Competitive Balance and Match Attendance and in The Rugby Championship

North American Association of Sports Economists Virtual Conference, 29 June - 1 July 2020

Ben Muratore, Ross Booth and Rob Brooks

Monash University

Corresponding author: ross.booth@monash.edu

Abstract

Key Words: competitive balance; match attendance; Rugby Championship; rugby union

The Rugby Championship is an annual international rugby union competition played between Australia, South Africa, New Zealand and, since 2012, Argentina.

Hogan, Massey and Massey (2013) analyse competitive balance and match attendance in European rugby union leagues. and find that while competitive balance is important, the strength of the home team has a larger impact on match attendance than does competitive balance.

In this paper we use ordinary least squares regression and Tobit estimation to investigate the relationship between competitive balance (measured by the ratio of actual-to-idealises standard deviation of win percent based on the past 4 games played by all teams), and match attendance in the Rugby Championship from 1996-2018. We also investigate the effect of the introduction of Argentina into the competition.

The results of both estimations show that less competitive balance is associated with lower match attendance. Additionally, we find that matches involving Argentina have lower match attendance

Introduction

The Rugby Championship, previously known as the Tri-Nations, is an annual competition between Australia, New Zealand, South Africa (and from 2012) Argentina. This paper aims to explore how competitive balance affects match attendance. Examining the impact of competitive balance is not a new phenomenon in sports economics, but this paper will be the first to explore its effects on attendance per game in The Rugby Championship.

Additionally, the creation of a home/away team try-to-point ratio to control for the quality of a team is the first of its kind for in the analysis of how competitive balance impacts game day attendance for Rugby Union matches. The paper finds whilst less competitive balance corresponds to a reduced attendance at a game, its economic significance is debatable. Unfortunately, the home/away team try-to-point ratio is found to be statistically insignificant. An interesting finding of this paper is the additional evidence for the David Beckham Hypothesis first proposed by Shapiro (2017) regarding the effect of super stars on attendance at away games.

In international Rugby Union, match attendance has become a particularly hot topic, due to the domination of the New Zealand national rugby union team known as the All Blacks. Since 1903, the All Blacks have an average win percentage of just under 78% **(**Espn Statsguru**).** Since 2015, they have only lost 4 games out of 35 played (Espn Statsuru). New Zealand have won the Rugby Championship 15 times out 22 seasons. The next most successful side, Australia, has won it only 4 times since 1996. (Espn Stats Guru). South Africa is the next most successful side to play against New Zealand, which has only won 40% of matches ever played (Espn Statsguru). New Zealand has only ever been beaten by 6 national teams out of the 20 they have played against since 1903.

Average match attendance in The Rugby Championship has fallen from a high of 63,528[1] in 2000 to a low of 30,610 in 2017. This is a worrying trend that happens to coincide with an improvement in New Zealand's on field performance during the same period. New Zealand has currently won 76% of all games they have ever played in the Rugby Championship, which has coincided with some of the lowest average match attendances ever recorded. Contrast this with the late 90's and early 2000's where New Zealand's cumulative win rate bottomed out at roughly 60%, which coincided with the competitions highest ever attendances of 107000 and 109000. An improvement in New Zealand's on field performance, coinciding with a downward trend in attendance indicates support for the uncertainty of outcome hypothesis first proposed by Rottenberg (1956), where a quality match-up between winning teams (Paul and Weinbach) is vital to maintain viewership/match attendance, especially for those who 'sit on the fence' (Tainsky et al. 2014).

Literature Review

In sports economics, match uncertainty is a key determinant to match attendance. As Hogan et al (2013) describe (p 426), one of the "key attractions of sports events from a supporter's point of view… [is] a degree of equality between the teams in a league". Thus, increasing match uncertainty, as measured by competitive balance (a concept that can be measured by calculating the dispersion of wins around 50%) will increase the number of spectators at a match. The significance of 50% is that it represents a completely even league where each team only wins half of their games.

[1] The source of these figures is the author's own calculations based on data sourced from ESPN.

McMillan (1997) argues that when the competitive balance of a league is relatively high, then spectator interest will be at its peak. Syzmanski and Kesenne (2004) also argue that successful leagues are ones where there is greater "degree of competitive balance". A U.K Government report argues that highly concentrated leagues, where one or a few teams win constantly, will not maximise spectators nor revenue (Arnaut 2006).

Sports economists favour redistributive policies that aim to increase competitive balance, and thus argue sports leagues require a "greater degree" of cooperation than other industries. (Borland and Macdonald 2003**).** The reason for this favour of redistributive policies can be attributed to the widely held belief that as competitive balance increases (i.e the league becomes more even for all participants) then the more consumer welfare is increased (that is, the more attractive the spectacle will be to the fans).

Rottenberg (1956) is often credited as the first person to link a relationship between competitive balance and team sports. Rottenberg says 'the nature of the industry is such that competitors must be of approximately equal 'size' if any are to be successful' (p242). Sports economists ardent desire for competitive balance and favouring of redistributive policies, is because they believe that lack of competition between two teams will lead to a reduction in fan interest, and ultimately cause ticket revenue to fall (Sanderson and Siegfried 2003).

According to Rottenberg (1956 p246) uncertainty of outcome is the tightness of the game and "is necessary if the consumer is willing to pay admission to the game". Uncertainty of match outcome means that the fan cannot know, or confidently infer the outcome of a

match, before it is played. An oft quoted line by Neale (1964 p2) is that a pre-game prayer by every team should be “oh lord make us good, but not that good”.

Competitive balance is used to measure uncertainty of outcome and can be broken down into match uncertainty (otherwise known as game uncertainty), within-season variation and between-season variation. Within-season variation is uncertainty across the season and concerns itself with the eventual champion of the league for that season. Between-season variation concerns itself with the possibility for one or a few teams to dominate the league over time. One measure of within-season variation is standard deviation of win percentage. A variant of this is known as the Relative Standard Deviation ratio or the Noll-Scully ratio (Noll (1988) Scully (1989)). It is the actual standard deviation of win percentages divided by an idealised standard deviation. The purpose of dividing the actual standard deviation by the idealised standard deviation is to get a sense of how far removed the competition is from what it would be if it was perfectly competitive. The ISD is significant because it is the standard deviation one would expect to see in a competition assuming the teams were all of equal quality and if they won half of all their games. This brings in the need for the home/away team try-to-point ratio, as an attempt to control for team quality.The actual standard deviation is compared to the ISD because the further away this measure is from the ISD (i.e a larger ratio), the less competitive balance there is.

Match uncertainty differs slightly from within-season and between-season variation wherein match uncertainty aims to determine the uncertainty of the outcome of a particular game. Match uncertainty is often measured by calculating the win percentages for each team up until the current match. Put simply, match uncertainty differs from competitive balance wherein the latter is an ex ante measure whilst within-season and between-season are ex post

measures. For example betting odds have become a popular measure of ex-ante match uncertainty.

Notwithstanding the general discussion above, there are however two conflicting forces on match attendance. The uncertainty of outcome hypothesis states that as the outcome of the game becomes more uncertain spectator interest is at its highest and match attendance should be maximised. However as Hogan et al (2013) argues, match attendance is likely made up of home team supporters who are there to see their team do well. Implying that as the home team success' increases, so too will attendance. This would naturally lead to a decline in competitive balance, thus contradicting the uncertainty of outcome hypothesis.

There is empirical evidence to support the view of increasing attendance as home team dominance increases. Whitney (1988) analyses Major League Baseball from 1970-84, and finds attendance peaks when the probability of the home team winning was around 0.4-0.6. Likewise, Knowles et al (1992) in a cross sectional analysis for the 1988 season, finds home attendance in Major League baseball peaks when the probability of the home team winning was 0.66. In addition, Peel and Thomas (1996) in a cross sectional analysis finds for First and Second Division Scottish soccer, that when the probability of a home team winning was 0.6, then this corresponded to a peak in match attendance.

Similarly, Hogan et al. (2013) analyse the home win ratio and away win ratio effect on match attendance in European club rugby and found both measures to be positive and statistically significant. The away win ratio however is only half the size of the home win ratio, 2600 more attendees versus 5700 more attendees respectively. The authors conclude (p439) that if "pure competitive balance were all that mattered, then we would expect the

difference in win ratios to be important", running a Wald leads to the rejection this hypothesis.

Borland and Macdonald (2003) review several empirical studies for different measures of uncertainty on different measures of attendance such as Cricket (Hynds and Smith, 1994) which looks at attendance by day; Rugby League in Australia (Alchin and Tranby, 1995) which looks at average attendance per match; Major League Baseball (Coffin, 1996) which looks at total attendance by home team by season; Australian Rules Football (Fuller and Stewart 1996) which looks at average attendance per match per capita; European Cup Soccer (Baimbrige, 1997) which looks at total attendance per match. Borland and Macdonalds (2003) investigation finds mixed results of the effect of uncertainty of outcome on match attendance

The effect of 'greater uncertainty of outcome' either has marginally positive effects (Cricket, Baseball, Soccer) or showed no significant effect (Rugby League, AFL). Measures of uncertainty included in these papers were variables for whether the series outcome was uncertain (Cricket), intra-season measures of distribution of wins (Rugby League), games behind the leader (Baseball), coefficient of variation of games won (AFL), and dummy variable for match significance (Soccer).

Papers by García and Rodriguez (2002) and Paul & Weinbach (2007) find that the quality of the match was important for Spanish club soccer and the NFL respectively. Paul and Weignbach (2007) results show fans prefer quality matches between winning teams, high scoring games, and they favour matches between teams that are competing for similar

positions in the league. The results of Hogan et al. (2013) found that European club rugby supporters had the same attitudes towards the league.

Peel and Thomas (1988) analyse attendance per match in English soccer, and find that as the home team win percentage increased so too did game day attendance – a result seemingly counter to that of the uncertainty of outcome hypothesis. Forrest and Simmons (2002) like Peel and Thomas (1988) also found a puzzling relationship. Forrest and Simmons paper found a 'U-shaped' relationship between game uncertainty (not to be confused with competitive balance) and English Football attendance.

Schmidt and Berri's (2004) paper on baseball and match attendance show that the effect was ambiguous depending on how competitive balance was analysed. The analysis involved estimating the effects of 1 year lagged, 3 year lagged and 5 year lagged Gini coefficients of win percentage on match attendance. The authors show that match attendance would actually increase if competitive balance decreased (i.e the league become more uncompetitive) in the short term. But if this imbalance persisted over 3 to 5 years then match attendance would decrease.

Buraimo and Simmons (2009) report an insignificant influence of game uncertainty on Spanish football attendance. They discover soccer fans in Spain showed preference for games with a high probability of a home win (when fans are sure a team will win) or a low chance of a home team win (when a stronger opponent is playing – the-so-called David vs. Goliath effect). By contrast, Lenten (2009) also found that increasing competitive balance (making the competition more even) is "associated" with an increase in average match attendance.

Tainsky et al. (2014) also had ambiguous results in their NFL paper, showing that the home market does not care for match uncertainty, but when non-local markets are watching then game uncertainty matters. This result is not too dissimilar to that of Dang et al. (2015). The authors analyse the effects of match uncertainty on TV ratings using data from the home and away seasons from 2009-2011 for the AFL, controlling for various factors. The paper finds the greater the game uncertainty, the greater the TV ratings. The conclusion of both papers essentially state that when the audience has no stake in the competition then the match uncertainty of outcome hypothesis holds true

Wen-Jahn (2014) analyses the effect of outcome uncertainties on match attendance in the National Basketball Association. The author incorporates six different measures of short-run league-level competitive balance as well as game uncertainty for two rivals. The author analyses the data using a Tobit model on game day attendance for games from the 2009/2010 2011-2012 season. The author uses the betting market to determine values of game uncertainty. The author also controlles for various economic and socio-economic factors such as GDP per capita, ticket prices as well as male population of the 29 locations where the games were played. Wen-Jahn (2014) shows that the measurements of competitive balance are significant and show the correct signs, that is, as competitive balance increased, i.e dispersion of win percent decreased, then attendance increased. However for game uncertainty, the author found the opposite, and as the betting odds favoured one team over another for a particular game, then game day attendance increased.

Hogan, Massey and Massey (2013) analyse competitive balance and match attendance in European rugby union leagues. They employ the use of an OLS model to analyse 4000

games played over the course of 15 seasons in the top three European Rugby Union leagues. They analys the effects of 3 different measures of competitive balance (short-term, medium-term and long term) to determine its effect on match attendance. The hypothesis of the paper is that the more balance between the teams, the higher the attendance will be. The short-term measure was the win ratio for the home and away team from the past 6 games. The medium-term was a dummy if the home team was in contention to make the finals, and the long-term measure was whether the home or away team won the championship the year before. The results of Hogan et al. (2013) are not too dissimilar from Wen-Jahn (2014), whereby both find that while competitive balance is important, the strength of the home team for match day attendance has a larger impact on match attendance than does competitive balance.

Methodology

Data

Game information data is collected from ESPN to determine the points for each team, the attendance for each game, the number of tries scored by each team and where the game was played. Population statistics are gathered from the respective government websites going back to 1996.

The hypothesis of this research paper is:

1) Less competitive balance (that is evidence of one team dominating the rest) has a negative effect on attendance per game in the Rugby Championship.

An ordinary least squared regression is used to estimates the relationship of competitive balance attendance per game is in the Rugby Championship using data from 1996-2018. Since the variables are clustered by year, clustered standard errors are used to account for heteroskedasticity and non-normality.

The use of a Tobit model estimation is because a significant amount of data is distributed around maximum capacity, making it difficult to obtain unbiased OLS estimates on the relationship between the dependent variable and the explanatory variables. Even though a game may be sold out, it does not necessarily mean it fits the trend in terms of what the explanatory variables would predict. For example, a stadium with a capacity of 115000 is going to be a lot harder to sell out than a stadium with a capacity of 18000, and thus a Tobit model is used to more accurately determine the relationship between the dependent variable and the explanatory variables.

The model assumes there is a latent (unobservable variable) y. The observable y is equal to the latent y whenever the latent y is above 0. The observable y is equal to zero otherwise. The reason for utilising a Tobit model is that 38 of the 183 games played resulted in a sell-out. Two possible explanations for above capacity attendance are that there is standing room that is not listed in the capacity constraints of a stadium or the event organisers expanded seating capacity for expected excess demand (Holmes 2010; Coates and Humphreys (2005)).

Long (1997) describes the relationship of X on Y as follows $E(y) = [Pr(Uncensored) \times E(y|y>\tau)] + [Pr(Censored) \times E(y|y=\tau_y)]$. τ is the censored value of y. The marginal effect of X on Y is described by McDonald & Moffitt (1980) as the change in the probability of being

above the censored value multiplied by the expected value of *y* if above plus the change in the expected *y* for the cases above the censored value multiplied by the probability of being above the censored value (menghublog.wordpress).

However the difficulty with the right censored point when estimating the Tobit model is that it is fixed. Setting an average of stadium capacity does not make sense as the stadium capacity constraints vary wildly from a minimum of 18000 and a maximum of 115000. A solution to this problem is to use ratio of attendance per game to capacity per game, where the actual attendance of the game is divided by the capacity of the stadium where the game is played. This means the upper limit of the Tobit model will be limited to 1, indicating a sold out game.

Measures of Competitive Balance

This paper bases its model on the work of Hogan et al. (2013) who also analyse competitive balance on match attendance at rugby union games in the European Championship Cup. The hypothesis of this paper is that less competitive balance reduces attendance to the Rugby Championship and is believed to be explained by the following factors: competitive balance (the evenness of distribution of wins in the competition), match/team quality (the skills on display by the competing teams as well as the quality of the team) and the historical significance of the match.

This research paper uses league level Relative Standard Deviation, also known as the Noll-Scully ratio. The RSD is traditionally used on a seasonal basis, however, it is modified

to estimate the effects on game day attendance. The last 4 games are used to determine each teams win percentage.

The Noll-Scully (Relative Standard Deviation) ratio is calculated as follows:

$$RSD = \frac{Standard\ Deviation\ of\ Win\ percentage}{Idealised\ Standard\ deviation}$$

The lower this ratio, the greater the degree of competitive balance.

The standard deviation is calculated in the following way:

$$STDWPCT = \sqrt{\sum_{i=1}^{n} \frac{(WPCT_i - 0.500)^2}{n}}$$

Here i, represents team i. n represents the number of teams.

The calculation is done as follows:

$$ISD = 0.5/\sqrt{t}$$

Where t, is number of games in a season.

Win percent is calculated the following way:

$$WPCT_i = \frac{number\ of\ wins}{number\ games\ played}$$

In Rugby Union, like other sports, a tie is possible. This paper treats a tied match the same as not winning. The denominator is 4 as the paper is only concerned with the last 4 games played.

Regression

The variable of interest is the Noll-Scully ratio, and there will be several control variables employed in the multiple linear regression.

The number of spectators at a game is constrained by the capacity of the stadium, so stadium capacity is controlled for in the multiple linear regression.

This paper also controls for the population of the city. As the population of the city increases, we should expect to see an increase in the attendance of a game.

Home try-to-points ratio and the away try-to-points ratio are a novel contribution to the literature that aims to control for team quality. This is the total number of points scored via tries divided by the total number of points scored for the away team and the home team. There are 3 main ways of scoring, tries, penalty goals and drop kicks. A try can only be scored by placing the ball down in the end zone of the opposition team, whereas a penalty is scored when the opposition team infringes on the rules, providing the opportunity to kick the ball through the goal posts, whilst drop kick is similar to a penalty goal, but doesn't happen due to an infringement on the rules, rather it occurs during the run of play.

Because Rugby has a lot of rules, penalties are easier to score than tries. Thus scoring tries is the most exciting way to score points due to the difficulty of having to get a player through 15 opposition players, so a team that scores the majority of their points through tries is considered to be a higher quality team than one that scores most of their points through alternate methods. Alternatively a smaller ratio could suggest to fans poor team quality and my result in fewer fans showing up to the game.

A dummy variable for success at last year's Rugby World Cup is also included as a control variable because crowds may want to see 'best' team in the world play. This dummy variable accounts for either the home team or the away team.

This paper controls for home and away teams' success, as determined by the win percent. This is done on a rolling basis, so only the last 4 games are considered.

A control variable to describe the importance of the match used in the model estimation is a derby variable that describes if the game is a derby or not. Teams with a traditional rivalry are likely to attract larger crowds because of the perceived importance of the game, and the belief that both teams will increase their efforts when playing resulting in a more attractive match for the spectators. A game played between Australia and New Zealand is considered a derby because the two countries are the closest neighbours playing the same sport. The two nations respectively use sports as a contest to determine which country is better than the other, and as a result any game played between the two nations is likely to result in higher attendance than usual.

Games played between South Africa and New Zealand are also considered derbies because South Africa has the best history against the New Zealand national side, winning 41% of games played against the All Blacks. Derbies between Australia and New Zealand and New Zealand and South Africa are not 2 separate variables, any derby, regardless of who is playing is considered a derby, thus there is only one derby variable.

Another control variable utilised to determine match importance is whether or not Argentina played in that game. Argentina is not as a well-established rugby playing nation, and does not enjoy a significant rivalry with any of the established teams. As a result, the paper expects any game Argentina plays in to reduce attendance.

In addition, controlling for the timing of the match was also undertaken. Dummies for if the game was played at night and in either June, July, August, September or October were included.

A final dummy variable included in the regression is a dummy variable corresponding to whether or not the home team defeated the All Blacks in their previous encounter. This is included because of the success of the All Blacks over their entire history, beating them in a match is akin to a David vs Goliath battle, and might increase attendance at the next home game.

Results

Figure 1: Attendance per game and Noll-Scully Ratio (over the past 4 games)

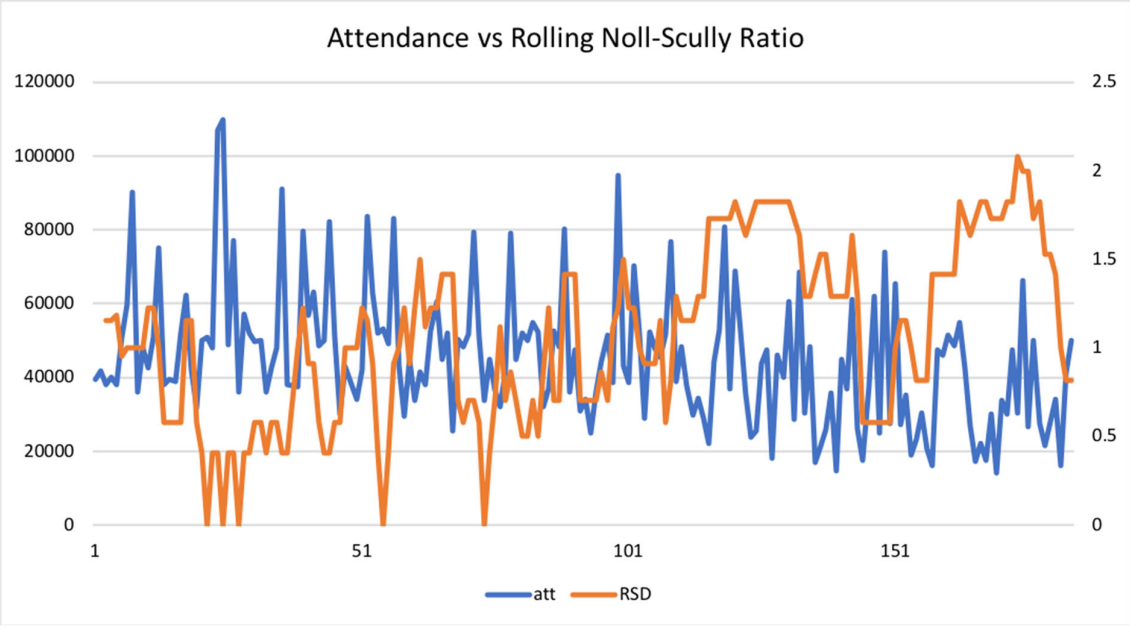


Figure 1 seems to indicate a relationship between the Noll-Scully ratio and attendance per game. Along the x-axis is the game number, game 1 being the first game played in 1996, and 180 being the 180th game played since 1996. Along the y-axis is the attendance and the secondary y-axis shows the competitive balance. The overall trend is as the Noll-Scully Ratio increases, attendance decreases.

Figure 2: Average Attendance (yearly) and Noll Scully Ratio (yearly)

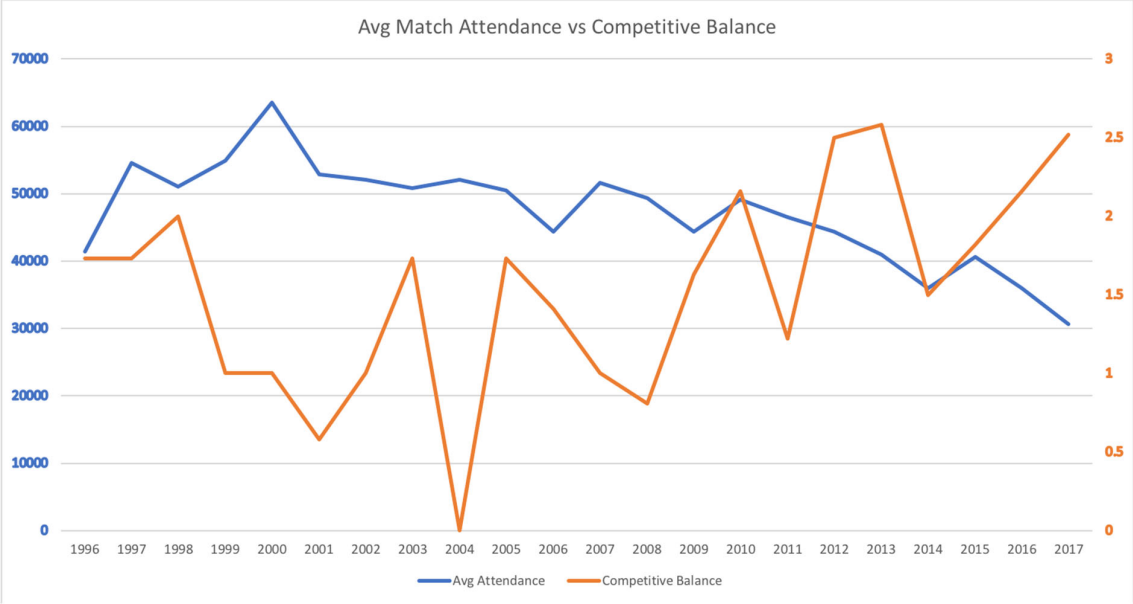


Figure 2 shows average match attendance and the Noll-Scully Ratio for the season from 1996 to 2017. The x-axis is the year, the y-axis is the attendance and the secondary y axis shows competitive balance for the season (not the rolling competitive balance as shown in the first graph). The purpose of this graph is to show a much clearer trend of attendance vs the Noll-Scully ratio.

Table 1 Variable Description

Variable	Description
att	Attendance of game t.
Cap	Capacity of the stadium
AD	Noll-Scully Ratio
pop	Population of the city/province where the game was played
homeratio	Ratio of points scored by tries compared to total points scored by the home team
awayratio	Ratio of points scored by tries compared to total points scored by the away team
Derby2	A dummy variable for whether it was a derby match or not
rollingasd	Rolling ASD calculated from the last 4 matches
ausrollingwin	Rolling win percentage for Australia calculated from the last 4 games played
nzrollingwin	The same as ausrollingwin but for New Zealand
Sarollingwin	The same as ausrollingwin but for South Africa
argrollingwin	The same as ausrollingwin but for Argentina
homewin	The win percentage for the home team, calculated from the last 4 games
awaywin	Same as homewin
hteamwonrwc	A dummy variable corresponding to if the home team won the Rugby World Cup the year before
awayteamwonrwc	Same as hteamwonrwc
beatabs	A dummy variable corresponding to if the home team beat the All Blacks in their prevous game
Month2	A dummy variable corresponding to what month the game was played
night	This is a dummy variable. It is set to 1 if the game is played after 6pm, or 0 otherwise. 0 indicating afternoon game
argplay	A dummy variable if Argentina was one of the match participants

Table 2: Summary Stats

Variable	Obs	Mean	Std.Dev.	Min	Max
att	183	44940.58	17736	14229	110000
cap	183	51435.08	20616.16	18000	115000
pop	183	4160000	4140000	51400	1.72e+07
AD	182	1.071	.487	0	2.082
homewin	184	.441	.307	0	1
awaywin	184	.507	.312	0	1
homeratio	179	.458	.235	0	.862
awayratio	178	.464	.207	0	1
argplay	184	1.207	.406	1	2
derby2	184	1.527	.501	1	2
hteamwonrwc	184	1.065	.248	1	2
awayteamwo~c	184	1.065	.248	1	2
beatabs	183	1.087	.283	1	2
junnight	183	.005	.074	0	1
julnight	183	.219	.414	0	1
augnight	183	.202	.403	0	1
septnight	183	.197	.399	0	1
octnight	183	.033	.179	0	1

Results

Linear Regression output

Table 3

att	Coef.	St.Err	t-value	p-value	Sig.
cap	0.670	0.033	20.10	0.000	***
pop	0.000	0.000	1.30	0.206	
AD	-3152.848	801.115	-3.94	0.001	***
homewin	1098.542	2902.567	0.38	0.709	
awaywin	2510.439	2388.895	1.05	0.305	
homeratio	-1256.143	2032.052	-0.62	0.543	
awayratio	1743.335	2718.349	0.64	0.528	
argplay	-5466.092	1986.440	-2.75	0.012	**
derby2	4990.588	1387.218	3.60	0.002	***
hteamwonrwc	816.069	861.098	0.95	0.354	
awayteamwonrwc	2183.241	1900.554	1.15	0.263	
beatabs	1680.457	2501.165	0.67	0.509	
junnight	-3963.555	2064.667	-1.92	0.068	*
julnight	-2909.936	1844.588	-1.58	0.129	
augnight	-411.848	1808.858	-0.23	0.822	
septnight	-1685.216	1450.942	-1.16	0.258	
octnight	106.270	2114.774	0.05	0.960	
_cons	10229.882	3097.771	3.30	0.003	***

Mean dependent var	45257.011	SD dependent var	18097.220
R-squared	0.879	Number of obs	174.000
F-test	.	Prob > F	.
Akaike crit. (AIC)	3571.319	Bayesian crit. (BIC)	3625.023

*** p<0.01, ** p<0.05, * p<0.1

Table 3 shows results indicating the Noll-Scully ratio has a statistically significant and negative impact on attendance per game. It is estimated that a 1 unit increase in the Noll-Scully ratio would decrease attendance for the match by approximately 3,200 attendees. Given the average attendance for The Rugby Championship over the time period was approximately 45,000, this represents a decline of just 7%, a decline which could be argued is not economically significant. This provides evidence in favour of the hypothesis that less competitive balance in The Rugby Championship reduces attendance per game. Because the Noll-Scully ratio is used to measure match uncertainty, if it increases, the outcome of the

game is less unpredictable to fans reducing their incentive to go watch. The results for competitive balance presented in table 3 are consistent with the literature and the uncertainty of outcome hypothesis.

Other statistically significant variables include the capacity of a stadium, which indicates a 1 person increase in stadium capacity will lead to a 0.67 person increase in attendance. Naturally the size of attendance of a game is constrained by the stadium, so the bigger the stadium the more people can attend.

The results show that if the game were a derby it would correspond to a 4,990 person increase in match attendance. Given that the average attendance over the course of the Rugby Championship was approximately 45,000, this corresponds to an 11% increase in match attendance.

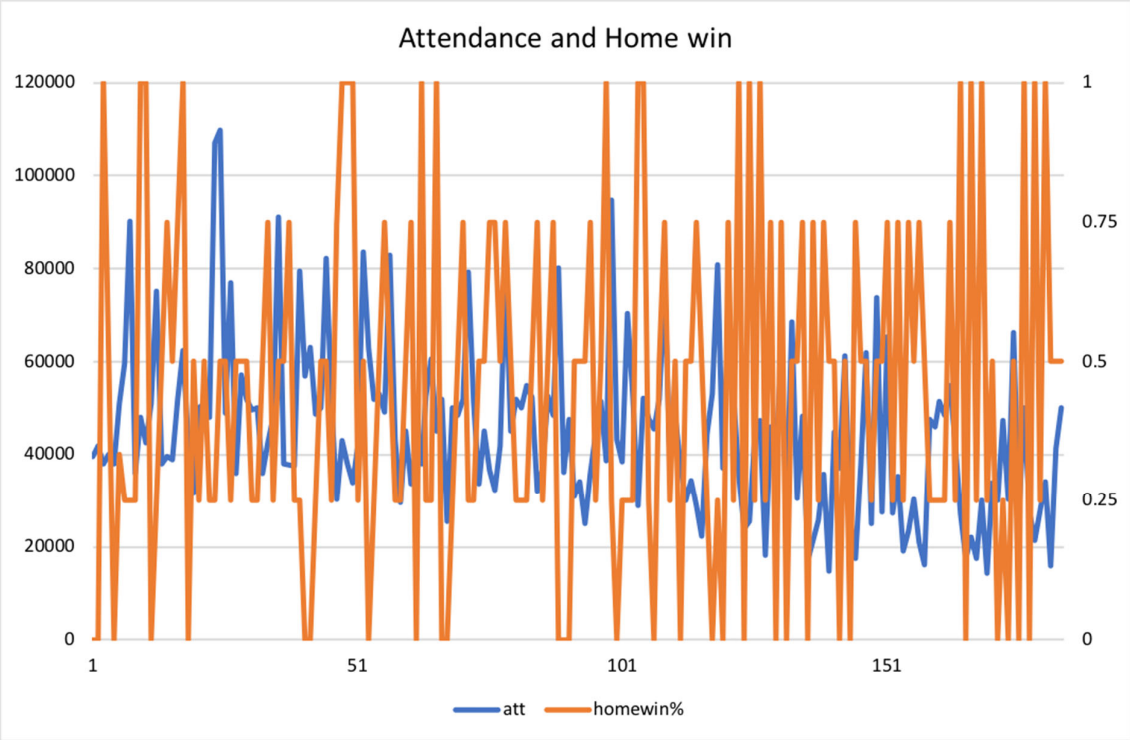
Conversely, if Argentina were a participant in a match, this would lead to a 5,466 person decrease in attendance. This is a 12% decrease in match attendance. This is not only statistically significant but economically significant. Unsurprisingly, because Argentina is a new entrant into the competition, and because they have not provided much competition to the established teams, attendees to The Rugby Championship are less inclined to watch.

The last statistically significant variable is the dummy variable of whether or not the game was played at June and at night. This variable takes on a value of 1 if the game was played in June and at night, or 0 otherwise. The coefficient of this dummy variable is -3,963, indicating that if the game was played in June and at night, it would result in 3,963 fewer people going to watch the game. Because all 4 teams are from the Southern Hemisphere, June

is one of the colder months, and as a result any games played in June and at night are likely to be quite cold thus discouraging people from attending.

Of interest is home win percentage and away win percentage being statistically insignificant. This is in stark contrast to Hogan et al. (2013) and Wen-Jahn (2014). Hogan et al. (2013) used the home/away win ratio as a determinant of competitive balance, whilst Wen-Jahn (2014) used the home/away win ratio as a control variable whilst trying to determine the effect of 6 different measures of competitive balance and game uncertainty on match attendance. In both instances they found comparatively similar results, where the effect of the home win percentage was twice that of the guest win percentage.

Figure 3: Attendance per game and Home win percentage



The x-axis represents the game played. i.e game 51 is the 51st game played since the first game played in 1996. The primary y-axis is the attendance for that game. The secondary y axis is the home win ratio. The orange line represents the home win ratio, and the blue line represents the attendance per game in the Rugby Championship.

In figure 3 attendance is trending downwards, however there appears to be no positive or negative trend for the home win ratio. In fact, it could be argued that higher home win percentage negatively affects attendance. If we look at the early games, the highest game attendance occurred when the home win ratio was 50%, and several instances of attendance being above 80,000 when the home win ratio was also low. But if we look towards game 100 onwards, where there is a higher concentration of home win ratios of either 0% or 100%, there are only 2 instances of attendance being above 60,000.

Figure 4: Attendance per game and Away win Percentage

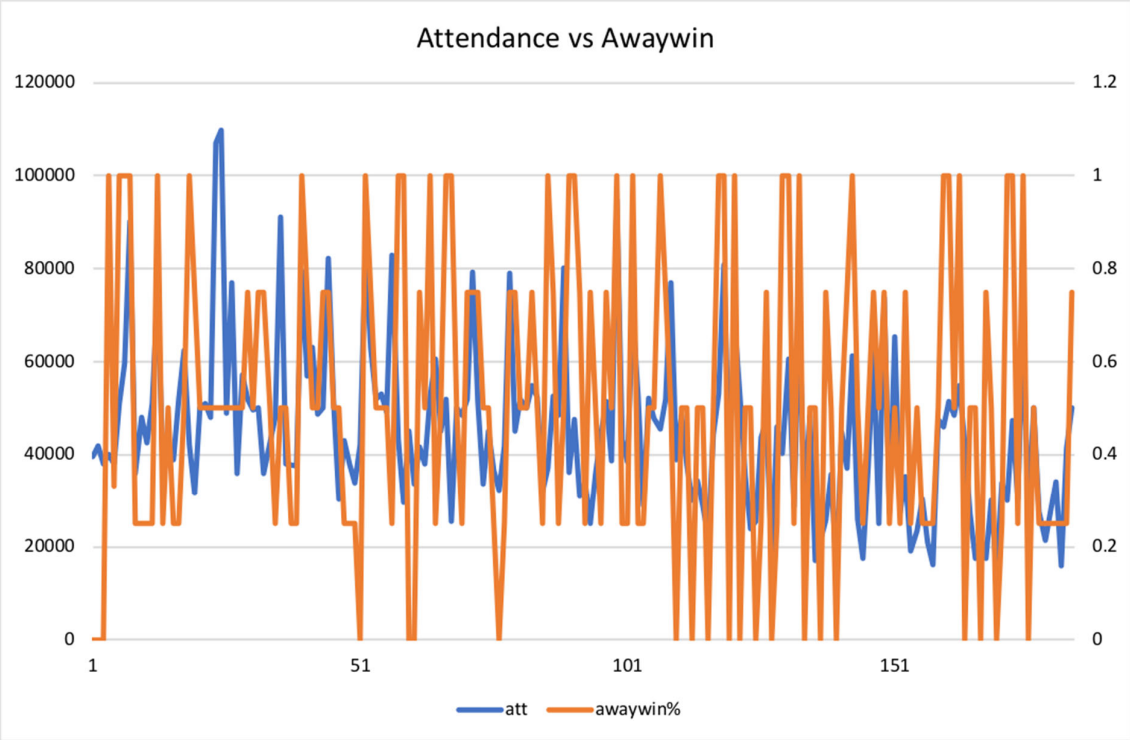


Figure 4 shows the away win percentage vs attendance. In the first 50 games, there is only 1 instance of the away ratio of ever reaching 0%, and that was in the very first game played. Contrast this to the graph showing attendance and home win ratio where there were numerous instances of the home win ratio being 0%. From game 100 onwards, there are a significant number of cases where the away win ratio was 0%. This coincides with the introduction of Argentina into the competition, which was the 110th game played in the competition, which did not first win until the 144th game. In fact, both variables trend downwards together, as the away win percentage were to decrease, the attendance would also decrease. Ultimately, there is no clear relationship between attendance per game and the two variables, which is a possible explanation for the lack of significance in the relationship found by the estimates

Robustness Analysis

Tobit regression output

Table 5

filled	Coef.	St.Err	t-value	p-value	Sig.
pop	0.000	0.000	-1.71	0.090	*
AD	-0.079	0.019	-4.17	0.000	***
homewin	0.109	0.053	2.08	0.039	**
awaywin	0.062	0.049	1.28	0.203	
homeratio	0.005	0.047	0.10	0.920	
awayratio	-0.021	0.054	-0.39	0.700	
argplay	-0.085	0.030	-2.86	0.005	***
derby2	0.055	0.026	2.10	0.038	**
hteamwonrwc	0.024	0.042	0.58	0.564	
awayteamwonrwc	0.096	0.037	2.60	0.010	**
beatabs	-0.017	0.042	-0.40	0.691	
junnight	-0.209	0.023	-9.00	0.000	***
julnight	-0.109	0.033	-3.30	0.001	***
augnight	-0.060	0.036	-1.67	0.097	*
septnight	-0.054	0.033	-1.63	0.105	*
octnight	-0.004	0.037	-0.10	0.923	
_cons	0.957	0.052	18.45	0.000	***
_cons	0.135	0.007	.b	.b	

Mean dependent var	0.890	SD dependent var	0.168
Pseudo r-squared	-2.553	Number of obs	174.000
F-test	37.618	Prob > F	0.000
Akaike crit. (AIC)	-68.220	Bayesian crit. (BIC)	-14.516

*** p<0.01, ** p<0.05, * p<0.1

A Tobit model was estimated as a robustness check for validity. A Tobit model is employed when there is censoring in observations of the dependent variable which makes estimating a relationship between the dependent variables and the independent variables more prone to bias when running an OLS regression.

The Noll-Scully ratio is still statistically significant at all conventional levels. The coefficient says that a 1 unit increase in the Noll-Scully ratio is estimated to reduce attendance per game 7.9%. Given that the mean attendance in the dataset was roughly 45000, this equates to a reduce attendance by up to 3550 fans. Similar to the OLS result, whilst there is statistical significance, there is not much economic significance involved. This helps provide more weight to the uncertainty of outcome hypothesis, and again provides evidence

for the hypothesis of the research paper that as competitive *imbalance* increases, match attendance decreases. The argument being that because the attendees believe they can infer with greater certainty the outcome of the game, they are less likely to attend as the competitive balance worsens.

The dummy for Argentina playing in the game is also statistically significant and negative. Table 5 shows that if Argentina was a participant in the match, it is predicted that it would result in a decline in attendance of 8.5%. This equates to a reduction of 3825 people. The economic significance of Argentina playing has waned when its effect is analysed using a Tobit model.

The argument for Argentina's negative influence is that because they are relatively new to the Rugby Championship and because Argentina has only won 5 games out of the 38 they have played in, fans are uninterested in watching them play. In addition because Rugby is a relatively insignificant sport in Argentina, this is likely to negatively influence attendance for home games played in Argentina.

The derby dummy is still statistically significant, but only at a 5% level. It predicts that if the game was a derby, it would lead to a 5.5% increase in match attendance. This is a 2500 person increase in match attendance. Again this is statistically significant, but it's economic significance is debatable. Intuitively, the result can be explained as such, because a derby game is a game between two traditional rivals, attendees may not be too concerned with the result because they want to go watch two historical rivals play against each other.

The dummy for whether or not the game was played in June and at night, is also still statistically significant, but it moves from a 10% level to a 1% level. Table 5 shows that if the game is played in June and at night, then it is predicted there will be 21% fewer attendees at a game. A reasonable explanation, for why fan attendance is reduced in June and at night is that because The Rugby Championship is played during winter, and June occurs during the respective nations coldest time of year, any game at night played is likely to have less attendees because the weather is likely to be less appetising than a game that is played for example during the afternoon when the sun is out. However because there are only 5 instances of a game played in June and at night (the competition was brought forward to accommodate the Rugby World Cup) their economic significance is marginal.

The home win percent is now statistically significant at the 5% level and a 1 unit increase in the home win ratio is predicted to result in a 10.9% increase in match attendance. This result is in line with previous literature, such given by Hogan et al. (2013) and Wen-Jahn (2014). It can also be argued that a 10.9% decline in match attendance is economically significant. The intuition behind this is simple, as attendance is likely made up of home team supporters, they are more likely to go watch a game when their team is doing relatively well.

The dummy variable for whether or not the game was played in July and at night is statistically significant at the 1% level estimating a decrease in attendance per game of 10.9% Because July is a winter month, and the game is played at night, fans are less likely to attend due to a high chance of inclement weather. Further more, our data is consistent with the findings, because 10 of the 40 observations of the July night dummy variable occur when match attendance is above capacity. As a result, the dummy variable becomes significant once the adjustment for censoring in the dependent variable is made.

The dummy for a game played at night in August and a game played at night in September is also statistically significant, but only at a 10% level, and negative. Predicting a 6% and a 5.4% decrease in match attendance respectively if the respective dummies are equal to one. The reason for the negative sign could again be attributed to the time of year the game is played. September and especially October are when the last games of the competition are wrapping up. At which point the winner of The Rugby Championship is likely already known, at this point the teams are no longer playing to win the competition and so fan interest is reduced.

The most interesting variable of discussion is the dummy for whether or not the away team won the Rugby World Cup the previous year. This is significant at the 5% level. It predicts an increase of 9.6% if the away team won the Rugby World Cup the previous year. An explanation for why this is possibly attributed to a phenomenon known as the David Beckham Effect (Shapiro 2017). Shapiro (2017) argues that David Beckham should have had a statistically significant and positive impact on home games when he signed up for the Los Angeles Galaxy Major League Soccer team. What Shapiro (2017) finds however was something counter-intuitive, David Beckham had a positive and statistically significant impact for games when he played at away venues. Shapiro (2017) argues because David Beckham is likely to play only once at opposition venues, it is the only chance for opposition fans to see David Beckham play against their home team.

The same effect could be used to describe why the away team winning the Rugby World Cup has a positive and statistically significant effect on match attendance. Because the Rugby World Cup winning away team is likely to play at opposition venues once, it is the

only chance for opposition fans to see them play against their home team increasing attendance. In addition, home fans are hoping to see their home team beat the reigning Rugby World Cup champions.

Summary and Conclusion

This paper utilised an Ordinary Least Squares model and a Tobit model to estimate the effects of competitive balance on attendance per game, gathering data on all matches played in The Rugby Championship (Tri-Nations pre 2012) since 1996. The results of both estimations find that less competitive balance corresponds to a statistically significant and negative decrease in attendance per game. However the economic significance of this coefficient is up for debate. Additionally, the Tobit model finds that if the away team won the Rugby World Cup last year, it resulted in a statistically significant and positive increase in match attendance. The results contribute to the empirical literature put forward in support of the uncertainty of outcome hypothesis inspired by Rottenberg (1956). In particular the results are similar to the results of Hogan et al. (2013), Wen-Jahn (2014) and Dang et al. (2015).

Hogan et al. (2013) and Wen -Jahn (2014) find that the home/away win percentage leading into the game has a statistically significant effect. The results of this paper finds no such relationship. The reason being that when match attendance and the home/away win percentage is compared graphically, no obvious relationship is present.

Despite questionable economic significance, policy options for the South Africa New Zealand Australia and Argentina Rugby Union (SANZAAR), the governing body overseeing the competition, are quite constrained. Players derive greater utility from representing their

nation and are willing to forego large salaries, as a result a salary cap is unlikely to make an impact. There is evidence of a draft (Booth, 2004) improving competitive balance for a competition in a single country, but it is not easy to draft players from one country to another.

Whilst redistributive policies for The Rugby Championship are not feasible, there is a club competition run by SANZAAR known as Super Rugby. It involves provincial teams from the respective 4 nations and Japan. There are 4 provincial sides from Australia, 5 from New Zealand, 6 from South Africa, 1 from Argentina and 1 from Japan. Super Rugby is used by the national coaches as a testing ground for potential international players.

Redistributive policies in Super Rugby can be implemented to improve competitiveness at an international level. A possible remedy then would be the pooling of resources, such as coaches, players and institutions. Booth (2004) has provided evidence of how such distributive policies can improve competitive balance as seen in Australian Rules Football, such lessons could be learned from this competition and applied to Super Rugby in the hopes of making The Rugby Championship much more competitive. This is ultimately a suggestion, and it is up to the respective national governing bodies to work together, the likeliness of which is questionable.

Additional research could be conducted to determine what affects socio-economic factors have had in match attendance, such as GDP per capita, or generating a measure for ticket prices over the years as data for ticket prices is non-existent for The Rugby Championship. Additional socio-economic factors could be competing interest from other sports such as soccer in Argentina and South Africa and Rugby League and AFL in Australia. Due to the time constraints, collecting such data was not feasible.

Future research could control for T.V ratings to determine the impact on attendance per game in the Rugby Championship. However this paper is unable to obtain such data because the matches are televised by 3 different broadcasters in each country, and due to time constraints could not be gathered. Additionally, an alternate measure of competitive balance such as utilising betting odds to determine match uncertainty could provide additional insight into the demand for sport.

To summarise, our modelling finds that the measure for competitive balance (The Noll-Scully Ratio) negatively affects attendance per game, however which nation is responsible for the worsening in competitive balance is a possible extension for further research. Additionally in the presence of right censoring on the dependent variable, Tobit estimation finds that the home win percentage and the away team winning the Rugby World Cup the previous year have positive impacts on attendance per game.

Reference List

Alchin, T.M., Tranby H.W. (1995), Does the Louis Schmelling Paradox Exist In Rugby League Match Attendances in Australia? Working Papers in Economics No WP95/09, Department of Economics, University of Western Sydney, Nepean Campus.

Arnaut, J. L., 2006. *Independent European Sports Review 2006*, London: HMSO.

Braun, S. and M. Kvasnicka, 2013. "National Sentiment and Economic Behaviour Evidence from Online Betting on European Football", *Journal of Sports Economics,* Vol. 141, pp. 45-64.

Baimbridge, M (1997) Match Attendance at Euro 96: Was the Crowd Waving or Drowning?, *Applied Economics Letters,* 4(9) 555-558

Booth, D.R. (2004), 'The Economics of Achieving Competitive Balance in the Australian Football League, 1897–2004', *Economic Papers*, **23**, 325–44.

Borland, J. and Lye, J. (1992), 'Attendance at Australian Rules Football: A Panel Study', *Applied Economics*, 24 (9), 1053–8.

Borland, J. and Macdonald, R., 2003. "Demand for Sport", *Oxford Review of Economic Policy*, Vol. 19, No. 4, pp. 478-502.

Coffin, D.A (1996) If You Build It, Will They Come? Attendance and New Stadium Construction, In J.Fizel, E.Gustafsen, and L. Hadley (eds) *Baeball Economics: Current Research,* Wesport, CT, Praeger.

Dang, T M., Booth, R., Brooks, R. & Schnytzer , A. (2015). Do TV Viewers Value Uncertainty of Outcome? Evidence from the Australian Football League, *Economic Record,* Vol. 91, 523-535.

Demmert, H.G. (1973), The Economics of Professional Team Sports. Lexington Books, Lexington, MA.

Forrest, D., Simmons, R. (2002). Outcome uncertainty and attendance demand in sport: The case of english soccer. *The Statistician*, *51*(2), 229–241.

Fuller, P. Stewart, M. (1996) Sports Watching in Australia: A Conceptual Framework, *Advancing Management of Australian and New Zealand Sport, Proceedings of the 2nd Annual Sport Management Association of Australia and New Zealand (SMAANZ) Conference*, held at Southern Cross University, Lismore, NSW, 22-23 November.

García, J. and Rodríguez, P. (2002), 'The Determinants of Football Match Attendance Revisited', *Journal of Sports Economics*, 3 (1), 18–38.

Hogan, V., Massey, P., Massey, S. (2013). Competitive balance and match attendance in European rugby union leagues. *Economic and Social Review*, 44, 425–446.

Hynds, M., Smith, I. (1994) The Demand for Test Match Cricket, *Applied Economics Letters*, 1(7) 103-106.

Knowles, G., Sherony, K., Haupert, M. (1992), The Demand for Major League Baseball: A Test for the Uncertainty of Outcome Hypothesis, *The American Economist*, 36(2), 72-80

Lenten, L. J. A., 2009b. "Unobserved Components in Competitive Balance and Match Attendance in the Australian Football League 1945-2005: Where is All the Action Happening?", *Economic Record*, Vol. 85, pp. 181-196.

MengHu Blog (2014, December 2018), The use of Tobit and Truncated Regressions for Limited Dependent Variabes accessed 28 september 2018, < https://menghublog.wordpress.com/2014/12/28/the-use-of-tobit-and-truncated-regressions-for-limited-dependent-variables/>

McDonald, M., Rascher, D. (2000), Does Bat Day Make Cents? The Effect of Promotions on the Demand for Major League Baseball, *Journal of Sport Management,* 14(1), 8-27

Neale, W. C. (1964). The peculiar economics of professional sports. *The Quarterly Journal of Economics*, *78*(1), 1–14.

Noll, R. G., 1988. *Professional Basketball,* Stanford University Studies in Industrial Economics, No. 144.

Paul, R.J. Weinbach, A.P. (2007), 'The Uncetainty of Outcome and Scoring Effects on Nielsen Ratings for Monday Night Football', *Journal of Economics and Business*, 59, 199–211.

Peel, D. A., Thomas, D. A. (1988). Outcome uncertainty and the demand for football: An analysis of match attendances in the English football league. *Scottish Journal of Political Economy*, *35*, 242–249.

Peel D. A., Thomas, D.A (1996), Attendance Demand: An Investigation of Repeat Fixtures, *Applied Economics Letter,* 3(6), 391-394.

Rottenberg, S. (1956), 'The Baseball Players' Labor Market', *Journal of Political Economy*, 64, 242–58.

Rascher, D. (1999), A test of the Optimal Positive Production Network Externality in Major League Baseball, in j. Fizel, E.Gustafsen and L.Hadley (eds), *Baeball Economics: Current Research,* Wesport CT, Praeger.

Sanderson, A. R., Siegfried, J. J. (2003). Thinking about competitive balance. *Journal of Sports Economics*, *4*(4), 255–279.

Schmidt, M., Berri, D. (2001). Competitive balance and attendance: The case of major league baseball. *Journal of Sports Economics*, *2*(2), 145–167.

Tainsky, S., Xu, J., Zhou, Y. (2014). Qualifying the game uncertainty effect: A game-level analysis of NFL postseason broadcast ratings. *Journal of Sports Economics*, *15*(3), 219–236.

Scully, G. (1989). *The business of major league baseball*. Chicago: University of Chicago Press.

Stats NZ, New Zealand Government, accessed 28 september 2018, < https://www.stats.govt.nz/topics/population>

Statsguru, ESPN Scrum, accessed 28 september 2018, < http://www.espnscrum.com/statsguru/rugby/team/8.html?class=1;template=results;type=team >

Shapiro S.L., DeSchriver T.D., Rascher, D.A. 2017. The Beckham effect: Examining the Longitudinal Impact of a Star Performer on League Marketing, Novelty and Scarcity , *European Sport Management Quarterly,* 17:610-634.

Szymanski, S., 2003. “The Economic Design of Sporting Contests”, *Journal of Economic Literature,* Vol. 61, No. 4, pp. 1137-1187.

Szymanski, S., Késenne, S. (2004). Competitive balance and gate revenue sharing in team sports. *The Journal of Industrial Economics*, *52*(1), 165–177.

Szymanski, S., 2009. Playbooks and Checkbooks An Introduction to the Economics of Modern Sports, *Princeton: Princeton University Press*.

Wen-Jahn, J., 2014. The Relationship Between Outcome Uncertainties and Match Attendance: New Evidence in the National Basketball Association, *Review of Industrial Organization,* 45:177-200.

Whitney, J. 1988. Winning Games versus Winning Championships; The Economics of Fan Interest and Team Performance, *Economics Inquiry*, 26, 703-724