, which includes Particle Matter (PM_{10}, $PM_{2.5}$) and gaseous pollutants (for e.g. O_3), etc., among many others (Samet & Zhang, 2015). Particulate Matter (PM) is identified as an air-suspended mixture of solid and liquid particles that have different types of number, size, shape, etc. (Giles, 2014). Specifically, PM_{10} (aerodynamic diameter below 10 um) and $PM_{2.5}$ (mean aerodynamic diameter below 2.5um) are two common criteria which are used to describe the particulate matter air pollution. For the gaseous pollutants, there are four criteria now adopted in assessing air pollution: sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), carbon monoxide (CO). Based on the above, China uses an "Air Quality Index"(AQI) which applies the six criteria to measure air quality.

As for large cities such as Beijing and Shanghai, it was reported that values of AQI there were higher than others (which indicates a more severe problem air problem), especially the Particulate Matter (Chen et al., 2011; Graff et al., 2009; Host et al., 2008). For instance, between 2001 to 2004, the annual average concentrations of PM 2.5 in Beijing were in the range of 96.5 to 106.7 μg/m^3 (Duan et al., 2006). It significantly exceeded the recommended concentration of 15μg/m3 from the ambient air quality standard of the US Environmental Protection Agency (Chen, 2011). In Shanghai, the average $PM_{2.5}$ concentrations in 2005 were around 56 μg/m^3 (Duan et al., 2006). Furthermore, Yang et al. (2012) analyzed the data of $PM_{2.5}$ in Beijing (2005–2006), Chongqing (2005–2006), Shanghai (1999–2000) and Guangzhou (2008–2009). The results indicated that the average daily concentrations of $PM_{2.5}$ were 118.5 μg/m^3 for Beijing, while the values in Chongqing, Shanghai and Guangzhou were 29.0, 67.6, and 81.7 μg/m^3, respectively. According to Chinese National Ambient Air Quality Standard (NAAQS), the concentrations were much higher than the 35 μg/m^3 standard of $PM_{2.5}$ (Hexun News, 2016). Since then, the air quality of urban areas in China has been continuously deteriorated. For example, Shenyang, which is the capital city of Liaoning Province in northeastern China, suffered terrible air pollution in 2015. During the winter, the concentrations of haze in Shenyang once were over 1400 μg/m^3 (Chinese Environment Monitoring Center, 2015). It was reported that the haze problem was most significant in the North China at first, and now it has gradually spread across China from the Yellow river valley to the central China, from northeastern to northwestern and southwestern (Dai, 2013). Specifically, Chengdu, which is a large city in southwestern area has suffered heavy air pollution in 2016. According to the 2016 Report of Air Quality in Chengdu, there were 104 days of light level pollution, 35 days of medium level pollution and 13 days of heavy pollution (Hexun News, 2016).

The effect of pollution's consequences has been very well studied. Scholars have pointed out that air pollution can directly or indirectly affect public health, especially by increasing the risk of cardiovascular disease, respiratory disease and lung cancer (Schwartz, 1993; Cohen, 2003; Tertre et al, 2002; Pope & Dockery, 2006; Guo et al, 2016). In particular, the impact of particulate matter air pollution is widely concerned and studied. Varying by aerodynamic diameter, particulate matter is categorized into three fractions: coarse particles or $PM_{2.5-10}$ (aerodynamic diameter between 2.5 and 10 um), fine particles or $PM_{2.5}$ (aerodynamic diameter under 2.5um) and ultra-fine particles or $PM_{0.1}$ (aerodynamic diameter under 0.1 um) (Pope & Dockery, 2006). According to National Ambient Air Quality Standards for Particulate Matter (2006), PM_{10} consists of fine particles and a subset of coarse particles, which could be breathed into the lung. As for PM2.5, it could penetrate the thoracic region of the lung even more easily and remain for a long time (Wilson & Suh, 1997). In addition, it was found that exposure to PM could contribute to cardiovascular disease by causing endothelial dysfunction, increased blood pressure, decreased heart rate variability, and even plaque vulnerability (Brook et al., 2010). What make things even worse, the high temperature in certain cities like Wuhan (the capital city of Hubei Province in central China) was found to enhance the acute mortality of PM air pollution where the effects of PM 10 were strongest in the condition of high temperature over 31°C (Qian et al., 2008).

Moreover, the association between period of exposure time and health impact of air pollution has been closely examined, which indicated that both long- term exposure and short-term exposure has significant impact on health (Tertre et al, 2002; Analitis, 2005). From the last decade, an increasing number of Chinese scholars started to focus on the different exposure time and the adverse impact it has on human health. Kan (2006) aimed to examine the effects of fine

and coarse particles on daily mortality in Shanghai. Results indicated that a 10 μg/m^3 increase in a 2-day exposure to $PM_{2.5}$ could cause a 0.41% (95% CI 0.01%, 0.82%) and 0.95% (95% CI 0.16%, 1.73%) increase of cardiovascular and respiratory mortality. The detrimental effects of air pollution have driven more and more people to pay attention to their health and seek better air quality (Samet & Zhang, 2015). The involvement of government (Zhang, 2014; Ren, 2015) and the practices of corporations are expected to improve current air quality (Peng, 2015; Han, 2007).

Public Perception of Air Pollution

Considering that air pollution has been a part of the daily suffering across China, it can play an important role in the everyday life of both the public and the private spheres. Since the last three decades, some western scholars have come up with the idea of risk perception to describe public understandings of air pollution (Auliciems & Burton, 1970; Bickerstaff, 1999; Bickerstaff & Walker, 2001; Bickerstaff, 2003). Risk perceptions are supposed to be developed from individual beliefs, judgements and feeling, as well as the wider cultural and social dispositions towards hazards. Based on the socialization theory (Haralambos & Holborn, 2002), the developing of public risk perception of air pollution can be a process of socialization, where individuals learn air pollution from society and build own their value system based on other people's assumptions as well as perception and interaction with society as a whole. Specifically, now it has been revealed that perceptions of air pollution have been embedded in public social life through individual own experience, media communication and public socialization (e.g. daily debate) etc. (Bickerstaff & Walker, 2001; Bickerstaff, 2003). Though literature on this issue is still limited in China, the increase of news reports, governmental discourses as well as public discussion upon haze are found to contribute to the significantly improved public risk perception

of the Chinese air problem (Dai, 2013). Here, a picture of how the public consciousness about "Chinese haze" has been improved is provided.

As a result of enduring bad air pollution, many people in China have developed various degrees of awareness concerning air pollution and its consequences (Yu et al, 2013; Sina, 2015). Media is a critical component of our daily life and supposed to contribute to the socialization process in terms of creating appropriate risk perceptions (Dai, 2013). Specifically, in 2014, the former Chinese state television reporter Chai Jing made a documentary -Under the Dome- in regards to Chinese haze, which provoked a wide public attention (Tran, 2015). Chai Jing was motivated to make the documentary concerning Chinese air pollution and health consideration for her daughter was told to have had a tumor when Chai Jing was still pregnant. In this film, she introduced the current situation of Chinese air pollution and the challenge in implementation of Chinese pollution regulation. Through visiting some big polluters and interviewing the local residents, Chai Jing found that many energy companies usually set the production standard directly by themselves. In order to improve the profits, steel producers and coal factories have often ignored the release regulations. A plenty of residents in the neighborhood of these factories were reported to have complained the air issue for a long time. However, related governing departments were not able to solve this problem. To further figure out the impact of heavy Chinese air pollution on individual health, she visited several scientific experts from various universities and related departments in the field. Combing the professional knowledge from experts with comprehensible translation of media, the film plainly showed audience how air pollution can do harm to health and increase the risk of cancer. Through this documentary, Chai Jing called on individuals to take responsibility to protect the environment and protect people themselves. During the 19 hours after its release, there were more than 1.3 million views on

www.youku.com. According to statistics, it had over 150 million views within four days before it was blocked on Chinese websites (DoNews, 2015). The film gained nation-wide attention and discussion in relation to Chinese air pollution and its health impact (Tran, 2015). Especially on weibo.com (a major microblogging site in China), there were immediately over 280 million posts concerning Chai's work and the "Chinese haze" at that time (Tran, 2015). Besides Chai, a lot of traditional media (e.g. television, newspaper, broadcasting) as well as new media (internet-based) have widely reported the "Chinese haze". For example, Dai (2013) found that there were around 200 reports running more than 240 minutes in regards to haze in Beijing TV during 19 days in January, 2013. Since then, "Chinese haze" has continuously been among the top 10 issues of the most urgent topics of public life (Wangyi, 2017). Media has been a critical component of modern society and penetrated individual everyday life. As such, the information provided by media has gradually influenced the development of the public perception of haze, which has become a popular topic among the general public with over 100 million items of online search in www.baidu.com.

Scientific experts, scholars and related directors also contributed to the formation of risk perception in regards to haze. In addition to scientific research, some scholars have tried to voice concerns, which can then be highlighted by media and public (Rooji, 2010). The production of Under the Dome, for example, was supported by a large number of scholars who shared the same serious concern about haze with Chai. For instance, Dr. Tang Xiaoyan from Peking University as well as Dr. Hao Jiming from Tsinghua University have both participated in and supported the scientific research of haze in the investigation. Besides, evidence shows that an increasing number of scholars have made their appeals to solve the current air problems. In this spring, a professor in Law School of Peking University, Shen Kui, was reported to be the first one who

has formally applied for the establishment of a "specific problem investigation committee" in regards to haze management. Shen completed his application through the official websites of the National Energy Board and the State Environmental Protection Department and called for the information disclosure of importing oil in relation to haze (Pengpai, 2017). "The problem should be put on the table to talk," Shen said, "The government of haze is very complex, and it should be a focus of the National People's Congress which could represent the thoughts of public" (Pengpai, 2017). The action was then hotly discussed in the Chinese scholarly field and supported by many researchers. Dr. He Bin from China University of Political science and Law, for instance, thought highly of Shen's idea and expressed his approval.

Being individuals in the socialized environment, people can learn about the "Chinese haze" in various ways such as media report, scholarly work as well as daily conversation. For example, "Chinese haze" has been heated discussed after the release of Under the dome on weibo.com, which is used as a most popular platform for people to express and exchange their thoughts and ideas. Based on that, air pollution has turned into an everyday issue which is frequently reported by media and discussed by the public. The public develops their risk perceptions of air pollution through such an everyday socialization process and in turn change their daily behaviors in order to protect themselves from the harm of haze. First, it can be reflected by the decrease of frequency that people go out in hazed period. "It's much better to exercise indoor than go outside. Exercising under the haze will bring more harms," said Song Limin, a professor in School of Environment Science of Fudan University (Sohu Sport, 2016). Numerous local media in various cities such as Shanghai and Taiyuan publicized the harm of exercise outside in haze period and called on people to reduce going out (China Quality News,

2016). Consequently, many people were reported to have started avoiding outdoor activities such as playing basketball and jogging in order to reduce the exposure of haze (Sina, 2016).

In addition, with the deepening of risk perception of air pollution, it is found that several industries such as information technology and manufacturing have been further influenced. For example, statistics showed that the sales of anti-haze mask, purifier as well as detector of PM2.5 in 2016 have been greatly improved by 260%, 50%, 85%, respectively (Sohu, 2016). Especially from Dec 16th to 20th, the sale volume of anti-haze masks has been over 15 million while most of them were sold to large cities such as Beijing, Shanghai, Chengdu, Tianjin and Guangzhou (Cai, 2015). Moreover, many individuals are found to have gradually developed an everyday habit to follow the AQI (Yu et al., 2013), new apps in regards to Chinese air pollution have been designed and explored. In particular, one of the most popular apps is named the Blue Map. It is designed for ordinary people to understand and monitor daily. Since its release, there have been more than 2 million downloads and a lot of good ratings given in the Apple Store. There was a review written by a user:

"I started to use this app after watching Chai' film. Now I feel very worry every day I look at the sky. I never knew that we have faced such a severe problem which can harm our health. It's our duty to protect our environment, not only for ourselves but also for our children and all the people we love. We should stand up and supervise the behaviors of government and industries. And I believe that one day we can find the blue sky back if everyone can work together."

As one review among a large number of others, it indicated the public concern and worry about air pollution. On the one hand, the development of public attention and risk perception of haze drives selling of this app. On the other hand, the app itself in turn participates in the

socialization process, improves the understanding of haze and satisfies public demands of more information concerning haze. As such, people have developed their own perception of haze through socialization, which in return changes the way individuals and industry behave and increases the attention of society, government and corporations on haze issues.

Chinese Super League

Soccer has become one of the most popular outdoor spectating sports (Zheng, 2015). Statistics from Nielsen indicated that 31% of urban people have interest in watching soccer and the number is still increasing (Gus, 2016). The soccer industry has rapidly developed, especially for the professional soccer leagues. Now there are various tiers within professional soccer leagues in China such as Chinese Super League, China League One, China League Two, etc. Among all of them, the Chinese Super League (CSL) has quickly grown and become the highest-tier soccer competition in the last decade (Watanabe & Soebbing, 2017). There are sixteen current clubs in the CSL league, which are mainly located in large cities of various areas and invested by different corporations. In these years, the soccer clubs have quickly grown up and promoted the development of Chinese soccer industry. Among all these teams, Beijing Guoan was one well known club with a very long history, which could be dated back to last century. Meanwhile, other popular teams such as Shanghai Shenhua, Guangzhou Evergrande and Shandong Luneng also attract a large number of fans and attendance.

It is supposed that soccer has been the priority of government and supported by several new policies (Gao, 2014). Since 2014, the medium and long-term development and the construction of soccer facility have been identified as key tasks in the document of "Opinions on accelerating the development of sports industry and promoting sports consumption" (Souhu, 2015). Follow that, a strategic plan "General Reform Plan to Boost the Development of Soccer

in China" was formally issued in 2015, which involved various aspects such as national soccer teams, professional soccer clubs and youth soccer, etc. (Xinhua, 2015). This reform plan had significant influence on the current development of Chinese soccer, which not only provided clear guidance in administrating soccer clubs and leagues but also attracted huge investment into the soccer business (Liu & Zhang, 2017).

There is a large amount of investment on soccer every year. Particularly in Chinese Super Leagues, it was reported that CSL has gained more than ￥300 million in the first season of 2014 (Daren, 2014). From then on, Pingan Insurance has become the biggest sponsor of CSL and increased its sponsorship to ￥181.5 million last year (Wikipidia, 2017). Besides, great many corporations focused on professional soccer industry and showed their willing to invest soccer clubs. For example, the Guangzhou Evergrande soccer club now plays a very important role in CSL. In 2011, the Evergrande Real Estate Group purchased the Guangzhou Soccer Club through a large sum of money of investment. The name was no later changed to Guangzhou Evergrande. The Alibaba Group paid CN￥200 million for its 40% stake in 2014 and altered the name to Guangzhou Evergrande Taobao Soccer Club. With such a financial support, Guangzhou Evergrande has tried to employ excellent foreign coaches as well as players. Specifically, the current coach staff team consists of several international coaches such as Luiz Felipe Scolari (Head Coach), Paulo Turra (Assistant Coach), Flávio Murtosa (Assistant Coach) and so on. For players, a large amount of money has been paid to buy foreign plays: Paulinho for $12.4 million, Goulart for $18.8 million and so on. Then in 2016, Jackson Martinez from Spanish team Atletico Madrid signed for Guangzhou Evergrande in the deal of $46.7 million. As such, the club has made a big difference and immediately won promotion. From 2011, Guangzhou Evergrande Taobao has won the CSL title every year. In addition, it is the only domestic club which won

AFC Champions League twice in 2013 and 2015. Now It has become the new top one club in China and attracts a lot of soccer fans.

Like Guangzhou Evergrande, other soccer clubs in CSL also spent a lot money to buy players from foreign countries. Specifically, Gervinho moved to Hebei China Fortune in the deal of about $ 17.1 million in 2015 (Lee, 2016). Brazilian international midfielder Ramires signed to Jiangsu Suning club for $36 million in 2016 (Matt, 2016). In the same year, Shanghai SIPG (a professional soccer club in CSL) has paid $61 million for Brazilian player Hulk and broke the record of $51 million for Alex Teixeira (Gus, 2016). The development of professional soccer leagues and clubs gradually attracted an increasing number of fans to follow and watch games (Gao, 2014). According to Wikipedia (2016), there are in total 5,789,135 attendances to CSL for all 240 games. The Guangzhou Evergrande club had the highest attendance of 44,883. The following were Jiangsu Suning, Chongqing Lifan and Beijing Guoan, where the attendance was 38,992; 38,114; and 36,178 respectively. Since 2015, CSL was reported to have an average attendance over 21,800, which is supposed to have the potential to catch up the top leagues in France and Italy (William, 2016).

However, under the pressure of severe air problems, new challenges from the environment emerged. First of all, hosting CSL in various large cities continues to attract soccer fans to follow and travel. The deleterious air pollution in these cities has the potential to adversely impact exposed fans' health and increase their risk for cardiorespiratory disease as well as lung cancer. To date, it still remained unreported in regards to soccer fans' awareness and understanding of air pollution and the health effects of exposure. In addition, with the gradual growth of their awareness, soccer fans can avoid attending CSL games in order to protect themselves from the harmful air. Thus, consumer interest as well as the operation of the soccer

business may be affected by the issue of air pollution. Nonetheless, current literature have mainly focused on the air pollution and certain polluting enterprise (Rooji, 2010; Chan & Yao, 2008), while there is limited discuss on the association between air pollution and other industries such as professional soccer. Even worse, no sport organizations have noticed the negative effects of air pollution on fans' health as well as their business operations. As a result, further attention and researches are still needed to answer these questions.

Theoretical Framework of Sport Demand

There has been extended discussion about the relationship between professional sport events and economics (Borland & MacDonald, 2003; Watanabe, 2015; Watanabe & Soebbing, 2017). In particular, sports economists have shown high interest in understanding the demand for sport events, which is regarded as a critical part of the examination of professional sport (Borland & MacDonald, 2003). Furthermore, decision-makers and executives have also highlighted that sport demand can reinforce the understanding of fans' consumption behaviors, and in turn improve management practices (Downard & Dawson, 2000).

From the perspective of professional sport leagues, the on-field competition is the core product, which further reflects the essence of where fan interest lies (Neale, 1964). Specifically, the core sport product includes not just the outcome of the game, but also the tactics, strategies, style, rules, and other facets of a sport contest (Sutton & Parrett, 1992). To some degree, these factors can be translated into fan interest, which in turn contributes to their consumption behavior, namely, purchasing tickets, watching live contests and buying associated products (Neale, 1964; Borland & MacDonald, 2003). Furthermore, the literature has also discussed various strategic goals and objectives in sport business that are related to demand. From this,

maximizing fan interest is still a top objective for most leagues and teams as consumer interest is vital in generating demand and revenue for these organizations.

With the understanding of such significance, sport scholars have conducted numerous studies considering fan interest and sport demand (Hunt et al, 1999; Quick, 2000; Funk & James, 2001). In reviewing previous studies, Borland & MacDonald (2003) argue that demand for sport can be categorized into direct demand and derived demand. First, direct demand is when the consumer pays for a good, and receives that good in return. Examples of this include the demand for watching game through pay-per-view. Second, derived demand in sport is when "the sporting contest is used as an input in production of another good or service" (Borland & MacDonald, p.479). For instance, sport game can be used to promote other products, such as clothing, outlets, advertisements and so forth.

Both types of sport demand play critical roles in the analysis and understanding of the professional sport market and help teams and corporations make proper judgement as well as decisions (Borland & MacDonald, 2003). Specifically, attendance is considered to be one of the most fundamental and straightforward forms of demand in examining sport products and is also a major source of revenue (Downward and Dawson, 2000; García et al., 2002). As such, there is an essential requirement of understanding the determinants of attendance.

From the consumer perspective, previous publications generally used five main types of determinants to model demand: consumer preferences; economic factors; quality of viewing; characteristics of sport contests; and supply capacity (Borland & MacDonald, 2003). As consumer behaviors can be driven by various motivations and factors, there can also exist some overlapping part between these five categories. First, consumer preferences such as habit are considered to be an essential characteristic of sport demand, where the loyalty for a team or a

sport star as well as a preferred seat are all possible to affect fan demand (Kahn, 2000; Borland & MacDonald, 2003). Besides the preferences of the sporting contest, there are other preferences such as timing of matches and fan accommodation which are found to be critical factors that can greatly affect consumption choices (Hansen & Gauthier, 1989). For example, Drever & MacDonald (1981) found that weekend games and end-of-season games can increase attendance while home dates have insignificant effect on attendance.

In respect to economic factors, there are various variables that may influence attendance demand, including the cost of attendance, income level of attendants themselves as well as macroeconomic factors (Borland & MacDonald, 2003). For cost of attendance, it is regarded to have negative effect on attendance, where the price of admission, opportunity cost (e.g., cost of travel, parking, food during the game period) can contribute to decreases in attendance. Additionally, macroeconomic factors are all theorized to have a relationship with demand, including GDP, unemployment rate, working hours and so forth. In addition, another critical factor in the study of attendance are substitutes such as watching a delayed contest or the potential to attend a different sporting event when there is more than one being offered.

Next, in considering the nature of sporting contests, fans are often influenced by the strength and relative quality of teams. According to Hansen & Gauthier (1989, p.17), the quality of sporting contest can be examined through (a) the uncertainty of outcome (b) the entertainment value such as the strategy applied by teams, (c) the finesse of the athletes, (d) the nature of the sport, (e) the competitive balance (Demmert, 1973; Drever & MacDonald, 1981), and so forth. That is, fans may be attracted to a strong team that wins a lot, while they also have been shown to prefer contests where team are evenly matched. Notably, it was found that fans may have interest in games with uncertain outcomes played by teams with average quality (Peel & Thomas,

1988; Buraimo & Simmons, 2008). Based on this, outcome uncertainty is argued to be one of most important dimensions in describing characteristics of sport contests. As Madrigal (1995) argued, the quality of a sporting contest can still be measured by its sense of drama, which relies a lot on the extent of outcome uncertainty. Worth to mention, competitive balance is also a critical factor to reflect the outcome uncertainty and have a close relationship with fan attendance of contests (Schmidt & Berri, 2001; Humphreys, 2002). According to Leifer (2000, p. 11), competitive balance yields winner and losers in both games and seasons while it still keeps open the chance that winners will lose and losers can win in subsequent games. The lack of competitive balance will lead to the fall of fan interest in the less competitive teams and can in turn decrease of fan interest in the more competitive teams (Humphreys, 2002).

Furthermore, supply capacity plays an important role in understanding and studying fan demand. As stadiums across different sports and leagues have various sizes, there is a need for studies to account for the supply of tickets available. This, sport demand studies utilize the stadium capacity as a control in a regression o account for various sizes. One problem that exists with such an approach is when there are a high number of sold out games. In such cases, it becomes necessary to correct estimations of attendance through using alternate methods like a Tobit regression. For the case of Chinese soccer, it is unlikely a Tobit regression is needed, as there are relatively few games where attendance is equal to or may exceed capacity. As such, the stadium size contributes a lot to determine the supply capacity (Borland & MacDonald, 2003). "Where desired attendance is more than stadium capacity, then rationing will occur, and attendance will be equal to stadium capacity and less than desired attendance" (Borland & MacDonald, 2003; p 483).

To some degree, supply capacity may overlap with quality of viewing, which also concerns the size and age of the stadium. Various studies have focused on quality of viewing when examining sport demand. Prior research has paid attention to how the age of the stadium and stadium capacity may affect the demand of attendance at Major League Baseball (MLB) games, where contrary results have been reported (McDonald & Rascher, 2000; Depken, 2001). In addition, other factors of viewing quality such as the effect of promotion as well as timing of matches have also been carefully examined through analyzing secondary data of attendance at sport leagues including NFL, NBA, as well as MLB (Baimbridge et al, 1996; Carmichael et al, 1999). Finally, weather conditions are also considered to be an important factor which may affect viewing quality. Schofield (1983) and Hynds & Smith (1994) have found that rain has negative influence on fan attendance of cricket while temperature and sunshine were found to have no significant relationship with attendance. British studies reported that spectators at soccer and rugby matches seem to be not responsive to rain or temperature (Bird, 1982; Carmichael et al, 1999) while attendance at football and baseball games in United States may be negatively affected by rain and extreme temperatures (Welki & Zlatoper, 1999; Butler, 2002). From this, it is noted that sport fans do change their consumption patterns based on environmental factors.

From the literature mentioned above, previous studies have focused on several aspects to examine sport demand and its determinants. Specifically, scholars placed focus on the sporting game quality as well as the quality of viewing. However, most scholars who studied the issue of weather conditions concentrated more on the effect of temperature and rain and sunshine, while they have not accounted for air pollution. As such, there are two research gaps found in current research of professional sport. First, there has been very limited discussion about how environmental problem, such as air pollution, may influence consumer behaviors, and thus affect

the business operations of professional sport teams. Most discussions have considered the topic from how sport corporations initiated efforts to influence consumer behaviors and thus protecting the environment. To be sure, the understandings of economic consequences of air pollution in the sport industry are nonexistent. Second, no literature exists which has considered air pollution as a potential determinant for sport attendance. Further research is needed to examine and explain whether air pollution can affect fan attendance and demand of sport. Considering the special characteristic of the Chinese market, this study mainly focuses on the examination of live attendance. Based on all of this, the current study pays attention to the Chinese soccer industry and posits two questions: Does Chinese air pollution have a significant effect on attendance at Chinese Super League matches; If so, are Chinese consumers sensitive to air pollution and how do they response to this type of pollution?

CHAPTER III

METHODOLOGY

In order to examine the relationship between Chinese air pollution and fan attendance at Chinese Super League matches, this research follows the guidance of previous economic studies which have utilized mathematical functions to develop a model to estimate demand (Borland & MacDonald, 2003). As noted, such econometric modeling is primarily used in sport economics research where regression is one of the most common techniques for estimating results (Watanabe, 2015). In order to build such models, it is important to consider the process of developing a function to estimate attendance. This is done by examining prior theoretical and empirical works, and selecting variables that are appropriate for research question.

Within the previous literature, a plethora of economic research utilized modeling to estimate determinants of attendance of several professional sports including football (Hansen & Gauthier, 1989), hockey (Zhang et al., 1996), baseball (Rascher & McDonald, 2000), basketball (Burdekin & Idson, 1991), as well as soccer (Peel & Thomas, 1988; Dobson & Goddard, 1992). Focusing on various leagues including MLB, NBA, NFL as well as NHL, sport scholars have specified demand models utilizing several independent variables representing determinants of demand (Borland & MacDonald, 2003). For instance, in order to understand the two types of direct demand for UFC, Watanabe (2015) used two functions to compare the demand for live attendance and Pay-Per-View, where 20 variables were employed in the model. Specifically, the choice of variables in these models was based on the demand determinants including economic factors, capacity, match timing and contest quality.

Moreover, data collection and statistical methodology are critical in the modeling process. There are three different types of data commonly applied in sport economics research, that is, panel data, cross-section data, as well as time-series data. In the work of Noll (1974), both collections of panel data and cross-section data were applied to estimate the attendance in MLB, NFL, and NHL. On the other hand, for example, Borland (1987) collected time-series data related to average attendance in VFL (Victorian Football League) matches played from 1950 to 1986. Lastly, another approach is evidenced in the demand research (Watanabe, 2015), where a panel dataset of two types of consumer interest was employed from 2001 to 2012, while other related factors such as price and population were also used as control variables. Specifically, this study uses panel data to examine attendance at CSL matches. The reason for this is that a panel is composed of the same observations repeating over time. Thus, as the data in this research examines CSL games, the teams will constantly be observed throughout the dataset.

As the purpose of this study is to model the effects that air pollution has on attendance, there is need to build a model for CSL attendance. In this case, the following function is developed to estimate attendance:

$$Attendance = f(P, M, T, S, A, W)$$

$$= \beta O + \beta_1 HomeWpct + \beta_2 AwayWpct + \beta_3 Population + \beta_4 GRP + \beta_5 Weekend + \beta_6 Holiday + \beta_7 March + \beta_8 April + \beta_9 May + \beta_{10} June + \beta_{11} July + \beta_{12} August + \beta_{13} September + \beta_{14} October + \beta_{15} November + \beta_{16} StadiumAge + \beta_{17} StadiumAgesqr + \beta_{18} Capacity + \beta_{19} AvgTemp + \beta_{20} Clear + \beta_{21} Rain + \beta_{22} Snow + \beta_{23} Derby + \beta_{24} Air\ pollution + \varepsilon$$

In this function, P represents team performance, M is market characteristics, T is Timing of Match, S stands for stadium characteristics, A is air quality, and W represents weather conditions.

To begin with, there is need to explain the dependent variable in this research. While studies examining attendance utilize different factors, such as average attendance, match attendance and total yearly attendance, it is important to define which form is used in this research. Specifically, as this study examines day-to-day changes in air pollution, match-level attendance is the most suitable dependent variable. The reason for this is that because air pollution levels fluctuate greatly from one day to the next, however yearly averages or totals may not representatively examine be representative to short-term spikes in pollution. Thus, match-level attendance is the most suited dependent variable for this study.

Next, turning focus to the factors on the right-hand side of the attendance function, there are six different categories of independent variables (See Table 4.1 in the Appendix). First, considering that fans may be attracted to a strong team that wins more, team performance plays an important role in affecting fan attendance (Borland & McDonald, 2003), where team winning percentage has been widely applied in early studies. Regarded as a proxy of team performance, team winning percentage can indicate the quality of a certain team, as well as the match. In turn, winning percent of home and away teams are commonly used to estimate the relationship between team performance and fan attendance at matches (DeSchriver & Jensen, 2002). In order to better measure team performance and strength, the research uses winning percentage of both home and away teams in this study.

Additionally, market characteristics are another critical factor that need to be considered in this study. In previous publications, these variables also take the form of economic factors which include various measures such as population, ticket price, per capita income as well as

GDP. For example, in the research of Coates & Humphrey (2007), metropolitan area population and income are included as control variables in their model. Considering the complexity of the large population in China, it can be extremely difficult to measure economic factors such as per capita income and travel costs. Within this study, market characteristics are variables taken into account. Primarily through macroeconomic factors are all theorized to have a relationship with demand and can affect consumption behaviors (Borland & MacDonald, 2003). To control for market characteristics, this study employs four variables: City Population, GRP, average household income as well as Derby matches. Specifically, City Population is the population for "build-up" area in a city. GRP stands for Gross Regional Product for that area teams plays for, which is usually utilized in measuring local economic production. For Derby matches, a dummy variable measuring whether a game is played between teams that are rivals or in close proximity to one another. Here, dummy variable that it takes the value 0 or 1 to indicate Yes or No.

Other major factors put forth by prior publications in influencing demand include match timing and stadium characteristics (Hansen & Gauthier, 1989). Notably, several popular dummy variables are usually employed to measure match timing, including weekend, holiday, month and year (Borland & MacDonald, 2003). In this study, a variety of game time conditions are considered such as whether it is played on a weekend, holiday, or in the months from March to November. All the match timing variables in this study are measured with dummy variables.

The factors of stadium characteristics include consideration of two aspects: stadium age and stadium capacity. Particularly for stadium age, to accurately understand the relationship between age and attendance, studies have accounted for both the age and its square term. This allows to not only measure if age has an impact, but if it does so at an increasing or decreasing rate. As for stadium capacity, it contributes a lot to determine the supply capacity, which is

necessary in the understanding of fan demand (Borland & MacDonald, 2003). Through stadium capacity, it is beneficial to account for the supply of tickets available. This research includes three variables to describe stadium characteristics: stadium age, stadium age square as well as stadium capacity.

Moreover, the study also controls for weather condition, to see if Chinese soccer fans are sensitive to environment conditions. There are several different independent variables for weather, which include the average daily temperature in all match cities, wind speed, rain, clear and snow. Clear in this study means that it is sunny or not cloudy. Among these, rain, clear and snow are dummy variables.

Finally, the research specifies a model by introducing the new factor of air quality (See Table 4.2 in the Appendix). Through using measures of air quality for each city in each day, the model can account for how the analysis of air quality in each game day of different cities over season, it can estimate how Chinese air pollution can affect the consumption choice of whether to attend a soccer contest or not. Considering it is a special factor that has not been utilized before, the study employed variables from different rating systems published by the Environmental Monitoring Center of China. Three types of air pollution were created in this study, that is, Air Quality Index (AQI) and two different air rating systems. First, the Air Quality Index (AQI) is a raw number that increases in value as the quality of the air goes down. Second, there are two variables describing different rating systems including RatingMPI and RatingProper. Particularly to account for the different level of air pollution, the research also adjusted AQI and the two rating systems by average in previous seven days, thirty days and a year. As such, several adjusted variables were added to estimate how fan attendance can be impacted by relative levels of air pollution.

In order to estimate results, it is necessary to collect secondary data for all these variables. First, the dependent variable of match attendance was gathered from the official match reports and box scores during the period from 2014 to 2016 on the Chinese Super League website and was then cross-checked through the German Transfermarkt.de website. For the variables of stadium characteristics and market factors, there are two main websites where the data of stadiums seats and age was also collected from the official website of Chinese Super League while the data of market characteristics was gathered from the website of China Statistical Yearbook. Third, air pollution during the three years from 2014 to 2016 was gathered in two forms from the Chinese government's Ministry of Environmental Protection, who regularly publishes daily data on their website. Both of the two rating systems are regularly applied by public media, which scale from 1 to 5 and 1 to 6 respectively. The number "1" represents the best air condition, while "6" is the most hazardous for human health. The reason for considering the rating system is because the Chinese media uses such system to communicate with the public in regard to air pollution level. Thus, it may have a more direct influence on the public than the actual AQI. In addition, other data collected such as the 2014 temperature and wind speed was from the official Chinese weather data website: http://www.tianqi.com.

In this study, the collected data is an unbalanced panel data set because relegated teams do not repeat in future years (Hsiao, 2003). In professional sports research, it is common to have unbalanced panel data for leagues when new teams may be included into a league through expansion or previous teams are relegated. This is the case for the Chinese Super League as the two lowest placed teams by the end of the season will be relegated to the China League One and the top two teams from the League One are promoted, taking their sports.

When analyzing models, there are three regression techniques which are commonly used, including Generalized Least Squares (GLS), Ordinary Least Squares (OLS) regression, and Generalized Method of Moments (GMM) (Borland & MacDonald, 2003; Lee & Smith, 2008). While each method has its advantages and short comings, there is a need to discuss which methodology can be employed to estimate the data collected for this model. When running the data in the model through the STATA statistical software, both fixed-effects and random-effects regressions were estimated. In order to test whether there is a significant difference between the coefficients of the fixed and random effects models (Gujarati, 2000), a Hausman test was conducted. The results showed that there was no significant difference between the models, indicating that either fixed effect regression or random effect regression is suitable to be employed. However, considering the existence of variables such as GRP, population, stadium age, as well as capacity, it is beneficial to apply random effect regression. The reason for this is that these variables hold stable and are time-invariant variables. Accounting that time-invariant variable cannot be estimated in a fixed-effects regression, the model was run as a GLS regression with random-effects. Notably, GLS is considered to be useful in panel data studies especially in the issues of heteroskedasticity and autocorrelation (Winfree & Fort, 2008). Therefore, the final results for this research uses a GLS with random effects, which is regarded to be beneficial when focusing on the demand for goods (Balestra & Nerlove, 1966).

CHAPTER IV

Results and Discussion

This study estimated nine models using different measurers of air pollution to examine whether air quality has an impact on attendance at CSL matches (See Table 5.1, 5.2 and 5.3 in the Appendix). To begin with, Table 5.1 displays the results of three models that control for AQI as well as the adjusted AQI metrics. The first model returns an R-Squared value of 0.6094, which means that 60.94% variation is explained through this data collection. In the other two models, the R-square is 0.6091 and 0.6089, respectively. Next, Table 5.2 shows the results of next three models which utilize the "RatingProper" metric and its adjusted variables separately. The R-square of these three models is reported to be 0.6092, 0.6089, and 0.6092, values that are similar to those in the models in Table 5.1. Finally, Table 5.3 includes three models of MPI as well as its adjusted weekly and monthly RatingMPI, where the R-square is reported to be 0.6093, 0.6089, and 0.6099, respectively. Overall, the R-Squared values from all of the models suggests that they have rather similar explanatory power.

First turning focus to the results of the variables controlling for air pollution, AQI is insignificant in relation to attendance, which suggests that air pollution does not impact the consumption of soccer games by Chinese fans. Considering that people may have been accustomed to the daily air pollution, there is a possibility that fans are more sensitive to the comparative value of these variables in previous period than those raw air quality data on certain

days. Keeping the rest of the variables in the model constant, this research then estimates the model using the adjusted weekly and monthly AQI. Similar to the AQI variable, both the adjusted weekly or monthly AQI is found to be insignificant in relation to fan attendance. These results show that Chinese soccer fans are not sensitive to the actual level of pollution that is present in the air as measured by the Air Quality Index.

While consumers may not be sensitive to the actual level of air pollution, it is possible that they may be responsive to the media reports that warn of the general quality of air pollution. Based on this, the next set of models used the rating system variables. The RatingProper, MPI rating system, and the monthly and weekly adjusted version of these variables were all found to be insignificant, even at the 10% level. From all these results, this study finds that air pollution does not have impact on fan attendance of the CSL games. As for this finding, there can be several possible explanations. First, fans may be not aware of the Chinese air pollution problem or be sensitive to the air quality on certain match days. Thus, either the absolute level of the air pollution or the relative level does not have influence on the decision to attend soccer matches. At the same time, there is also the possibility that fans have noticed the bad air quality but the desire to attend a match drives fans to continue their consumption of sport, even when conditions pose a risk to their health. Worth to mention, a part of fans may purchase game ticket in a far advance of that game day. Thus, it is possible that though they know the air is detrimental, they still tend to take the risk to go to watch a soccer game, support their favorite teams and use the purchased ticket. Even worse, soccer fans may have noticed the air problem, but they are accustomed to such an environment where they spend most of their time. Therefore, air pollution does not negatively impact soccer game attendance, but it indeed hurts the health condition of fans who are usually exposed to the polluted air. Besides, it is also the result of the neglect of

clubs, leagues as well as the Chinese Soccer Association. As is known, the Chinese air pollution has become a significant issue since 2011. In 2013, several fans and reporters had asked the measures of Chinese Soccer Association regarding air pollution (Sohu, 2013). However, there was no exact reply or answer. Till now, no reminder or warning regarding the bad air quality has been found from any club and league. Also, the government can be responsible for this result at the same time. Even though various positive measures (including closing factories, limiting individual cars and so on) taken in order to improve the current air quality (Environmental Protection, 2017), there is still blank space in providing the public with necessary education of air pollution. Based on the insignificant results and these possible causes there is no any evidence showing that an increase in the value of AQI or rating systems can hurt attendance. In other words, the results show that air pollution has no obvious impact on fan attendance and ticket using.

As for the other determinants included in the models, there are several variables found to be consistently significant through the various models. Primarily, team strength of home team and away team is found to have a significantly positive effect on fan attendance. In these models, both home team and away team win percent variables are positive and significant at the 1% level. To be exact, a percentage increase in the winning percentage of a home team can lead to about 150 increases in attendance while a percentage increase in the winning percentage of an away team can attract 100 more people. This result is similar to what was found in several previous studies that fans are attracted to contests with strong teams (Schofield, 1983; Borland & McDonald, 2003). Especially when there are two strong teams, fans will be more interested in these games as they also have high outcome uncertainty (Buraimo & Simmons, 2008).

In terms of market characteristics, population and derby are found to be positive and significant at 1%, while GRP was negative at the 1% level of significance among these models. From this, results show that both population and derby can contribute to an increase in fan attendance while an increasing GRP can reduce the game attendance. The findings of the market characteristics are similar to previous studies such as Cairns et al., (1986), Welki & Zlatoper (1994) as well as Borland & McDonald (2003), etc., who find that the size of local population and derby can be important indicators of potential attendance. In this study, the results can reinforce this argument where population and derby can positively affect game attendance. Specifically, cities with higher populations have greater market potential, and thus CSL teams in large cities seem to be able to better draw fans to matches. Additionally, GRP is found to have a significantly negative effect on attendance. When there is a higher GRP in that city, fewer people may attend the CSL games.

As for weather conditions, temperature is found to be positive and significant at the 10% level across all these nine models. It indicates that Chinese soccer fans prefer to go for a game when it is warmer. A higher temperature is found to have a positive impact on fan attendance where one degree Celsius at the game day can lead to an increase by about 90 persons in attendance. According to the previous studies, there are generally mixed findings regarding temperatures. Schofield (1983) and Hynds & Smith (1994) find that temperature has no significant effect on attendance while Weiki & Zlaptoper (1999) and Butler (2002) argue that extreme temperature has significantly negative impact on fan attendance. At the same time, wind speed is negative and significant at the 5% level in the model of adjusted monthly AQI and significant at the 1% level of all the other models. This indicates that Chinese soccer fans tend to go out for soccer games when there is no wind or only low-level wind. This finding falls in the

line with Anthony et al (2014) findings where a breeze (light wind at lower level) can positively influence on-field attendance. Besides, the rain variable is only found to be negative and significant at the 10% level in the two models of monthly Proper and monthly MPI. Considering that the rain variable is only found to be significant in two models out of nine, it shows that most Chinese soccer fans are not very sensitive to rain in a game day. This finding is counter to Schofield (1983), Hynds & Smith (1994) and Welki & Zlatoper (1999) finding where rain significantly leads to a decrease in fan attendance at football and basketball matches. But it backs up the finding of Bird (1982) and Carmichael et al (1999) where rain does not significantly affect attendance at rugby and soccer matches. Other variables of clear and snow are found to be insignificant in this study, which shows that people do not have a preference of sunshine or snow in a certain game day. Also, there are very few CSL games days found to be snowy.

In term of the determinants of match timing, the holiday variable is found to be insignificant in the AQI model but positive and significant at the 10% level in other models. The weekend variable is insignificant which shows that the attendance of Chinese soccer fans is not influenced by the day of the week, which is counter to Forrest & Simmons (2006) findings where weekends can be more beneficial. As for the month variables from March to November, November is omitted because of collinearity while the rest months are insignificant. The results suggest that Chinese soccer fans do not have a preference based on any specific month of the year. Based on this, the results show that Chinese soccer fans are only sensitive to holidays, when there can be an increase of about 1,800 more people attending the CSL games. This finding can reinforce Knowles et al. (1992) & Carmichael et al. (1999) research where attendance during holidays are suggested to be higher than usual. One possible reason may be that an increasing number of people may be available and have spare time to go for a soccer game during holidays.

Additionally, stadium characteristics are found to be significantly correlated to CSL game attendance where capacity and age can all contribute to the increase of attendants. Results of these stadium characteristics variables are indicated to be significant across all the nine models. Stadium capacity was positive and significant at the 1% level. Considering that stadium capacity can usually be regarded as supply capacity, the larger stadium with more seats was supposed to encourage more soccer fans to come for a game. This finding backs up the argument presented by Borland and McDonald (2003) that fans may use the stadium size to calculate the possibility that they can get a seat. Thus, individuals are inclined to go to a game at a larger stadium.

More interesting are the results of stadium age, which is contrary to the McDonald and Rascher (2000) and Depken (2001) findings where age has significantly negative impact on attendance. In this study, the stadium age variable is positive and significant at the 1% level and age squared is negative and significant at the 1% level. It is important to note that stadium age is argued to act as a proxy of stadium capacity and thus lead to a biased effect of stadium age (Borland & McDonald, 2003). However, through controlling for both these two variables, this study finds both of them are significantly positive. Based on that, Chinese soccer fans seem to be inclined to go to stadiums with a longer history rather of new ones. Specifically, one possible explanation for this finding is that stadium age correlates to stadium capacity. When the stadium in China is older, it is often found to be larger. For example, Beijing Worker's Stadium for Beijing Guoan was built in 1956, which can provide a maximum of seats for about 60,000 people. And built 12 years ago, Changchun Stadium for Yatai can only include 25,000 persons.This Considering that age square is reported to be significantly negative in this research, the study finds that the CSL attendance is increasing with the increase of stadium age, but doing so at a decreasing rate.

Overall, there are various variables that significantly impact fan attendance, including team strength, weather conditions, derby matches, population and GRP, as well as holidays. However, through estimating the air pollution data and these adjusted values from 2014 to 2016, air pollution is found to have no significant impact on fan attendance, which shows that Chinese soccer fans do not change their consumption behavior for sport based on the level of pollution in the air.

Conclusion

In this study, models employing different variables to control for air pollution are developed to examine the relationship between air pollution and fan attendance at CSL games. The findings help to illustrate the demand of Chinese sports fans as well as their consumption behaviors. On one hand, with all these air pollution variables being insignificant, the results provide evidence that Chinese soccer fans are not responsive to air pollution and are willing to expose themselves to polluted open air. On the other hand, the findings serve to collaborate previous research related to the factors that play significant roles in determining fan attendance at CSL games.

Primarily, the current study has several contributions in building on the empirical literature regarding the intersection of sport and environment. First, this study comes up with the new environmental issue of air pollution in professional sports industry. As discussed in the literature review, most existing publications regarding sport and environment focus on factors such as wastes and gas releases (Babiak & Trendafilova, 2011; Inoue & Kent, 2012). However, there is no mention about the problem of air pollution which has risen as an important detrimental environmental issue all over the world (Brunekreef & Holgate, 2002). Through

bringing out this issue, the present study provides a new perspective for scholars to further focus on.

It is the first study to examine the relationship between fan attendance and air pollution. According to the existing researches, many scholars merely discuss how to minimize the negative environmental impacts of hosting events through initiating efforts of sport teams, organizations and all the participants. For instance, researchers have discussed measures to ameliorate detrimental air quality during the 2008 Beijing Olympics such as restricting cars and shutting down factories (McLeod et al, 2017). There is a research gap that very limited attention has been paid to how environmental issues and problems can in return impact fans' consuming behaviors, which may then influence the business operations of professional sport teams. In other words, no study is found to have ever thought about the economic impact of environmental issues on the sport industry. Despite that air pollution has grown as a significant issue of public social life in not only China but also the world, there is no literature considering it as a prospective determinant of game attendance. In this study, it is important to provide a better understanding in the relationship between air pollution and its influence on consumer behaviors. As this finding shows an insignificant relationship between air pollution and fan attendance, this research presents evidence about the consumption behavior of Chinese soccer fans regarding air pollution. The results also provide new insights to future sport researches regarding the health effect of air pollution on sports participants. Considering that air pollution does not affect the game watching of soccer fans, it is necessary for scholars to further focus on the impact of air pollution on the health condition of sports fans as well as athletes in game days.

The current study is also beneficial to deepen theoretical understanding into the demand of sport. According to the previous literature, sports economic scholars have paid substantial

attention to various factors and dimensions of sport demand, such as consumer preference, sporting contest and so on. This is the first study to introduce and categorize air pollution as a new determinant. To measure it, the study provides several different dimensions including these daily reported data of AQI and two other rating systems (Proper and MPI) as well as the calculated relative data in a previous week/month. Through estimating these measures of air pollution, the research serves to illustrate the effect of air pollution on fan demand from a theoretical standpoint.

Also, the study provides an empirical examination of the existing determinants. The results show that several variables from these different categories across these models are consistently significant in this research. For example, as a proxy of team performance, team strength of both home and away team is found to have a significantly positive effect on fan attendance. Besides, other variables including average temperature, wind, derby, population, GRP, holiday, stadium capacity, stadium age and age square are all found to play important roles in determining fan attendance at CSL games. On one hand, the findings examine the results of previous studies and give validations to the use of these factors in demand models. On the other hand, they provide further knowledge of the sport demand of Chinese soccer fans and contribute to a better understanding of Chinese sport market.

Furthermore, the present study provides an analytic way to measure the effect of air pollution in this research. First, a big data set of attendance, weather conditions as well as air pollution from 2014 to 2016 is collected to give a considerate understanding of the economic demand of soccer fans in this research. Second, employing three variables of AQI, Proper and MPI as well as other six adjusted variables, this study provides to make a comparison between

the nine economic models. It is also beneficial for the study of air pollution to become reliable and valid while contribute to provide a doable methodology with further researches.

There are still several limitations in this study. First of all, there is a missing data of attendance in 2015. With 720 games from 2014 to 2016 in total, there are only 718 observations in this study. Also, instead of the accurate AQI value during the soccer games, the air pollution data of Air Quality Index used in this study is the average daily AQI data of that day. Considering that the data of Air Quality Index is released by the Department of Chinese Environment Protection per hour, only the average value of AQI in the previous days is posted on the official website. Thus, it can be a limitation which can affect the accuracy of results. Likewise, there is a similar issue existing in the data of weather conditions. For dummy variables of clear and rain, sometimes it can be "fair to cloudy" or "showers cleared up", which include both two conditions. It is hard to exactly know the weather conditions of the game hours. Thus, it can also limit the accuracy of this study.

For future research, there can be several directions. Primarily, a considerate survey and interview can be taken to examine the true feeling of soccer fans about games on haze days. There is a possibility that fans have already been aware of the air problem and have taken actions to protect themselves when they choose going out to watch games. If so, it can be imperative for sports scholars and organizations to deeply learn the behavior of these sports fans. A survey or interview may help a lot to illustrate the relationship between air pollution and fan behavior and support this current study. What's more, because relevant data such as air pollution and weather data before 2014 cannot be found, this research only collected data in previous three years, Considering that the development of individual perception as well as its influence on behavior can be full of complexity and in a changing pattern (Haralambos & Holborn, 2002), a

longitudinal study for more time is needed to replicate the results in the future. Since individual conception and behavior towards air pollution can be changeable, it is necessary to follow the future data and repeat to examine the effect of air pollution on fans and sports events. Thus, more explanatory and practical studies can be taken based on future data.

Additionally, researches can further focus on the impact of air pollution on other aspects of clubs and organizations such as brand image, business legitimacy and so on. In this study, it only provides evidence to the relationship between air pollution and attendance as well as ticket using. However, there is still blank space regarding the economic impact of air pollution on many other aspects of organizations. Thus, further studies based on this research are needed to continue digging into the relationship between air pollution and sports industry as well as other places.

Implication

The current study calls for the Chinese soccer fans to focus on this detrimental air quality as well as the health cost of attending the CSL games. As found, most soccer fans may not be sensitive to the impact of air pollution on their health conditions while there is no related education or tips provided by the soccer teams, leagues and organizations. Thus, the insignificant results provide significant insights for fans and all other participants to pay attention to the air pollution issue. It is necessary to prompt them to protect themselves from exposing directly to the harmful open-air.

Also, this research has important implications for sports leagues and organizations. First, It seems to be good news for the soccer games and organizations because fans attendance and ticket using behavior is not influenced by air pollution. However, according to previous literature as well as reports regarding air pollution, there are still impacts in fan experience, especially in

game watching. For example, haze has negative impacts in visibility and prevents audience from watching games. And this is reported to be a problem not only in China but also in Europe and other areas (Qi, 2018). Additionally, though this insignificant result finds air pollution does not negatively impact ticket use and attendance, there is still a potential that a prospective fan rejects to purchasing ticket because of air pollution. Besides, considering that the development of individual conceptions of air pollution can be a dynamic socialization process, it is necessary for sports leagues and organizations to pay more attention to this air issue. Though this study provides the first examination of the relationship between air pollution and fan attendance, there can still be various unknown effects of air pollution on the operation and promotion of the CSL clubs and games. Thus, it is essential for sports organizations to do more surveys and research regarding the effect of air pollution on fans and games. In this way, a more considerate understanding of air pollution as well as its impact on sports teams, leagues and organizations can built.

Second, this research suggests soccer teams and organizations to think of fans' health in terms of the corporate social responsibility as well as the future developing strategies. As known, bad air quality can be detrimental and have both short and long- term impacts on health quality, increasing risks of lung cancer and respiratory diseases (Tertre et al, 2002; Pope & Dockery, 2006). On one hand, it is these CSL teams and games that drive soccer fans to go out and expose themselves to harmful air pollutants. Thus, teams and related sports organizations are supposed to have responsibility to take measures to protect their soccer fans instead of putting them at risk. On the other hand, it may help sports teams and organizations to strengthen their business legitimacy and gain strategic advantages at the same time. Early in 2013, there has been fan discussion about air pollution and soccer games on Chinese forums (Baidu, 2013; Sohu, 2013).

For instance, in the Baidu Post Bar of Beijing Guoan, there was a post from a soccer fan: “There are a lot of haze days that coincide with CSL games. That is so harmful for the athletes and other participates. Have these organizations taken any measures?”. Some fans are even found to use air pollution as an attacking method to disparage the rival teams. These examples all help to illustrate the existence of legitimacy problems of sports organizations.

According to the provisions of CSR that require organizations to meet environmental demand in business (Babiak, 2009; Ioakimidis, 2007), it is essential for teams and clubs to rethink about their own policies in planning, scheduling and hosting competitions. Considering the special power of soccer teams and leagues, they can also offer a unique platform for educating soccer fans about air pollution and help fans to build awareness of the air pollution problem. Besides, such an environmental CSR consideration can also inspire sports organizations including clubs and sports accessories companies to think about their future development. As known, air pollution has affected individual exercising and purchasing behaviors and led to an economic boom in manufacturing industries of anti-haze masks and purifier (Yu et al., 2013). Based on this, clubs and leagues can also think about renovating and modernizing stadiums in preventing air pollution. In regards to sport accessory companies, this is also a chance to design and manufacturing new anti-haze products, including masks, clothes and so on.

In addition, the research provides an examination and overview of factors that may affect sport demand of Chinese soccer fans, including team strength, stadium characteristics, marketing characteristics, weather conditions and match timing. With this insight, sports managers can better understand and examine the demand of Chinese soccer fans as well as the determinants of sports league attendance. For instance, it can provide evidence for sports executives about where

and when to host games. Specifically, marketing characteristics show that games at cities with a larger population can have more attendants. In terms of match timing, when it is on weekends or during holidays, there can be more attendance at games. However, fans seem to care little about which month the game is scheduled in. As for weather conditions, Chinese fans prefer to go for a game with higher temperatures and no rain or wind. Whether it is sunny or snowy does not significantly influence fans' attendance. Similar to sports fans in other countries, CSL soccer fans are more interested in games with stronger teams. Games with strong teams are usually found to have a larger number of tickets sales and more attendants. One thing that can be different from soccer industries in other countries is stadium age. Chinese soccer fans are found to prefer stadiums with more capacity as well as a longer history. Based on all these findings, sports executives are capable of attributing and managing resources more efficiently. Also, it can be beneficial for soccer leagues to improve events in planning and management process.

It also yields implications of sports industry as well as the Chinese Soccer Association. As known, air pollution is not a new issue without attention any longer. It has continuously influence on individual behaviors, public society and various industries such as manufacturing (Yu et al., 2013). There have been related news reports and fans discussions concerning the attitude in air pollution of Chinese Soccer Association. In 2013, the first eight CSL home games were found to all suffer from severe haze problem. In terms of it, a report from Huashang Newspaper argued that the Chinese Soccer Association the Chinese Soccer Association had no emergency plans or any response to this air issue (Huashang News, 2013). Also, related discussions of air pollution can be found among soccer fans from different forums such as Baidu and Hupu (Baidu, 2013). It shows an increasing number of people started to notice and complaint about air pollution. However, till now no warning or suggestions regarding air

pollution from the CSL teams, games and organizations has ever been found. On one hand, it indicates that limited attention regarding air issue has been paid in the professional sport field. On the other hand, it can show that sports industry is trying to evade questions in terms of air quality. Once fans understood the health impact of air pollution, there can be a big loss in various aspects such as ticket sales, game attendance, the quality of game and so on. However, as found that several fans and media reports continue arguing the air issue, it is important for sport industry to face up with this problem and find a solution. Only the sports industry has the big power to gather these sports clubs and organizations together and build connection with other environmental departments and the government. Thus, it is possible to build a multiple-level system which composes of managers in sports industry, governmental policy makers, and environmental policy makers to work together on the air pollution issue. In addition, considering that air pollution can be a global issue in many regions, it yields implications for sport events in both China as well as other markets plagued by pollution.

Additionally, this study raises new questions of ethics in sports industry. Within prior sport and environmental research, most publications discussed how stake holders and sports fans can be prompted to protect our environment via sports events and organizations (Inoue & Kent, 2012). However, there is no focus on if the environment itself may affect the health and well-being of sports participants. Besides Chinese soccer fans, there are still many other participants under risks including athletes who may be exposed to the polluted air for a much longer time than attendants. For example, both the defensive midfielder Erik Paartalu at Tianjin Teda and the goalkeeper coach Ian Walker at Shanghai SIPG were reported to argue the bad air quality in China in the interviews (Tecent Sports, 2016). In some articles, this issue is also commented to be the violation of human rights. According to McLeod et al. (2018, p. 19), “Consequently,

health and competition, human rights and sport, the people and the fan favorite, were all arrayed against the particulates and the particulates' allies". Following this sentence, they highly applauded Beijing Olympics 2008 for its solutions to improving air pollutions including closing factories and restricting vehicles. As McLeod et al. (2018, p. 27) notes, "One (possibly unintended) consequence of the 2008 Olympics was the awakening of public awareness around environmental aspects of their human rights." Thus, it is necessary for sports scholars as well as the whole industry to focus on the detrimental influence of environmental factors on sports fans and athletes.

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APPENDIX

Table 4.1 Variables Description

Variable	Description
Attendance	Match Attendance
HomeWpct	Win Percent of Home Team
AwayWpct	Win Percent of Away Team
Population	City Population (in 10000)
GRP	Gross Regional Project for area team plays in
Derby	Dummy Variable for Rival/Local teams playing against each other (1 = Yes)
Weekend	Dummy Variable for games played on Weekend (1 = Yes)
Holiday	Dummy Variable for games played on National Holidays (1 = Yes)
March	Dummy Variable for games played in March (1 = Yes)
April	Dummy Variable for games played in April (1 = Yes)
May	Dummy Variable for games played in May (1 = Yes)
June	Dummy Variable for games played in June (1 = Yes)
July	Dummy Variable for games played in July (1 = Yes)
August	Dummy Variable for games played in August (1 = Yes)
September	Dummy Variable for games played in September (1 = Yes)
October	Dummy Variable for games played in October (1 = Yes)
November	Dummy Variable for games played in November (1 = Yes)
StadiumAge	Age of Stadium in Years
StadiumAgeSq	Square of the Age of the Stadium
Capacity	Total capacity for stadium for soccer matches
AvgTemp	Average daily temperature
WindSpeed	Average wind speed
Clear	Dummy Variable for games played on a clear day (1 = Yes)
Rain	Dummy Variable for games played on rainy days (1 = Yes)
Snow	Dummy Variable for games played on snowy days (1 = Yes)

Table 4.2 Air Pollution Variables

Variable	Description
AQI	Average Air Quality Index (AQI) for the city
RatingMPI	Air Quality Rating Scale (rating from 1 to 5)
RatingProper	Air Quality Rating Scale (rating from 1 to 6)
AQIAdjSeven	= Daily AQI – Average Weekly AQI
AQIAdjThirty	= Daily AQI – Average Monthly AQI
MPIAdjSeven	= Daily RatingMPI – Average Weekly RatingMPI
MPIAdjThirty	= Daily RatingMPI – Average Monthly RatingMPI
ProperAdjSeven	=Daily RatingProper – Average Weekly RatingProper
ProperAdjThirty	=Daily RatingProper – Average Monthly RatingProper

Table5.1 Models of AQI, weekly AQI and monthly AQI

Variables	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
HomeWPCT	15,157	1,877***	15,138	1,878***	15,152	1,879***
AwayWPCT	10,780	1,600***	10,805	1,600***	10,836	1,600***
AvgTemp	91.253	51.764*	89.296	51.704*	87.756	51.805*
Wind	851	310 ***	-875	308***	-879.762	309**
Rain	1,128	690	-1,119	690	-1,120	691
Snow	432	912	478	910	497.32	910
Clear	365	849	-347	848	-333	849
Derby	3,539	874***	3,545	875***	3,536.	875***
Population	5.818	0.612***	5.822	0.612***	5.822	0.612***
GRP	-0.497	0.054***	-.494	0.054***	-.493	0.055***
Holiday	1,825	1,042*	1,830	1,043*	1,872	1,044*
Weekend	791	696	813	696	823	696
March	3,759	2,909	3,730	2,925	3,478	2,918
April	2,105	2,814	2,147	2,827	1,968	2,821
May	981	2,795	1,048	2,807	895	2,802
June	-217	2,904	-152	2,914	-291	2,914
July	1,772	2,807	1,871	2,821	1,708	2,818
August	771	2,824	911	2,839	742	2,832
September	-1,335	2,856	-1,207	2,877	-1,409	2,872
Octomber	605	2,862	651	2,878	458	2,882
November	---	---	---	---	---	---
Capacity	0.253	0.021***	0.253	0.021***	0.253	0.022***
Stadiumage	1,047	68.075***	1,041	67.643***	1,039	67.915***
Agesqr	-10.591	0.722***	-10.531	0.718***	-10.516	0.721***
AQI	-6.83	7.243	---	---	---	---
AQIAdjSeven	---	---	5.098	7.912	---	---
AQIAdjThirty	---	---	---	---	-0.757	7.606
_cons	-14,235	3,612***	-14,763	3,622***	-14,548	3,618***
R-square	0.6094		0.6091		0.6089	

*p<0.10
**p<0.05
***p<0.01

Table 5.2 Models of Proper, weekly Proper and monthly Proper

Variables	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
HomeWPCT	15,157	1,877***	15,156	1,878***	15,121	1,878***
AwayWPCT	10,807	1,599***	10,841	1,599***	10,808	1,599***
AvgTemp	90.055	51.753*	87.632	51.698*	91.706	51.895*
Wind	-865	309***	-881	308***	-877	308***
Rain	-1,116	690	-1,117	690	-1,144	691*
Snow	442	913	495	910	480	909
Clear	-346	848	-332	848	-338	848
Derby	3,553	875 ***	3,543	876***	3,535	874***
Population	5.817	0.612***	5.822	0.612***	5.799	0.613***
GRP	-0.496	.0549***	-0.493	0.054***	-0.493	0.054***
Holiday	1,830	1,043	1,869	1,044*	1,788	1,047*
Weekend	806	696	823	696	834	696
March	3,666	2,908	3,478	2,912	3,706	2,909
April	2,068	2,815	1,972	2,821	2,136	2,819
May	965	2,797	900	2,804	1,046	2,802
June	-218	2,907	-290	2,912	-83.188	2,917
July	1,748	2,808	1,707	2,815	1,844	2,813
August	729	2,824	738	2,829	845	2,828
September	-1,370	2,856	-1,410	2,867	-1,219	2,868
Octomber	545	2,861	449	2,868	684	2,875
November	--	---	---	---	---	---
Capacity	0.253	0.021***	0.252	0.021***	.251	0.021***
Stadiumage	1,045	68.046***	1,039	67.565***	1,043	67.72***
Agesqr	-10.567	0.721***	-10.51	0.717***	-10.554	0.719***
Proper	-253	356	---	---	---	---
ProperAdjSeven	---	---	40.327	357	---	---
ProperAdThirty	---	---	---	---	-292	365
_cons	-14,180	3,631***	-14,545	3,612***	-14,738	3,611***
R-square	0.6092		0.6089		0.6092	

*p<0.10
**p<0.05
***p<0.01

Table5.3 Models of MPI, weekly MPI and monthly MPI

Variables	Coef.	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
HomeWPCT	15,121	1,878***	15,143	1,879***	15,077	1,877***
AwayWPCT	10,809	1,599. ***	10,840	1,599***	10,786	1,598***
AvgTemp	92.468	51.969*	88.185	51.848*	96.694	52.037*
Wind	-860	309***	-881	308***	-866	308***
Rain	-1,129	690	-1,122	691	-1,158	690*
Snow	417	914	491	911	426	910
Clear	-333	848	-331	848	-313	847
Derby	3,541	874***	3,543	875***	3,513	874***
Population	5.813	0.612***	5.821	0.612***	5.801	0.612***
GRP	-0.496	0.054***	-0.493	0.054***	-0.493	0.054***
Holiday	1,836	1,042*	1,865	1,044*	1,728	1,046*
Weekend	792	696	822	696	813	695
March	3,706	2,907	3,495	2,908	3,901	2,908
April	2,105	2,815	1,983	2,819	2,276	2,818
May	1,000	2,797	912	2,803	1,170	2,800
June	-199	2,906	-279	2,911	47.244	2,913
July	1,753	2,807	1,713	2,812	1,938	2,810
August	730	2,824	742	2,827	933	2,826
September	-1,358	2,856	-1,398	2,865	-1,063	2,866
Octomber	558	2,860	459	2,865	854	2,872
November	---	---	---	---	---	---
Capacity	0.253	0.021***	0.252	0.021***	0.249	0.021***
Stadiumage	1,046	68.097***	1,039	67.61***	1,047	67.729***
Agesqr	-10.586	0.723***	-10.513	0.717***	-10.602	0.719***
MPI	-354	424	---	---	---	---
MPIAdSeven	---	---	73.721	412	---	---
MPIAdThirty	---	---	---	---	-540	404
_cons	-14,034	3,646***	-14,558	3,610***	-14,902	3,609***
R-squared	0.6093		0.6089		0.6099	

*p<0.10
**p<0.05
***p<0.01

VITA

WANTONG FU

Department of Health, Exercise, Sport and Recreation Management, University of Mississippi
1802 West Jackson Avenue Email: rachelfw99@gmail.com

EDUCATIONAL BACKGROUND

Masters of Sports and Recreation Administration, May 2018
University of Mississippi
Thesis: Air Pollution and Fan Attendance: The Case of the Chinese Super League
Concentration: Sport Economics

Bachelor of Management in Hospitality and Tourism Management, June 2016
Chongqing Jiaotong University, Chongqing, P.R. China
Core courses: Tourism Economics, Marketing

EXPERIENCE

Graduate Assistant in the Sport Economics and Analytics Lab, Aug 2016 – May 2018

• Working on research projects
• Data collection and analysis.

Graduate Teaching Assistant in Recreation Management, Aug.2016 –May 2018
Taught activity courses for undergraduate students in the Department of Health, Exercise Science, and Recreation Management.

Team Leader of *Chinese National University Student Innovation Training Program (SITP): Evaluation and Implication for management education of Linear / Nonlinear Thinking Style,* Jun 2016
• Collected and analyzed domestic and foreign related literature
• Analyzed these interview data with Nvivo10
• Reported results
Funds: $ 3,000

RESEARCH

Watanabe, N. M., Fu, W., Yan, G. (Accepted as Poster). The Impact of Air Pollution on Fan Attendance: An Analysis of the Chinese Super League. North American Society for Sport Management 2017 Conference, Denver, CO

MEMBERSHIP

North American Society for Sport Management (student member since 2017)

North American Society for the Sociology of Sport (student member since 2016)

HONORS & AWARDS

Kevs Ermin Professional Development Award, University of Mississippi, May2017
Graduate Assistantship, May 2016- May 2018
Excellent Graduate Award, Chongqing Jiaotong University, Jun 2016

SKILLS

Software Proficiency:

- STATA
- SPSS 23
- Cool Edit 2
- Photoshop CS5.1
- Vensim
- Nvivo.10
- Netlogo
- R Statistical Software

Languages: Chinese (Native Language); English

WORK EXPERIENCE

Graduate Assistant of University of Mississippi, May 2016 – May 2018