Apples and oranges? Comparing player performances between the Australian Football League and second-tier leagues

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Abstract

This study developed a model to determine the extent to which player performance objectively differs between various Australian football (AF) leagues. Champion Data (CD) ranking points were obtained during the 2016–2019 seasons, for all players across the Australian Football League (AFL) and the ten main second-tier AF leagues. Data pertaining to each player's age, playing position and the AF leagues in which they competed in were also collected. Phase One investigated the difference between the AFL and the senior second-tier leagues in which AFL affiliate teams participate in. Post-hoc tests indicated that objective player performance was substantially different between the AFL and each of the four senior second-tier leagues (effects ranging from 16.8 to 21.6 CD ranking points). Phase Two investigated the difference between the second-tier leagues from which players are traditionally drafted by an AFL club. Post-hoc tests indicated that objective player performance was substantially different between the four senior second-tier leagues as well as the under-18 national championships, in comparison to each of the reserve and under-18 state leagues. Professional sporting organisations may utilise the methods provided here as an example of what could be implemented to support decisions regarding player contracting, recruitment and team selection.

Keywords: decision support, performance analysis, data visualisation, player evaluation, team sport**.**

Introduction

Objective assessment of individual player performance is commonplace in contemporary professional team sports (Bonney, Berry, Ball, & Larkin, 2019; Carling, Reilly, & Williams, 2008). In many team sports, player performance is measured objectively using the same metric(s) across various leagues. These include both holistic objective measures of player performance, as well as simple box score statistics (Maymin, 2017). For instance, the Whoscored.com rating is used to assess performances in various association football leagues, including five of the major European leagues (Dendir, 2016). Alternatively, standard box score statistics are frequently used to outline and draw conclusions about player performances in various basketball leagues including the National Basketball Association, the United States' National Collegiate Athletic Association Basketball, as well as the Euroleague (Dehesa, et al., 2019; Mandić, Jakovljević, Erčulj, & Štrumbelj, 2019; Salador, 2011). Despite different leagues reporting these measures and statistics in the same way, scoring achieved in a college game or in the Euroleague, is not indicative of scoring achieved in the National Basketball Association (Coates & Oguntimein, 2010; Mandić, et al., 2019).

Some research studies have looked to ascertain the ability of performance measures and box score statistics at second-tier levels to predict career outcomes at the professional level (Berri, Brook, & Fenn, 2011; Maymin, 2017). However, there is very little research which has investigated the ability to quantify the difference of a specific measure between leagues. This capacity to translate a player performance measure across various competitions is inherently valuable to many sporting organisations, and is a vital understanding required to effectively make

organisational decisions regarding player recruitment, contracting and team selection (Liu, Schulte, & Li, 2018).

Professional organisations from many different sports seek to compare both objective and subjective player performance metrics between various competition standards. In order to appropriately make comparisons between performance in different leagues, decision makers must be able to comprehend and account for the factors which make each league unique. Some factors include the systematic difference in league qualities, the pace of play in each league, as well as minor differences in rules (Mandić, et al., 2019). By modelling for these factors, there is the ability to scale the difference in performance objectively between leagues, and create applications to help systematically compare performance, allowing for practical use in an applied setting.

The Australian Football League (AFL) is the elite competition of Australian football (AF), consisting of 18 competing clubs. AF is an invasion team sport played between two opposing teams consisting of 22 players each (18 on the field and four interchange). Each AFL club list consists of up to 47 players (Australian Football League, 2020), whereby those who are not selected to play for their AFL club on any given week have the opportunity to play with their club's affiliate second-tier club. Elite junior players can be drafted or recruited by an AFL club at or after the national draft, from the year in which they become 18 years of age (Australian Football League, 2020). Players can be drafted to a club through a variety of ways (Appendix 1). The large list sizes allow for AFL clubs to persist with players who they believe have the potential to develop whilst training within their clubs elite environment, but playing within their clubs affiliate second-tier

team. As such, the ability to comprehend the transferability of an objective measure of player performance from one league to another is advantageous in order to assess performance progression and forecast future performance of both potential draftees, as well as players already listed by their own, or other AFL clubs.

The aim of this study was to determine the extent to which the player performance, defined as Champion Data (CD) ranking points, differs between various AF leagues. This study approached this aim in two phases. Firstly, the study investigated the difference between the AFL and the senior second-tier leagues in which AFL affiliate teams participate in. Secondly, the study investigated the difference between all second-tier leagues in which players are traditionally drafted to by an AFL club.

Methods

Data

Data were collected across the AFL and the ten main second-tier leagues. These second-tier leagues include each league which AFL affiliate second-tier clubs participate in, as well as the leagues which players are traditionally drafted from into the AFL. Each of the second-tier leagues and their specific inclusion within the study are presented in Table 1. The CD ranking points were utilised as the objective measure of player performance in this study due to its availability across each of the eleven leagues/competitions, as well as its previous use in the AF notational literature (Gogos, Larkin, Haycraft, Collier, & Robertson, 2020; Hiscock, Dawson, Heasman, & Peeling, 2012; Hunkin, Fahrner, & Gastin, 2014; Stewart, Stavros,

Phillips, Mitchell, & Barake, 2016; Sullivan, Kempton, Ward, & Coutts, 2020). The CD ranking points are produced by statistics provider CD (Champion Data Pty Ltd., Melbourne, Australia), and measure a player's performance by awarding players a fixed value for specific performance actions. The values for these actions were determined by an analysis performed to estimate the scoreboard effect of multiple statistics, whereby positive points are attributed for valuable events and negative points for ineffective events (Jackson, 2016). In order to account for both match-to-match and league-to-league variations, such as the match durations and the number of players each league allows teams to have on their interchange bench (all leagues are consistent in having 36 active players on the field at any given time), CD standardises the ranking points against a fixed total number of points per match. The data used in this study were acquired from CD, and included a match ranking for each player within all regular season rounds during the 2016-2019 seasons. Each player's date of birth, and seasonal positional role classification were collected (determined by CD's classification at the conclusion of each season; classifications outlined in Table 2). Prior to data collection, the study was approved by the relevant human research ethics committee.

Whilst AFL Player Ratings is a more encompassing and validated measure of player performance in AF (McIntosh, Kovalchik, & Robertson, 2018), it is unavailable at the second tier level. Though the CD ranking points have not been formally validated externally, Jackson (2016) has shown them to be a credible indicator of player performance when compared to both subjective and objective evaluations. These comparisons include the AFL Coaches Association votes, the AFL's award for the fairest and best player (Charles Brownlow Medal), as well as the relationship

between the differential of combined team CD ranking points with both match outcome and margin.

**** TABLE 1 NEAR HERE ****

**** TABLE 2 NEAR HERE ****

Phase One: Player performance of AFL listed players across matches within both the AFL and second-tier leagues with their affiliate club.

Data analysis

To align with the specific aim of Phase One, data from the AFL and the senior second-tier leagues in which AFL affiliate teams participate were included (NEAFL, SANFL, VFL and WAFL). This included 3782 unique players across the four seasons, of which 778 players participated in both the AFL and one of the second-tier leagues within the same season. The total sample size for this phase was *n = 106,164* match ratings.

Statistical analysis

Descriptive statistics (mean and standard deviation) for the CD ranking points across league, position and age were obtained. To determine the extent which player performance objectively differs between the AFL and each of the senior second-tier state leagues, a linear mixed model was applied using the CD ranking points as the dependent variable, and league, position and age as the independent variables. This approach was used to control for the variability created by the repeated measures

for each player, and was conducted using the *lme4* package (Bates et al., 2015) in the R statistical computing software version 3.3.2 (R Core Team, 2016). League (n = 5), position (n = 8) and age were considered fixed effects. Random effects were specific to each player for each season (i.e., if a player was present for multiple seasons, they were assigned a random factor for each season) in order to minimise any within-player longitudinal variance that may arise. The model took the form of:

$$CDpm = \beta 0 + \beta 1Xpm + \beta 2Ypm + \beta 3Zps + \propto ps + Epm$$

where CDpm is the CD ranking points of player p in match m. β0, β1, β2, and β3 are fixed coefficients, and X, Y, and Z are observed covariates. Xpm and Ypm represent the player's age on the day of the corresponding match and the league in which the player was competing in, respectively. Zps represents the player's positional effect, which stays consistent across each season. The parameter ∝ps is a player-season random effect, which makes the intercept of the model specific to each player for each season. This effect is a draw from a normal distribution with equal variance for all player-seasons. The parameter Ɛpm denotes the player match residual error.

Results

Descriptive statistics of the CD ranking points are outlined in Figures 1 and 2 for each of the different leagues, positions, and age. Though age is considered

continuous in the model, Figure 2 displays age as discrete variable to more simply visualise the change in CD ranking points longitudinally. Results of the linear mixed models revealed that all factors affected levels of performance at $p < 0.001$. The model produced a root mean square error of 23.6 and Chi-square values of 3134.0 for league, 1294.9 for position and 1762.2 for age. The fixed effect coefficients for the model are outlined in Table 3. Results of the post-hoc Tukey test are outlined in Figure 3, allowing for pairwise differences in league to be visualised through the least squares means.

**** FIGURE 1 NEAR HERE ****

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**** TABLE 3 NEAR HERE ****

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By applying the fixed effect estimates and the player specific random effects from the linear mixed model, player performance (as outlined by the CD ranking points) can be visualised and tracked for a player across various leagues within a season. As an example, Figure 4 outlines an application for how player performance can be equitably standardised using the fixed effects estimates, and visualised in order to track player performance whilst competing in both the AFL and a second-tier leagues. Alternatively, the player specific random effects provide a measure of player ranking which is adjusted for each of the fixed effects characteristics. In order to track seasonal performance of multiple players longitudinally, Figure 5

outlines how these can be used as a more suitable alterative measure to mean ratings to support organisational decisions.

**** FIGURE 4 NEAR HERE ****

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Phase Two: Player performance of non-AFL listed players competing in one or more second-tier leagues.

Data analysis

Players who were not listed by an AFL club during any of the 2016-2019 seasons, had played a minimum of three matches across any second-tier league and were 18 years of age or older at some point during each respective calendar year (in order to align with AFL draft requirements) were included in Phase Two. This resulted in 5593 unique players across the four seasons, with each player playing in a mean of 12.0 (± 5.1 SD) games, across 1.3 (± 0.5 SD) different second-tier leagues. The total sample size of games for this phase was *n = 119,556* match ratings.

Statistical analysis

To further investigate the extent of the gap of objective player performance between AF leagues, a linear mixed model was again applied using the CD ranking points as the dependent variable. League (n = 10) and position (n = 7) were considered fixed effects. Similarly, the random effects were specific to each player for each season in order to minimise any within-player longitudinal variance. The model takes the same form as the model outlined in Phase One, however, β1 and Xpm are

removed as player age was not a consideration within Phase Two. Post-hoc Tukey tests were also performed to determine whether performance was different between each league.

Results

Results of the linear mixed model revealed that all factors affected levels of performance at $p < 0.001$. The model produced a root mean square error of 25.3 and Chi-square values of 4602.8 for league and 2119.1 for position. The fixed effect coefficients for the model are outlined in Table 4. The results of the post-hoc Tukey test are outlined in Figure 6, allowing for pairwise differences in league to be visualised.

**** TABLE 4 NEAR HERE ****

**** FIGURE 6 NEAR HERE ****

Similarly to Phase One, Figure 7 outlines an application for how the fixed effect estimates can be standardised and visualised in order to track performance across multiple second-tier leagues within the same season .

**** FIGURE 7 NEAR HERE ****

Discussion

The aim of this study was to determine the extent to which the player performance, defined as CD ranking points, differs between various AF leagues. Phase One investigated the difference in CD ranking points between the AFL and the senior

AFL affiliated second-tier leagues. The applications of this model have the potential to support organisational decisions relating to weekly team selection, as well as player contracting. Phase Two investigated the difference between CD ranking points across all second-tier leagues. This phase was included to further investigate how a similar methodology and application could be applied to support organisational decisions more related to player drafting.

The CD ranking points outlined in Figure 1A indicate that all leagues have a relatively similar mean and distribution. These means are fairly consistent between leagues due to the standardisation undertaken by CD, whereby the minor discrepancies seen are attributed to the differing number of players each league allows teams to have on their interchange bench. In contrast to these descriptive statistics, the regression coefficients outlined in Tables 3 and 4, and the post-hoc comparisons outlined in Figures 3 and 6 provide a more intuitive understanding of the differences seen in the CD ranking points between each of the separate leagues. Specifically, the Phase One comparisons highlight a substantial difference in the CD ranking points between the AFL to that of each of the four senior second-tier leagues. Whilst these findings are expected considering the AFL is the elite competition of AF, these differences illustrate the main rationale for investigating the extent to which the value of player performance objectively differs between various AF leagues. In Phase Two, the comparisons highlight that there are substantial differences between the four senior second-tier leagues as well as the under-18 national championships, in comparison to each of the reserve and under-18 state leagues. With the under-18 national championships being a main draft pathway for elite under-18 players (Sullivan, et al., 2020), and the majority of players competing in these championships also competing in one or more of these

reserve and under-18 state leagues, these findings reiterate the need for a method to quantify the difference in objective player performance measurements between leagues.

The size of the root mean square errors in both mixed models indicate that other performance factors not captured by the rankings should also be considered when using the models to forecast player performance. Despite this, the models outlined have various practical utilities for professional sporting organisations, and could be used to support their decision making processes. Specifically, they provide an ability to objectively track player performance progression concurrently, or retrospectively across multiple leagues. The model outlined in Phase One allows for the CD ranking points to be appropriately compared for players playing in matches for both their AFL club, and their clubs affiliate second-tier club. Additionally, the model could be used to compare performances between two or more different players competing in different leagues. As an example, Figures 4A and 4B indicate the raw CD ranking points, and the adjusted CD ranking points, respectively, for two specific players longitudinally, whilst competing in various leagues. The adjusted CD ranking points accounted for the fixed effect estimates relevant to each player, providing an equitable objective measure of performance for each player. In this example Player One had a higher mean of raw CD ranking points across the season (+43.6). However, after accounting for these fixed effects estimates there is a large variation in rankings, leaving Player Two with a higher mean (+7.8) of adjusted CD ranking points across the season. As such, these adjusted ranking points could be better suited to support the decision to select or omit a player for a given team based on their recent performances, or to support recruiting/list management decisions.

The model in Phase Two allows for the CD ranking points to be appropriately compared for potential draftees across the various second-tier leagues, and could be utilised to support decisions regarding player drafting. A specific example of how the Phase Two model could be used to similarly adjust the ranking points to visualise and track player performance of two potential draftees longitudinally at the conclusion of the 2017 season is provided in Figures 7A and 7B. To further investigate the applicability of objective models in this study, future applications could be conducted to determine how well these models work in comparison to current practice and/or subjective models used in professional AF organisations.

In addition to providing a method for which player performance can be tracked match-to-match longitudinally, the player specific random effects produced by the mixed models can also provide an indication of overall season performance for each player. These could be used as a more suitable measure of seasonal player performance than mean player rankings, and could similarly be used to support organisational decisions regarding recruitment and list management. This type of ranking is generalisable to all players in the dataset for each respective phase, as the random effects account for the fixed effects used in our models, allowing for comparisons between players across different ages, leagues and playing positions (McIntosh, Kovalchik, & Robertson, 2019). For example, the comparison of Figures 5A and 5B outline how the mean season CD ranking points and player random effects in Phase One could be used to visualise seasonal performances for players across various seasons. Specifically, Figure 5A indicates that Player Three had a higher mean of CD ranking points across the 2019 season as compared to the other three players, and was his highest mean ranking across the four seasons. However, the player random effects outlined in Figure 5B provide a different

narrative, indicating that once league, position and his age have been accounted for, his seasonal performance was somewhat lower than that of both Players One and Four during the 2019 season, and was his lowest measure across the four seasons. This application of player random effects as a measure of seasonal player performance could be used for various purposes, including supporting contract decisions between players, targeting players from opposition clubs, or alternatively to rank or highlight potential draftees from second-tier leagues.

The ability to transfer objective player performance measures between leagues is a sports industry wide predicament. Whether this be the ability to forecast performances post being drafted into a professional league, translate performances between a senior league and a reserves league, or between two separate elite leagues; this capacity to comprehend how a performance measure translates is inherently valuable to many sporting organisations. As such, the methodologies outlined in this study have implications for use within other team sports. The applications presented could be used as an example of what could be implemented within professional organisations where an objective player performance metric is available across various leagues.

Although the sport of AF has defined rules (Australian Football League, 2019), many of the second-tier leagues include unique rules which differ from both the AFL, and that of other second-tier leagues. As an example, some of the under-18 AF leagues have anti-density rules in order to better provide an environment that best allows each player opportunities to showcase their skillset (West Australian Football League, 2020). Though these uniqueness' are likely to have an effect on the CD ranking points values of players within their matches, the effect of these

unique rules are consistent within each league, and further emphasise the need for a methodology which can objectively account for these between league differences.

A limitation of this study should also be noted. The inclusion of all second-tier leagues in Phase Two meant that there was a lack of cross-competition observations between many leagues. For example, apart from comparisons made to the under-18 national championships, and comparisons between leagues played within the same state of Australia, the VFL-NEAFL comparison was the only comparison which had over five players compete in both leagues within the same season.

Conclusion

This study produced a methodology which determines the extent to which player performance objectively differs between various AF leagues. In both phases, a linear mixed model was conducted to identify the effect of individual characteristics and competing leagues on player performance. The Phase One comparisons highlighted a difference between the AFL and each of the four senior second-tier leagues, whereby the objective value of performance was lower at the AFL level. In Phase Two, the primary findings highlighted a similar difference, whereby the objective value of performance was lower in the four senior second-tier leagues as well as the under-18 national championships, in comparison to each of the reserve and under-18 state leagues. The implementation of these methodologies could provide valuable knowledge for professional AFL organisations, and could assist with organisational decisions relating to player recruitment, contracting and team

selection. Furthermore, similar methodologies and applications could be implemented within other team sports.

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Disclosure Statement

The authors report no conflict of interest.

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Appendices

Appendix 1. Descriptions of the three annual AFL drafts. In all three drafts, clubs select players in the reverse order to which they finished on the final premiership ladder in the previous AFL season.

Draft Type	Club Participation	Trading of Picks	Description
National Draft	Compulsory draft. Each club must exercise a minimum of three selections.	Picks can be traded between clubs.	Players selected by a club become ineligible to be included on the primary list of any other club for a period of two seasons. For the most part this draft consists of players finishing secondary school, who have been competing in elite junior second-tier competitions.
Preseason Draft	Non-compulsory draft.	Picks cannot be traded between clubs.	Players selected by a club become ineligible to be included on the primary list of any other club for a period of two seasons. For the most part this draft consists of players who missed out on selection in the National Draft.
Rookie Draft	Non-compulsory draft.	Picks cannot be traded between clubs.	Players selected becomes part of the clubs rookie list, and cannot compete within the AFL until being promoted to the clubs primary list. For the most part this draft consists of players who missed out on selection in the National Draft or older players from second-tier competitions.

Tables

Table 1. The main Australian football second-tier leagues, and their specific inclusion within this study.

League/ Competition	Phase(s)	Description
NAB League	Two	An under-18 league based in the state of Victoria.
NEAFL	One/Two	The 'North East Australian Football League' is a senior second-tier league based in the states of New South Wales, Queensland and the Northern Territory.
SANFL	One/Two	The 'South Australian National Football League' is a senior second-tier league based in the state of South Australia.
SANFL Reserves	Two	A reserves league whereby the competing clubs are affiliated with the SANFL clubs.
SANFL Under 18s	Two	An under-18 league whereby the competing clubs are affiliated with the SANFL clubs.
VFL	One/Two	The 'Victorian Football League' is a senior second-tier league based in the state of Victoria.
WAFL	One/Two	The 'West Australian Football League' is a senior second-tier league based in the state of Western Australia.
WAFL Reserves	Two	A reserves league whereby the competing clubs are affiliated with the WAFL clubs.
WAFL Under 18s	Two	An under-18 league whereby the competing clubs are affiliated with the WAFL clubs.
Under 18 National Championships	Two	An annual national championship event for players aged under-18. This competition is typically a main draft pathway for selected elite players.

'NAB League' formally known as the 'TAC Cup' prior to the 2019.

458 Table 2. Description of the eight player positions used in this study.

Player Positions	Description
Key Forward	Tall forward. Is typically the predominant target when moving the ball into the forward line.
General Forward	Small/medium forward. Plays predominantly in the forward half of the ground but with more freedom than a key forward.
Key Defender	Tall defender. Plays on opposition key forwards with the primary role of nullifying their opponent.
General Defender	Small/medium defender. Plays a role on opposition small/medium forwards and usually helps create play from the backline.
Midfielder	Plays a roaming role, with an emphasis on gaining possession of the ball when it is contested after a stoppage in play.
Wing	Is a subset of the midfield position. Typically an endurance player whose role it is play as the widest midfielder.
Midfield Forward	Splits time equally between the forward line and the midfield.
Ruck	Typically the tallest player on their team. Plays a roaming role, and has the primary role of competing with the opposition ruck when the ball is thrown into the air after a stoppage in play.

459 *'Wing' is an AFL specific position, and is only included in Phase One analyses. The*

460 *'midfielder' position encompasses those who play the wing role in all other leagues.*

Table 3. Phase One fixed effect regression coefficients, outlining the estimated difference in CD ranking points from the reference level of each factor.

	Regression coefficients	Std Error
(Intercept)	9.95	1.54
Age	2.25	0.06
Position - Gen Def	-15.26	0.63
Position - Gen Fwd	-19.09	0.65
Position - Key Def	-19.09	0.78
Position - Key Fwd	-17.32	0.84
Position - Mid-Fwd	-9.33	0.88
Position - Ruck	-9.10	0.94
Position - Wing	5.86	1.29
League - NEAFL	21.63	0.50
League - SANFL	20.04	0.57
League - VFL	19.26	0.40
League - WAFL	16.82	0.55

Reference level for each factor were: position midfield, league AFL.

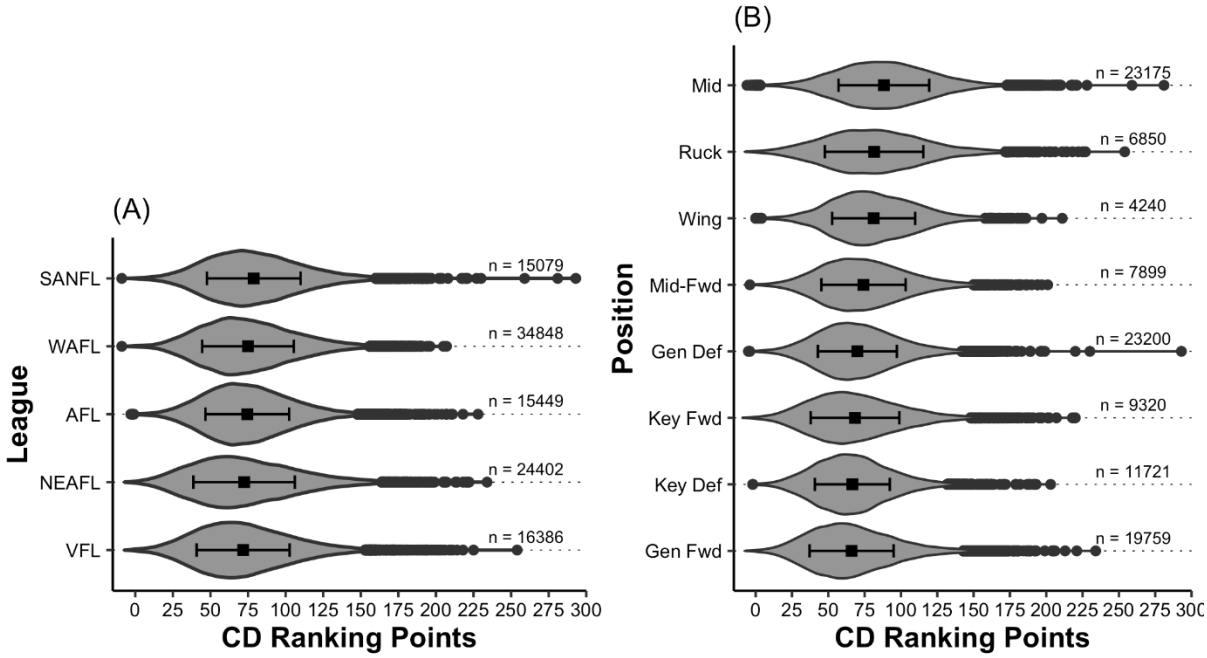
Table 4. Phase Two fixed effect regression coefficients, outlining the estimated difference in CD ranking points from the reference level of each factor.

	Regression coefficients	Std Error
(Intercept)	74.49	0.87
Position - Gen Def	-23.03	0.60
Position - Gen Fwd	-26.04	0.62
Position - Key Def	-24.05	0.80
Position - Key Fwd	-22.05	0.86
Position - Mid-Fwd	-15.15	0.84
Position - Ruck	-18.38	0.86
League - NAB League	20.58	0.83
League - NEAFL	6.28	0.93
League - SANFL	3.79	0.93
League - SANFL Reserves	24.27	0.89
League - SANFL U18s	34.03	0.97
League - VFL	5.55	0.92
League - WAFL	-0.06	0.93
League - WAFL Reserves	19.03	0.90
League - WAFL U18s	21.50	0.93

Reference level for each factor were: position midfield, league U18 Championships.

Figures

Figure 1.



473 Figure 2.

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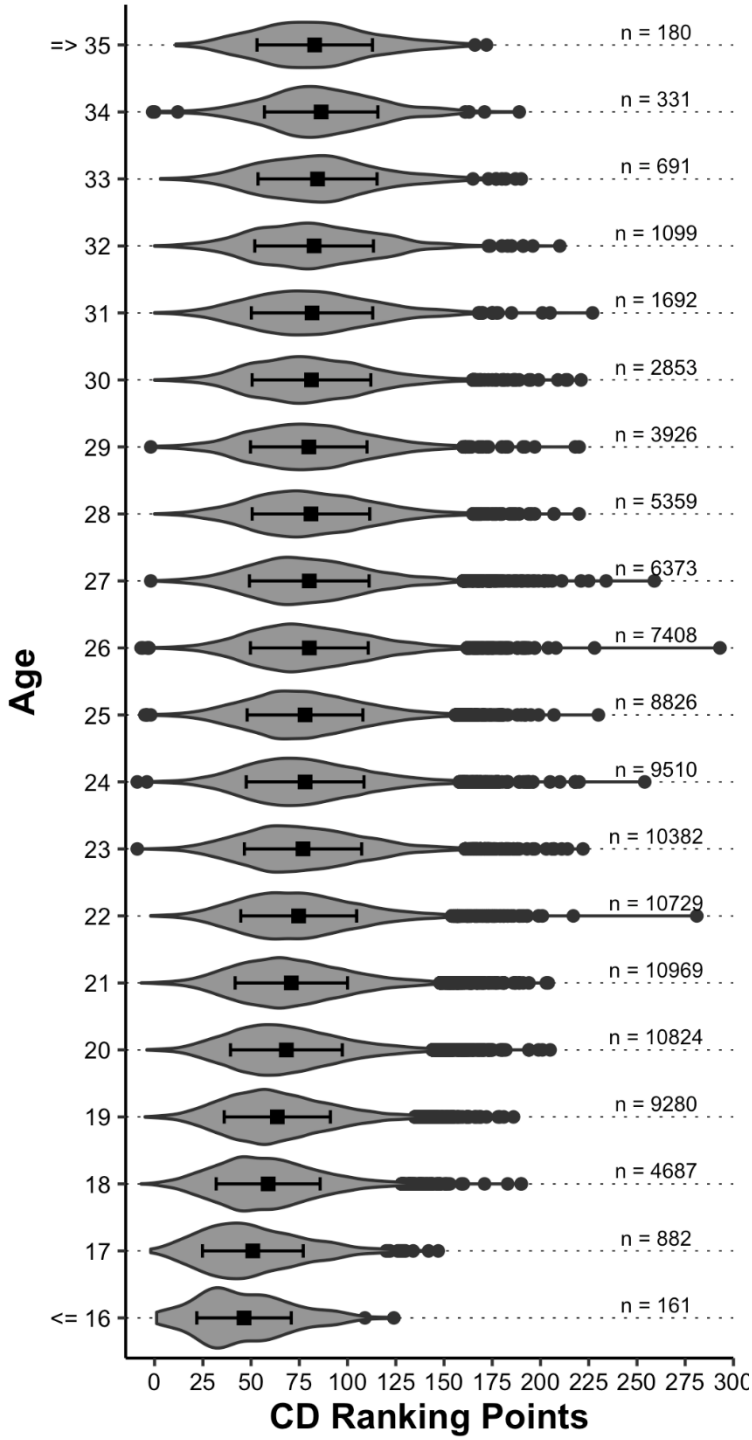

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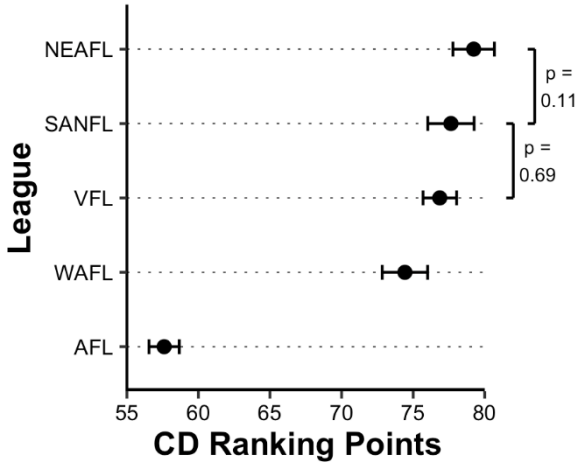
476 Figure 3.



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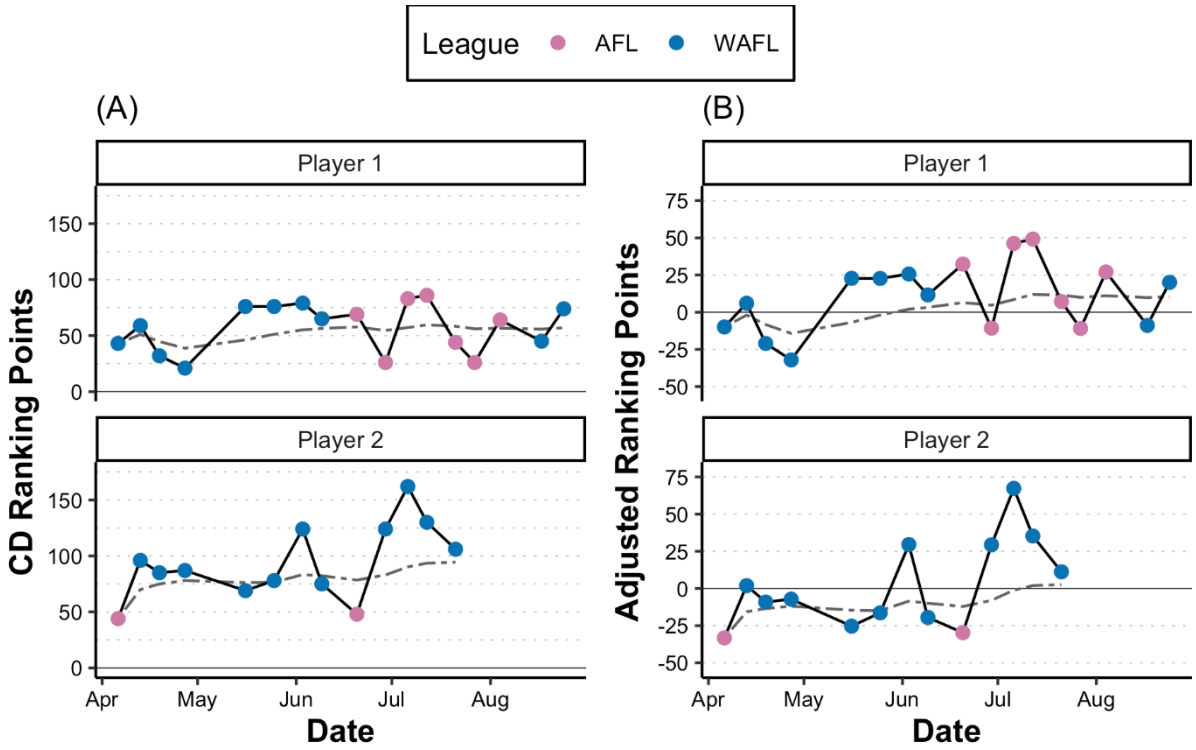
478 Figure 4.

479



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481 Figure 5.

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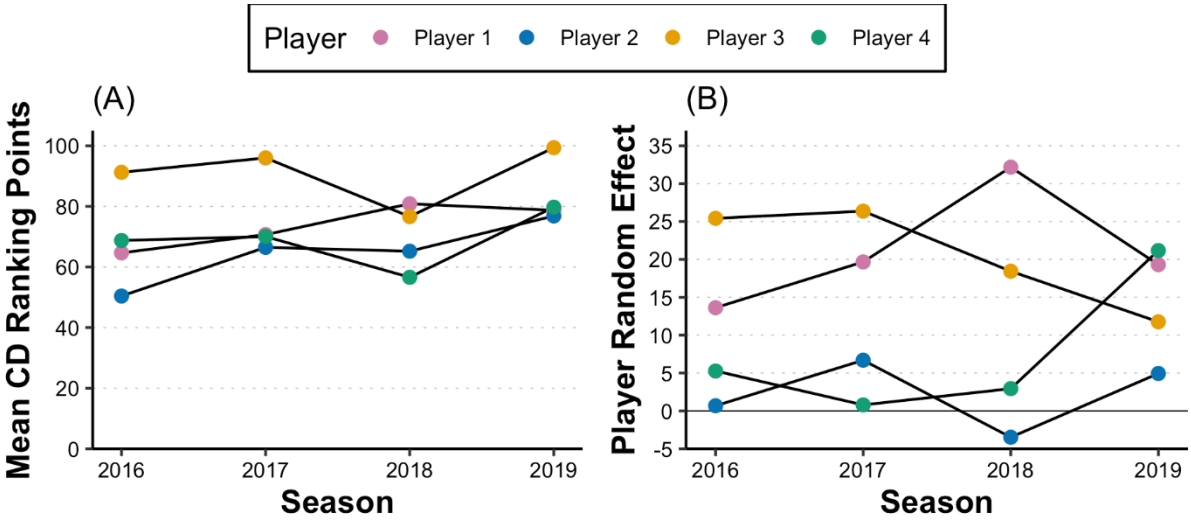

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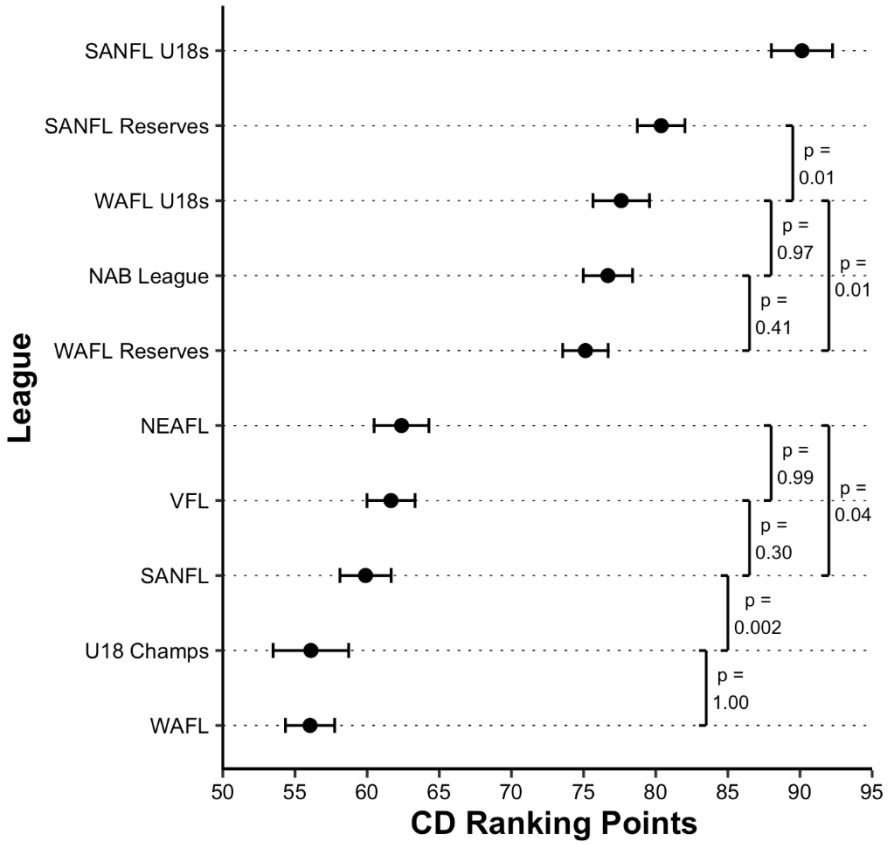
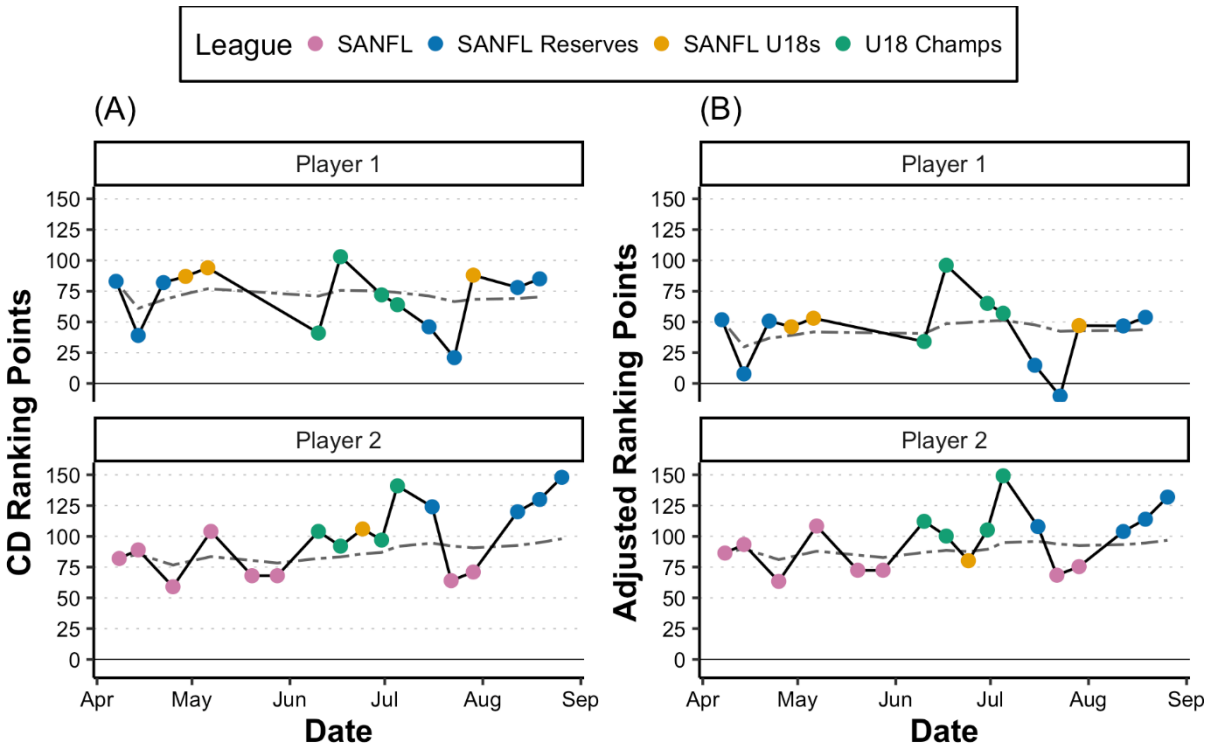
484 Figure 6.


SANFL U18s
SANFL Reserves
WAFL U18s
NAB League
WAFL Reserves
NEAFL
VFL
SANFL
U18 Champs
WAFL
League
p = 0.01
p = 0.97
p = 0.01
p = 0.41
p = 0.99
p = 0.04
p = 0.30
p = 0.002
p = 1.00
50
55
60
65
70
75
80
85
90
95
CD Ranking Points

486 Figure 7.

487



488

Figure Captions

Figure 1. Violin plots outlining the mean, standard deviation and density of the CD ranking points for each the (A) AFL and senior second-tier AF leagues and, (B) player positions, in Phase One.

Figure 2. Violin plot outlining the mean, standard deviation and density of the CD ranking points for age (outlined as a discrete variable), in Phase One.

Figure 3. Least squares means (± 99% confidence intervals) of League averaged over the levels of position in Phase One. P-values are outlined for all pairwise comparisons where a significance level of $p < 0.001$ was not achieved.

Figure 4. (A) CD ranking points, and (B) adjusted ranking points (with rolling means) for two specific players during the 2019 season, standardised by the Phase One linear mixed model fixed effects.

Figure 5. (A) Mean CD ranking points, and (B) player random effects across the 2016-2019 seasons, for four out-of-contract players from a particular AFL club (out of contract as at the conclusion of the 2019 home and away season).

Figure 6. Least squares means (± 99% confidence intervals) of League averaged over the levels of position in Phase Two. P-values are outlined for all pairwise comparisons where a significance level of $p < 0.001$ was not achieved.

Figure 7. Adjusted ranking points and rolling mean for two specific players during the 2017 season, standardised by the Phase Two linear mixed model fixed effects.