

# Playing to the Crowd: Impact of Attendance on Team Performance in United Rugby Championship.

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# Objective.



- ▶ Analysing team performances may provide valuable information for the organisation and design of tournaments as well as for team management (Ortega et al., 2009).
- ▶ Paper analyses performances of teams in the United Rugby Championship (URC).
- ▶ Research question: Impact of attendance on team performance as an explanatory factor in home advantage.

# Home advantage

Widely observed phenomenon  
(Nevill & Holder, 1999).

1. Crowd influence on officials.  
Garricano et al. (2005);  
Boyco, et al. (2007);  
Dohmen & Sauermann (2016);  
Dawson et al., (2020 & 2022).
2. Player shirking.  
Koyama & Reade, (2009)
3. Empty Stadiums.  
Bryson et al., (2021).  
Fischer & Haucap, (2021).  
Guerette et al., (2021)



# URC

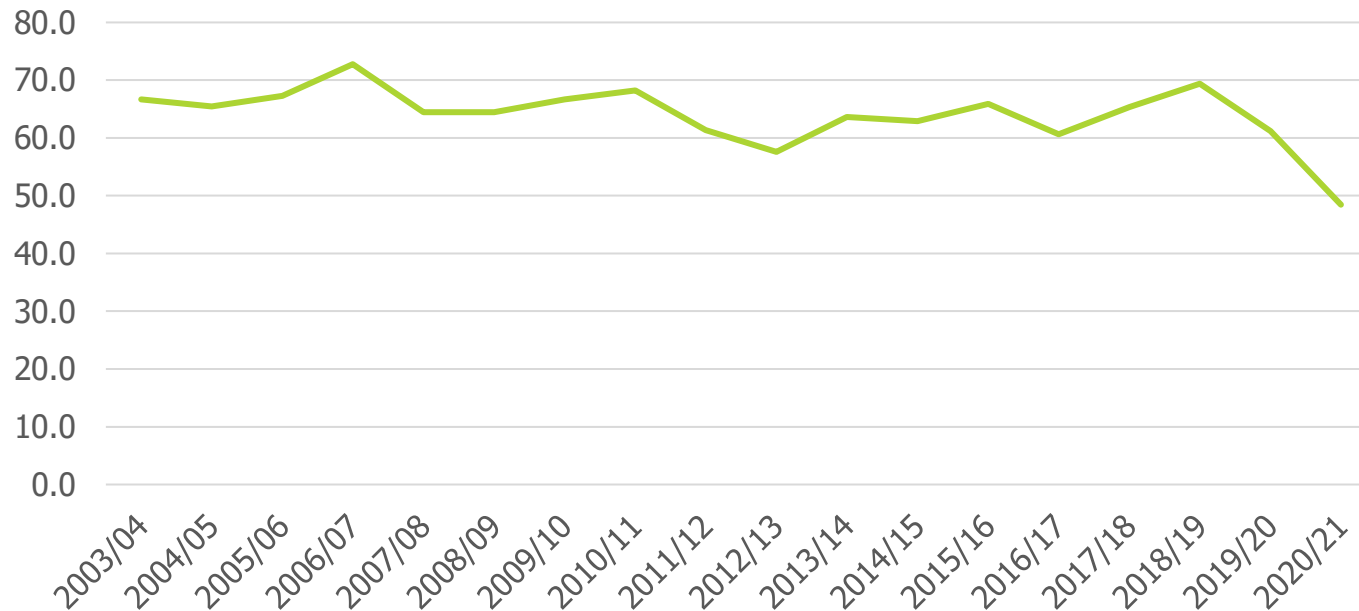


One of three major European Rugby Union leagues.

- ▶ Established 2001 Teams from Ireland, Scotland & Wales.
- ▶ 2 Italian teams added 2010/11
- ▶ 2 South African teams added 2017/18.

# URC Displays High Level of Home Advantage.

URC Home Wins %



# Literature 1

## Team Performance.

- ▶ Laird & Lorimar, (2004) – Try scoring in rugby.
- ▶ Ortega et al. (2009) – Differences between winning & losing teams - Six Nations Rugby.
- ▶ Lohawala & Rahmen, (2018) – Differences in winning strategies in one & five-day cricket.
- ▶ Delbianco et al., (2021) – Team Effort - English Premiership Rugby.

## Literature 2



Teams' responses to changed incentives.

Three-point rule in soccer:

Dewenter et al., (2014);

Hon & Parinduri (2016).

Bonus league points in rugby:

Winchester, (2014);

Lenten & Winchester, (2015);

Butler, et al., (2019);

Fioravanti et al., (2021).

Changes in relative score values in rugby; Hogan & Massey, (2018)

# Production Frontier Models – 2 Types

## Match Performance Measures (Shots, passes etc.)

Carmichael et al., (2000 & 2001) - Football;  
Espitier-Escuer & Garcia-Cebrian, (2004); Spanish Football;  
Hofler & Payne, (1998 & 2006) – Basketball.

## Expenditure

Barros & Leach (2006); Gerrard (2006) - English PL Football;  
Singh (2011), IPL Cricket;  
Barros et al. (2014) French Rugby Union;  
Hogan & Massey 2021 French Ligue 1 Football.

## Combination

Carmichael et al. (2010) PL Football.



Number of different models.

- ▶ Compare summary data for home and away teams (Orega et al., 2009).
- ▶ Difference in difference model (Fischer & Haucap, 2021)
- ▶ Bivariate model (Dawson et al, 2020 & 2022)
- ▶ Production Frontier (Carmichael et al, 2010) Not included.

## Methodology



Data.  
Scores and  
various  
performance  
measures from  
1,042 matches  
2012/13 –  
2019/20  
seasons.



Category	Variable	Description
Scoring	Try ConScore/ConMiss PenScore/PenMiss DGScore TotPts	Tries Scored Conversions Scored/Missed Penalties Scored/Missed Drop Goals Scored Total Points Scored
Attack	Poss Metres Pass Kick LB DB Off	% Possession Metres Run with Ball Passes Kicks from Hand Line Breaks Defenders Beaten Offloads
Defence	TackMade/TackMiss Turn PenCon	Tackles Made/Missed Turnovers Penalties Conceded
Source of Possession	ScrumWin LineWin RuckWin MaulWin	% Own Scrum Wins % Own Lineouts Won % Rucks Won % Mauls Won
Match Characteristics	Att% Day Hwin/Awin Qhome/Qaway Derby	Attendance % Capacity. Day and Time of Match Win Ratios Home & Away Team Play-off Probability Home & Away Derby Match (Same country).
H = Home A = Away		

# Overview 1 - Scoring

	Home			Away			
	Mean	Std Dev	Median	Mean	Std Dev	Median	Diff
Try	2.97	2.08	2.00	2.11	1.54	2.00	0.86***
ConScore	2.23	1.78	2.00	1.53	1.35	1.00	0.70***
ConMiss	0.81	0.95	1.00	0.64	0.78	0.00	0.17***
PenScore	1.87	1.51	2.00	1.60	1.35	1.00	0.28***
PenMiss	0.77	0.92	1.00	0.72	0.81	1.00	0.05
DGScore	0.13	0.41	0.00	0.06	0.25	0.00	0.07***
TotPts	25.09	12.52	23.00	18.28	10.14	17.00	6.81***
Obs	1,042			1,042			2,084

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

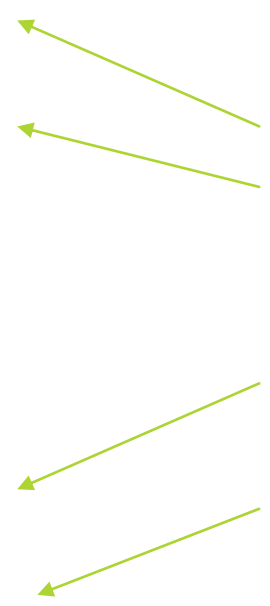
# Overview 2 – Performance Measures

		Home			Away			
		Mean	Std Dev	Median	Mean	Std Dev	Median	Diff
 Attack	Poss	52.10	12.94	52.00	47.90	12.94	48.00	4.20***
	Metres	405.60	129.17	394.50	357.67	119.69	348.00	47.93***
	Pass	146.64	42.23	141.0	137.09	42.16	134.00	9.55***
	LB	7.85	4.86	7.00	6.21	4.12	6.00	1.64***
	DB	18.30	7.72	17.00	15.84	7.14	15.00	2.46***
	Offload	9.10	4.99	8.00	7.90	4.49	7.00	1.20***
	Kick	23.08	7.48	22.00	22.56	8.38	22.00	0.52
	Obs	1,039			1,039			2,078
	TackMade	120.11	38.95	117.00	127.82	41.59	124.00	-7.71***
	TackMiss	15.90	7.24	15.00	18.39	8.01	17.00	-2.49***
	Turn	13.79	3.94	14.00	13.82	3.94	14.00	-0.03
	PenCon	8.87	3.00	9.00	10.21	3.07	10.00	-1.34***
	Obs	1,042			1,042			2,084
Possession	ScrumWin	90.29	13.45	100.00	88.62	15.84	88.89	3.45***
	LineWin	87.77	11.34	88.89	86.19	11.59	87.50	1.58***
	RuckWin	96.02	2.50	96.41	96.28	28.38	95.82	-0.27
	MaulWin	86.20	18.00	90.00	83.35	21.95	81.89	2.86**
	Obs	998			998			1,996

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

# Difference in Difference 1

Scoring				
	All	High Attendance	Low Attendance	Diff
Tries	0.8 (2.64)	1.31 (2.41)	0.60 (2.72)	+0.071***
ConScore	0.67 (2.25)	1.05 (2.16)	0.50 (2.27)	+0.55***
ConMiss	0.14 (1.24)	0.19 (1.23)	0.11 (1.25)	+0.08
PenScore	0.27 (1.72)	0.27 (1.75)	0.27 (1.71)	+0.01
PenMiss	0.04 (0.98)	0.06 (0.98)	0.02 (0.99)	+0.03
DGScore	0.07 (0.44)	0.02 (0.40)	0.09 (0.46)	-0.07***
TotPts	6.58 (17.20)	9.51 (17.90)	5.22 (15.61)	+4.28***
Obs	1,015	321	694	1,015



\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Group means and standard deviations (in parentheses).

# Difference in Difference 2

	Attack			Diff.
	All	High Attendance	Low Attendance	
Poss.	4.21 (26.06)	8.79 (24.53)	2.09 (26.49)	6.70***
Metres	45.77	70.09	34.50	35.59***
Pass	9.47 (60.80)	15.63 (60.71)	6.62 (60.68)	9.01**
LB	1.57 (5.98)	2.21 (6.02)	1.27 (6.04)	0.94**
DB	2.38 (10.18)	2.97 (10.02)	2.10 (10.25)	0.87
Offloads	1.17 (6.11)	1.08 (5.82)	1.22 (6.24)	-0.14
Kicks	0.53 (6.96)	0.88 (6.02)	0.36 (5.94)	0.53
Observations	1012	320	692	1012

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

Group means and standard deviations (in parentheses).

# Difference in Difference 3

		Defence/Possession			
		All	High Attendance	Low Attendance	Diff.
Defence	TackMade	-7.43 (52.65)	-12.30 (54.77)	-5.17 (51.51)	-7.13**
	TackMiss	-2.37 (10.16)	-2.95 (9.96)	-2.10 (10.25)	-0.85
	Turn	-0.04 (5.00)	-0.14 (5.22)	0.01 (4.89)	-0.14
	PenCon	-1.37 (4.42)	-1.66 (4.29)	-1.24 (4.48)	-0.42
	Obs	1015	322	693	1015
	ScrumWin	3.42 (19.41)	4.54 (19.92)	2.89 (19.16)	1.65
Possession	LineWin	1.74 (15.74)	1.15 (16.07)	2.02 (15.59)	-0.88
	RuckWin	-0.27 (28.82)	1.05 (3.76)	-0.91 (34.92)	1.96
	MaulWin	2.95 (28.68)	2.78 (31.95)	3.04 (26.86)	-0.26
	Obs	971	311	660	971
	* p<0.10, ** p<0.05, *** p<0.01 Group means and standard deviations (in parentheses).				

# Bivariate 1 - Scores

	Tries		ConScore		ConMiss		PenScore		PenMiss		DGScore		TotPts	
	Home	Away	Home	Away	Home	Away	Home	Away	Home	Away	Home	Away	Home	Away
Att/Cap	0.0973	-0.395*	-0.105	-0.517***	0.234*	-0.517***	0.0232	0.00144	0.112	-0.0353	-0.0131	0.0481*	-0.675	-3.056**
	(0.24)	(0.24)	(0.23)	(0.18)	(0.14)	(0.18)	(0.18)	(0.16)	(0.13)	(0.13)	(0.04)	(0.03)	(1.51)	(1.31)
Hwin	1.337***	-0.843***	1.023***	-0.530***	0.210	-0.530***	-0.0868	-0.0625	-0.130	-0.0275	-0.119**	0.0527	8.159***	-5.510***
	(0.27)	(0.22)	(0.24)	(0.20)	(0.14)	(0.20)	(0.21)	(0.19)	(0.16)	(0.16)	(0.06)	(0.03)	(1.59)	(1.43)
Awin	-2.001***	1.035***	-1.554***	0.866***	-0.348**	0.866***	0.646***	0.379**	0.0512	-0.104	-0.00706	-0.0263	-11.64***	8.053***
	(0.28)	(0.20)	(0.24)	(0.17)	(0.14)	(0.17)	(0.20)	(0.18)	(0.14)	(0.12)	(0.06)	(0.03)	(1.62)	(1.28)
Hqual	0.552***	-0.482***	0.530***	-0.322**	0.0487	-0.322**	-0.112	-0.197*	-0.189**	-0.0769	0.0235	-0.0116	3.744***	-3.612***
	(0.16)	(0.15)	(0.14)	(0.13)	(0.08)	(0.13)	(0.11)	(0.10)	(0.08)	(0.07)	(0.02)	(0.02)	(1.01)	(0.97)
Aqual	-0.579***	0.114	-0.502***	0.0825	-0.0553	0.0825	-0.0364	0.0817	-0.123*	-0.0354	-0.00170	-0.00821	-3.972***	1.162
	(0.17)	(0.12)	(0.16)	(0.11)	(0.07)	(0.11)	(0.11)	(0.11)	(0.07)	(0.07)	(0.02)	(0.02)	(1.04)	(0.81)
Derby	-0.576***	-0.214*	-0.294**	-0.0999	-0.304***	-0.0999	0.233**	0.309***	-0.0143	-0.0625	-0.00493	0.00583	-2.660***	-0.478
	(0.16)	(0.12)	(0.14)	(0.11)	(0.08)	(0.11)	(0.12)	(0.12)	(0.08)	(0.08)	(0.03)	(0.02)	(0.93)	(0.71)
KO > 5pm	0.0751	-0.201*	0.152	-0.111	-0.0728	-0.111	0.158	0.156	-0.0631	-0.00519	0.0231	0.0256	1.041	-1.148
	(0.13)	(0.11)	(0.11)	(0.10)	(0.07)	(0.10)	(0.11)	(0.10)	(0.08)	(0.07)	(0.03)	(0.02)	(0.76)	(0.70)
Constant	3.360***	2.717***	2.495***	1.938***	0.869***	1.938***	1.539***	1.357***	1.063***	0.920***	0.170***	0.0185	27.37***	21.60***
	(0.23)	(0.18)	(0.20)	(0.16)	(0.12)	(0.16)	(0.18)	(0.14)	(0.14)	(0.12)	(0.04)	(0.03)	(1.36)	(1.14)
Obs	1021	1015	1018	1012	968	1012	1028	1022	730	735	922	916	1040	1040
R <sup>2</sup>	0.18	0.13	0.16	0.09	0.03	0.09	0.02	0.02	0.02	0.01	0.00	0.01	0.19	0.15

Standard errors in parentheses

Standard errors are clustered by fixture

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$



# Bivariate 2 - Attack

	Poss		Metres		Pass		LB		DB		Offloads		Kicks	
	Home	Away	Home	Away	Home	Away	Home	Away	Home	Away	Home	Away	Home	Away
Att/Cap	2.181	-2.181	13.52	1.230	11.19**	20.68***	-0.490	0.0104	0.279	1.179	-0.184	0.378	-1.145	-1.458
	(1.53)	(1.53)	(16.75)	(15.67)	(4.91)	(5.84)	(0.62)	(0.56)	(1.24)	(0.95)	(0.62)	(0.55)	(0.93)	(1.12)
Hwin	5.375***	-5.375***	72.25***	-57.86***	-7.359	14.11**	2.435***	-1.299**	4.673***	-2.505**	1.624**	0.0527	-0.625	0.515
	(1.83)	(1.83)	(16.82)	(16.61)	(6.29)	(5.80)	(0.67)	(0.59)	(1.06)	(1.05)	(0.69)	(0.60)	(1.07)	(1.09)
Awin	-9.566***	9.566***	-88.98***	86.02***	18.25***	-19.04***	-3.179***	1.331**	-3.646***	3.933***	-1.775***	0.267	0.576	1.969*
	(1.67)	(1.67)	(16.16)	(15.33)	(5.56)	(5.54)	(0.62)	(0.52)	(1.06)	(0.91)	(0.66)	(0.61)	(0.98)	(1.05)
Hqual	4.129***	-4.129***	28.14***	-38.73***	-3.496	5.459	0.978**	-1.076***	2.116***	-0.463	-0.577	-1.429***	0.343	-1.665**
	(1.26)	(1.26)	(9.29)	(10.36)	(3.75)	(3.77)	(0.38)	(0.35)	(0.57)	(0.66)	(0.42)	(0.38)	(0.60)	(0.65)
Aqual	-1.551	1.551	-39.44***	4.274	5.266	2.478	-0.844**	0.989***	-1.252*	1.444**	-0.766**	-0.335	-0.469	0.0844
	(0.96)	(0.96)	(9.83)	(9.43)	(3.57)	(2.97)	(0.34)	(0.30)	(0.65)	(0.60)	(0.37)	(0.45)	(0.52)	(0.68)
Derby	-1.319	1.319	-25.48**	-7.227	-0.733	-6.615*	-0.454	-0.587*	-1.317**	-0.710	-1.274***	-0.732**	1.015	0.950
	(0.98)	(0.98)	(10.31)	(9.26)	(3.44)	(3.84)	(0.38)	(0.31)	(0.63)	(0.56)	(0.38)	(0.36)	(0.76)	(0.81)
KO > 5pm	1.015	-1.015	-3.061	-26.40***	-5.631*	0.921	-0.240	-1.093***	0.115	-1.287**	-0.796**	-0.818**	0.500	0.730
	(0.87)	(0.87)	(8.49)	(8.61)	(3.06)	(2.90)	(0.33)	(0.31)	(0.51)	(0.51)	(0.36)	(0.34)	(0.56)	(0.57)
Constant	50.54***	49.46***	425.0***	392.0***	128.0***	131.9***	8.689***	7.162***	17.14***	14.65***	11.31***	9.793***	23.27***	22.74***
	(1.50)	(1.50)	(13.76)	(13.83)	(5.01)	(4.85)	(0.54)	(0.49)	(0.93)	(0.83)	(0.55)	(0.58)	(0.91)	(1.02)
Obs	939	939	1032	1032	1032	1032	1032	1032	1032	1032	1032	1032	993	993
R <sup>2</sup>	0.11	0.11	0.12	0.11	0.03	0.05	0.08	0.08	0.09	0.06	0.04	0.03	0.00	0.01

Standard errors in parentheses  
Standard errors are clustered by fixture  
\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

# Bivariate 3 - Defence

	TackMade		TackMiss		Turnover		PenCon	
	Home	Away	Home	Away	Home	Away	Home	Away
Att/Cap	5.064 (4.29)	11.43** (5.01)	1.464* (0.87)	0.186 (1.24)	0.974** (0.49)	0.457 (0.53)	-0.975*** (0.35)	-0.335 (0.40)
Hwin	1.125 (5.83)	17.49*** (5.77)	-2.307** (1.08)	4.820*** (1.11)	-0.389 (0.59)	0.994* (0.57)	-2.073*** (0.44)	0.525 (0.42)
Awin	16.25*** (4.96)	-9.969* (5.37)	3.292*** (1.05)	-4.541*** (1.21)	0.240 (0.53)	-0.701 (0.49)	0.694* (0.42)	-1.501*** (0.39)
Hqual	2.794 (3.70)	6.256 (4.13)	-0.529 (0.66)	2.066*** (0.58)	-0.144 (0.34)	-0.604* (0.34)	0.300 (0.27)	-0.0124 (0.25)
Aqual	5.176* (2.77)	9.616*** (3.09)	1.614*** (0.61)	-0.996 (0.66)	-0.590* (0.32)	-0.464 (0.31)	0.163 (0.31)	-0.293 (0.20)
Derby	1.603 (3.12)	-3.301 (3.52)	-0.864 (0.57)	-1.363** (0.62)	-0.240 (0.32)	-0.148 (0.33)	0.502** (0.24)	0.151 (0.25)
KO > 5pm	-5.108* (2.72)	0.219 (2.84)	-1.274** (0.51)	0.0822 (0.52)	-0.212 (0.29)	-0.175 (0.28)	0.0229 (0.19)	-0.0587 (0.21)
Constant	105.0*** (4.26)	104.9*** (4.80)	14.72*** (0.82)	17.52*** (0.93)	14.15*** (0.48)	14.51*** (0.43)	9.551*** (0.34)	11.17*** (0.36)
Observations	1040	1040	1032	1032	1031	1031	1033	1033
R <sup>2</sup>	0.03	0.05	0.05	0.09	0.01	0.01	0.05	0.03

Standard errors in parentheses  
 Standard errors are clustered by fixture  
 \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

# Bivariate 4 - Possession

	ScrumWin		LineWin		RuckWin		MaulWin	
	Home	Away	Home	Away	Home	Away	Home	Away
Att/Cap	3.030*	2.062	0.468	0.468	0.455	-0.525	-4.574	-0.422
	(1.59)	(2.04)	(1.70)	(1.70)	(0.36)	(0.52)	(3.22)	(3.30)
Hwin	3.002	-1.392	-0.259	-0.259	0.287	5.324	1.212	-7.208*
	(2.10)	(2.12)	(1.67)	(1.67)	(0.38)	(4.85)	(3.18)	(3.77)
Awin	-0.691	6.151***	0.150	0.150	-1.197***	0.483	-4.413	5.637
	(1.73)	(1.90)	(1.49)	(1.49)	(0.33)	(0.56)	(2.91)	(3.51)
Hqual	-0.543	0.579	-1.498	-1.498	0.325*	-0.821	3.104*	1.186
	(1.07)	(1.22)	(1.13)	(1.13)	(0.19)	(0.56)	(1.63)	(2.03)
Aqual	0.399	2.160*	1.244	1.244	0.708***	0.435	1.538	-1.692
	(0.89)	(1.11)	(0.85)	(0.85)	(0.15)	(0.32)	(1.46)	(2.11)
Derby	-1.426	0.164	0.226	0.226	-0.151	-1.398	3.318*	-0.543
	(1.27)	(1.26)	(0.96)	(0.96)	(0.21)	(1.33)	(1.84)	(2.38)
KO > 5pm	0.138	-2.790**	0.787	0.787	0.0413	0.412	1.611	3.587*
	(0.98)	(1.09)	(0.78)	(0.78)	(0.19)	(0.64)	(1.62)	(2.09)
Constant	87.80***	82.89***	85.59***	85.59***	95.34***	94.02***	84.37***	82.39***
	(1.57)	(1.76)	(1.26)	(1.26)	(0.29)	(1.21)	(2.58)	(3.22)
Observations	993	993	996	996	988	988	635	634
R <sup>2</sup>	0.01	0.03	0.01	0.01	0.03	0.00	0.02	0.01

Standard errors in parentheses  
Standard errors are clustered by fixture  
\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

# Some Preliminary Conclusions.

- ▶ Home teams outperform away teams
- ▶ Attendance has some effect.
- ▶ Team quality and possibility of play-off qualification matters for both home and away.

# Future Work

- ▶ Distance travelled – South African teams
- ▶ Scheduling (Murray, 2018).





Thank You

Comments, queries welcome.