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Monash Warwick Alliance

Age, experience and team stability in the AFL:
The recipe for success

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Warwick-Monash Economics Student Papers

September 2023 No: 2023/62

ISSN 2754-3129 (Online)

https://warwick.ac.uk/fac/soc/economics/research/wmesp/

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Recommended citation: Milne, A. (2023). Age, Experience and Team Stability in the AFL: The Recipe for Success. *Warwick Monash Economics Student Papers* 2023/62.

[1] Warwick Economics would like to thank Gianna Boero and Samuel Obeng for their contributions towards the selection process.

Age, experience and team stability in the AFL: The recipe for success

Andrew Milne

Abstract

This paper analyses the importance of age, experience and team stability for on-field success for clubs in the Australian Football League (AFL). We use a fixed effects model to estimate our main results, with the key findings showing the importance of team composition and team stability. Team stability, representing social capital within the team, was shown to be a key factor in estimating home and away wins in the AFL over the years of 2010 to 2021. We find the importance of age as a limiting factor in a team's capacity to generate home and away wins, whereby a minimum average age of a team is a necessary but not sufficient requirement for team success. Additionally, it was found the age bracket with the greatest impact on win percentage is players in their early twenties (21-25 years old). We find the most important component of a team's composition is the level of match experience held by the team as a whole, with the proportion of players with greater than 100 matches experience contributing positively and significantly to team performance.

Keyword: AFL; Age; Experience; Team Stability; Social Capital

JEL classification: Z20; Z21

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Online Appendix:
https://www.dropbox.com/scl/fi/rb1pnm45a7mhm44o4bwem/APPENDIX.docx?rlkey=0c0x426izxdj9c0fz7ide3x4v&dl=0

1. Introduction

This research paper explores the role of age, match experience, and team stability at the team level in the AFL, and how changes in composition may impact team performance. While prior research explores the way in which age and experience contributes to individual performances, little work has been done to understand these same forces at the team level, in addition to the application of team stability in the AFL. Thus, this research paper will extend the current literature to include team composition as a factor in team performance, and how club's may be able to manipulate their age, experience and team stability to maximise team performance.

In many team sports, older and more experienced players have the capacity to act as on field 'coaches', helping set up players from a stoppage, sort out the defensive structure, or instruct other players to commit to actions. Although a leader's direct influence on the match through generating match-winning statistics such as clearances, kicks, and bounces may not be as influential as other players, these more experienced players may indirectly generate these statistics for their team, or alternatively, inhibit the capacity for the other team to generate these statistics. While previous research has shown that age has a quadratic-shaped relationship with individual performance (Gastin et al., 2013), this may not be true in the case of optimizing team performance. The alternative is that younger players' enthusiasm and energy may also have additional benefits to the team by increasing team motivation, indirectly contributing to higher team performance. This paper aims to quantify and qualitatively assess the way in which relationships between players as a function of age, match experience and team stability may impact team performance, and aims to determine if there is an optimal team structure as a function of these variables' clubs can exploit to gain a competitive advantage.

To further add context to my findings an historical look at both Greater Western Sydney (GWS) and the Gold Coast Suns (GCS) will be undertaken to determine if their differing fortunes relating to club success may be attributed to their team composition as a function of age, experience and team stability.

The AFL has recently announced the introduction of a nineteenth team into the competition, and so the findings will therefore be applied with the general purpose of how a new team's list should be constructed as a function of age, match experience, and list stability. Finally, a brief examination of the types of concessions that should be put forth to aid the new team will be analysed, on the basis as to whether the concessions will be able to effectively fulfil the key team composition elements we have uncovered.

In summary, this paper will establish the importance of age, match experience and team stability, at the team level, on a team's capacity to generate wins throughout the home and away season. The commentators within the AFL media currently relate the average age of a team, and the average number of matches played to establish which team is better placed to win a given match of football. We hope to shed light on how accurate this view is by either substantiating or disproving this line of thinking, and draw further inferences and conclusions about how clubs should maximise performance through team composition.

2. Literature Review

As there are multiple components of the list structure which will be examined, there exists previous literature which have explored how the different aspects of age, match experience, and shared match experience (Social Capital) are related to performance metrics.

To understand the basis of modern list management, we must first understand the previously established method for determining how clubs currently recruit players. Research undertaken by Stewart et al. (2007) describes the most relevant individual statistics in determining the outcome of a match from a team-perspective. Stewart et al. (2007) demonstrated that clearances from both the centre and general ball ups, being able to kick the ball further to a team-mate (rather than a 50/50 contest), and bounces taken by an individual are the most important statistics to generate to increase the likelihood of winning. This research informs clubs' list profiles by highlighting the types of players a club should choose to draft, recruit or, alternatively, delist. Thus, clubs should try to recruit and retain the players who have the capacity to generate the highest number of these statistics on a per game basis to either increase the points scored by their team, or limit the capacity for the opposition to score. Robertson et al. (2016) furthers the research undertaken by Stewart et al. (2007) to determine whether the commonly used performance indicators could reliably explain and predict match outcomes. Stewart et al. (2007) and Robertson et al. (2016) reached the same conclusion, finding a correlation between the number of inside 50s and clearances as having a strong positive correlation with whether a team was more likely to win a match. We conclude the basis for modern clubs recruitment is set in the quantitative assessment of the capacity for players to generate ‘match-winning' statistics, rather than recruit (or retain) players on the basis of their age, experience, and impact on team stability.

The first key idea we investigate in our research is the role of age on performance. Prior research has determined the impacts of ageing, match experience, and physical fitness may have on an individual's match performance, quantified on the basis of 33 statistics deemed relevant to success in the AFL (Gastin et al., 2013). Gastin et al. (2013) measured whether there was a correlation between an individual’s training regimes and individual performance, and the possible influence of experience on this relationship. In this research it was discovered that a relationship between age, match experience and preseason levels of aerobic fitness have a statistically significant impact on an individual’s match performance. Furthermore, we would expect a young, first year player to not have had time to fully develop their body strength and fitness level relative to their older counterparts, reducing their capacity to be competitive against these older and more mature opponents (McMullin et al., 2014).

The next key idea is that of experience of a team, whereby experienced players can act as on-field leaders for the playing group. Marshall (2017) investigated whether the absence of leaders from the playing field led to a downturn in the performance of the individual players in the team, and of the team as a whole. It built on the previously established idea that transformational leadership is strongly linked with increased sporting team performance (Marshall, 2017). Given the complex nature of AFL, having strong on field leaders is expected to have a strong positive impact on other team members, and thus team performance. Marshall (2017) did not find a significant relationship between their absence and the number of matches the team won, which suggests that leadership within the AFL is resilient to change. The restriction of this paper is that it only analyses the effect of the team leaders’ absence intra-season. Often-times, it can be assumed, that the role of the leader is to drive the culture within a club. Hence, although a leader is absent from the playing field they are still present at the club to act as support for the other players, and to promote healthy training standards for the rest of the team.

The final key idea is that of social capital, which has been researched in many settings outside of sport, with prior results finding there are significant performance benefits associated with higher levels of social capital (Clopton, 2011; Soda, Usai and Zaheer, 2004). The idea of social capital is exhibited by a group’s key characteristics (language, social norms) and their relationship to their team, and organization in which they work. A similar idea was explored by Clemente et al. (2014) in a game of soccer, whereby the researchers formulated the idea that interactions between players may have an impact on the capacity for a team to generate scores, thereby improving winning percentage. The idea of social capital is explored within this paper, being defined by the variable of team stability, as we explore its role in impacting the capacity for a team to generate wins.

The main paper my research will extend upon is McMullin et al. (2014) who explored expansion team's successes in the AFL. McMullin et al. (2014) determined the key factors in teams' performances in the formative years of the club by exploring the role of list stability, social capital, list age and list experience. This paper extends the work of McMullin et al. (2014) to include the teams of the Gold Coast Suns (GCS) and Greater Western Sydney (GWS), two teams which have been in the competition with enough time for us to examine the roles of team stability, age, and experience as a possible driving force behind their performances.

3. Methodology

This section of the paper will explain the variables used, how the data was collected, the regressions which will be analysed, and the range of sensitivity analysis which was undertaken.

The main outcome variable being investigated is team performance, and is defined as the team win percentage at the end of the Home and Away season. If a team were to win every match in a given home and away season it would relate to a 100% win percentage, and is defined in our data as a value of 1. Thus, win percentage is bound between 0 and 1.

The data was collected primarily from *AFL Tables*[1], an online website not officially endorsed by the AFL, but which had the key individual level data we could use to construct our main variables. We constructed variables to represent the age, experience and team stability of the team. The age of a player is defined as the start of the calendar year. The experience variable is games played, and is also defined as at the start of the season; a debutant in season 2021 will have played zero matches at the start of the season. A player is defined as having played a game only if they took to the field, a slight difference between our data and the official AFL data. In the AFL data a player who is a substitute but plays zero minutes of the game is counted as playing a game.

The last variable we have constructed is the team stability variable. The primary measure of team stability is the average number of matches each player has played with each other across two seasons,

[1] https://afltables.com/afl/afl_index.html

both across the home and away season and in finals. We can simplify both the structure of team's playing lists to be 40 players, with 22 players playing each match, and the season structure to be 22 games total. With 22 players across 22 matches, there is a cumulative 484 matches played by a team in a season. The average number of matches the team has played with each other across two seasons can be split into the average matches played together in the current season, plus the average matches played together from the previous season.

For the current season this can be simply calculated as the cumulative number of matches played in the current season, divided by the number of total players used in total across the season. Hence, if the same players play every game for all 22 games, then at the end of the season, each player will have played 22 games with each other player. As the number of players used increases, the average number of matches played with each other reduces. For example, the Golds Coast Suns (GCS) in 2019 used 38 players across the season for a total of 484 matches played. This relates to an average of 12.737 matches each player has played with each other player.

We now explain how we calculate the average matches played together in the previous season. We take the cumulative number of matches of those who have played in both the current and previous season, only taking the number of matches they played in the previous season, and divide this number by the total number of players used across both seasons. If the same 22 players played across both seasons, then they would have played 22 matches together in the previous home and away season. Conversely if there are 22 new players for the current season, then the number of cumulative matches played by the current players in the previous season is 0. Using the GCS as an example once more, there were 32 players who played in both 2018 and 2019. These 32 players played 432 matches together in 2018 out of 484 matches total. The total number of players used across the two seasons was 45. This gives us the average number of matches played together of 9.6 for players who played in both 2018 and 2019. Intuitively, even if a team has played the same number of players who played across both seasons (32 in the case of GCS), a team in which these 32 players were responsible for all 484 matches in a season would have a higher team stability than in a team in which these 32 players were responsible for playing only 300 total cumulative matches.

We can then add up the two year's average number of matches played to give ourselves a team stability variable across two seasons. In the GCS scenario, we calculate a total average matches played together of 22.337 for the 2018 and 2019 seasons. There is therefore an implied lower bound of 12.1 for a list of 40, and an upper bound of 44 over the home and away seasons. This measure of team stability includes the number of players used over both seasons, but it also takes into account the number of matches these players have played.

The primary model which is being used is a Fixed Effects model, expressed by equation 1 below (where α_i represents the fixed effects of team *i*). Utilising the data as a panel allows us to run an Individual[2] Fixed Effects[3] model when analysing age and experience variables, mainly to account for systematic differences between teams. Differences between clubs include resources, facilities, game schedules, travelling differences, and match attendance, all of which have the possibility of influencing match outcomes. In the short run these effects are time invariant, and can impact how well individuals in a team train, their recovery, or their motivation. In order to determine whether a random effects or fixed effects model was most suitable for the data, the Hausman specification test was used[4]. Standard errors are clustered at the team level.

$$Win\ Percentage_{i,t} = \alpha_i + \beta_1 AgeVariable_{i,t} + \beta_2 ExperienceVariable_{i,t} + \varepsilon_{i,t} \ (1)$$

For team stability analysis, we run an individual Fixed Effects Model and include Time Fixed Effects[5], as expressed by equation 2 below (where α_i represents the fixed effects of team *i*, and '*Season'* is a vector of dummy variables representing each season, equalling 1 in time *t*). Time fixed effects are included to account for the shorter 2020 season, which was reduced due to COVID-19 constraints. In both 2020 and 2021 we see a drop in team stability across all teams compared with previous years. We do not see any difference in the age or experience of the teams compared to previous years, and as such do not need to account for time fixed effects in this analysis. Standard errors are clustered at the team level.

$$Win\ Percentage_{i,t} = \alpha_i + \beta_1 TeamStability_{i,t} + \beta_2 Season_t + \varepsilon_{i,t} \ (2)$$

No lagged dependent variable was included in the regression for the two following reasons. The first reason is because we do not believe that a team's past performances are relevant to the results we are trying to establish. Including a lagged dependent variable as a regressor may obscure the results we hope to see; win percentage is bound between 0 and 1, and including a lagged dependent variable restricts the variability in win percentage we hope to see. As win percentage is a proxy for team

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[2] In this instance, Team Fixed Effects.

[3] A joint F-test on year dummies was used to determine time effects were not required for these variables using the testparm command in *Stata 17*.

[4] Using the Hausman command in Stata 17, a p-value of <0.1 indicates using a FE model.

[5] A joint F-test on season dummies was used to determine that Time Effects would be included for team stability, using the testparm command in *Stata 17.*

performance, it is still possible for a team to perform better in one season relative to the prior season yet still see a reduction in win percentage. We therefore exclude the lagged dependent variable as it may induce bias in our estimates. The secondary reason is to avoid problems with endogeneity arising within the model. We therefore believe that omitted variable bias is not of concern within the model, and by including a lagged dependent regressor there is the possibility of inducing endogeneity within the model.

3.1. The Main Specification

The main model upon which our results are examined and analysed is based on the following criteria. Players are only included in the data set for the age and match experience variables if they have played 6 or more matches during the season. In excluding these players it is important to remember that this has no impact on the team stability variables constructed.

The age categories are players aged twenty years or younger, players aged between 21 and 25 (early twenties), between 26 and 30 (late twenties), and lastly 31 years or older. The experience categories chosen for matches played are 15 or less, between 16 and 50 matches, between 51 and 100 matches, and 101 matches and above. Matches are defined at the commencement of the season.

We believe that these four categories, both in age and experience, reflect the increases in skill, leadership and maturity which are exhibited by a player over their 'life-cycle' in the AFL. Most AFL players are recruited straight from secondary school, and these proportion set out stages as they increase their skills and fitness over the years in the AFL system and become both on-field and community leaders.

3.2. Other Specifications

A range of sensitivity analyses were undertaken in order to ensure the robustness of the results. The first sensitivity analysis undertaken is to keep the proportions of age and matches played constant, but to include all players in the data set (instead of excluding players with fewer than 6 matches played within a season).

The second sensitivity analysis which was undertaken was the inclusion of whether a team had a new coach as a control variable. The underpinning reason for its inclusion is that a new coach may be more likely to play younger and less experienced players on the basis that their job security in their first year is not based on the performance of the team, and a new coach may be correlated with a rebuild of the team where a larger number of players are delisted, thereby impacting team stability.

4. Main Analysis

4.1. Age

Upon initial inspection, the average age has a strong correlation with a team's win percentage, and appears to exhibit diminishing returns. Although we gain very little from analysing

Table 2, we instead focus on how the ages of the players are distributed within the team to gain further insights into the age of a team impacting team performance in Table 1.

[Table 1]

[Table 2]

The proportion of ages which is most detrimental to the performance of a team over the course of the season is having players twenty or under constituting a high proportion of the player base. Although having a proportion of one is unobservable, the coefficient of -0.9055 captures the drastic reduction in performance of a team having a high number of players in this age bracket. The highest proportion that we do observe is 0.706 by GWS in 2012, the year in which they were admitted into the AFL, and a year in which they won only two matches for the season. The impact of young age on team performance changes quickly, whereby the proportions designated as players aged in their early twenties (21-25) and late twenties (26-30) already becoming significantly positive, while the proportion of players aged 31 and above is positive, but not statistically significant, aligning with the idea of age having a diminishing return to performance. It therefore appears that having players aged twenty or under is detrimental to team performance, although this negative relationship quickly deteriorates to become positive for all following proportions. Table 3 holds the average age constant and highlights the importance of having a high proportion of individuals aged in their early twenties, rather than having a large distribution of player ages, both older and younger, to obtain the same average age in the team. Holding the average age of a team at the mean age, it is detrimental to have many players aged either twenty or under, or in their thirties. This supports the idea that age exhibits a quadratic form at the team level, and presents the idea that there is a minimum age requirement which must be met for a team to produce wins.

[Table 3]

4.2. Games Played

As shown in

Table 4, the average number of matches played by individuals within a team has a positive and significant correlation with team performance, also appearing to exhibit diminishing returns. Increasing the average games played by one standard deviation from the mean is expected to increase team performance by 0.2652, or roughly the equivalent of 5 matches in a 22-match season. The highest average number of matches played by a team was 128.68 by Hawthorn in 2015, the year in which they won their third of three premierships in back-to-back years.

[Table 4]

As with age, averages tell only part of the story. To uncover further information about the impact of match experience on team performance a look into how match experience is dispersed across the players is also important, as done in

Table 5. Unsurprisingly, having players who have played fewer than 15 matches at the commencement of the season is detrimental to team performance, even allowing for the concession within this model that they must have gone on to play a minimum of 6 matches in the season to be considered eligible for analysis. What is interesting, however, is that the next proportion of games played being between 15 and 50 matches is not significant. We can therefore infer that at this stage players begin to have the capacity to positively contribute to the team's performance. The following two proportions are both significantly positive, indicating that a team with a high proportion of players with more than 50 matches played is strongly correlated with team performance. Thus, for teams to maximise performance they should focus on playing as many players with greater than 50 matches of experience, or even more beneficially 100 matches, as possible.

[Table 5]

4.3. Team Stability

What is the most interesting to analyse from these simple regressions is the impact of team stability on team performance. Unlike the aforementioned regressions, in which players had to play a minimum of six matches to be eligible, this is a modified measure of how many players have been used over two seasons, taking into account the number of matches each player has played. Two things are interesting to note. The first is that the coefficient of average matches together played over one season is higher than the coefficient on average games across two seasons. This suggests that within season stability is more important that cross season stability. The coefficient of team stability relating to one season (intra-season) is 0.098, while the coefficient relating to team stability across two seasons (inter-season) is 0.05. A one standard deviation increase in intra-season team stability correlates to an increase in win percentage of 0.317, or about 7 matches in a season. The second interesting thing to note is that a coefficient of 0.05 (inter-season stability) relates almost exactly to 1 match in a 22-match season (0.045). The interpretation is therefore straight forward: by increasing the average number of matches played between two seasons by one match, the team is expected win just over one additional match. The coefficient for intra-year stability being more important that inter-year stability may be attributable to injury. A team with a higher number of injured players may be forced to play additional players they would have otherwise not needed to[6], reducing team performance by requiring the team to play individuals not in the best 22 players. Despite this, total

[6] However, injury data was not able to be gathered from the AFL.

team stability having a statistically significant coefficient of 0.0459 suggests that the ability to build social capital across seasons improves team performance.

[Table 6]

4.4. Correlation between Age and Experience

From the above, we have observed the positive relationship that exists between increasing age and team performance and increasing match experience on team performance. The next question then becomes, what is more important between the two – given the correlation that exists between age and experience[7] we must account for the possibility that an increase in one is capturing the effect of the increase in the other variable. One method to account for this is to hold the other variable as a control. By regressing win percentage on both the average age of a team and the average games played of a team we find that only the average games is positive and significantly correlated with winning percentage (

[7] Table 12

Table 7, regression 1). It therefore appears that experience has a greater impact on team performance than age does. The second regression in

Table 7 indicates that there is a minimum average age a team must achieve in order to be successful, with age exhibiting the same quadratic form discussed earlier. Thus, although experience is more important than age in general, age is a necessary but not sufficient condition for performance; experience is required in addition to a minimum average age.

[Table 7]

5. The Team Composition Clubs should try and achieve

So far we have discovered that the average age of a team and average matches played of a team are positively correlated with a team's performance. We have also established that the most significant explanatory variables for poor team performance is the proportion of players aged twenty or under, and the proportion of players who have played fewer than 15 matches at the commencement of the season. Conversely, we have discovered that the variables which best explain a high win percentage are the proportion of players who have played 100 or more matches, and the proportion of players aged in their early twenties (21-26 years old). We have also discovered that, holding each other as a constant, experience is more important than age in determining team performance. However, age and experience are not necessarily held constant, and thus it seems prudent to explore whether there are any additional advantages to be gained in this area. From

Table 9, we can see clearly that there are additional gains to be made, and that having the highest proportion of players with more than 100 matches played is not the only important component of a team's playing list. In fact, having a high proportion of players with greater than 100 matches played is significantly more beneficial if the team has a sufficient proportion of players aged in their early twenties. This therefore suggests that the most beneficial team composition is one with the highest number of experienced players combined with the highest proportion of players aged in their early twenties.

[Table 8]

If instead we use the average games played as the experience variable rather than proportion of players with greater than 100 matches played, as done in Table 8, we get comparable results. The main difference is with regards to the proportion of players aged older than 30. Although the coefficient on proportion of players aged over 30 is negative,

Table 9 illustrates that if these players aged over 30 have played greater than 100 matches there is still a net benefit to be made as the magnitude on the proportion of players with greater than 100 matches played is greater than the magnitude of the coefficient on proportion of players in their thirties.

[Table 9]

5.1. Examples of Team Composition

A good team composition should consist of the team with the highest amount of experience while still being able to control for the negative returns to age as players get older. A team should therefore strive to get the highest level of match experience while holding the age of a team such that it has a high proportion of players aged in their early twenties. According to the results gathered the most successful team in terms of win percentage would be a team which has both the highest proportion of players with match experience of over 100 matches in conjunction with the highest proportion of players aged in their early twenties. Although this may seem reasonable, in practice it may be quite difficult to achieve. West Coast Eagles, in 2017 had the highest proportion of players with match experience above 100 games of 0.643 and recorded a proportion of players in their early twenties of 0.393. In contrast, the highest proportion of players aged in their early twenties was Essendon in 2013 with a proportion of 0.714 and had a proportion of players with greater than 100 games of match experience of just 0.143.

However, if we look at the two most successful clubs over this period (by win percentage) we can see that it is possible to strike a balance between both. Collingwood in 2011 won 0.9091 of the matches for that year while Hawthorn in 2013 won 0.864 matches. Collingwood had a proportion of 0.516 of players with greater than 100 matches played and a proportion of 0.482 in their early twenties compared to the competition average of 0.308 and 0.442, respectively. Hawthorn had 0.52 with greater than 100 matches played and 0.56 in their early twenties compared to the competition average of 0.277 and 0.479, respectively. Both these teams had higher than the average both in terms of the proportion of players with greater than 100 matches played and the proportion of players aged in their early twenties, illustrating the benefits of being able to capture this team composition.

A secondary aspect of team composition clubs must be aware of is the value of retaining players over multiple seasons, thereby increasing the social cohesion of the team. Clubs should be aware to not undervalue the impact of losing players to other clubs, especially players who played a high number of matches in the previous season.

5.2. The Gold Coast Suns and Greater Western Sydney between 2013 to 2019

The previous results have allowed as a framework upon which we can analyse the differing fortunes of the Gold Coast Suns and Greater Western Sydney, the two most recent teams introduced into the competition. The GCS and GWS had similar concessions, including access to players within their zones, high picks in the national draft, an increase in total player payments (salary cap) and the capacity to sign up to 10 previously listed players in the AFL and up to 16 uncontracted players (McMullin et al., 2014). Despite this, GWS managed to make the grand final in 2019 while the GCS have failed to make a finals appears at any point.

Team Composition over 2014 to 2015

After being introduced into the AFL in 2013 with a young and inexperienced team, by 2014[8] the team composition of GWS had started to move in the right direction to generate wins, represented by a win percentage of 0.273 in 2014, 0.5 in 2015. According to our model, the key variables of interest are the increase in both the average matches played of the team and the average age of the team, both of which were driven by team stability. The proportion of players aged twenty and under reduces from 0.636 in 2014 to 0.233 in 2015, compared to the competition average of 0.201. This large reduction in players aged twenty or under is driven by team stability: there is a substantial increase in the proportion of players aged in their early twenties increasing from 0.226 in 2013 to 0.633 by 2015. This is in conjunction with the proportion of players with fewer than 15 matches played reducing from 0.548 in 2013 to 0.303 in 2014 and reducing again to 0.2 by 2015, below the competition average of 0.236. The team stability variable of average matches played across two seasons has increased between 2013 and 2015 from 17.89 matches to 22.987 matches, thereby implying GWS have managed to retain their players as they get older and more experienced.

In comparison, the GCS in 2014 won just under half of the matches for the year[9], unsurprising given the relative closeness of the team in key areas to the mean. The proportion of players aged twenty and under of 0.276 is well within one standard deviation (0.136), alongside the team stability variable

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[8] Although GWS had a new coach in 2014, it was not due to poor performance, but rather the opposite; the club was showing signs of strength, and so Kevin Sheedy as the coach no longer saw himself as part of the future of the club. (The Guardian, 2015)

[9] The average number of matches won by a team in a year is half

of average number of matches played within a team across two years of 22.444 compared to the competition average of 24.537 also falling within one standard deviation (3.009).

In 2015, however, GCS won less than half of the matches as they had in the previous year, with a win percentage of 0.205, with a key factor being team stability. The team stability at the GCS reduces from 22.444 in 2014 to 21.013 in 2015, falling outside of one standard deviation (3.158) from the mean across the competition (24.423). Interestingly, this reduction in team stability stems entirely from intra-season stability rather than inter-season stability. This is confirmed by looking at the proportion of both games and ages, with increases in both the proportion of players aged in their late twenties offset by an almost equal reduction in the proportion of players in their early twenties. Similarly with matches played, there is an increase in the average matches played of the team driven by an increase in the proportion of players who have played greater than 50 matches. The reduction in winning percentage can therefore be partly attributed to the reduction in team stability experienced across the season, and somewhat attributed to factors unexplainable by our model.

Team Composition over years 2016 to 2019

By 2016, GWS has an average matches played together of 27.138 compared to the competition mean of 24.543, the proportion of players aged twenty or under has fallen to 0.111, lower than the competition mean of 0.194, while the proportion of players who had played fewer than 15 matches at the start of the year was 0.111, also well under the competition average of 0.246. GWS were playing an older and more experienced team, and was therefore in a better position than the average team in terms of age and experience. This was reflected in their performances for that year, achieving their highest yet win percentage of 0.727, relating to winning 16 matches.

The team composition of the GCS over 2016-2019 remains remarkably consistent, and so too does their win percentage. In the key areas of proportion of players aged twenty or under, GCS are above the competition average by within one standard deviation in three of the four years. In the other year (2018), the average age of the team reduces substantially, which can be partially attributed to the appointment of a new coach in that season[10]. Other than in 2018, the relevant proportions of players aged in their early or late twenties, and proportion of players with fewer than 15 matches played or greater than 100 matches played remains consistent across these years. What is most concerning is that the proportion of players with greater than 100 matches experience is more than one standard

[10] As investigated in sensitivity two: the coach as a control variable

deviation lower than the competition average in three out of the 4 years, contributing heavily to their poor performances over this time period. Thus, Using the proportions of a team's age and experience helps explain a team's win percentage, with GCS stable team composition relating to a stable, although low, win percentage from 2016 to 2019.

6. Sensitivity Analysis

6.1. Sensitivity One: Eligibility

If we include all players in the data set, rather than excluding players with fewer than 6 matches played we find remarkably similar results (

Table 10) to the main model. The key area of difference is the magnitude of the coefficient on the proportion of players who have played 100 or more games. The coefficient reduces from 0.715 in the main model to 0.432, and is smaller than the coefficient on the proportion of players with between 50 and 100 matches played. This is counter-intuitive to the theory that increasing match experience will always improve match performance. A possible explanation for this may stem from the role of age. By including all players in this model, we are including players who have 100 or more matches but did not necessarily play 6 matches in a season. An explanation as to why such experienced players may not play 6 matches in a season may be due to their age, and the overall limiting factor of age on their capacity to influence match outcomes[11]. Additionally, older players are more susceptible to injury[12], and so their in-game injury[13] may relate to a reduction in team performance in that match. Overall, however, playing individuals with greater than 100 match experience is still positively correlated to a team's win percentage, and supports the same conclusions drawn from the main model.

[Table 10]

6.2. Sensitivity Two: Including the Coach as a control Variable

We introduce a coach variable, a dummy equaling 1 if the team has a new coach in that year[14], and 0 otherwise[15]. Appointing a new coach for a team is often a sign that the team is not performing as well as hoped. An established coach at a team may understand that the team's performances reflect primarily on themselves, and as such a team which performs poorly may look to replace the coach. A coach which has been at a club for multiple years is likely aware of the pressures they are under, and so will field the most experienced side they can in an effort to generate wins and save their career. A new coach, on the other hand, is often given a grace period where they are safe from scrutiny, and are instead entrusted with 'rebuilding' the team. A new coach may therefore be more inclined to play younger and less experienced players as they do not have the primary goal of generating as many wins as they can, but rather to establish a core group of talented young players they can build their team around in the coming years. As the club rebuilds their team and use a lot of players, we also expect team stability to reduce. Interestingly, this theory does not necessarily hold in the data. While

[11] Age has a negative correlation with individual performance (Gastin et al., 2013)
[12] Older AFL players are more susceptible to hamstring injuries (Gabbe et al., 2005)
[13] Although exact numbers on injuries remain elusive and difficult to compile; the AFL injury report does not compile injuries on a per-team, per-year basis, making this a difficult area to explore.
[14] If a club replaces the coach midway through the year, in that year 'coach' will equal 0, and in the following year it will equal 1.
[15] GCS and GWS in their first year have 'coach' equal to 0.

the average age and average games played variables do indeed reduce when a club has a new coach, it is not by a statistically significant amount[16]. This may be due to the limitations of the data we have; a coach has been replaced only a total of 37 times over our time period[17]. We may therefore not have enough data to be able to generate significant results for these variables. Despite this, there is still reason to believe when there is a new coach teams are less experienced as they play a greater proportion of players with fewer than 15 matches experience, and reduce the proportion of players with greater than 100 matches experience. However, we do see that our measure of inter-season team stability does reduce as we would expect[18]. This suggests that at the end of a season in which the coach is replaced these clubs may also move on more of their players than other clubs, or use more players in total across both years.

We can still run a regression of win percentage holding the coach variable as a control, as done in

[16] Table 15

Table 16

[17] Meaning that on average each team has replaced their coach approximately twice over the 12 seasons investigated

[18] Table 17

Table 11. Although the coefficient on the coach variable is negative it has no statistically significant impact on a team's win percentage apart from the possibility these teams play younger and less experienced sides with lower team stability.

[Table 11]

7. Team Composition of a new Club

Finally, we can come to understand the type of team structures which are most likely to be successful in the AFL. The priority in constructing the list of the new team to be introduced into the AFL should be focused around list retention and team stability. Team stability allows for an increase in social cohesion amongst the group, while also allowing for an increase in the overall age and experience of the team over time, both of which contribute positively to win percentage. Even still, it is still beneficial for the team to be able to compete for wins from the outset without needing to wait for young talent to mature. Below, we set out key criteria which should be met for the new team, and the concessions the AFL should make to ensure the criteria are met.

7.1. Concessions for the Introduction of a Tasmanian Team

In order to establish a club that can quickly compete for wins in its first year in the competition, the AFL will make certain concessions for the new club, as was done with the clubs introduced prior. Below we propose some possible concessions that the AFL could make on the basis of achieving a set of key criteria. The first criteria is to ensure the experience, in terms of games played, is sufficiently high. The second is to limit the number of inexperienced players (both age and matches played). The third is to ensure that the team remains stable over the formative years of the club to promote continued team improvement.

To achieve these objectives the experience level of this new team must be as high as possible, achieved through the concession of allowing for AFL listed players to be signed onto the new team. Additionally, increased salary cap is required to persuading players who may be otherwise unwilling to play for a newly established team. When recruiting these players, the most highly experienced players should be taken with the youngest ages possible; ideally target individuals in their early twenties with greater than 100 matches experience.

The ability to list uncontracted players is a concession that should also continue, with the players who should be targeted being recent delistings of players aged in their early twenties with a high number of AFL matches played. By recruiting these players, the new club can increase their average age, thereby overcoming the minimum average age requirement. Players in the state leagues such as the VFL, WAFL, and SANFL should also be targeted, with it being suitable to give the new club priority to draft from this source ahead of other teams.

Lastly, the concession to priority access to the national draft should also be kept ensuring elite young talent is coming into the club, promoting success over multiple years. A further proposal to implement is requiring some of these draft picks to be traded to other clubs in return for experienced players, thereby increasing the age and experience of the overall team. It is also important to update the terms of the draftees initial contract. At the present, draftees are contracted for only two years. To promote team stability, a recommendation we put forward is to increase the length of these initial contract to 4 years for all top ten draft picks, and three years for all other draft picks. This ensures team stability over the years and means that before their contract has expired they will be in their early twenties, a crucial determinant of team success.

8. Conclusion

In summary, our research has provided an overview of the role of age, match experience and team stability in the AFL, and its impact on a team's capacity to generate wins during the home and away season. Our results show that the primary aspect in which teams should build their team composition is through increasing the number of players who have played greater than 100 matches. Clubs should supplement this experience level with as high of a proportion of players aged in their early twenties as possible. However, the most important aspect of age is that it exhibits a quadratic form at the team level, and that there is a minimum age requirement necessary for a team to generate wins. The idea of social capital has also proven to hold at the team level, and is a key determinant of performance; clubs who can retain players across seasons, and use less players within seasons are more successful. In uncovering these findings, their importance was shown to hold both when building a list (GCS and GWS) as well as when challenging for the Grand Final (Collingwood and Hawthorn). We have furthered the current literature on key components of team and list structure, informing clubs on the performance maximizing composition they should aim for. In doing so, we have also set out key criteria if a new club was to be introduced into the AFL, and recommendation of concessions the AFL may afford to ensure the criteria is fulfilled.

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Table 1

VARIABLES	(1) Win percentage	(2) Win percentage	(3) Win percentage	(4) Win percentage	(5) Win percentage
Prop twenty under	-0.877**	-0.906***			
	(0.343)	(0.124)			
Prop early twenty	0.218		0.366*		
	(0.294)		(0.184)		
Prop late twenty	0.271			0.529***	
	(0.292)			(0.105)	
(omitted) Prop Thirty Plus	-				
Prop Thirty P					0.246
					(0.34202)
Constant	0.506*	0.686***	0.331***	0.354***	0.491***
	(0.273)	(0.0256)	(0.085)	(0.029)	(0.024)
Observations	159	213	213	212	160
R-squared	0.291	0.236	0.043	0.067	0.003
Hausman	0.002	0.054	0.068	0.000	0.004
Number of team encoded	18	18	18	18	18
Team FE	yes	yes	yes	yes	yes
Time EFF	no	no	no	no	no

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2

VARIABLES	(1) win percentage
Average Age	1.003**
	(0.467)
$(\text{Average Age})^2$	-0.019*
	(0.010)
Constant	-12.382**
	(5.554)
Observations	213
Number of team_encoded	18
R-squared	0.171
Hausman	0.008
Team FE	yes
Time EFF	no

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3

VARIABLES	(1) win percentage	(2) win percentage	(3) win percentage	(4) win percentage	(5) win percentage
Average Age	0.055	0.012	0.089***	0.076***	0.113***
	(0.059)	(0.026)	(0.014)	(0.025)	(0.013)
Prop Twenty Under	-0.200	-0.828***			
	(0.798)	(0.235)			
Prop Early Twenty	0.696		0.454***		
	(0.563)		(0.151)		
Prop Late Twenty	0.476			0.031	
	(0.339)			(0.169)	
(omitted) Prop Thirty Plus	-				
Prop Thirty Plus					-0.858***
					(0.261)
Constant	-1.221	0.379	-1.831***	-1.331**	-2.166***
	(1.862)	(0.673)	(0.353)	(0.549)	(0.319)
Observations	159	213	213	212	160
R-squared	0.295	0.237	0.211	0.130	0.206
Hausman	0.005	0.000	0.000	0.004	0.005
Number of team_encoded	18	18	18	18	18
Team FE	yes	yes	yes	yes	yes
Time EFF	no	no	no	no	no

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4

VARIABLES	(1) win percentage
Average Games	0.015***
	(0.004)
$(\text{Avg Games})^2$	-0.000**
	(0.000)
Constant	-0.291
	(0.169)
Observations	213
Number of team_encoded	18
R-squared	0.223
Hausman	0.075
Team FE	yes
Time EFF	no

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5

VARIABLES	(1) win percentage	(2) win percentage	(3) win percentage	(4) win percentage	(5) win percentage
Prop 15 less	-1.141***	-0.905***			
	(0.143)	(0.118)			
Prop 15 to 50	-0.521***		-0.033		
	(0.172)		(0.162)		
Prop 50 to 100	-0.255			0.448**	
	(0.192)			(0.187)	
(Omitted) Prop 100 plus	-				
Prop 100 plus					0.715***
					(0.156)
Constant	0.957***	0.731***	0.507***	0.406***	0.271***
	(0.095)	(0.030)	(0.035)	(0.039)	(0.050)
Observations	213	213	213	213	213
R-squared	0.278	0.236	0.000	0.039	0.128
Hausman	0.0020	0.0167	0.000	0.000	0.0085
Number of team_encoded	18	18	18	18	18
Team FE	yes	yes	yes	yes	yes
Time EFF	no	no	no	no	no

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6

VARIABLES	(1) win percentage	(2) win percentage	(3) win percentage	(4) win percentage
Intra-Season Stability	0.088***		0.098***	
	(0.005)		(0.006)	
Inter-Season Stability	0.015***	0.049***		
	(0.005)	(0.006)		
Total Team Stability				0.046***
				(0.004)
Constant	-0.919***	-0.051	-0.889***	-0.657***
	(0.082)	(0.066)	(0.083)	(0.090)
Observations	213	213	213	213
R-squared	0.605	0.244	0.587	0.502
Number of team_encoded	18	18	18	18
Team FE	yes	yes	yes	yes
Year EFF	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7

VARIABLES	(1) win percentage	(2) win percentage
Average Age	-0.006	1.162***
	(0.029)	(0.368)
(Average Age)^2		-0.025***
		(0.008)
Average Games	0.006***	0.007***
	(0.002)	(0.002)
Constant	0.210	-13.543***
	(0.594)	(4.355)
Observations	213	213
R-squared	0.194	0.235
Number of team_encoded	18	18
Team FE	yes	yes
Time EFF	no	no

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8

VARIABLES	(1) win percentage	(2) win percentage	(3) win percentage	(4) win percentage
Average Games	0.003*	0.006***	0.005***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Prop Twenty Under	-0.643***			
	(0.213)			
Prop Early Twenty		0.470***		
		(0.140)		
Prop Late Twenty			0.008	
			(0.127)	
Prop Thirty Plus				-1.012***
				(0.276)
Constant	0.426***	-0.165*	0.097	0.038
	(0.142)	(0.090)	(0.068)	(0.084)
Observations	213	213	212	160
R-squared	0.264	0.263	0.180	0.231
Number of team_encoded	18	18	18	18
Team FE	yes	yes	yes	yes
Time EFF	no	no	no	no

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 9

VARIABLES	(1) win percentage	(2) win percentage	(3) win percentage	(4) win percentage
Prop 100 plus	0.305	0.840***	0.615**	0.705***
	(0.189)	(0.138)	(0.231)	(0.201)
Prop Twenty Under	-0.763***			
	(0.177)			
Prop Early Twenty		0.524***		
		(0.149)		
Prop Late Twenty			0.117	
			(0.167)	
Prop Thirty Plus				-0.236
				(0.268)
Constant	0.559***	-0.011	0.272***	0.292***
	(0.092)	(0.088)	(0.041)	(0.066)
Observations	213	213	212	160
R-squared	0.253	0.211	0.122	0.117
Number of team_encoded	18	18	18	18
Team FE	yes	yes	yes	yes
Time EFF	no	no	no	no

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10

VARIABLES	(1) win percentage	(2) win percentage	(3) win percentage	(4) win percentage	(5) win percentage
Prop 15 less	-1.264***	-0.898***			
	(0.197)	(0.122)			
Prop 15 to 50	-0.726***		-0.099		
	(0.197)		(0.168)		
Prop 50 to 100	-0.310			0.660**	
	(0.278)			(0.238)	
(omitted) Prop 100 plus	-				
Prop 100 plus					0.432***
					(0.144)
Constant	1.123***	0.794***	0.521***	0.377***	0.389***
	(0.144)	(0.040)	(0.035)	(0.045)	(0.037)
Observations	213	213	213	213	229
R-squared	0.264	0.198	0.002	0.057	0.064
Number of team_encoded	18	18	18	18	18
Team FE	yes	yes	yes	yes	yes
Time EFF	no	no	no	no	no

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 11

VARIABLES	(1) winpercentage	(2) winpercentage	(3) winpercentage	(4) winpercentage
Coach	-0.070**	-0.023	-0.044	-0.043
	(0.032)	(0.022)	(0.027)	(0.028)
Team Stability		0.045***		
		(0.004)		
Average age			0.990**	
			(0.449)	
$(\text{Average age})^2$			-0.019*	
			(0.009)	
Average games				0.015***
				(0.004)
$(\text{avg\_games})^2$				-0.000**
				(0.000)
Constant	0.512***	-0.641***	-12.189**	-0.262
	(0.006)	(0.097)	(5.34)	(0.165)
Observations	213	213	213	213
R-squared	0.023	0.505	0.180	0.231
Number of team encoded	18	18	18	18
Team FE	yes	yes	yes	yes
Time EFF	no	yes	no	no

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Correlation between Age and Experience

The correlation between average age and average experience is statistically significant. The negative interaction suggests that the combined effect is lesser than the sum of the two effects separately. The data used excludes players who played less than 6 matches within a season.

Table 12

VARIABLES	(1) Win percentage
Average age	0.087*
	(0.045)
Average games	0.045***
	(0.014)
(omitted) average age	-
(omitted) average games	-
Interaction (Average age*average games)	-0.002***
	(0.001)
Constant	-2.115**
	(0.985)
Observations	213
Number of team encoded	18
R-squared	0.244
Team FE	Yes
Time EFF	No

Robust standard errors in parentheses

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

Controlling for Players in their Early Twenties

Table 13 shows that when controlling for the proportion of players aged in their early twenties (a key predictor of positive team performance), the proportion of players with greater than 200 matches played is positive and significant. The data used excludes players who played less than 6 matches within a season.

Table 13

VARIABLES	(1) Win percentage
Prop early twenty	0.425**
	(0.165)
Prop 200plus	0.615*
	(0.301)
Constant	0.261***
	(0.086)
Observations	187
Number of team encoded	18
R-squared	0.062
Team FE	yes
Time EFF	no

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

All Player Eligible – Sensitivity Analysis One

The following regressions form part of the discussion in sensitivity one, in which we change the proportions of matches played. In the regressions in the sensitivity analysis, we include only players who have played 6 or more games within a season. However, in table 14 below the regressions include all players, regardless of how many matches they played within a season.

Table 14

VARIABLES	(1) win percentage	(2) win percentage	(3) win percentage	(4) win percentage	(5) win percentage	(6) win percentage
Prop 25 to 50	-1.007**	-1.010***				
	(0.371)	(0.131)				
prop_25to50	-0.078		0.412*			
	(0.379)		(0.222)			
Prop 50 to 100	-0.087			0.660**		
	(0.375)			(0.238)		
Prop 100 to 200	0.099				0.812***	
	(0.325)				(0.190)	
Prop 200 plus = o,	-					
Prop 200 plus						0.418
						(0.396)
Constant	0.920***	0.907***	0.446***	0.377***	0.331***	0.480***
	(0.315)	(0.053)	(0.029)	(0.045)	(0.040)	(0.030)
Observations	192	213	213	213	213	192
R-squared	0.251	0.279	0.016	0.057	0.096	0.007
Number of team_encoded	18	18	18	18	18	18
Team FE	yes	yes	yes	yes	yes	yes
Time EFF	no	no	no	no	no	no

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Coach Variable Regressions – Sensitivity Analysis Two

The following regressions form part of the discussion in sensitivity two, in which we analyse how appointing a new coach may impact the age, experience, team stability and win percentage of a club. The data used excludes players who played less than 6 matches within a season.

Table 15

VARIABLES	(1) Average games	(2) Prop 15less	(3) Prop 15to50	(4) Prop 50to100	(5) Prop 100plus
coach	-3.701	0.037**	-0.012	0.001	-0.025*
	(2.617)	(0.016)	(0.017)	(0.019)	(0.013)
Constant	74.622***	0.282***	0.217***	0.189***	0.312***
	(5.345)	(0.022)	(0.011)	(0.015)	(0.030)
Observations	213	213	213	213	213
R-squared	0.105	0.108	0.026	0.033	0.092
Number of team_encoded	18	18	18	18	18
Team FE	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16

VARIABLES	(1) Average age	(2) Prop Twenty Under	(3) Prop Early Twenty	(4) Prop Late Twenty	(5) Prop Thirty Plus
coach	-0.223	0.013	0.012	-0.021	-0.007
	(0.128)	(0.017)	(0.019)	(0.013)	(0.008)
Constant	23.415***	0.238***	0.475***	0.246***	0.066***
	(0.240)	(0.022)	(0.020)	(0.022)	(0.015)
Observations	213	213	213	212	160
R-squared	0.227	0.090	0.055	0.090	0.127
Number of team_encoded	18	18	18	18	18
Team FE	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 17

VARIABLES	(1) Intra-Season Stability	(2) Inter-Season Stability	(3) Total Stability
coach	-0.135	-0.672*	-0.807
	(0.308)	(0.330)	(0.520)
Constant	14.060***	10.888***	24.947***
	(0.449)	(0.526)	(0.918)
Observations	213	213	213
R-squared	0.271	0.143	0.122
Number of team_encoded	18	18	18
Team FE	yes	yes	yes
Time FE	yes	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, *